# KERICE 2020
# BOOK OF ABSTRACTS

**WEBINAR: 10 STEPS IN BUILDING AN IoT SOLUTIONS COMPANY**

**LIST OF JUDGES**

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## LIST OF WINNERS

| DEPARTMENT | AWARD | VIDEO ID | NAME | TITLE |
|---|---|---|---|---|
| Biotechnology Engineering | Gold | BPM007 | Yusilawati Ahmad Nor | Oil Sorbent From Waste Lubricating Oil And Styrofoam |
| | Silver | BPM004 | Nur Izzati Binti Mohd Razali | The Effect Of Different Isocyanates In Mechanical Properties Of Polylactic Acid/Palm Oil Based Polyurethane As A Biodegradable Packaging Material |
| | Bronze | NN004 | Mizan Izzati Binti Mat Zin | Chitin Nanopaper From Fungal-Based Source |
| | Bronze | BER001 | Amina Tahreen | Potential Of Electrocoagulation (Ec) Process To Sustainably Treat Palm Oil Mill Effluent (Pome) For Wastewater Reuse |
| Civil Engineering | Gold | CAM001 | Altamashuddinkhan Nadimalla | Recycled Pet Bottles And M-Sand As Fine Aggregate Replacement In Concrete For Sustainable Construction |
| | Silver | CAM005 | Aida Nabila Binti Jamaluddin | Strength Characteristics Of Geopolymer Mortar Containing Waste Paper Sludge Ash (WPSA) |
| | Bronze | CAM007 | Nur Aina Farahana Binti Abdul Ghani | Non-Destructive Evaluation Of Rigid Pavement Using Spectral Analysis Of Surface Waves (SASW) |
| | Bronze | CAM004 | Nur Aqilah Binti Mohd Rosli | Riverbank Erosion Study At Sungai Pusu |
| Electrical and Computer Engineering | Gold | VL001 | Mohd Afiq Mohd Asri | Low-Cost And Rapid Prototyping Of Electrochemical Microfluidic Biosensor |
| | Silver | WCS001 | Rafhanah Shazwani Binti Rosli | Wi-Sense: Rssi-Based Integrated Physical Intrusion Alarm And Indoor Automation |
| | Bronze | SE006 | Wan Nurul Suraya Binti Wan Nazulan | Detection Of Sweetness Level For Fruits (Watermelon) With Machine Learning |
| | Bronze | PP001 | Saidatul Haneen Binti Badruhisham | Integration Of Hybrid Biomass-Solar Photovoltaic-Wind Turbine In Microgrid Application |
| Mechatronics Engineering | Gold | CUT001 | Muhammad Ikmal Hakim Bin Shamsul Bahrin | Development Of Interactive Audio System For Helping Blind And Visually Impaired Students To Read Tactile Graphics Materials |
| | Silver | HER002 | Ifrah Shahdad | Performance-Based Adaptive Modulation Of Hand Rehabilitation Using A Finger-Extensor Mechanism |
| | Bronze | HER001 | Chowdhury Mohammad Masum Refat | Machine Learning For Facial Expression Driven Rehabilitation System Based On Stretchable Sensor |
| | Bronze | IMS005 | Dr. Azni Nabela Wahid | Enhancing The Performance Of Piezoelectric Energy Harvester By Using Corrugated Cantilever Beam |
| Mechanical Engineering | Gold | DC002 | Nur Aqilah Binti Azman Shah | IIUMSAT-2: Design And Realization Of A Nanosatellite For Malaysia Siswasat Competition 2020. |
| | Silver | T001 | Mohammed Faheem | Impact Of Crosswire On Mixing And Core Length Of Mach 2.0 Supersonic Jet |
| | Bronze | SMD001 | Sharis-Shazzali Bin Shahimi | Damage Assessment On Numerical Modelling Of Rotating Engine Blades Subjected To Bird Strike |
| Manufacturing and Materials Engineering | Gold | AMS004 | Nurfarahin Binti Mohd. Nordin | Development Of Microcellular Polylactic Acid Biocomposite Foamed Via Supercritical Carbon Dioxide |
| | Silver | AMS003 | Siti Norbahiyah Binti Mohamad Badari | Wear And Frictional Properties Of Kenaf/Carbon Fibers Reinforced Epoxy Hybrid Composites |
| | Bronze | AMS002 | Nur Hudawiyah Binti Abu Hassan | Development High Entropy Alloy As Catalyst For Azo Dye Degradation |
| | Bronze | AMS009 | Raimi Fariz Bin Nasrudin | Non-Acidic Isolation Of Cellulose Nanofibril (CNF) From Empty Fruit Bunch (EFB) And Its Characterization |

**Kulliyyah of Engineering Research, Innovation and Commercialization Exhibition (KERICE) 2020**
**8th December 2020**

**List of Abstracts**

**ID: AMS001**

## Title: SYNTHESIS OF ACTIVATED CARBON AS ELECTRODE MATERIALS FOR SUPERCAPACITOR APPLICATION

**Hasan Marzuki & Alya Naili Rozhan**

Abstract: The demand for the energy is expected to rise as the population of human continues to increase. This is due to the importance of the energy that plays huge roles in human's life that contribute to the social and economic development. As for now, most energy resources are derived from fossil fuel such as petroleum, gas and coal. These resources are depleted over the years as the fossil fuels are not renewable, therefore renewable energy sources such as solar, wind, biofuels must be explored to accommodate the needs of energy.Thus, the extensive exploration of renewable energy has attracted significant research on the electrochemical energy storage devices such as rechargeable batteries and supercapacitor. Therefore, this research is focusing on the synthesis of activated carbon empty fruit bunch(EFB) to be used as active materials in supercapacitor electrode preparation. The activated carbon will be prepared via two-step activation, in which the EFB will undergo pyrolysis process to convert them into bio-char, the bio-char then will undergo activation process using physical and chemical activation. The activated carbon produced will then be characterized using Brunauer, Emmett, Teller (BET)/Barrett, Joyner, Halenda (BJH) test to determine the pore size and surface area of the activated carbon. The electrode preparation is done by mixing the activated carbon as active materials, carbon black as conductive agent, and polytetrafluoroethylene (PTFE) as binder with composition of 80:10:10. The electrode then used in cyclic voltammetry and galvanostatic charge-discharge to evaluate the electrochemical performance of the activated carbon.

**ID: AMS002**

## Title: DEVELOPMENT HIGH ENTROPY ALLOY AS CATALYST FOR AZO DYE DEGRADATION

**Nur Hudawiyah Abu Hassan & NorHuda Hidayah Nordin**

Abstract: Azo dyes are rapidly used in various industries such as textile, cosmetic, paper, food and pharmaceutical industry. However, it becomes a continuous source of environmental pollution. Various methods had been used to remove azo dye in solution such as physical adsorption, biodegradation, degradation by metallic glass and photo catalysis. However, these methods are expensive, ineffective, kinetically slow and lower catalytic activity. Treating azo dyes in solution requires a catalyst to enhance the process of degradation. The Fenton process is one of the advanced oxidation degradation processes where iron catalyzed hydrogen peroxide to generate hydroxyl radical. Herein, high entropy alloy (HEA) has been proposed as a catalytic material to enhance the performance of Fenton process for azo dye degradation. HEA has been reported as a promising catalyst due to its high surface area. The higher the number of active sites, the higher the rate of azo dye

degradation as more active sites are available for adsorption of azo dyes. The results have shown that HEA can be used as a catalyst to fasten the reaction process since the degradation time is proven to be shorter in the presence of HEA. The time taken for the reaction to complete in conventional method is about 14 minutes while it took only about 8 minutes for conventional Fenton with HEA and only about 4 minutes for electro-Fenton with HEA method. The method derived from the results of this study will contribute in treating azo dyes for wastewater treatment in Fenton process.

**ID: AMS003**
**Title: WEAR AND FRICTIONAL PROPERTIES OF KENAF/CARBON REINFORCED EPOXY HYBRID COMPOSITE.**
**S.Norbahiyah, Norshahida Sarifuddin, Afifah Mohd Ali, Ikhwan Yusuff and Hanafi Ismail**

Abstract: Kenaf was recognized as a potential alternative fibrous material for composites. The interest in kenaf grows as a reinforcement for polymeric composites is increased due to their properties such as lightweight, renewability, low density, high specific strength, non-toxicity, low cost and biodegradability to one side of its characteristics are similar to wood. In this study, the response of 40wt% fiber loading of kenaf-carbon hybrid composite reinforced epoxy matrix on tribological performances were attempted. It was hypothesised that synthetic and natural fibers are expected to enhance tribological performance of the hybridized composite. Vacuum-infused kenaf and carbon fibers hybrid composites were tribologically tested in dry sliding condition using Pin-on-Disk tester. The hybrid composites samples were subjected against a rotating abrasive surface with variable applied loads (10-30N) and sliding speeds (20.94-52.35 m/s). Kenaf/Carbon hybrid composite showed a significant friction and wear properties response in hybridization sequence type. Results have shown that wear performances and average coefficient of friction are increased due to loadings. Nonetheless, significantly affected by sliding speed increment. The wear and friction properties are presented from the resultant of volume loss due to material worn out.

**ID: AMS004**
**Title: DEVELOPMENT OF MICROCELLULAR POLYLACTIC ACID BIOCOMPOSITE FOAMED VIA SUPERCRITICAL CARBON DIOXIDE**
**Nurfarahin Mohd Nordin, Hazleen Anuar, Fathilah Ali, & Yose Fachmi Buys**

Abstract: Biobased and biodegradable polymers have attracted great attention because of the increasing concerns over the environmental influence and sustainability of petroleum-based polymer. Poly(Lactic acid) (PLA) is a biobased and biodegradable polymer, its use as a polymer matrix for foam production has increased in recent years. Negative environmental impact due to processes has agitated, which leads to the rise of technology processing that reduces the impact on the environment. In this work, a physical foaming agent, supercritical carbon dioxide (SCCO2) is used to produced foamed PLA instead of using a chemical foaming agent. Durian skin waste is utilized and used as a filler to improve PLA properties by obtaining durian skin fibre (DSF) from durian skin waste. DSF is going through freeze drying process to obtain nano-size durian skin fibre (DSNF). Cinnamon essential oil (CEO) is incorporated into PLA/DSNF biocomposite as an antimicrobial agent which later, the biocomposite are foamed by using SCCO2. The parameter of SCCO2, pressure and

temperature are varied to investigate the effect of variation parameter on the foaming cell size, crystallization, tensile properties and density. The function of CEO as an antimicrobial agent for PLA/DSNF biocomposite also will be looking over.

**ID: AMS006**

**Title: SYNTHESIS OF COPPER NANOPARTICLES FOR CONDUCTIVE INK APPPLICATION**

**Nur Afiqah Rosli & Noor Azlina Hassan**

Abstract: Metal nanoparticles are fascinating materials that find many applications in fields of basic and applied research. Copper nanoparticles with high fraction of surface atoms and high specific surface area have been widely studied. The copper nanoparticles have special physical and chemical characteristics which include catalytic activity, optical properties, anti-microbial and electronic properties. However, copper nanoparticles are difficult to prepare as they easily oxidize and agglomerate in ambient air has limit the wide applications of copper nanoparticles especially for conductive ink application. There are already numerous numbers of studies on synthesizing copper nanoparticles in the presence of carbon oxide and hydrogen gas as to prevent the oxidation of copper nanoparticles. On the other hand, handling these gases is rather difficult and use of such gases is avoided when possible. Thus, an alternative method to prevent the oxidation of copper nanoparticles by incorporating of capping agent. Capping agent will act as stabilizing agent along with preventing agglomeration and stopping uncontrolled growth. In this study, simple, economical, convenient and environmentally-friendly chemical reduction technique was used for the synthesis of copper nanoparticles from copper hydroxide as the precursor, polyvinylpyrrolidone (PVP) as capping agent ,pure ascorbic acid (L-AA) as reducing agent and diethylene glycol (DEG) as solvent. These chemicals are environmentally friendly and nontoxic. It is expected the outcomes of the study take a step closer toward developing a strategies for the synthesis of copper nanoparticles without inert gases protection. In addition, the proposed approach to synthesize copper nanoparticles presents potential applications as conductive ink for flexible electronics.

**ID: AMS007**

**Title: FABRICATING SUSTAINABLE SODA LIGNIN-POLYLACTIC ACID (PLA) 3D PRINTABLE BIOCOMPOSITE MATERIALS**

**Nurul Amirah Abd Rahman & Hazleen Anuar**

Abstract: Pollutions have become one of the most concerning global issues especially on the utilization of petroleum-based plastics due to the increment of plastics in various applications. The development of biodegradable materials has been considered as promising solution on this issue. One of the ways is to incorporate natural fibers reinforcement in the biocomposites applications. There are already numerous numbers of studies on using natural fibers as well as their components such starch and cellulose for bio-based products enhancement. However, the uses of lignin are still not fully utilized and less developed even though it is one of the highest components in the fibers. Thus, this project proposed to investigate the incorporation of alkaline lignin from Empty Fruit Bunch (EFB) waste in the biodegradable Polylactic Acid (PLA) polymer, as a way to reduce the uses of polymer

plastics as well as to comply with the sustainable development. Therefore, the main objective of this research is to produce 3D printable biocomposite material of filament from soda lignin-PLA through extrusion process. In this study, the soda lignin will be extracted from oil palm empty fruit bunch (OPEFB) via alkaline extraction process using sodium hydroxide (NaOH) as cooking liquor. Then, continues with fabrication of lignin/PLA blended filament for 3D printing that can be done by using extruder machine. In order to achieve good mechanical, thermal and physical properties of the filament produced, it is important to conduct characterization on the soda lignin produced to ensure high purity of lignin is obtained. Accordingly, the lignin also needs to have high miscibility with PLA, other than the essentials of adding natural plasticizer, Epoxidized Palm Oil (EPO) that will ensure good mechanical properties of the filament produced. Hence, this study would be one of the solutions for sustainable development that minimize the uses of non-biodegradable materials while utilize waste product for better use.

**ID: AMS008**

**Title: MEDICAL MAT BASED ON POLY(3,4-ETHYLENE DIOXYTHIOPHENE): POLY(STYRENE SULFONATE)/SILVER NANOPARTICLES FOR PRESSURE ULCER PREVENTION**

**Nur'Aishah Ahmad Shahrim, Zuraida Ahmad, Amelia Wong Azman & Yose Fachmi Buys**

Abstract: Conductive mat is made based ontextile fabrics with conductive polymer (CP) complex poly (3,4-ethylenedioxythiophene):poly(styrene sulfonate) (PEDOT:PSS) is one of the most desirable methods used for biomedical applications. At present, there is a broad interest in studying PEDOT:PSS-based conductive textiles as a part of e-textiles owing to its water dispersion form, which make it convenient to be processed. Many recent advances have been based on approaches such as coating, deposition, dipping, and printing have been commonly applied to fabricate electrically conductive fabrics from PEDOT:PSS. The emergence of PEDOT:PSS-based conductive textiles may be beneficial in the prevention of pressure ulcers (PUs). Yet, these approaches are dependable on the end-application. Furthermore, the typical problem of textile is the moisture retention capacity of its structures allows the growth of micro-organisms, causing several unwanted effects not only on the textile itself but also on the consumer. As such, one way to resolve this is to use an antimicrobial agent. Thus, in this study, silver nanoparticles (Ag NPs) will be incorporated with PEDOT:PSS via sol-gel technique. Then, the developed PEDOT:PSS/Ag NP hydrogel will be applied onto the woven cotton-polyester knitted fabric using immersion or dipping process. Accordingly, the effect of Ag NP on the electrical, morphological, and mechanical properties of PEDOT:PSS-based conductive textile will be investigated. It is expected that the conductivity of the produced mat will be enough to prevent PUs by implementing electrical stimulator device, and at the same time, increasing attachment of the CP to the fabric, as well as improving stretch ability and durability to washing. These observations will later provide insight into the study of mechanisms for PEDOT:PSS/Ag NPs conductivity, leading to the development of medical mat. Overall, this study nevertheless a valuable contribution to healthcare and beneficial to the Ummah.

**ID: AMS009**

**Title: NON-ACIDIC ISOLATION OF CELLULOSE NANOFIBRIL (CNF) FROM EMPTY FRUIT BUNCH (EFB) AND ITS CHARACTERIZATION**

**Raimi Fariz Nasrudin & Noorasikin Samat**

Abstract: Acid hydrolysis has turn out to be one of common technique to extract nanocellulose by removing most of the amorphous phases. However, due to the high corrosiveness of acid this method seems to be hazardous especially in high temperature.Acid hydrolysis also involves multiple chemical procedures and plus, it may result an inimical effect on the thermal properties of celluloses due to the embodiment of sulfate half ester group into the nanocellulose. A greenapproach shall be carried out in producing cellulose nanofibril (CNF) which will emphasis more on CNF'sproductivity. Non-acidic one-step ammonium persulfate (APS) oxidizing process is used to isolate the CNF from oil palm empty fruit bunch (EFB) followed by freeze-dry technique. Morphology and crystallinity analysis of the CNF is carried using Transmission Electron Microscopy (TEM) and X-Ray Diffraction (XRD) respectively. Thermogravimetric analysis (TGA) is used to evaluate CNF's thermal stability followed by chemical composition analysis by using Fourier-Transform Infrared Spectroscopy (FTIR).

**ID: AMS011**

**Title: SOLID WASTE INTEGRATED THERMAL PROCESSING DIRECTED FOR ZERO EMISSION**

**Siti Salwa Khamis and Hadi Purwanto**

Abstract: With the rapid growth in population and the ever-growing municipal solid waste (MSW) monthly/annually as well as the lack and/or inadequate public awareness of the '3R' program – to reuse, reduce and recycle waste – pose a major environmental and health concerns including greenhouse effects from landfill. An alternative to landfill in MSW management is to incinerate the MSW. However, the present conventional incineration technology in Malaysia is not very effective at incinerating MSW because of the high moisture content, low calorific value, and high operational cost. The project proposes a sustainable MSW integrated thermal processing directed to zero emission for Malaysia. The new approach is to handle and benefitted the MSW in an integrated system which involved mechanical, thermal, and chemical process using moisture as medium source, heat recovery, and value-added product utilization. An integrated solution starts with compacting and preheating the MSW to remove water content (leachate) as a preparation for converting MSW into char using carbonization process. The char will be forwarded to thermal processing for syngas production, some of heat will be partially infiltrated back to carbonization process. The rest of the heat will be utilized for steam generation in treating leachate from compacting process using hydrothermal processing. The result of MSW carbonization gives good carbon content and calorific value for it to be a good source of fuel. The hydrothermal processing can treat leachate that produced from the MSW rapidly and it meets Water Quality Standard Malaysia (WQSM). This shows an opportunity to make full use of MSW, solve the problems of waste explosion in the landfill, for a healthier, cleaner, and safer lifestyle for Malaysia. It is believed that this is fundamentally correct approach for

a sustainable solution for waste management system for the improvement of urban development of the country.

**ID: AMS012**
**Title: REGENERATION BEHAVIOUR OF SILICA WITH CONCRETE WASTE FOR CAPTURING CO2**
**Mudrikah Sofia Mahmud, Farah Diana Mohd. Daud, Abdul Maleque, Siti Asmahani Saad & Afifah Mohd Ali**

Abstract: The development of carbon dioxide (CO2) capture and storage (CCS) has been considered as a promising technology for reducing the amount of CO2 in the atmosphere and hence, minimizing global climate issues. Recently, a few research indicates the ability of concrete to capture CO2 from surrounding through the carbonation process. As a calcium-based adsorbent, concrete might suffer the intrinsic drawback of declining CO2 capture capacity during multi-cycle operation; hence, it indicates the poor performance of regeneration property. Incorporation of silica (SiO2) in concrete could be considered as a practical approach in improving the stability of concrete-based adsorbent towards cyclic CO2 adsorption. The utilization of silica in concrete production has been proven significantly in improving several properties of concrete, especially mechanical properties such as compressive and tensile strengths. Therefore, this project investigates the effect of silica addition on the regeneration behaviour of concrete-based adsorbent for capturing CO2, which is prepared through natural self-healing route. With the purpose of re-utilization of agricultural waste, silica used in this project is synthesized from rice husk ash (RHA). The natural self-healing method involves two process conditions, such as the percentage of void porosity and curing time, which affects the development of the concrete structure. The effect of different amounts of silica added and different parameters of processing conditions (void porosity and curing time) on the prepared concrete-based adsorbents will be evaluated according to its chemical compositions, physical, morphological and mechanical properties and CO2 adsorption capacity. The concrete-based adsorbent prepared in this research is expected to retain high adsorption capacity after several repeats of adsorption, benefited from the properties of silica. The finding of this research will manifest the potential of low cost industrial and construction waste as an adsorbent material with significant improvements in regeneration performance.

**ID: AMS013**
**Title: MECHANICAL, THERMAL AND FLAMMABILITY PROPERTIES OF HALLOYSITE NANOTUBES REINFORCED POLYAMIDE 11 NANOCOMPOSITES**
**Nur Najma Athirah Azahari, Hazleen Anuar, Azman Hassan, Mohammad Jawaid & Zahurin Halim**
Abstract: This study focused on the influence of different filler loading on the microstructural changes, thermal stability, mechanical and flammability properties of the PA 11/FR/HNTs nanocomposites. The bio-based polyamide 11 (PA 11), flame-retardant (FR) and natural halloysite nanotubes (HNTs) were used for the preparation of PA 11/HNTs nanocomposites by using melt-compounded via twin-screw extrusion for all the composites. Three HNTs loadings (2, 4 and 6 phr) and three FR (2, 4 and 6 phr) were selected. The HNT nanotubes are well dispersed in PA 11 matrix in the studied composition range as shown by

microscopy. A homogenous dispersion of HNTs and PA 11 matrix was observed by using transmission electron microscopy and scanning electron microscopy. Differential scanning calorimeter and thermogravimetric analysis measurements indicated that HNTs behaved as nucleating agents by accelerating the rate of crystallization, thus increasing crystallization temperature. Interestingly, good halloysite dispersion in PA 11 matrix increases the tensile strength and Young modulus of PA 11 without sacrificing the ductility. Highly dispersed nanotubes also bring favourable changes in the thermal stability and microstructure characteristic of PA 11. Limiting oxygen index, cone-calorimeter and micro-scale combustion calorimeter results demonstrated that the addition of HNTs also decreased the peak heat release rate of the nanocomposites. Additionally, glass transition temperature, crystallization temperature and degree of crystallinity of the nanocomposites tends to increase with increase in nanotubes loading. These results indicate the effectiveness of HNTs on the mechanical, thermal and flammability performance of PA 11/FR/HNTs nanocomposites.

**ID: AMS014**

**Title: COLLOIDAL HYDROGEL OF INTERLINKED NANOGELS AND CARBON DOTS FOR ENVIRONMENTAL APPLICATION.**

**Syazwani Mohd Zaki, Noor Jasmine Mohd Adli & Mohamad Izzudin Abdul Kadir**

Abstract: Nanogels are crosslinked polymer particles that have characteristics of hydrogels and nanomaterials. The primary advantages of nanogels are larger surface area that permit an attachment of various ligands due to its multivalent interaction of the interior network. In Addition, nanogels has excellent sensitivity to pH owing to hydrophilic network structure. The mechanical properties of nanogels can be significantly improved by double network (DN) approach that associated with strong interpenetrating network entanglement. In DN structure, the first network is tightly crosslinked to rigid polyelectrolyte whilst the second network loosely crosslinked interpenetrating structure of the first network. The improvement in DN structure is owing to the network and entanglement. In addition, this chemically crosslinked in DN resulted in a very stable network structure owing to the covalent bonding and controllable pore size. Nevertheless, DN hydrogels have major limitation due irreversible and permanent bond breakage of the first network at high strain. Hence chemically linked DN hydrogels are not able to recover efficiently from damage and lose most of its mechanical properties. The ductility of hydrogels can be enhanced by double crosslinking (DX) which introduces a lightly crosslinked second network. The advantages of DX network are larger flexibility and greater tunable properties. Major problems of DX nanogels are lacking in mechanical strength due heterogeneity of the network structure that have limited stiffness. In fact, nanogels are usually soft and fragile in the swollen state. Due to the problems mentioned above, composite nanogels are attracting much attention because of improved mechanical properties with greater functionalities. The inclusion of second materials or fillers will enhance the breaking strength of nanogels. In addition, the crosslinked structure of composite nanogels conferred the structural stability. Interestingly, the structure network of composite nanogels can be modified to respond to specific complex molecules of toxic heavy metal ions (such as Hg2+ and Pb2+), macromolecules and cells. Carbon nanomaterials known as carbon dots (CDs) is employed to compensate the deficient properties of nanogels. CDs is an attractive candidate because it can be produced from

inexpensive carbon sources that are abundant in nature. Besides, CDs also are resistant to photo bleaching. The advantages of CDs are the size of nanoparticles with less than 10 nm in diameter that exhibit excellent solubility in various solvents with desirable biocompatibility and fluorescence. The role of CDs in the nanogels is to integrate the unique optical properties of CDs in the network structure. In this work plant leaves will be used as starting material and CDs will be synthesized by carbonization and microwave assisted method. The incorporation of CDs in nanogels network structure is anticipated to improve the breaking strength of the gels. The nanogels will be synthesized by emulsion polymerization and will be functionalized with GMA to enhance the functionality of the nanogels. The aim of this work is to produce colloidal hydrogel of interlink nanogels and carbon dot for environmental application.

**ID: AMS015**
**Title: FABRICATION OF FLEXIBLE PIEZOELECTRIC NANOGENERATOR DEVICE USING MOLYBDENUM DISULFIDE BASED NANOCOMPOSITE DEPOSITED ON PET SUBSTRATE**
**Fatin Umaidah Ramli, Nur Idayu Ayob, & Mohd Ambri Mohamed**

Abstract: Piezoelectric energy harvesting device has been widely explored to demonstrate its potential application in the development of the renewable energy sources. The ongoing study on this issue has received significant research attention as many realize the conventional sources of energy are depleting while there is a greater consumption of it in the industry today. Therefore, it is crucial to figure out an alternative way to establish a sustainable source of energy to replace the conventional one. For this purpose, fabricating piezoelectric nanogenerator devices is one of the solutions which can produce electrical energy from pressure or stress. This study is conducted with aim to enhance the obtained output voltage of the previous research by utilizing a new graphene-like 2D materials, which is Molybdenum disulphide (MoS2) instead of BaTiO3 within the fabricated nanogenerator device. In this study, the device was fabricated using nanocomposite mixture consisting of polyvinylidene fluoride (PVDF) polymer, graphene quantum dots (GQDs), and Molybdenum disulphide (MoS2) on the polyethylene terephthalate (PET) substrate through a solution processed route. Poly(3,4-ethylenedioxythiophene)-polystyrene sulfonate (PEDOT: PSS) was used as a bottom conductive layer while silver nanowires as a top metal electrode contact. The multi-stacking layer of PEDOT: PSS and nanocomposite layer were deposited using spin coating technique whereas the top electrode was formed by a spray coating method. Then, the effect of filler (GQDs and MoS2) within the PVDF polymer matrix were systematically studied through the device. The structural of the nanocomposite layer was characterized using Scanning Electron Microscopy (SEM) and Raman Spectroscopy. Overall, higher output voltage of 5.04 V was obtained in this study which is significant for supplying power to small-scale electronic devices. It is believed this is due to the presence of MoS2 in enhancing the output voltage of the fabricated nanogenerator device.

**ID: ASM001**

**Title: RAPID LEVELLING PIN-TYPE SETTING TOOL FOR DESKTOP FUSED DEPOSITION MODELING 3D PRINTER WITH TRIZ PROBLEM SOLVING APPROACH**

**Rudi Kurniawan Arief & Erry Y. T. Adesta**

Abstract: Research on the topic of 3D printing process has rapidly grow for this past 5 years but less research found to overcome the problems cause by the lack of bed levelness condition. Using TRIZ Inventive Problems Solving method, this research solved the problems by inventing a new levelling tool system. Based on the TRIZ suggestions, a novel tool to level the heated bed able to reduce difficulties and setup time. This tool is easy to use, save more setup time and can perform better levelling result. Good levelness resulted by this new tool validated by measuring the position of each corners of the heated bed using CMM machine with 0,1mm deviation result far below minimum suggested gap. With better levelling result this tool also help reduce the waste of time in levelling setup and waste of material because of failure caused by levelness deviation.

**ID: ASM002**

**Title: STUDY ON TOOL WEAR OF CARBIDE CUTTING DURING MILLING DIFFERENT FIBRE ORIENTATIONS OF CARBON FIBRE REINFORCED PLASTIC (CFRP)**

**Siti Fatirah Ramli & Nor Khairussima Muhamad Khairussaleh**

Abstract: In recent years, usage of Carbon Fibre Reinforced Plastics (CFRP) especially in aircraft industry is widely used. This is due to its properties which are light weight to ratio and stronger than aluminum. Manufacturing sectors is demanding the usage of CFRP as it was one form of composite material in which the properties are good. Machinists are facing lot of problems during machining CFRP at assembly phase. One of the problem that concerned the machinist the most is the high tool wear and shorter tool life of cutting tool occurred during machining CFRP lead to high production cost .This research investigate on the tool wear mechanism of uncoated carbide cutting tool during milling of CFRP at three different fibre orientation (0◦ ,45◦ and 90◦).The main objective of this study is to study on the tool wear mechanism and tool life of uncoated solid carbide cutting tool during milling on the CFRP at different fibre orientations. Research is carried out by using spindle speed of 1000 rpm to 8700 rpm, feed rate of 500 mm/min to 1000 mm/min and depth of cut of 1 mm to 1.5 mm. Box Behnken Design under Response Surface Method (RSM) is used to generate higher order response surfaces using fewer required runs than a normal factorial technique. The optimization of cutting parameters for 0◦, 45◦, and 90◦ is analyzed using Analysis of Variance (ANOVA). The tool wear trend increases as machining time continued. It was recorded that higher spindle speed, lower feed rate and lower depth of cut lead to minimal tool wear hence prolonged the tool life and proven by ANOVA.

**ID: ASM003**

**Title: APPLICATION OF TRIZ INVENTIVE PRINCIPLES TO MODIFY CLOVE BUDS OVEN DRYING**

**Beauty Suestining Diyah Dewanti, Erry Yulian T. Adesta & Ahmad Faris bin Ismail**

Abstract: After harvesting, drying the clove buds can be done by direct drying using the sun drying method or using an artificial dryer. Currently, clove farmers have started using artificial dryers, namely ovens, because Indonesia's clove harvest season is almost the same as the rainy season. So that the sun drying method relatively inhibits the drying process. However, the farmers' oven still needs to be improved to meet the quality and quantity of dry cloves that are following market standards. In this study, the TRIZ method was used to redesign the clove drying oven. From the observations on clove plantations and literature studies, several problems were grouped according to the TRIZ method criteria, then finished with the TRIZ method's steps. This research is an oven with laboratory-scale with suitable materials, namely plywood and an LPG (Liquid Petroleum Gas) as energy resources.

**ID: ASM004**

**Title: DIE MANUFACTURING PROJECT MANAGEMENT SUSTAINABILITY IMPROVEMENTS**

**Salfarina binti Rozeman**

Abstract: Automotive die making industry in Malaysia are facing challenges to meet the demand from local automotive OEM (Original Equipment Manufacturer) due to limited capabilities and capacities compared to overseas die makers. With the current trend of global uncertainty, it is crucial for local die makers to able to support local automotive OEM in terms of full model change and does not too much depend on foreign support. This would beneficial in terms of enhancing the local die industries and improving Malaysian economy. Based on case study of one of local stamping company in Malaysia with an establish die project management team, this research focus on the strategy to enhance the capacity and capability in order to sustain current the market trend, mainly focuses on five key areas; man, machine, method, materials and commercial. The approach is to establish a focus strategy, target performance, current performance analysis, improvements plan, implementation, evaluation processes. The expected outcome are improved processes, sustainability monitoring and control procedure to maintain the achieved improvements.

**ID: ASM005**

**Title: CONCEPTUAL DESIGN OF AN AUTOMATIC BATIK PRINTER VIA HOUSE OF QUALITY AND PUGH SELECTION APPROACH**

**Nurul Anissa Mohd Asri, Sharifah Imihezri Syed Shaharuddin & Norhashimah Shaffiar**

Abstract: In Malaysia, the production of batik is dominated by two techniques, also known as batik 'tjanting' and batik 'blok' or 'stamp'. Batik 'tjanting' enables greater freedom of design and takes longer to manufacture compared to batik 'blok'. As a result, several studies have shown similarly high rates of musculoskeletal disorders (MSDs) among artisans in Kelantan and Terengganu due to their working pose during the batik 'tjanting' process.In order to overcome these issues, there has some innovative efforts to develop an automated batik printing machine. However, the number of studies for batik printers is very limited and in

Malaysia last established in 1995. Therefore, this project aims to systematically create a HoQ batik printing machine that takes into account the voice of batik professionals and non-batik practitioners. It is possible to categorize possible customer requirements or features of a batik printer into printing speed, quality of printing, operation, temperature and cost. The consumers which consist of batik practitioner and non-batik practitioner rated the importance of the eight printer attributes using an 8-point scale. Further conceptual design of the batik printer was aided using the Pugh selection approach. The result of the survey revealed that the order of customer preferences differs for the consumers. Able to adjust and maintain temperature of wax, highly chosen by batik practitioner while non-batik practitioner chose ease of operation for main features of automatic batik printer. This novel approach to provides an alternative of 'tjanting' batik process as well as fast rapid production of batik 'tjanting' to meet with features was chosen by batik and non-batik practitioner. Hence, the outcome of the approach is hoped to provide an automatic batik printer and to resolve the batik 'tjanting' maker's problem.

**ID: ASM006**

**Title: CONCEPTUAL DESIGN OF AN AUTOMATIC BATIK PRINTER VIA HOUSE OF QUALITY AND PUGH SELECTION APPROACH**

**Nurul Anissa Mohd Asri, Sharifah Imihezri Syed Shaharuddin & Norhashimah Shaffiar**

Abstract: In Malaysia, the production of batik is dominated by two techniques, also known as batik 'tjanting' and batik 'blok' or 'stamp'. Batik 'tjanting' enables greater freedom of design and takes longer to manufacture compared to batik 'blok'. As a result, several studies have shown similarly high rates of musculoskeletal disorders (MSDs) among artisans in Kelantan and Terengganu due to their working pose during the batik 'tjanting' process.In order to overcome these issues, there has some innovative efforts to develop an automated batik printing machine. However, the number of studies for batik printers is very limited and in Malaysia last established in 1995. Therefore, this project aims to systematically create a HoQ batik printing machine that takes into account the voice of batik professionals and non-batik practitioners. It is possible to categorize possible customer requirements or features of a batik printer into printing speed, quality of printing, operation, temperature and cost. The consumers which consist of batik practitioner and non-batik practitioner rated the importance of the eight printer attributes using an 8-point scale. Further conceptual design of the batik printer was aided using the Pugh selection approach. The result of the survey revealed that the order of customer preferences differs for the consumers. Able to adjust and maintain temperature of wax, highly chosen by batik practitioner while non-batik practitioner chose ease of operation for main features of automatic batik printer. This novel approach to provides an alternative of 'tjanting' batik process as well as fast rapid production of batik 'tjanting' to meet with features was chosen by batik and non-batik practitioner. Hence, the outcome of the approach is hoped to provide an automatic batik printer and to resolve the batik 'tjanting' maker's problem.

**ID: ASR003**
**Title: CORRELATION BETWEEN FACIAL THERMAL PATTERN AND THE EMOTIONAL STATES OF AUTISM SPECTRUM DISORDER (ASD) CHILDREN**

**Mohammad Ariff Rashidan, Shahrul Na'im Sidek, Hazlina Md. Yusof, Madihah Khalid, Ahmad Aidil Arafat Dzulkarnain, Aimi Shazwani Ghazali, Sarah Afiqah Mohd Zabidi, & Faizanah Abdul Alim Sidique.**

Abstract: Autism Spectrum Disorder (ASD) is a childhood neurodevelopmental condition related to cognitive and language deficiency. Previous study shows that children with neurodevelopmental disabilities are unable to disclose their emotions effectively, verbally communicate their affective states, and lack sufficient facial expressions, with particular difficulties in contact with socio-emotion. Present methods mostly use in-contact approach to measure affective states among children who suffer of lack of facial expression. This research proposes to develop a novel affective states identification system based on the multi-view frontal face thermal images dataset for the Autism Spectrum Disorder (ASD). Facial temperature will be recorded at the most significant region of interest (ROI) at the forehead area. The emotion deduction from the facial thermal variations will be then compared to subjective ratings of images using the International Affective Picture System (IAPS) database. The subjects are expected to show appropriate emotional responses related to the given stimuli concerning two-dimensional space, namely valence and arousal. The correlation between thermal patterns and affective states will be investigated further. The affective states modality developed from this research is significant in the development of affective states identification module in the structured emotion-based pedagogy employing human-robot interaction (HRI) framework for a novel, early intervention therapy for ASD children.

**ID: ASR004**
**Title: FABRICATING FUZZY LOGIC CONTROLLER FOR MICRO-EDM PROCESS**
**Wan Ahmad Bin Wan Azhar and Assoc. Prof. Dr. Tanveer Saleh**

Abstract: One of the demanding manufacturing processes nowadays is Micro Electrical Discharge Machining. A low discharge energy per pulse is crucial to achieve micro-level machining. This is achieved by controlling parameters in the power supply unit as well as proper control of tool movement.The overall performance of EDM is deteriorated in extended machining time and uncontrolled discharges cannot be tolerated in micro-EDM. Moreover, the conventional RC-based EDM power supply does not support discharge energy control during the machining process for various machining conditions. Therefore, the objective of this research is to develop a fuzzy logic controller to intelligently control the discharge energy and tool movement in micro-EDM RC-based power supply during the machining. In order to achieve this goal, an RC-based power supply is modified to have gap voltage control, RC's capacitance control and short-circuit detection sensitivity control capabilities. Next, a fuzzy logic controller is implemented to intelligently control the discharge energy, tool movement, and short-circuit current detection sensitivity based on the relative frequency of short circuit and open circuit. It is expected that machining performances will increase because the adaptive control of the FLC will cater various

machining conditions. This research proposes a novel approach in improving the machining process through discharge energy control and tool movement using fuzzy logic theory.

**ID: ASR006**
**Title: ULTRASONICALLY ASSISTED DEVICEFORMICRO ELECTRO DISCHARGE MACHINING**
**Md Shohag Mollik**

Abstract: Micromachining technologies have enjoyed a recent resurgence due to massive demands in many engineering, production and manufacturing sectors. Micro Electric Discharge Machining (µ-EDM) is one of the most popular techniques available to produce microscopic features and components for various industries. This technique can ensure better machining performance in terms of reduced Heat Affected Zones and surface finishing. It also comes with inherent disadvantages such as high machining time, low material removal rate (MRR) and unstable machining. To overcome these factors vigorous flushing of dielectric fluid is performed. The flushing is achieved through imparting ultrasonic vibration on either of the tool, dielectric fluid or workpiece. The vibration aids in carrying away the debris accumulated in the spark-gap region. A novel design of an ultrasonic vibration fixture has been proposed. This fixture will facilitate vibration of the workpiece that is required to improve machining performance. Further enhancement of the design leads to better machining performance. System Identification helps to determine the nature of the system and model the input-output response. The oscillation of the system can be easily characterized and validated using System Identification. Machining results are compared to gain some more insight about the nature of ultrasonic vibration assisted µ-EDM.

**ID: ASR007**
**Title: EFFECT OF LASER PARAMETERS ON VARIOUS ASPECTS OF LASER-µEDM BASED HYBRID MICROMACHINING**
**Mir Akmam Noor Rashid and Tanveer Saleh**

Abstract: Nowadays, Laser beam micromachining (LBMM) and Micro electro-discharge machining (µ-EDM) have drawn great attention to fabricating the miniaturized parts. LBMM is a very fast process; however, it results in higher recast layer and taperness, low circularity, dominant heat-affected zone (HAZ) on the machined products. On the contrary, µ-EDM is a slow process but produces lower taperness, recast layer and HAZ. Also, the circularity is better for µ-EDMed holes as compared to the Laser machined ones. To bring together the advantages of both techniques, a Laser- µ-EDM based sequential hybrid micromachining method has been proposed. This paper presents an experimental investigation on stainless steel (type 304) to observe the effects of Laser input parameters on the machining performance of Laser- µ-EDM based hybrid micromachining. The scope of the work is limited to 1-D machining, i.e. drilling micro holes. The effects of laser power, scanning speed, and pulse frequency were investigated in detail to observe the overall performance of the Laser- µ-EDM based hybrid drilling process. It was found that Laser input parameters mainly scanning speed and power influenced the output performance of hybrid micromachining significantly. It was observed that the increase in Laser scanning speed could reduce the overall material removal rate (MRR) of the hybrid process by a

margin of ~8% (maximum). On the other hand, an increase in Laser power helps to improve the total MRR, which may be as high as 5%. Machining stability in terms of occurrence of the short circuit during µ-EDM, was found to be worsening with Laser power and scanning speed. Finally, Laser- µ-EDM based hybrid micromachining was proved to be far better than pure Laser and µ-EDM based machining as regards to both productivity and machining quality.

**ID: ASR008**
**Title: MACHINE LEARNING BASED DUAL STAGE MODEL FOR SEQUENTIAL LASER-µEDM MICRO DRILLING**
**Wazed Ibne Noor**

Abstract: Micromachining technologies have enjoyed a recent resurgence due to massive demands in many engineering, production and manufacturing sectors. The term micro-machining refers to the processes that machine intricate microstructures and shapes. The dimensions of these microstructures and shapes lie in the range of 1µm to 999µm. Laser beam micromachining (LBMM) and Micro Electrical Discharge Machining (µ-EDM) are both non-conventional, contactless machining process. LBMM removes material through focused laser beam which melts and vaporizes the material surface. µ-EDM facilitates frequent electric discharges between a highly charged electrode and workpiece surface to remove material. and The scope of this particular research is focused on 1D microdrilling process that produce microholes. Both LBMM and µ-EDM pose various advantages and disadvantages that are inherent to the processes. LBMM offers ultra-fast machining of holes but it produces high levels of Heat-Affected Zone(HAZ) and Recast Layer. HAZ and Recast Layer are undesirable surface properties that need to be removed for the sake of quality. On the other hand, µ-EDM process removes material a lot slower than LBMM and suffers from frequent disruption due to short-circuits occurring during machining. Nevertheless, HAZ and Recast Layer associated with µ-EDM is almost insignificant compared to that of LBMM. A sequential Laser-µEDM process for micro-drilling purpose has been developed to combine the benefits of both processes. This process facilitates more stable and efficient machining regime. It also removes undesirable effects inflicted on the workpiece such as Heat affected Zone(HAZ), Recast Layer, Hole Taper etc. Artificial Neural Networks(ANN) and other machine learning methods offer accurate algorithms for approximating the relationship between various input-output parameters of the sequential process. Prediction of the outcomes of the hybrid microdrilling process using ANN-Machine Learning based modelling have been proposed, a feat which is unprecedented.

**ID: ASR009**
**Title: SNAKE ROBOT BASED MAPPING OF RUGGED TERRAIN**
**Marwan Badran, Md. Raisuddin Khan, Siti Fauziah Bt. Toha and Zulkifli Bin Zainal Abidin**

Abstract: Mapping of a rugged terrain is a challenging task, especially when the target area is inaccessible by humans. This kind of mapping task is also difficult to be accomplished with the traditional robots with active wheels; since they may turn over or get stuck. In this

project, a snake robot is proposed as an alternative option that can be adaptive with such uneven surfaces. A prototype of the snake robot consisting of multi-link body and servomotors has been developed. Control algorithms have been implemented in the robot that allow the snake robot to twist and move like the natural one and collect coordinate data while maneuvering over rough terrain. Such robots will be useful in mapping hilly terrain, agricultural field, mine field and any cluttered yards in the industries.

**ID: ASR010**
**Title: MOTION PLANNING USING VISUAL ENCODING FOR SIX-DEGREE-OF-FREEDOM ROBOTIC ARM**
**Hafiz bin Iman and Raisuddin Khan**

Abstract: We present motion planning for a six-axis robotic arm using a rapidly exploring random tree (RRT) planner in an encoder-less context. This solution aims at resolving the problem of unreliable encoders used in 3D printed robotic manipulators. Here, we define an encoder-less context as a trajectory control sans physical rotary encoder. Our definition of a physical encoder covers absolute and relative encoding sensor system. Our six-axis robotic arm is retrofitted with a depth sensor on its end effector to establish visual sensing. Our platform demonstrates motion dependent on an encoder-less motion via visual estimation of the state through scene learning. We populate the scene with a fiducial marker. The marker helps ascertains an absolute position in space to assist position calibration. The robot was given two affine frames to follow in repetition. The robot's state estimation uses a posterior estimate to establish a Bayes' rule structure from the visual feedback. We mathematically map the structure into node-based topology to search for an optimized estimation. We observe insignificant statistical errors by using our topological estimation method. Consequently, the robotic arm follows the designated frames on top of RRT planner with minimal error.

**ID: ASR011**
**Title: COLLISION AVOIDANCE USING A SIMULTANEOUS LOCALIZATION AND MAP-BUILDING SOLUTION FOR SIX-DEGREE-OF-FREEDOM ROBOT MANIPULATOR IN ENCODER-LESS CONTEXT**
**Hafiz bin Iman and Raisuddin Khan**

Abstract: We present collision avoidance planning under a dynamic environment for a six-axis robot manipulator in an encoder-less context. We develop this solution to reduce mechanical weight, cost, complexity, and uncertainty when rotary encoders are intro in robotic arm design. We define an encoder-less context as trajectory controls without the use of a physical rotary encoder. We attached a depth sensor at the end effector of the robot manipulator. Two affine frames are introduced for the robot to follow repetitively. An exogenous moving object is introduced randomly to the line of a planned motion. We include a probability-weighted floating joint attached to the robot base-joint to encode the moving object in the workspace. With this approach, the state estimation of the robot's configuration and the state of the exogenous object can be computed in a single algorithm. We use a graph-based simultaneous localization and mapping (SLAM) solution to estimate the state of the robot and the state of the exogenous object to avoid collision. The algorithm

feeds on the visual feedback from the depth sensor. A rapidly exploring random tree (RRT) algorithm receives input from the state estimation to replan motions when a collision state observer anticipate collision. Our approach to encoding moving object as the robot floating joint using a SLAM solution is solvable under rapidly exploring random tree (RRT) planner.

**ID: ASR012**
**Title: THUMB ATTITUDE ANALYSIS USING HIGH DENSITY SURFACE EMG**
**Muhammad Mukhlis Suhaimi, Aimi Shazwani Ghazali, Ahmad Jazlan and Shahrul Na'im Sidek.**

Abstract: Advanced hand prostheses are usually governed by the sampling features extracted from the surface-electromyograph signal (sEMG) recorded from the residual muscles of the amputee's limb. The control of multi-articulated thumb as an opposable digit is vital to realize various hand grip attitudes. Current technique to record the sEMG signal centered at the thumb musculature, intrinsic to the hand area. The other four extrinsic muscles governing the thumb lie on the deep compartment of the forearm posing challenge to capture their characteristics. For transradial amputees, despite the loss of access to the intrinsic muscles controlling the thumb movement, the access to the information from the extrinsic muscle would be non-negotiable. Thus, the research main objective is to investigate the relationship of muscle synergies that act upon different thumb attitudes from forearm musculature, directly or indirectly engaged in thumb movement using classification algorithm based on the high density sEMG signals. To achieve the objective, a systematic study on forearm musculature and the sEMG generated during thumb movement will be carried out. This is due to the fact that they are largely associated to the governance of other digits and wrist as well. The cues from the high-density (HD) sEMG pattern will be used to select the sampling features for the development of classification algorithm. An HD-sEMG device will be used to collect the signal characterizations. It is envisaged that the main output of the research will be a new finding of thumb attitude classifier which is based on the synergy of forearm musculature responsible for overall hand function. The output is significant in developing a dedicated control framework for prosthetic hand for tansradial amputees that can operate as closely as normal.

**ID: BER001**
**Title: ELECTROCOAGULATION (EC): A SUSTAINABLE ALTERNATIVE TO TREAT BIOTREATED PALM OIL MILL EFFLUENT (POME) FOR INDUSTRIAL REUSE**
**Amina Tahreen, Mohammed Saedi Jami and Fathilah Ali**

Abstract: Malaysia being one of the leading palm oil producers in the world has made enormous leaps in its production rate over the years. While the rising industry adds to the local economy, it is correspondingly generating a concerning amount of waste that is detrimental to the environment. Conventional methods for the treatment of palm oil mill effluent (POME) consist of advanced oxidation processes involving harsh chemicals, aerobic and anaerobic digestion systems, employing ponding systems before discharge into rivers. Large surface area is required for the ponding systems, involving long retention time and subsequent production of foul stench resulting in environmental pollution while the

environmental discharge limits are unmet with high content of organic matter. This study aims to optimise the critical operational parameters namely current density, initial pH and time, using electrocoagulation (EC) to treat bio-treated POME, and investigate its reusability in the palm oil industry. EC is an attractive electrochemical process with simple set up, inexpensive and environmentally friendly procedure to remove pollutants by anode dissolution and therefore, carries a promising potential to be scaled up to treat huge amount of POME at the industrial level. Using aluminium electrodes with inter electrode distance of 10 mm on synthetic wastewater (representing biotreated POME), and a range of initial pH, current density and time of 3-8, 10-40 mA/cm2 and 15 to 60 minutes respectively, the effect of the three critical variables were investigated on the best chemical oxygen demand (COD) removal %. The highest COD removal of 71.5% was achieved at pH 6, current density 40 mA/cm2 and EC time of 15 minutes. The experiment was validated with real biotreated POME with the optimised parameters and resulted in the removal of 62.4% COD, 99.45 % turbidity, 99.1% total suspended solids and 92% of colour. The outcome of this study proved a significant reduction in the targeted pollution parameters in a very short time span of 15 minutes without the use of harsh chemicals or emission of harmful by-products, strongly overtaking the conventional processes. EC, therefore paves way to future membrane ultrafiltration integration to further enhance the treated effluent quality to meet reusable process water quality standards, to contribute a step further to reduce pollution and mitigate global fresh water scarcity.

**ID: BER002**

**Title: FABRICATION AND CHARACTERIZATION OF GRAPHENE OXIDE-POLYMER NANOCOMPOSITE MEMBRANE AS ADSORBENT FOR LEAD REMOVAL**

**Nik Rashida Nik Abdul Ghani, Mohammed Saedi Jami, Md. Zahangir Alam, Wan Wardatul Amani Wan Salim and Nurul Sakinah Engliman**

Abstract: Heavy metals such as lead, predominantly associated to wastewater effluents from the semiconductor industry, are harmful to the environment and human health. The utilization of polymeric membrane has been reported in numerous investigations on wastewater management of heavy metals. Therefore, this study aims to remove lead from wastewater effluent by membrane technology with dual function of adsorption and filtration process using nanomaterial of graphene oxide (GO). Graphene oxide-polymer nanocomposite (GPN) membrane was fabricated via non-solvent induced phase inversion (NIPS) method where the modification of polyethersulfone (PES) membrane was conducted by incorporating graphene oxide (GO) in the matrix polymer solution. The characterizations of the prepared GPN membranes were investigated through tensile strength, porosity, surface zeta potential, SEM and AFM. Batch adsorption experiments were conducted on GPN and the results showed GPN under 10 minutes exposure and acidic condition (pH 5) exhibited higher lead removal which is about 97%. The maximum adsorption capacity, adsorption isotherm and kinetic properties of the GPN also were determined. The Langmuir isotherm and pseudo-second order kinetic models were found to be the best-fitting models of the adsorption of lead from aqueous solution. This indicated that the monolayer adsorption mechanism occurred on the surface of the membrane and involved chemisorption due to physicochemical interactions.

**ID: BER003**

**Title: PREPARATION AND CHARACTERIZATION OF ACTIVATED CARBON FROM BAOBAB FRUIT SHELL BY CHEMICAL ACTIVATION FOR THE REMOVAL OF METHYLENE BLUE**

**Radhia Nedjai, Ma'an Fahmi Rashid Alkhatib, Md Zahangir Alam, and Nassereldeen Ahmed Kabbashi**

Abstract: Activated carbon is regarded as an excellent adsorbent and is commonly used for its massive capacity for adsorption. Activating agents affect the surface and porosity of the generated activated carbon. The purpose of this study was aimed at evaluating the characteristics of activated carbons derived from Baobab fruit shell through chemical activation using H3PO4, ZnCl2, and KOH for the removal of methylene blue. Significant changes on the material surface following the activation process were observed through SEM and FT-IR analyses. Scanning electron micrographs of BF-ACs showed that porous structures were formed during activation, while, the FT-IR results indicated that the carbons have abundant functional groups on the surface. The adsorption isotherm data were fitted to Langmuir and Freundlich adsorption models. It was found that biosorption of methylene blue onto the prepared activated carbons closely fit the Langmuir model. Among the different activated carbons, the one prepared with KOH shows the highest methylene blue adsorption (113.63 mg/g) and maximum adsorption capacity (95.54%), which is directly related to the specific surface area of activated carbons. The adsorption process can be well described by the pseudo-second-order kinetics.

**ID: BER004**

**Title: OPTIMIZATION OF FACTORS AFFECTING ANAEROBIC CO-DIGESTION OF FOOD WASTE AND SEWAGE SLUDGE FOR BIOGAS PRODUCTION**

**Md Sabuj Hosen, Dr. Mariatul Fadzillah Mansor*, Dr. Md Zhangir Alam and Dr. Fazia Adyani Ahmad Fuad**

Abstract: In the present era, to meet the global energy demand and at the same time to minimize environmental pollution, anaerobic digestion of organic wastes such as food waste (FW) and sewage sludge (SS) could be a sustainable process towards waste management and energy production. Apart from that anaerobic mono-digestion of FW poses various operational challenges due to substrates and variability. Anaerobic co-digestion (ACo-D) of the aforementioned substrates together establishes better process stability. This present study aims to optimize key factors (feed pH, hydraulic retention time) affecting operational conditions of continuous ACo-D of FW and SS to maximize biogas production under mesophilic temperature (37 ± 1 ◦C) through one-factor-at-a-time (OFAT). Based on the physicochemical properties, the substrates were characterized as total solids, total volatile solids, total suspended solids, volatile suspended solids, total chemical oxygen demand (TCOD), soluble COD, total phosphate, total ammonia, reducing sugar, and pH where FW exhibits maximum values for all the parameters except pH in comparison with SS. Preliminary screening was conducted by using OFAT for narrowing down the variables (7.5, 8.5, 9.5; 7, 14, 21 days) before proceeding to optimization. The highest biogas generation was achieved at feed pH 8.5 with HRT 14 days. Effluent samples was analyzed every three days interval on substrate digestion, chemical oxygen demand (COD) removal and final total solid. Application of OFAT will be considered as an economical and reliable tool for

modelling, optimizing and studying the interactive effects of the two process factors (feed pH and HRT) for the production of renewable biogas.

**ID: BER005**
**Title: MUNICIPAL SOLID WASTE AND PALM KERNEL SHELL MIXTURE AS FEEDSTOCK IN THE GASIFICATION PROCESS**
**Diallo Amadou Dioulde Donghol; Ma'an Fahmi Rashid Alkhatib; Zahangir Md Alam; Maizirwan Mel**

Abstract: One of the renewable and sustainable energy sources to replace polluting fossil fuels is residues of municipal solids and biomass. The efficient management of this energy will help to solve the problems associated with fossil fuels. There are several routes to convert biomass into useful products depending on the biomass characteristics and the requirement of the end product and its applications. Furthermore, biomass gasification has considered being the preferred viable option for the conversion of a variety of biomass feedstock. This study highlights the possibility of mixing biomass (palm kernel shell) and municipal solid waste (MSW) to make clean energy that regards the environment (climate change) and sustainable development. Chosen components of MSW, specifically plastics, textiles, foam, and cardboard mixed with PKS in desired proportions. Volatiles, ash moisture content, have moderate concentrations that do not negatively influence the gasification process, according to the study results. The study established that the mixture MSW and PKS can be a raw material for the gasification process. According to the calorific value, this is, around 21.13 MJ/kg for an MSW + PKS ratio of 0.25 to 28.82 MJ/kg for an MSW + PKS ratio of 1.5. Other polluting elements were found such as Chlorine (0.064 wt.% to 0.171wt.%), Sulfur 0.321wt.% to 0.512 wt.% respectively. Elements such as antimony (Sb), arsenic (As), bromine (Br), lead (Pb), and mercury (Hg) were not found, in any of the elements analyzed. Moreover, those who are present are within the standards set by the competent services. Therefore, this mixture of MSW and PKS can replace the polluting and depleting fossil fuel in the gasification process with little to no impact on the environment.

**ID: BER006**
**Title: MODELLING OF CONSTANT PRESSURE EXPRESSION OF HOMOGENEOUS SEMI-SOLID MATERIAL**
**Mohammed Saedi Jami and Masashi Iwata**

Abstract: Mechanical expression is the separation of liquid from a two-phase solid/liquid system by compression due to movement of a retaining wall rather than pumping the solid/liquid system into a fixed chamber as in filtration. In this study, the basic consolidation equation was derived by combining the fundamental equation for power law non-Newtonian flow through the cake with the equation of continuity and solved numerically using the Runge–Kutta method. As a model solid/liquid mixture, cellulose powder mixed with an aqueous solution of sodium polyacrylate was used. The mixture was preconsolidated under a constant pressure ps1, resulting in a homogeneous cake of thickness L1. Then it was expressed under a constant pressure p. The time course of the thickness L of the sample was measured. $L\infty$ is the final thickness of the compressed cake. The agreement between calculated and experimental Uc was satisfactory when the creep effect was considered.

**ID: BER007**

**Title: EFFECT OF ADDITION OF IRON NANOPARTICLES ON BACTERIAL GROWTH KINETIC DURING BIOGAS PRODUCTION**

**Ainul Husna Abdul Aziz and Nurul Sakinah Engliman**

Abstract: Utilization of fossil fuels produces greenhouse gases which will deteriorate the environment. Intensive research had been done to substitute the fossil fuels into more sustainable and clean energy sources. Biogas is one of the prominent alternative energy that can be used in the future since it is combustible in engines and does not produce any harmful by-products that are harmful to the environment. There are many factors affecting biogas production and one of it is the addition of micronutrient. The presence of micronutrient in anaerobic fermentation is important as it is able to stimulate the enzymatic reaction and thus, enhance the biogas production. Therefore, this study is aimed to find the suitable micronutrient in the form of nanoparticles and also to determine the optimum concentration that is able to enhance the biogas production using mixed culture bacteria. All the collected data provided from the experiments was used for kinetic modelling using Monod and Gompertz model in order to find the maximum biogas production as well as μ. The results showed that iron nanoparticles was the best micronutrient that can enhance the biogas production when the optimum concentration was at 150 mg/L, where it gave the highest volume of biogas production at 247 mL after 72 hours of fermentation. The kinetic modelling showed the relation between the biogas production and bacterial growth with μ_max for this system was 0.056 s^(-1)under Monod model while for Gompertz model, it is suggested that the maximum biogas produced, P_max was 237 mL with the maximum production rate of 15.11 mL/h for this system. The results from the kinetic models can be used for scaling up purpose in order to improve the production yield and cutting operational cost.

**ID: BER008**

**Title: SOLID-STATE BIOCONVERSION SYSTEM TO PRODUCE MYCO-COAGULANT FOR WATER TREATMENT**

**Maroua Fellah, 1Md.Zahangir Alam, Abdullah Al-Mamun, Nassereldeen Ahmed Kabbashi, Nurul Sakinah Binti Engliman**

Abstract: Water pollution is one of the major problems that threaten the whole world. Rivers suffer from high turbidity and suspended solids which is conventionally removed by adding a chemical coagulant. However, chemical coagulants are hazardous to the environment and can cause health issues to a human being. Therefore, this research focuses on producing Myco-coagulant (MyCoag) from fungus by developing a solid-state bio-process system. To produce the MyCoagulant, the fungus was grown on different solid-state media which are cocopeat, sawdust, rice bran, and Palm kernel cake for 7 days. Therefore, the myco-coagulant was extracted from the biomass using buffer solution pH7. Then the supernatant which is considered as the main Myco-coagulant was collected from the biomass and applied to test its efficiency in removing turbidity from kaolin suspension by using the jar test apparatus. The myco-coagulant extracted from cocopeat showed a good flocculating rate in kaolin suspension by reducing the turbidity from 736 NTU to 28.20NTU about 96.16% as compared to other substrates. Based on these findings, there is a potential to produce Myco-coagulant, form fungus using a solid-state bio-process system. Hence, in this study, it is expected that further optimization of the process parameters will lead to getting an efficient myco-coagulant in removing turbidity and sediment solids from river water.

**ID: BPM001**
**Title: Microencapsulation of Acalypha indica Linn extracts using Chitosan-PCL for drug delivery**
**Maizatul Akmal Johari, Fathilah Ali, Azlin Suhaida Azmi and Jamarosliza Jamaluddin**

Abstract: Drug delivery is one of the major applications of biodegradable polymer science. Chitosan is a non-toxic and naturally biodegradable polymer. It is soluble in acidic aqueous media and insoluble in higher pH media. Chitosan has been modified to improve its properties such as stability and the modified derivatives have been widely used in many applications especially for drug delivery. Selection of the compatible polymer is important to ensure the system can well cooperate with Acalypha indica extract and biocompatible with human body system. There are several methods of copolymerization. In this study, blending technique will be used whereby it involves the mixing of chitosan with other polymer and the polymer use in this study will be Polycaprolactone (PCL). The aim of this study is to design a chitosan-PCL copolymer for the encapsulation of Acalypha indica active compounds for drug delivery by using emulsion-solvent evaporation technique. Acalypha indica often considered as common shrub in a garden but the benefits of this plant has been recorded in Ayurvedic medications and scientifically proven. Hence, the crude extracts have been extracted and the phytochemicals inside the crude extracts are less stable in nature. These active compounds need to be encapsulated to stabilize them as well as delivered well into the targetted body system. In this experiment, 0.2% w/v of Chitosan and PCL were used. The encapsulated crude extract of Acalypha indica ¬with chitosan-PCL copolymer were characterized using scanning electron microscope (SEM) to verify the formation of microencapsulation.

**ID: BPM002**
**Title: PREPARATION AND CHARACTERIZATION OF LIGNIN FROM OIL PALM EMPTY FRUIT BUNCHES (OPEFB) FOR 3D PRINTING BIO-COMPOSITES MATERIAL**
**Mohammad Shahrizad Pairon and Fathilah Ali**

Abstract: Malaysia is the second largest contribution towards the production of crude palm oil worldwide. As the most consumed edible oil, crude palm oil gained high demand in Asia, European Union (EU) and United States (US). High production of crude palm oil had resulted in the huge production of agricultural waste in Palm Oil industry. Oil palm empty fruit bunches (OPEFB) was the largest fraction of solid waste produced compared to mesocarp fibre and palm oil shell. The slow degradation of OPEFB could cause the production of leachate and the release of unpleasant smellsintothe environment. Hence, lignin from the lignocellulose structure in OPEFB could be used as filler in the production of bio-composite materials. The lignin could be reinforced into additive material, such as polylactic acid (PLA) in 3D printing to increase the mechanical properties. 1,4-Dioxane is one of the extraction solvents used to extract lignin from lignocellulose biomass but never been tested on OPEFB. 1,4-Dioxane with high selectivity towards the lignin linkage is used to dissolve the lignin from the cellulose and hemicellulose in OPEFB. This study aims to extract lignin from OPEFB using 1,4-Dioxane with the presence of hydrochloric acid (HCl) as acid catalyst. The removal of the extractives will be done by cold distilled water and cold

ethanol:benzene before proceed with the extraction of lignin. Purification and separation process will be done by concentration and precipitation to remove the extraction solvent. The micrographs from optical microscope show the removal of most of the soil in OPEFB. The acidity in cold distilled water and cold ethanol:benzene indicate the removal of extractivesin the OPEFB. Scanned electron microscopy (SEM) micrographs show the smooth surface of OPEFB become rough with the formation of pores after the extraction of lignin from OPEFB. Fourier test Infra-red (FTIR) spectrograph confirms the presence of aliphatic hydroxyl, methoxyl and phenolic groups in the chemical structure of the extracted lignin.The presence of the functional groups indicates the lignin has been extracted from the OPEFB and can be used as filler in PLA as 3D printing bio-composite material.

**ID: BPM004**

**Title: INFLUENCE OF ISOCYANATES ONBIODEGRADABLE POLYLACTIC ACID-PALM OIL BASED POLYURETHANE FILM**

**Nur Izzati Mohd Razali, Fathilah Ali, Azlin Suhaida Azmi, Tuan Noor Maznee Tuan Ismail**

Abstract: Plastic has been a part of human life since its discovery and subsequently, the excessive usage of plastic has increased the pollution rate globally. In the light of this issue, the usage of polyurethane (PU) in various industries has cause the unavoidable PU pollution of in daily life. Therefore, producing biodegradable PU are very in demand. PU is synthesizable through a reaction between a prepolymer, isocyanate and polyol. In PUs polymer chain, isocyanate will become the hard domain of the polymer whereas polyol will become the soft domain of the polymer. Hence, in order to produce PU that are flexible enough to be used as a packaging material, the types of isocyanates used will be a contributing factor to PU flexibility. In this study, three types of isocyanates were used, which were 2,4-toluene diisocyanate (TDI), 4,4'-diphenylmethane diisocyanate (MDI) and 1,6-hexamthylene diisocyanate (HDI). Both TDI and MDI are from aromatic group whereas HDI is from aliphatic group. Palm oil polyol was used as the polyol in the PU synthesis since palm oil polyol is a part of biodegradable resources. PU was synthesized through conventional heating method, as reported by other studies. The effects of different isocyanates of PU films were studied. The results of this study will pave a way in biodegradable PUs synthesis using sustainable resources (palm oil polyol).

**ID: BPM005**

**Title: MICROBIAL CHITOSAN THIN FILM FROM PALM OIL MILL EFFLUENT FOR POTENTIAL APPLICATION AS NOVEL TACTILE SENSOR**

**Alia Tasnim Hazmi, Farah Ahmad, Maziati Akmal Mohd Hatta, Aliza Aini Md Ralib**

Abstract: Piezoelectric is mainly used as energy harvester and as a sensor. Many materials, organic and non-organic, can induced piezoelectricity as long as the crystalline structure is non-centrosymmetric. For renewable and biodegradable material, fungal chitosan is chosen as the piezoelectric material. However, there are many gaps in the fabrication of fungal chitosan thin films that can ensure good mechanical and piezoelectric properties. Thus, the research aim is to fabricate the fungal chitosan thin films and use it to detect the human

pulse. The cultivation of Aspergillus oryzae will be done using the palm oil mill effluent (POME) with suitable media composition to optimise the synthesis of chitin. The chitin will then be converted into chitosan through several processes. Using the fungal chitosan, the thin films will be produced and several analyses will be done to study the properties of the films. The chitosan thin film will then be tested as a tactile sensor.

**ID: BPM006**

**Title: DEVELOPMENT OF FORMULATED ENZYMES FOR HIGH YIELD OIL PALM EXTRACTION PROCESS**

**Sonia Hadj Arab**

Abstract: Today, the oil palm industry in Malaysia has grown rapidly and has shown massive contribution to economic growth. Knowing the potential of palm oil has in several industries, this research aims to optimally extract the bio oil from palm fresh fruit bench with a high yield using specific formulated enzymes. The rapid development of this industry has led to serious consequences on the environment, especially causing water pollution. For this reason, a specific technique will be selected using green process for extraction and most important is to enhance the yield extracted using aqueous enzymatic extraction process and this will be followed by immobilization of this enzymes via Cross-linked Enzyme aggregate (CLEA) technology for further stabilization. It is pertinent to maximize the extraction yield and to optimize the extraction process. For that matter, One-Factor-At-a-Time (OFAT) strategy will be first carried out to determine the maximum values of the process parameters, and this will be followed by adopting a Face Centered Central Composite Design (FCCCD) strategy under the Response Surface Methodology (RSM). After the optimum enzymatic oil palm extracted with high yield, characterization of this palm oil is important to determine its applications in different industrial fields.

**ID: BPM007**

**Title: OIL SORBENT FROM USED ENGINE OIL AND STYROFOAM**

**Yusilawati Ahmad Nor and Muhammad Aidith Mohd Nasir**

Abstract: The development of a countermeasure to oil spillage on water surface has gained researchers' interest worldwide. In Malaysia, particularly in Selangor oil polluted water issue has becoming a biggest concern to the government and the people. The oil sorption method using activated carbon pellet was choosing among the approach for the treatment due to its excellent eco-friendliness, cost-effective, feasibility, and universal applicability. However, there is still a demand to develop efficient and low-cost oil adsorbent which are environmentally friendly and can be easily produced on a large scale. Among others, oleophilic and hydrophobic are important characteristics of oil sorbent which determine the efficiency of the sorbent material. Thus in this study, oil sludge from waste engine oil (WEO) and Styrofoam which is known to have such characteristics at large availability and no cost was investigated as potential oil sorbent material. In this regard, carbon residue from WEO was formed into pellet using resorcinol formaldehyde (RF) binder to obtain porous structure before it was further coated with Styrofoam to obtain porous carbon-Styrofoam pellet (PCSP). The process parameters were optimized using Design Expert software 7 to obtain

pellet with highest oil adsorption capacity of 150% of the pellet weight at 700℃ carbonization temperature, 90% carbon sludge and 15% Styrofoam. The analysis result confirms that the PCSP possess macroporous structure and hydrophobic properties needed to function as good oil sorbent material. This study opens up the potential approach to develop efficient oil sorbent material which are environmentally friendly, cheaper and can be easily produced on a large scale using environmental waste of WEO and Styrofoam.

**ID: BPM008**

**Title: OPTIMIZATION AND KINETICS STUDY OF RECOMBINANT COLLAGEN-LIKE PROTEIN PRODUCTION IN 2 L BIOREACTOR AND SCALE-UP STUDY**

**Abeir Hussein Mohamed Gameil, Prof. Dr. Faridah Yusof, Dr. Azlin Suhaida Azmi, Dr. Noor Illi Mohamad Puad**

Abstract: Collagen is an indispensable biopolymer in food, pharmaceutical, and biomedical industries. This study is designed to explore the potential of the recombinant collagen-like protein of Rhodopsuedomonas palustris for a robust scaled-up production of the said protein. It is the general aim of this research to scale-up the production processes of recombinant collagen-like protein by optimizing the small-scale fermentation process parameters to optimize production of recombinant collagen-like protein from E. coli fermentation. Collagen-like protein from R. palustris will be expressed in recombinant E. coli (BL21) via a cold expression method using pColdII vector and IPTG as an inducer, in a 2 L bioreactor. Then, screening of seven process variables (using Plackett Burman Design) and optimization (using RSM) of selected factor levels for optimum yield will be conducted. This is followed by a kinetic study to model the process in the 2 L bioreactor. The fermentation will be up-scaled into a 7.5 L bioreactor by maintaining the oxygen transfer rate (constant kLa) and constant impeller tip speed. The protein obtained via homogenization and aqueous two-phase purification will be characterized through circular dichroism spectroscopy, and trypsin digestion. It is expected that high-yield production of collagen-like recombinant proteins will be obtained from E. coli fermentation in both 2 L and 7.5 L bioreactors, with no significant differences between the two bioreactor fermentations. Hence, the scale-up would be considered successful. The yields are expected to be comparable to 10 g/L yields of recombinant Scl2 protein for the 2 L scale. All experimental designs will be made by Design Expert software. Analysis of data will be carried out using the analysis of variance (ANOVA) method. There is a great deal of interest in obtaining recombinant collagen as an alternative source of material for biomedical applications. An optimized, scaled-up production of recombinant collagen-like proteins from E. coli fermentation will cater to this growing market demand, and provide Halal, non-immunogenic collagen-like proteins.

**ID: BPM010**

**Title: NOVEL COMPOUNDS AS POTENTIAL ANTI-DENGUE THERAPIES VERIFIED VIA INHIBITION OF HUMAN HEXOKINASE ISOFORM II**

**Suriyea Tanbin and Fazia Adyani Ahmad Fuad**

Abstract: Dengue is one of the most fatal diseases in the world, which is caused by dengue virus (DENV). It has been reported that a glycolytic enzyme, namely the human hexokinase

II (HKII) has a significant role in supporting viral replication in the host cell, thus the enzyme has been proposed as a drug target. The main aim of this research is to discover novel anti-dengue agents for the treatment of dengue infection through in silico screening and HKII enzymatic inhibition studies. Initially, potential inhibitors were screened from computational drug design experiments and evaluations of the potency of these compounds were executed through experimental work involving enzyme and DENV glycolytic enzyme inhibition assay. The selected compounds; such as chitin, 4R,5R-9-[(2S,3R,4S,5S)-3,4-dihydroxy-5-(hydroxymethyl) tetrahydrofuran-2-yl]-4,5-dihydro-1H-purin-6, 3-Fluoro-3-deoxy-D-glucopyranose and daidzin, which are the analogues of the original HKII ligands, exhibited effects on HKII's enzymatic activity, with remaining activities of 63.68%,70.42%,85.09% and 65.15%, respectively, compared to HKII's activity in the absence of any inhibitors. Among the mentioned inhibitors, chitin and daidzin have shown better inhibition, compared to the other compounds. Subsequently, these inhibitors were tested through viral inhibition assay using human Dermal Fibroblast cell infected with DENV-2 serotypes, where the multiplicity of infection was 0.5 (MOI). The cytopathic effect of the cell was observed after 48h of incubation period, where reduction of virus was measured using real time qRT -PCR method. Chitin has shown significant viral load of 3.249×105 cell/ml, which corresponds to 23.3% viral reduction with non-toxic effect at 32µM of inhibitor concentration, which correlated well with the earlier HKII inhibition assay. The rest of the inhibitors are under experiments. In conclusion, selected inhibitors that were obtained from virtual screening analyses have great potentials as potent HKII and DENV inhibitors, which can further be developed as future anti-dengue therapeutics.

**ID: BPM011**

**Title: Spore forming bacteria community with industrial potential at coastal area of Malaysian South China Sea.**

**Maya Dehimi and Prof. Dr.Faridah Yusof**

Abstract: The Southern South China Sea (SSCS) is an important interface between the terrestrial and marine ecosystems. In aquatic environments, bacteria are subjected to a variety of environmental factors such as intense temperature and salinity. The resistance to serious environmental factors is a major benefit in creating bacterial spores. This research involved analyses of water and sediment gathered from four stations at the Kuantan sea in Pahang, Malaysia, to determine the composition of microbial assemblies employing 16S rRNA. The physicochemical parameters were measured and reported to provide scientific data on this area. Thefindings of the study showed that the diversity of bacteria in sediment samples was much greater than in water samples. The distribution of microbial species in a water body is influenced by physicochemical parameters. Furthermore, genetic identification revealed the presence of staphylococcus warneriand other different types of Bacillus species.

**ID: BPM012**

**Title: OPTIMIZATION OF EXTRACTION OF SOLID COCONUT WASTE OIL USING ULTRASONIC-ASSISTED EXTRACTION**

**Ahmad Syahir bin Zaini and Sarina Sulaiman**

Abstract: Extraction of oil can be done in many ways of method which had been invented by researchers in their studies such as centrifugation, hot and cold extraction, enzyme

extraction and microwave extraction. Seeds, waste products and plants become sources for these oil extraction work. As compared with current oil extraction method (OEM), a new method is being introduced in present research to develop more effective processes which is ultrasonic-assisted extraction (UAE), where it has more advantages in term of time, cost, quality, safety and also it can be performed under ambient temperature. The usage of ultrasound to produce rapid movement of solvent is an effective extraction technique because it is resulting in a higher acceleration of extraction as well as mass transfer speed. Compared to other advanced extraction technique, UAE is more beneficials which more economical, convenient by reduction of time consumption, environmental-friendly, great oil quality and can be performed under ambient temperature. In this project, a series of compression and rarefaction waves caused in the molecules of the medium and the collapse of the bubble within the process under the acoustic cavitation ultrasound principle will be analysed. Experimental design of this project was analysed using Face-centeredCentral Composite Design (FCCCD) of Response Surface Methodology (RSM) with three parameters which are time (10, 20,30,40,60) (min), temperature extraction (30,40,50,60,70) (℃) and material to solvent ratio (1:1, 1:1.5, 1:2, 1:2.5, 1:3, 1:3.5) (g/ml). 47 min, 45℃ and 1:3.2 ratio was an optimal condition for this project.

**ID: BPM013**

**Title: IMPROVEMENT OF EMPTY FRUIT BUNCH (EFB) PELLET QUALITYWITH WASHING TREATMENT METHOD**

**Zaim Hadi Meskam, Maizirwan Mel, Fathilah Ali**

Abstract: Empty fruit bunch (EFB) is one of the largest residues of the palm oil industry, and it is being recognized as one of the most potential kinds of biomass for energy production in Southeast Asian and Malaysia is listed as one of the world largest supplier of palm oil. Despite the abundant resources of EFB, it still has several limitations in its use. It has been reported that, in combustion EFB in boilers, some compound evolving from abundant alkaline metals in EFB which is can causing fouling and corrosion problems to boilers. Within the potential of EFB as biomass sources, improvement of the physical on EFB convert in palletizing form and through pre-treatment to increase it quality.In addition, industrial energy usage was concern on high potassium content due to slag and fouling problem especially in biomass combustion power plant.However, its high moisture content (60%-70%) and bulky made it limitation to logistic, storage and handling problems. Based on our research finding, the potassium content can be removed by water treatment. Therefore, the experiment on washing treatment have been designed to shows the removal of alkali metal content in EFB. Various type of water such as distilled water, purify water, sea water, alkaline water and acidic water have been used to study the effectiveness of removal the potassium content. The result showed that the watertreatment in alkaline pH conditioncan remove metal ion such as potassium in Empty Fruit Bunch to produce high grade of solid fuel for combustion. However, the cost effectiveness of the washing treatment needs to be considered because the usage of water treatment is huge and effluent problems.

**ID: CAM001**

**Title: RECYCLED PET BOTTLES AND M-SAND AS FINE AGGREGATE REPLACEMENT IN CONCRETE FOR SUSTAINABLE CONSTRUCTION**

**AltamashuddinkhanNadimalla, Siti AliyyahMasjuki, Siti Asmahani Saad, and Maisarah Ali**

Abstract: Recycled PET Bottles are classified as non- biodegradable waste materials which also harmful to the environment and the M-sand is a by-product of the rock crushing process and has reported as a large amount of waste disposal in the landfill per year. These materials have a special characteristic to be used as fine aggregate replacement. This research aims to study the potential of recycled PET bottles with the incorporation of M-sand as fine aggregate replacement in concrete. Concrete Class 30 were produced with different percentage of (shredded PET bottles aggregates-0.5%, 1%, 1.5% & 2%),(M-Sand- 25%, 50%, 75% and 100%) and (1.5% proportion of shredded PET bottles aggregates were added to corresponding proportions of M-sand as stated above) in the concrete mix design. This mix design is referred from the Department of Environment (DOE) method, and the test specimen was cast for 7-days,28-days, and 90-days of curing. The performance of recycled PET bottles and M-sand concrete was investigated based on several experimental methods such as slump test, VeBe test, compaction factor test compressive strength test, flexural strength test, UPV test, and SEM test. Based on this research, It can be concluded that the strength of the concrete increase at an optimum value of shredded PET bottles and M Sand which is 75% of M Sand and 1.5% of PET but the strength drop down after it passes the optimum value. A novel empirical equation is proposed for the relationship between (slump, VeBe, and compaction factor) and also (compression strength, flexural strength, and UPV) for the shredded PET bottles and M-Sand based C30 concrete.A new empirical equation is proposed with the help of machine learning techniques and experimental data to predict the compression strength and flexural strength of concrete.

**ID: CAM003**

**Title: INVESTIGATION ON THE COMPATIBILITY OF WASTE COOKING OIL (WCO) FOR BINDER MODIFICATION AND ITS PERFORMANCE IN HOT MIX ASPHALT**

**Wan NurAifa Wan Azahar and Farah SalwanaKharuddin**

Abstract: Enormous Waste Cooking Oil (WCO) is illegally disposed into landfill directly without undergoing any proper treatment and induced undesirable impact to environment. Therefore, WCO recycling for binder modification considered as an effective waste management. However, common adverse effect when dealing with WCO is decrement trend of rutting resistance performance. It is related with soft modified binder which depicts the weakness of chemical bonding inside material. Hence, there is issue of chemical compatibility arise and interprets an assumption of incompatibility between these two materials, that should be further clarified. Strong justification for incompatibility issue is related with different polarity group interaction which never investigated yet. This research aims to identify fundamental parameter in affecting the incompatibility between WCO and asphalt binder. Laboratory work divided into four phases.In Phase 1, a preliminary compatibility properties test was conducted at two stages which consists of chemical analysis by using Gas Chromatography-Mass Spectrometry (GC-MS) based on the polarity group

identification (polar and non-polar) and different WCO quality parameter (acid value, water content and antioxidant). Therefore, the chemical treatment of WCO which is transesterification process is proposed to enhance the compatibility properties between materials in Phase 2. The modified binder incorporating with 0, 5, 10, 15 and 20% of untreated and treated WCO was tested for physical and rheological test (penetration, softening point and DSR) to determine the optimum percentage. The optimums untreated and treated WCOs were utilised for further mechanical performance evaluation of Asphaltic Concrete 14 (AC14) mixture, through resilient modulus, dynamic creep and indirect tensile strength (ITS) test in Phase 3. The microstructure observations were performed in Phase 4 to investigate the adhesion bonding between modified binder and aggregates in bituminous mixture by conducting Atomic Force Microscopy (AFM) andField Emission Scanning Electron Microscope (FESEM) test.Results showed that the incompatibility characteristic is revealed between untreated WCO and asphalt binder based on the identification of polar and non-polar compounds interaction. The rheological test indicates that the failure temperature of modified binder using treated WCO has increased to 70 oC which represents for increment of rutting resistance performance. In addition, treated WCO mixture recorded superior performance by being less susceptible to permanent deformation as compared to the control mixture due to the enhancement of adhesion bonding performance in treated WCO mixture based on the compacted structure arrangement through FESEM visualization.

**ID: CAM004**

**Title: RIVERBANK EROSION STUDY AT SUNGAI PUSU**

**Nur Aqilah Mohd Rosli and Saerahany Legori Ibrahim**

Abstract: Riverbank erosion is a major concerns in all parts of the world due to its extensive impacts geomorphologically and economically. This study aims to quantify the rates of riverbank erosion of Pusu River using erosion pins method. Two sections of the river were selected namedly site A and site B where site A is a straight section while site B is situated on the outside bend. 21 pins were installed at each site in a grid pattern. Measurement of erosion pins exposure were taken from February 2019 to April 2019. Field observation were made to identify the possible factors influencing the bank erosion. The average rates of bank erosion ranged between 0.05 cm/day to 0.21 cm/day at site A and 0.09 cm/day to 0.51 cm/day at site B. Bank failure occurred at site B towards the end of measurement period due to high flow after heavy rainfall event.Field observation suggest that rates of river bank erosion was influenced by several factors such as the flow velocity and vegetative cover of the bank. Suitable bank protections were recommended based on the rates of bank erosion obtained from the field.

**ID: CAM005**

**Title: STRENGTH CHARACTERISTICS OF GEOPOLYMER MORTAR CONTAINING WASTE PAPER SLUDGE ASH (WPSA)**

**Aida Nabila Jamaluddinand Siti Asmahani Saad**

Abstract: Ordinary Portland cement (OPC) is considered as an essential material in construction industries. Nevertheless, recently, production of this material is proven to discharge a huge amount of carbon dioxide (CO2) to the environment. In this regard,

researchers are working hard in order to find a sustainable solution to reduce the damage to environment due to construction activities. On the other hand, underutilisation of by-product materials i.e. waste paper sludge ash (WPSA) from paper milling industry is becoming an alarming issue nowadays. The by-product requires proper landfilling method to manage the disposal problem. One of the ways to solve this problem is by incorporating the WPSA into cementless concrete, which is known as geopolymer concrete.The geopolymer technology is seen to be a good alternative to reduce those problems as well as to ensure sustainable construction material. In this technology, the WPSA is a unique and creative source material to replace the cement because it consists of a high amount of Aluminium (Al) and Silicon (Si) and reacts with the alkaline solution. However, past studies used WPSA as a partial replacement of cement in concrete production. Thus, this research proposed to investigate the fully used WPSA in the production of concrete as a geopolymer. The main objective of this research is to determine the microstructure and mechanical characteristics of WPSA in geopolymer mortar. In this research, the materials involved are WPSA, sand, and the alkaline solution. The WPSA is the end product of the paper milling process. The WPSA must have a high amount of Al and Si and the ratio of Si: Al must be 2 to ensure the suitability of it to replace the cement. Then, the alkaline solution containing the 6M of sodium hydroxide (NaOH) and sodium silicate (Na2SiO3) was used to activate the WPSA as a binder material in geopolymer mortar. After that, the Si-O and Al-O functional group must be presented to ensure the polymerisation process occurred in the WPSA based geopolymer. The geopolymer mortar is cured in an electronic oven for a day at various temperatures which are 24ºC, 60ºC, and 90ºC, and then placed under room temperature until the testing days. The heat-cured process helps the geopolymer mortar to have good mechanical properties. The development of the compressive strength was measured when the age of mortar achieved 7, 14, and 28 days. Hence, the WPSA is an excellent substituent for cement to reduce pollution. This is the best way to make sure that the concrete industry is more competitive in using the combination of waste materials with natural materials.

**ID: CAM007**

**Title: NON-DESTRUCTIVE EVALUATION OF RIGID PAVEMENT USING SPECTRAL ANALYSIS OF SURFACE WAVES (SASW)**

**Nur Aina Farahana Abdul Ghani , Norfarah Nadia Ismail, Nur Izzi Md. Yusoff, Nadiah Md. Husain, Wan Nur Aifa Wan Azahar, Tengku Iman Arifah Tengku Ibrahimim**

Abstract: Rigid pavement evaluation is a significance step in maintenance and rehabilitation (M&R) process. However, this process usually employs method that is not only destructive, but also costly and labor intensive. The most common procedure done is coring, which involves drilling of the rigid pavement structure. Thus, this study is trying to employ a non-destructive in-situ method to evaluate the rigid pavement. This method, namely Spectral Analysis of Surface Waves (SASW) is used to establish the modulus profiles of the pavement and to develop the subsurface profiles of the rigid pavement. The measurement configuration employs usage of two receivers and a source. It is also dependent on stress wave theory that spreads through elastic elements and Rayleigh wave movements monitoring. A series of transient impact sources with a range of frequencies and its capability of scattering over the surface layer of the pavement are used to produce the Rayleigh wave energy. By generating and measuring surface waves, a plot with surface wave velocity against wavelength and a dispersion curve can be built. The Young's modulus versus depth can detect the properties

of pavement-layer. The SASW method is proven to reduce the labor and cost, while providing fast and reliable result for rigid pavement evaluation.

**ID: CAM008**

**Title: FLOW-3D CFD MODEL OF BIFURCATED OPEN CHANNEL FLOW**

**Nur Adani Adnan, Izihan Ibrahim and Saerahany Legori Ibrahim**

Abstract: Bifurcation is a morphological feature present in most of fluvial systems; where a river splits into two channels, each bearing a portion of the flow and sediments. Extensive theoretical studies of river bifurcations were performed to understand the nature of flow patterns at such diversions. Nevertheless, the complexity of the flow structure in the bifurcated channel has resulted in various constraints on physical experimentation, so computational modelling is required to investigate the phenomenon. The advantages of computational modelling compared with experimental research (e.g. simple variable control, reduced cost, optimise design condition etc.) are widely known. The great advancement of computer technologies and the exponential increase in power, memory storage and affordability of high-speed machines in the early 20th century led to evolution and wide application of numerical fluid flow simulations, generally referred to as Computational Fluid Dynamics (CFD). In this study, the open-channel flume with a lateral channel established by Momplot et al (2017) is modelled in Flow-3D. The original investigation on divided flow of equal widths as simulated in ANSYS Fluent and validated with velocity measurements, was to distinguish two prevailing turbulent structures in the lateral channel, i.e. standard 2D recirculatory and 3D helical. The resulting linear function relating Froude number with aspect ratio is now tested with Flow-3D. Initial model results when compared with experimental data of Momplot et al (2017) are encouraging. Simulated flow patterns exhibit the two distinct structures identified in the earlier work. Further work, i.e. to refine the comparisons and produce consistent visualizations, is ongoing towards achieving the objectives of this research.

**ID: CN001**

**Title: SIMULATION ANALYSIS OF A MOBILE PRODUCER'S IMPACT ON CONNECTIVITY AND SCALABILITY IN NDN ENVIRONMENT**

**Zaharadeen Ahmed, Aisha Hassan Abdalla Hasim, Othman O. Khalifa, Huda and Adiba M. Ramli**

Abstract: Named Data Networking is a new content centric network architecture that can possibly overwhelm most issues of IP mobility and security. NDN approach is commonly identified under Information Concentric Network or Content Concentric Network and is centered on addressing contents by themselves using names, rather than assigning IP addresses to packets on hosts where information is located on the global Internet. Mobility management scheme (Mobile Producer - Named Data Networking MP-NDN)is proposed with improved network connectivity and scalability for the mobile producer during and after inter-technology handoff. This is achieved by using rendezvous-based mobility management approach.For network connectivity, anchorless (locator-free) approach is used for producer's connectivity during handoff for intra and inter access point change over. This ensure mobile producers' registration and location update as it successfully achieves mobile handoff within an outside the network core. For network scalability, the number of rendezvous server is

increased for each simulation scenarios of pull, push, upload and share to ensure traffic redistribution and by integrating scenario aware algorithm with the proposed scheme. ndnSIM2.1 and Python 3.8 in Linux environment are used,and random way point movement model is selected in term of producer movement. In simulation, an output for throughput of link_1 and link_2, congestion window and round-trip time are presented. However, In analytical approach, handoff delay (based on moving speed and link delay), packet loss (based on moving speed and link delay) and signalling cost (based on location update cost, binding update cost and packet delivery cost) is computed for number of data stream per rendezvous. The result is compared with (Producer Mobility Support Scheme – PMSS) and (tracing-based producer mobility support solution in NDN – KITE).

**ID: CN002**
**Title: SMART VIRTUAL COGNITIVE BEHAVIORAL THERAPY WITH SPOKEN DIALOG SYSTEMS SUPPORT**
**Ayesheh Ahrari Khalaf, Prof. Aisha Hassan Abdalla Hashim, Assoc. Prof. Dr. Rashidah Funke Olanrewaju and Dr. Akeem Olowolayemo**

Abstract: Since the invention of computers, one of the biggest goals and desire of researchers and engineers is to be able to have a natural dialogue between humans and machines. Therefore, Artificial Intelligence (AI) was introduced with natural language processing and natural language generating. Interactive conversational systems are concerned as the fastest-growing areas in AI. Many companies used these technologies to establish different kinds of Virtual Personal Assistants(VPAs) such as Google Assistant, Amazon Alexa, Apple's Siri amongst others. But even though a lot of chatbots have been introduced through the years to diagnose or treat psychological disorders, we are yet to have user-friendly bot available. In this research, up-to-date technologies in VPAs are used such as voice recognition, Natural Language Understanding (NLU), text-to-speech with Mental State Classification (MSC) algorithm to develop a virtual cognitive behavioral therapy app. A smart virtual cognitive behavioral therapy with spoken dialog systems support is developed. This app can diagnose the level of depression and suggest treatment to the users using a conversational user interface which makes it a noble iOS therapy app with interactive voice response systems.

**ID: CUT001**
**Title: DEVELOPMENT OF INTERACTIVE AUDIO SYSTEM FOR HELPING BLIND AND VISUALLY IMPAIRED STUDENTS TO READ TACTILE GRAPHICS MATERIALS**
**Muhammad Ikmal Hakim Shamsul Bahrin and Hazlina Md Yusof**

Abstract: Blind and visually impaired people use tactile graphics to access visual information. They are important for STEM (Science, Technology, Engineering and Mathematics) subjects, orientation and mobility. Tactile graphics can be explored using touch senses but due to physiological limitation of the fingertips, it is very challenging to understand the perspective, size relationships and related abstractions via touch. Not only that, blind and visually impaired people need assistant to interpret and describe the content of the tactile graphics. Unfortunately, help is not always there for them especially at home. The effective and preferable solution is the audio tactile graphics system. Therefore, we are

proposing an interactive audio tactile graphics system based on computer vision system to provide more interactive and guided reading session for the blind and visually impaired students. This could also reduce time to examine and synthesis every components of the tactile graphics and give more motivation to gain knowledge. Not only that, the system could also facilitate the gap existed from the teacher's perspective in special education.

**ID: CUT002**
**Title: 3D FACE ANALYSIS USING DEEP NEURAL NETWORK MODELS**
**Ahmed Rimaz Faizabadi and Dr. Hasan Firdaus Bin Mohd Zaki**

Abstract: The machine vision is going to be a critical part of IR 4.0. Many vision applications require face analysis and recognition. The deep learning technology driven by improvement in computer hardware and algorithms and the availability of large datasets provides the thrust for the advancement in visual recognition. The 2D methods for machine vision are writhe from several limitations such as Parallax, Depth of focus, Ambient light, Variations in contrast, and prone to adversarial attacks. The 3D face recognition is very promising to deal with Pose, Illumination, Expression (PIE), Occlusions and can be suitable for unconstrained environments. However, the 3D data are highly irregular, like point cloud and mesh. The non-grid, like structures of 3D data, affect the performance of deep networks. The 3D data need conversion through quantization or Multiview images. The conversion of data results in large memory requirements, heavy computations and loss of information present in 3D data. This research aims to develop a novel and efficient point cloud based deep neural network model for 3D face recognition that directly consume point clouds for recognition. The model should be trained and tested on a large 3D facial dataset and must be sensitive to biases. A specialized, extensively trained deep learning-based network for 3D face recognition that works effectively in an unconstrained environment is the expected outcome of this work. It can be a cornerstone of a plethora of visual recognition applications.

**ID: CUT003**
**Title: DEVELOPMENT OF A DRIVER DROWSINESS MONITORING SYSTEM USING ELECTROCARDIOGRAM**
**Nur Shahirah Nor Shahrudin and Assoc. Prof. Dr. Khairul Azami Sidek**

Abstract: Driver drowsiness has become a common issue that leads to road accidents and death. Accidents not only affect the physical body of the driver, but it also affects people in the surrounding, physical road conditions, and environments. It is proven in previous studies that biological signals are closely related to a person's reaction. Electrocardiogram (ECG), which is an electrical indicator of the heart, provides such criteria as it reflects the heart activity. Morphological signal of the heart is strongly correlated to our actions which relates to our emotions and reactions. Thus, this study proposed a non-intrusive detector to detect driver drowsiness by using the ECG. A total of 10 subjects were obtained from The Cyclic Alternating Pattern (CAP) Sleep database. The signals are later processed using low pass Butterworth filter with 0.1 cutoff frequency. Then, QRS complexes are extracted from the acquired ECG signal. Classification techniques such as RR interval and different of amplitude at R peak were used in order to differentiate between normal and drowsy ECG

signal. Cardioid based graph was used to support the argument made in analyzing area and circumference of both normal and drowsy graph. The result shows that RR Interval of a drowsy state increased almost 22% rather than in normal state. The percentage different of amplitude difference at R peak between normal and drowsy state can reach up to 36.33%. In terms of cardioid, area, perimeter and Euclidean distance of the centroid are always higher than drowsy. Thus, from the outcomes that been suggested for drowsiness detection using RR interval and amplitude of R are able to become as the most efficient drowsiness detection.

**ID: CUT004**
**Title: DRIVER DROWSINESS DETECTION USING DIFFERENT CLASSIFICATION ALGORITHMS**

**Nur Shahirah Nor Shahrudin and Assoc. Prof. Dr. Khairul Azami Sidek**

Abstract: Capability of electrocardiogram (ECG) signal in contributing to the daily application keeps developing days by days. As technology advances, ECG marks the possibility as a potential mechanism towards the drowsiness detection system. Driver drowsiness is a state between sleeping and being awake due to body fatigue while driving. This condition has become a common issue that leads to road accidents and death. It is proven in previous studies that biological signals are closely related to a person's reaction. Electrocardiogram (ECG) is an electrical indicator of the heart, provides such criteria as it reflects the heart activity that can detect changes in human response which relates to our emotions and reactions. Thus, this study proposed a non-intrusive detector to detect driver drowsiness by using the ECG. This study obtained ECG data from the ULg multimodality drowsiness database to simulate the different stages of sleep, which are PVT1 as early sleep while PVT2 as deep sleep. The signals are later processed in MATLAB using Savitzky-Golay filter to remove artifacts in the signal. Then, QRS complexes are extracted from the acquired ECG signal. The process was followed by classifying the ECG signal using Machine Learning (ML) tools. The classification techniques that include Multilayer Perceptron (MLP), k-Nearest Neighbour (k-NN) and Bayes Network (BN) algorithms proved to support the argument made in both PVT1 and PVT2 to measure the accuracy of the data acquired. As a result, PVT1 and PVT2 are correctly classified as the result shown with higher percentage accuracy on each PVTs. Hence, this paper present and prove the reliability of ECG signal for drowsiness detection in classifying high accuracy ECG data using different classification algorithms.

**ID: CUT005**
**Title: A REVIEW OF ECG DATA ACQUISITION FOR DRIVER DROWSINESS DETECTION**
**Nur Shahirah Nor Shahrudin and Assoc. Prof. Dr. Khairul Azami Sidek**

Abstract: Over the years, cases related to road accidents and road fatalities keeps increasing. Both cases have potential to put life of a person at risk. One of the factors that leads to accidents are drowsiness. However, several lives can be saved with accurate and reliable drowsiness detection system. Thus, many researchers take this issue seriously by developing drowsiness detection mechanism in reducing cases related to driver drowsiness. As drowsiness is strongly correlated with the heart activities, hence bio-signal is the most

preferable indicator to measure the drowsiness level. Reflection of electrical signal in the human body known as Electrocardiogram (ECG) are widely used in monitoring human action and reaction to prevent the occurrence of these devastating incidents. Thus, this paper will review the drowsiness detection technique focusing on ECG data acquisition for driver drowsiness detection. As the first step plays an important role for the whole system, this paper discussed on some open issues in drowsiness mechanism. We hope that this review will support and give some ideas to the future researchers in increasing the reliability of ECG measures towards driver drowsiness detection in reducing accident cases.

**ID: CUT006**

**Title: SIMPLE TOUCH SENSOR BASED GAME AS AMBIENT ASSISTIVE DEVICE FOR MILD AUTISM SPECTRUM DISORDER CHILDREN.**

**Sarah Afiqah Mohd Zabidi, Hazlina Md. Yusof and Sukreen Hana Herman**

Abstract: As of today, children diagnosed with Autism Spectrum Disorder (ASD) are becoming an increasingly common occurrence in our schools and society, this trend is also increasing the need to develop assistive devices for ASD children. This paper shows the development of a system that was designed to help children with ASD. This Arduino-based device is in the form of an interactive game and is equipped with common components such as touch sensor, MP3 player and LEDs to increase replicability. A research was done based on the Early Intervention module to develop a game that could help improve cognitive skill of ASD children. Early Interventions for children with ASD has been proven to help in improving ASD symptoms. This simple interactive game using touch sensor was designed to focus on helping ASD child improve their cognitive skills.

**ID: CUT007**

**Title: STUDY OF THE EFFICACY OF EMOTION-BASED ROBOTIC SYSTEM IN EARLY INTERVENTION TRAINING IN AUTISM SPECTRUM DISORDER (ASD) CHILDREN.**

**Sarah Afiqah Mohd Zabidi and Hazlina Md. Yusof**

Abstract: Autism Spectrum Disorder (ASD) is a pervasive neurodevelopmental disorder that is characterized by difficulties with social and communicative functioning, restricted interests, repetitive behavior, and sensory deficits. The cost of ASD intervention is tremendous with huge individual and social consequences. Among the symptoms of ASD are difficulties to focus that leads to difficulties in learning. In recent years, robotic systems have been introduced with considerable success for ASD intervention because of their potential to engage children with ASD. Thus, the objective of this project is to investigate the current teaching method used by the autism therapists and solve the weaknesses via robotic means. This project focuses on developing a robotic system as part of the affect-sensitive robotic assisted rehabilitation platform for that will be substantial help for ASD children using facial thermal imaging as input. The system has the ability to complement therapists to reduce the complexity of ASD child emotion using a closed-loop HRI framework with affective state cues and emotion-based learning pedagogy features to improve their engagement skills. The robotic system setup will be programmed to suit different training tasks. Inputs from classified subject's subcutaneous face temperature and emotional based teaching pedagogy modules will determine the robot’s engagement with the

child. The setup will be adaptive to the changes of emotional states and training tasks. To date, no work has been done to investigate the real-time modification of robot behaviour in human-robot interaction framework which adapts to the emotional state of the subject and corresponds to the current emotional state.

**ID: DC001**
**Title: THE EFFECT OF COEFFICIENT OF FRICTION BETWEEN RAIL VEHICLE WHEELS AND RAIL TRACK ON OPERATION POWER CONSUMPTION**
**Nur Shahibrahim Bin Mahamudin and Fadly Jashi**

Abstract: Many researches have been conducted in rail operation and engineering area, as with the objective to reduce energy consumption in rail operation, in order to fully optimize daily energy consumption. Energy consumption in rail operation can be divided into 70% traction power such as vehicle propulsion system and 30% non-traction power such as station electrical consumption. Many researches have already been carried out on advance traction system such as regenerative breaking storage system, hybrid battery and others, however very few of them concern towards track condition and maintenance plans. This research will focus on the interaction between the rail vehicle wheels and the rail track and how the coefficient of friction between these two affects the rail operation power consumption. As rail grinding is an important rail preventive maintenance to improve track surface, indirectly coefficient of friction is expected to improve that may result in reduce of rail operation power consumption. Tractive losses or resistance can be summarise in Davis equation, mathematical model that being use in rail industries to find train performance and design feature.

**ID: DC002**
**Title: DESIGN AND REALISATION OF A NANOSATELLITE FOR MALAYSIA SISWASAT COMPETITION 2020**
**Muhammad Syukri bin Johari, Nurul Najihah binti Bakar, Mai Nurul Fareesya binti Mohamad Anuar, Muhammad Saalihaan bin Zil Kamal, Nur Aqilah binti Azman Shah, Chen Lijun, Kamal Hazim bin Kamal Bahrin, Hariz Azamuddin bin Shafie, Mohamad Nurmirza Asyraaf bin Sulong and Mohamed Okasha**

Abstract: This study provides the conceptualization and the development of IIUMSAT-2, a nanosatellite that is designed by a group of undergraduate engineering students from International Islamic University Malaysia (IIUM) to simulate actual satellite ability in space. This nanosatellite is built for the Malaysia SiswaSAT Competition 2020, organized by the Malaysian Space Agency (MySA) and the Ministry of Science, Technology and Innovation (MOSTI) Malaysia to provide the opportunity for local students to experience hands-on space projects at low costs. In this study, the broad mission objectives, quantitative needs, and requirements for the can-sized satellite (CANSAT) are defined to satisfy the competition criteria. Furthermore, mission software & hardware architectures, as well as system drivers are described to allow the assessment of the CANSAT's performance. IIUMSAT-2 is capable of simulating the actual satellite ability in space. It is able to transmit telemetry data such as the surrounding temperature, pressure, altitude, humidity, and carbon concentration

to the ground station during the descent phase. Additionally, attitude sensors, GPS module, and on-board camera are integrated in the system to monitor the physical behaviour of IIUMSAT-2. The systems are divided into smaller subsystems such as Payload Subsystem, Communication & Data Handling Subsystem, Electrical Power Subsystem, and Mechanical Subsystem. These subsystems are integrated and it is monitored at the Ground Control Station. Designing a space mission requires a tool that provides systematic processes and procedures starting from conception until the end of the mission. This project adopts the Space Mission Analysis and Design (SMAD) approach. It is an invaluable tool for this project as it improves and shortens the preliminary mission design process by laying out the mission parameters and refinement of requirements in a timely manner at minimum cost and risk. To achieve the requirements, critical review, and analysis of CANSAT's projects in literature are explored. This allows one to overcome the difficulties, fill the gap and shortcomings, and achieve a successful mission.

**ID: HER001**

**Title: MACHINE LEARNING FOR FACIAL EXPRESSIONS DRIVEN REHABILITATION SYSTEM BASED ON STRETCHABLE SENSOR**

**Chowdhuy Mohammad Masum Refat and Dr. Norsinnira Zainul Azlan**

Abstract: Facial expression recognition (FER) allows computers to learn human emotions. Nowadays, the facial expression recognition system uses different applications such as self-driving cars, healthcare, and smart environments—most of the facial expression system based on computer vision and image processing technologies. However, computer vision technologies are quite expensive because they need a massive amount of memory and computation resources. Also, computer vision depends on the environment change. For example, if the environments are low light or dark, it cannot accurately detect facial expressions. However, sensor technologies overcome all the limitations, and it is cheap, low-power, wireless communication, high-capacity, and data processing. This study aims to developed facial expression recognition and classifications systems based on stretchable sensor data driving a rehabilitation system. Two different stretchable sensors (commercial and developed) are used for four facial expressions (Neutral, Happy, Sad, and Disgust) data collection. The stretchable sensor data is time-series data with noise and high dimensionality. The dataset will be normalized and aggregated to remove noise and high dimensionality. It will be processed as an input to the machine learning model, and then the model is compiled and fitted by five machine learning algorithms, including K- Nearest neighbour (KNN), Decision Tree (DT), Support Vector Machine (SVM), Logistic Regression (LR) and Random Forest algorithms. After training and testing, random forest algorithms perform better than other machine learning algorithms for stretchable sensor-based facial expression data. The random forest machine learning facial expression model is used for the elbow rehabilitation system, where the expression will drive the machine's movement. The simulation result shows that random forest commercial and developed stretchable sensor accuracy 96% and 90%. Offline hardware experiment with elbow rehabilitation system performance 93% and 83% for commercial and developed stretchable sensor data. Developed stretchable sensors are used in real-time hardware tests. Three test subjects overall real-time hardware accuracy is 74.99%. Elbow rehabilitation system shows

that the proposed methods successfully drive a robot system to behave according to the recognized facial expression. The proposed system will improve the rehabilitation system and enhance the treatment and improve patients' quality of life.

**ID: HER002**

**Title: PERFORMANCE-BASED ADAPTIVE MODULATION OF RESISTANCE IN HAND REHABILITATION USING A FINGER-EXTENSOR MECHANISM**

**Ifrah Shahdad and Norsinnira Zainul Azlan**

Abstract: In order to encourage active participation from patients in robot-aided therapy, control algorithms provide minimal assistance by triggering assistance based on patient participation. However, such control strategies especially the assist-as-needed ones, fail to account for changes in patient performance within a single exercise session as assistance is modulated on a session-session basis. This leads to a slacking response from the patient which impedes recovery. In this research, performance-based online modulation of resistive force is proposed to be carried out using the impedance control scheme. Implementation of the scheme would take place on a 1 Degree of Freedom Finger Extensor mechanism for hand rehabilitation. Since the performance of the patient will be taken into account, the resistive force applied on to the patient's hand during open-close exercises, would be modulated in real-time by the developed controller, based on the reaction force exerted by the patient on to the robot. Thus, patients with a greater residual force will have to fight a greater resistive force opposing their motion and vice versa. An immersive virtual environment providing a depiction of the exercise on-screen would also be developed to complement the controller effort. The performance of the proposed controller would be evaluated through simulation and hardware experimentation. The proposed performance-based controller is expected to tailor robotic therapy to the individual patients' needs and increase patient engagement in rehabilitative exercises. Hence, consequently aid in restoration of hand motor function.

**ID: HER003**

**Title: RAINFALL INTENSITY-DURATION THRESHOLD INDUCED LANDSLIDE OCCURRENCES IN PENINSULAR MALAYSIA**

**Abdul Muaz Abu Mansor Maturidi and Norhidayu Kasim**

Abstract: High-intensity rainfall has been recognized as the triggering factor for the occurrence of the shallow landslide in Peninsular Malaysia. In addition, the geological, morphological, and hydrological features of this region contribute to the catastrophe as well. The disaster had claimed hundreds of lives and threatens the socio-economy and well-being of the civilians. Therefore, in order to mitigate the losses from this endless issue, it is necessary to develop an efficient landslide early warning system for estimating the upcoming soil slip events. Developing empirical rainfall intensity-duration (I-D) threshold is one of the mechanisms to predict the possibility of landslides in this region. By analysing the specific rainfall event that has triggered the historical landslides in Peninsular Malaysia, the important parameters that consist of rainfall intensity and rainfall duration will be extracted. Subsequently, the obtained parameters will be utilized to come up with the I-D threshold graph in the form of the scatter plot presented in logarithmic scale. By applying power-model

regression, the I-D threshold will be generated from the best fit line, and then being emulated and positioned at the lowest plot sample. The proposed empirical Intensity-Duration (I-D) threshold for Peninsular Malaysia has been figured out as I=81.44D-0.82 (I = rainfall intensity in mm/hr and D = duration in hour). Furthermore, to identify the formulation of the I-D threshold from other regions, a comparison has been conducted by identifying the I-D threshold proposed by various researchers around the globe, which shows a reasonably higher value for the I-D thresholds of Peninsular Malaysia. This trend occurs due to the fact that rainwater requires more time to adequately seep into the thick layer of soil that commonly existed in Peninsular Malaysia in order to trigger the slope failure. This developed I-D threshold could be implemented in the landslide early warning systems that enables the authority to disseminate the warning and conduct pre-emptive measures to evacuate the civilians in the affected area. But to achieve that, the developed I-D threshold must be incorporated with other rainfall parameters as well (e.g. cumulative antecedent, normalized rainfall) so that the susceptibility landslide model could be established and well-integrated to the warning and alert devices.

**ID: IMS001**
**Title: DEVELOPMENT OF FINGERPRINT THICKNESS BASED AUTHENTICATION METHOD UTILIZING NIR SPECTROSCOPY**

**Qamarul Aiman bin Tajul Ariffin and Nadzril Sulaiman**

Abstract: Fingerprint physiology makes it an ideal for biometrics authentication, primarily the tiny details located on its surface called minutiae. Fingerprint scanning systems are designed to detect minutiae. Images of detected minutiae are processed through matching algorithms in order to verify a query fingerprint that is identical to a stored fingerprint. However, fingerprint authentication based on minutiae can be easily bypassed and the need for a more secure method is required. With respect to the issue, this work explores the possibility of detecting the thickness of the skin layer within a fingerprint as a method of biometrics authentication. Current thickness measuring methods that are non-invasive for that task are identified as, Pyroelectric Sensor, Optical Coherence Tomography (OCT) and Near Infrared Spectroscopy (NIR). Of the three listed, this research believes NIRS as a promising method for authentication based on skin layer thickness.

**ID: IMS002**
**Title: TOWARDS AUTOMATED ENHANCEMENT OF LAPAROSCOPIC VIDEOS**

**Nouar AlDahoul**

Abstract: Laparoscopic videos are suffering from various distortions during the surgery which lead to loss of visual quality. These distortions have impact on a surgeon’s visibility and other related tasks such as segmentation and instrument tracking in robot-assisted surgery and image guided navigation systems. The distortions in a laparoscopic video are due to technical problems in the equipment or side-effects of the instruments such as smoke. To address these problems, most of the existing solutions rely on making some changes to the technical equipment using one of the many available troubleshooting options. The existing solutions are time-consuming and not robust enough. Therefore, automated video

enhancement systems are required to avoid previous problems. Identification of distortion is the main and important component in the feedback loop to enhance the video quality in real time. This research work aims to address this problem by developing a fast and accurate model for distortion classification as the first step towards designing a robust enhancement system. The results including classification accuracy and F1 score are promising and found to outperform state-of-the-art. Additionally, the model runs in real time with speed of 20 FPS.

**ID: IMS003**

**Title: LIDAR-BASED OBJECT RECOGNITION WITH NOVEL CLUSTERED EXTRACTION METHOD**

**Muhammad Rabani Mohd Romlay, Azhar Mohd Ibrahim and Siti Fauziah Toha**

Abstract: Low-end LiDAR sensor provides an alternative for depth measurement and object recognition for lightweight devices such as mobile robots and unmanned aerial vehicles (UAV). However, due to low computing capacity, complicatedalgorithms are incompatible to be performed on the device. Sparse information within the point cloud data further limits the feature available for extraction to be used as the input of the classification process. Therefore, it is necessary toconstruct a classification method which could receive sparse 3D point cloud data input, while providing ample leverage for the classification process to accurately differentiate objects within limited computing capability. To achieve reliablefeature extraction from sparse LiDAR point cloud, this paper proposes Clustered Extraction (CE) method for feature extraction followed by k-nearest neighbour (kNN) object classification process. In the proposed method, multiple geometry features that lie within distinctive clusters were computed at once based on individual centroid, prior to initialized kNN model trained for object classification. The integration of the CE and kNN algorithms enable us to utilize lightweight actuated LiDAR input and provides low computing means of classification while maintaining accurate detection. Based on genuine LiDAR data collected, experiments are conducted with processing steps of filtering, clustering and object classification. The final result shows reliable accuracy with 84% prediction through the fusion of CE-kNN algorithms proposed.

**ID: IMS004**

**Title: OPTIMAL PIEZOELECTRIC SHUNT DAMPER USING ENHANCED SYNTHETIC INDUCTOR FOR STRUCTURAL VIBRATION CONTROL**

**Azni Nabela Wahid and Nazri Suhaimi**

Abstract: Piezoelectric material has the ability to convert mechanical energy to electrical energy and vice versa which makes it suitable as an actuator and sensor. When used as a controller in sensor mode, the piezoelectric transducer is connected to an external electrical circuit where the converted electrical energy will be dissipated through Joule heat; also known as piezoelectric shunt damper. In this work, a piezoelectric shunt damper is used to damp the first resonance of a cantilever beam by connecting its terminal to an RL shunt circuit configured in series. The optimal resistance and inductance values for maximum energy dissipation are determined by matching the parameters to the first resonant of the cantilever beam, where R = 78.28 kΩ and L = 2.9kH are found. The mathematical modelling of a cantilever beam attached with a piezoelectric patch connected to an optimal RL shunt

circuit is derived and simulated where 52.83% and 69.67% vibration reduction is seen in MATLAB and COMSOL, respectively. In the experimental studies, the series shunt circuit is constructed and since the value of inductance is significantly high, a synthetic inductor is built by using two op-amps where the potentiometers can be varied to change the electrical impedance. The vibration reduction obtained from experiment is found to be 67.37% at 15.2 Hz. Findings from this work can help in designing an optimal piezoelectric shunt damper to reduce structural vibration which is a common source of failure in such system.

**ID: IMS005**

**Title: ENHANCING THE PERFORMANCE OF PIEZOELECTRIC ENERGY HARVESTER BY USING CORRUGATED CANTILEVER BEAM**

**Azni Nabela Wahid and Firdaus Husaini Mohd Nordin**

Abstract: Piezoelectric material has the ability to generate electric charge in response to applied mechanical stress. For this, it is used widely as transducers in mechanical energy harvesters to harvest electrical energy from mechanical vibration. Although promising, energy harvesters suffer from the limited amount of power generation which is only around a few miliWatts. In this research, the amount of voltage generated by a piezoelectric energy harvester is improved by replacing a conventional flat cantilevered piezoelectric beam with a corrugated cantilevered beam. The relationship between the number of curves of the corrugated cantilevered beam with the amount of voltage generated is investigated. The system consists of a corrugated beam covered with a polyvinylidene fluoride (PVDF) film with different number of curves, while maintaining the same volume. From simulation results using COMSOL, it is found that the more curves the corrugated beam has, the higher is voltage generated. From the experiment, the voltages acquired are 0.86mV, 1,79mV and 7.38mV for a straight piezoelectric beam, 2-curve corrugated beam and 4-curve corrugated beam, respectively. Compared to the conventional energy harvester of the same volume, a corrugated beam has higher stiffness, and is pre-stressed due to the curves, therefore as the number of the curve increased, a higher output voltage from the device can be expected. Findings from this study can help in the design of piezoelectric-based energy harvester with higher power output for a reliable renewable energy generator.

**ID: IMS006**

**Title: IMAGE BASED VISUAL SERVOING OF QUADCOPTER FOR TARGET TRACKING VIA NORMALIZED SPHERICAL IMAGE FEATURES**

**Omar Awadh Ahmed Bnhamdoon, and Noor Hazrin Hany Mohamad Hanif**

Abstract: In image-based visual servoing (IBVS) of a quadcopter, the use of the normalized image moment features derived from the virtual camera approach to control the translational degrees of freedom (DOFs), due to the requirements related to the depth information of the tracked object, increases the cost and complexity of the control system (i.e., the need for depth reconstruction algorithms, depth uncertainty adaptive algorithms, and/or additional depth sensors). To overcome these limitations, this paper proposes an image-based position control algorithm to regulate the translational DOFs of a quadcopter relative to a target object using normalized spherical image features derived from a virtual spherical camera approach.

With these image features, the complexities of depth information requirements can be relaxed while maintaining the rotation invariance property associated with the virtual camera approach. To handle the case of temporary loss of target tracking, a Kalman filter method is adopted. In terms of the control system, image-based outer-loop and velocity-based inner-loop controllers are developed using proportional (P) and proportional-integral-derivative (PID) control actions, respectively. During positioning and hovering tasks, the proposed control algorithm has a maximum average positioning accuracy of approximately 96.34%. For target tracking and hovering tasks, after the first movement of the target object has completed, the proposed control algorithm regulates the image feature error in a maximum time of approximately 9.06 s. These outcomes provide optimistic possibilities of the proposed control algorithm in facilitating the development of adaptive image-based position control algorithms for quadcopters.

**ID: IMS007**

**Title: BIO-INSPIRED AMPHIBIOUS ROBOT FOR MULTI-MODAL LOCOMOTION**

**Mohammed Rafeeq, Siti Fauziah Toha, Salmiah Ahmad, Mohd Ashraf Razib**

Abstract: Bioinspired Robotic platforms are based on knowledge from nature. Most robots focus on a single type of locomotion, such as walking, swimming, or flying. However, multi-locomotive robots have recently attracted considerable attention for researchers. In this research, the aim is to develop a multi-mode locomotive amphibious robotic platform that is capable to operate both on the water and on the ground surfaces with a single design. Passive articulated wheels are used for Ground locomotion, while a rocker bogie mechanism is to be adopted and optimized to make the motion for stable locomotion on both the surfaces. The robot uses a wheel propeller with a hull structure to remain on the water surface based on buoyancy and drag forces. To initiate the understanding of the system, the modeling of locomotion mechanism with kinematic and dynamic analysis is performed, and an appropriate control algorithm will be designed for motion control of the robot. The velocity and heading is analyzed through simulation and experiments at various terrains to validate the performance of the platform. This robot could be applied in reconnaissance, search and rescue operation, etc. after hydrodynamic analysis with achieved results. It is anticipated that the mobility and environment adaptability of designed amphibious robot would significantly enhance both on land and water surface.

**ID: MC1001**

**Title: DESIGN OF DUAL BAND NOTCHED ULTRA WIDEBAND MICROSTRIP PATCH ANTENNA FOR 5G LOWER BANDS APPLICATION**

**M. M. Hasan Mahfuz, Md Rafiqul Islam, Norun Abdul Malek, Md. Shazzadul Islamand, and G. M. Asadullah**

Abstract: Fifth-generation (5G) forums in ASEAN countries have proposed lower frequency bands for 5G applications at 4.5 – 5.5 GHz and also the fixed-satellite service (FSS) has realised 3.3 – 3.8 GHz in C-band for 5G cellular communication recently, which leads the necessity of proposing antennas for the particular bands. In this paper, a compact ultra-

wideband (UWB) patch antenna with dual band-notched characteristics has been proposed for lower 5G bands. The UWB has been achieved with a partial ground plane and further two notched 5G bands have been obtained with a rectangular slot on the patch and by connecting an arc shape open loop (ASOL) on top of the patch. The antenna has achieved a wide – 10 dB bandwidth of around 12.4 GHz (2.91 – 15.3 GHz) and VSWR < 2 except for two notched lower 5G bands of 3.3 – 4.2 GHz and 4.5 – 5.5 GHz. Besides, the proposed antenna has achieved a peak radiation efficiency of more than 80 % for UWB, while at the notched bands as low as 40%. Moreover, the proposed antenna is compact with a dimension of 29×23 mm2 that makes it suitable for lower 5G bands application.

**ID: MC1002**
**Title: DESIGN OF MICROSTRIP PATCH ANTENNA ON RUBBER SUBSTRATE WITH DGS FOR WBAN APPLICATIONS**
**Nazmus Sakib, Siti Noorjannah Ibrahim, Muhammad Ibn Ibrahimy, Md. Shazzadul Islam and M. M. Hasan Mahfuz**

Abstract: The physical flexibility has a significant impact on microstrip antenna design for wireless body area network (WBAN) application and designing such an antenna on a flexible substrate has many challenges. This paper presents an inset-fed microstrip patch antenna designed on a rubber substrate with defected ground structure (DGS). DGS is used to further enhance the antenna performances. The designed antenna is expected to operate at 2.45 GHz within the ISM band range and the return loss is -37.33dB with wide –10dB bandwidth of 101MHz. In addition, the VSWR value is 1.03 at the resonant frequency with an increase of 7.5% in the realized gain compares to the antenna without DGS. The accumulated surface current is 174 A/m on the radiating patch with a maximum realized gain of 3.42 dB and the maximum radiation efficiency of more than 60%. The antenna design, simulation, and performance analysis have been conducted using Computer Simulation Technology (CST) software. This paper focuses on the improvement in the return loss and antenna operating bandwidth of the flexible antenna to make it suitable for WBAN application.

**ID: MC1003**
**Title: Design a compact CPW Monopole Antenna on Rubber Substrate for ISM band application**
**Nazmus Sakib, Siti Noorjannah Ibrahim, M. M. Hasan Mahfuz and S. Yasmin Mohamad**

Abstract: One of the most challenging works on compact antenna design is to maintain the flexibility orientation. This paper demonstrates a Coplanar Waveguide (CPW) fed monopole antenna with rubber substrate at 2.45 GHz center frequency for ISM band application. The proposed antenna attained the realized gain at 4.06 dB with the radiation efficiency around 90% at peak value and the bandwidth of 541.5 MHz. The antenna was designed using the CPW structure. CST microwave studio applied to design the proposed antenna simulation. The main purposed of this study is to improve the antenna performances specially the bandwidth, gain, and radiation efficiency. Moreover, another aim of that antenna design is to reduce the antenna size and thickness upon the existing related design with rubber substrate.

**ID: MC1004**

**Title: DESIGN OF UWB MICROSTRIP PATCH ANTENNA WITH VARIABLE BAND NOTCHED CHARACTERISTICS**

**M. M. Hasan Mahfuz, Md. Shazzadul Islam, Islam Md Rafiqul, Mohamed HadiHabaebi and Nazmus Sakib**

Abstract: Recently lower frequency band 4.5 – 5.5 GHz is proposed by the ASEAN countries for 5G cellular application and therefore, it is essential of designing an ultra-wideband (UWB) antenna for the particular band-notched characteristics. In this article, a compact tuning fork shape ultra-wideband (UWB) patch antenna with a variable band-notched characteristic has been proposed for 5G cellular application. The UWB antenna has been achieved by using a tuning fork shape with a simple partial ground plane. A pair of ring shape slits (RSS) on the ground plane has been added to achieve the band-notched characteristic. The proposed antenna has achieved a large – 10 dB bandwidth of 7.8 GHz (2.9 – 11 GHz) and the VSWR value is less than 2 for the entire bandwidth excepted for notched frequency bands of lower 5G bands (4.5 – 5.5 GHz). Moreover, the antenna has a peak radiation efficiency of more than 87% for UWB and less than 27% for the notched frequency band. The notched-band is shifted with the change in the position of RSS's within the vertical axis and thus, the variable band-notched characteristics have been achieved. Besides, the proposed antenna is compact with the dimension of 45×34 mm2 that makes it suitable for the lower band of 5G application.

**ID: MC1005**

**Title: DESIGN A CPW ANTENNA ON RUBBER SUBSTRATE FOR MULTIBAND APPLICATIONS**

**Nazmus Sakib, Siti Noorjannah Ibrahim, Muhammad Ibn Ibrahimy, S. Yasmin Mohamad and M. M. Hasan Mahfuz**

Abstract: This paper presents a compact CPW monopole antenna on rubber substrate for multiband applications. The multi band applications (2.45 and 3.65 GHz) is achieved on this antenna design with better antenna performances. Specially this antenna focused on ISM band application meanwhile some of slots (S1, S2, S3) have been used and attained another frequency band at 3.65 GHz for WiMAX application. The achievement of the antenna outcomes from this design that the bandwidth of 520 MHz for first band, the second band was 76 MHz for WiMAX application and the radiation efficiency attained around 90%. Moreover, the realized gain was at 4.27 dBi which overcome the most of existing design on that field. CST microwave studio has been used for antenna simulation.

**ID: MC1007**

**Title: EMPIRICALLY DEVELOPED MODEL FOR DUST STORM ATTENUATION PREDICTION**

**E.I. Eltahir and Md. Rafiqul Islam**

Abstract: Microwave (MW) and millimeter-wave (mmW) propagation are severely affected by dust storms and sand storms in arid and semi-arid areas. Electromagnetic waves may

suffer from attenuation due to suspended particles during a dust storm. This paper proposes an empirical model to predict the attenuation due to dust storms based on a one-year measurement of visibility, humidity and their effects on MW links in Sudan. Signal strength variations on two operational MW links at 14 and 22 GHz as well as visibility were monitored simultaneously. The model is developed empirically using measured attenuation and measured storm characteristics (e.g., visibility, dielectric constant, frequency, and moisture content). The predicted attenuation from the proposed empirical model is compared with the attenuation at frequencies ranging from 7.5 to 40 GHz measured at different locations, and good agreement is found. Additionally, this method is characterized by simplicity and capability to predict reliable dust storm attenuation for a wide range of frequencies and moisture levels.

**ID: MC1008**
**Title: DEVELOPMENT OF MULTILANGUAGE VOICE CONTROL FOR SMART HOME**

**Amirul Hakim Bin Ruslan and Ahmad Zamani Bin Jusoh**

Abstract: In the coming days, IoT is playing a very important role in each individual's life and lifestyle. IoT has made life simpler. The application of IOT is demanding in many industries including for home automation. Home automation is the concept of making any home "smart". In this modern life, Automation is not a new thing. This technology has been using many years and normally can be seen in big companies. This automation concept can benefit our daily lives through many ways. However, the smart home technology in the market right now only support a few languages, generally English. For people who English is not their native language, it becomes a barrier in utilizing voice recognition installed in the smart home. Therefore in this project, Multilanguage IoT Home Automation System that focused on people who does not speak English especially elderly people in Malaysia to perform their chores routine such as turn on or turn off light by using voice commands given in their preferred language is developed. Other than voice commands, it also can be controlled wirelessly by using apps developed in the Smartphone. This system will be based on Raspberry Pi incorporate with Google Assistant and is designed to be an affordable and reliable home automation system yet, easy to setup and use. This project can have a strong and positive impact to the society especially on persons with physical disabilities and older persons whom English is not their native language.

**ID: MC1009**
**Title: SPEECH EMOTION RECOGNITION USING SPECTROGRAMS AND CONVOLUTIONAL NEURAL NETWORKS**

**Taiba Majid, Syed Asif Ahmad Qadri, Prof. Dr. Teddy Surya Gunawanand Dr. Hasmah Mansor**

Abstract: Speech Emotion Recognition (SER) is the task of recognizing the emotional aspects of speech irrespective of the semantic contents.Recognizing these human speech emotions have gained a lot of importance in recent years in order to improve both the naturalness and efficiency of Human-Machine Interactions (HCI).Deep Learning techniques have proved to be best suited for emotion recognition over traditional techniques because of their advantages like fast and scalable, all-purpose parameter fitting and infinitely flexible function. But, still there is no common consensus on how to measure or categorize emotions

as they are subjective. The primary challenges of emotion recognition are choosing the emotion recognition corpora (speech database), identification of different features related to speech and an appropriate choice of a classification model. Therefore, this research proposes a different architecture of Deep Learning technique - Convolution Neural Networks (CNNs) known as Deep Stride Convolutional Neural Network (DSCNN)using the plain nets strategy to learn discriminative features and then classify them. The main objective isto design a suitable model by taking a smaller number of convolutional layers and eliminate pooling-layers to increase the computational stabilitythus, increasing the accuracy of speech emotion recognition (SER) compared to state-of-the-art CNN.Instead of pooling layers, special strides have been used for the necessary dimension reduction. DSCNN is trained on two acted databases; Berlin Emotional Database (Emo-DB), a German database and Indian Institute of Technology Kharagpur Simulated Emotion Hindi Speech Corpus (IITKGP-SEHSC), a Hindi database. The speech signals of two databases are converted to clean spectrograms by applying STFT on them after preprocessing.For the evaluation process, four emotions angry, happy, neutral, and sad have been considered. Evaluation results show that the proposed architecture DSCNN outperforms the-state-of -art CNN with recognition rates of 90.67% for Emo-DB on 200 epochs and 91.33% forIITKGP-SEHSCon 300 epochs. Further, F1 scores have been calculated for both databases, the average % of F1 score for IITKGP-SEHSC is 98.01% and for Emo-DB 97.56% which is quite better than any state-of-the-art models of CNN. Hence, this study has set new benchmarks for both the databases for upcoming work in the field of SER.

**ID: MC1010**

**Title: AFFECTIVE COMPUTING FOR MENTAL HEALTHCARE SOLUTIONS**

**Arselan Ashraf, Muhammad Farheza Alghifari, Taiba Majid, Syed Asif Ahmad Qadri, Prof. Dr. Teddy Surya Gunawan, Dr. Mimi Aminah Wan Nordin, Dr. Nik Nur Wahidah Nik Hashim, Dr. Farah Dayana and Dr. Hasmah Mansor.**

Abstract: Affective computing is an emerging interdisciplinary research field bringing together researchers and practitioners from various fields, ranging from artificial intelligence, natural language processing, to cognitive and social sciences. The idea behind Affective Computing is to give computers the skill of intelligence that tends to understand human emotions, which we channel for mental healthcare solutions. Despite, these successes, the field still lacks firm theoretical foundations and systematic guidelines in many areas, particularly so in emotion modelling and the construction of computational models of emotion recognition and emotion effects (depression, anxiety etc). This research deals with Affective Computing to improve the performance of Human-Machine Interaction. The focus of this work is to detect emotional state of a human using deep learning techniques primarily intended to achieve affordable mental healthcare. This research involves 3 domains – Speech Emotion Recognition, Speech Depression Prediction and Visual Emotion Recognition. Speech is the most significant mode of communication among human beings and a potential method for human-computer interaction (HCI). Therefore, this project utilizes two speech databases for the training and testing process. A public English dataset Surrey Audio-Visual Expressed Emotion (SAVEE) database is utilized for emotion recognition and a clinical interview-based database Distress Analysis Interview Corpus Wizard of Oz (DAIC-WOZ) for depression detection. The main objectives are to recognize the silent discriminants and effective features of speech signals and detecting the presence or absence of depression in speech. For the emotion recognition different network model of Convolutional Neural Networks (CNN) is proposed for feature extraction and classification, by taking a smaller

number of convolutional layers to increase the computational stability. CNN is trained on spectrograms generated from the SAVEE dataset. Evaluation results show that the proposed architecture of CNN with validation accuracy of 96% on 1000 iterations outperforms the state-of-art model CNN. For depression prediction, Deep Neural Network (DNN) is used as classifier to detect depression using a speech feature, i.e. the averaged Mel-frequency cepstral coefficients (MFCC). The system shows eminent results of 97.5% when distinguishing between depressed and not depressed using a 100neuron single layer neural network, and up to 98.3% when distinguishing between depressed, potentially depressed, and not depressed using a network configuration of [100 100]. As facial expressions are the important parts of how humans communicate and develop the impressions of the people around by understanding their emotions, therefore this research also aims to recognise emotions visually by developing a suitable model for Visual Emotion Recognition based on the selection of proper feature frames of facial expression where the main objective is to analyse pre and post processes involved in the methodology of the model. Convolutional Neural Network (CNN) used for building an emotion recognition system is trained on an image database fer2013 consisting of seven different emotions. Google Colaboratory, an integrated development environment (IDE) is utilized for the process. The evaluation results yield an accuracy of 97% on the training set and 57.4% on the testing set when Haar cascade technique is applied. Based on the results, this research proves to be promising in the emotion modelling and emotion recognition, thus enhancing the Human-Machine Interaction (HCI).

**ID: MMS001**

**Title: AN ANALYTICAL NUMERICAL PROCEDURE FOR THE MEASURMENT OF POLLUTION IN A SYSTEM OF INTERCONNECTING LAKES**

**Indranil Ghosh, M.S.H. Chowdhury and Suazlan Mt Aznam**

Abstract: Pollution has become a very serious threat to our environment. Using deferential equations, monitoring pollution has become a useful tool in saving the air, water, and soil to pave the way of Sustainable Development Goals (SDGs). Although just a monitoring device, deferential equations, used by people that care about what is happening to the environment, can be a solution to the problems. Showing the simplicity of the lake pollution model and it's three cases of input functions, just we used numerical technique the New Iterative Method (NIM) on this model with decent accuracy. Comparisons with the standard fourth order Runge Kutta method (RK4) results and the results obtained by the New Iterative Method (NIM) shows that NIM is a powerful efficient procedure for measurement of pollutant in systems of interconnecting lakes.

**ID: NN002**

**Title: ALL-SOLID-STATE ION-SELECTIVE SENSOR FOR MEASUREMENT OF POTASSIUM IONS IN COMPLEX BIOFLUIDS**

**Ihda Uswatun Shalihah Shohibuddin and Wan Wardatul Amani Wan Salim.**

Abstract: Next-generation devices that are sensitive with stimulus-responsive properties are highly desired goal in diagnostics technology.Sensor devices possess challenges in exhibiting sensitive response of fast electron transfer, especially when used in a biological complex medium.Potassium (K+) ions play a major role in physiological functions such as nerve impulse transmission, muscle contraction, and cellular functioning. Ultimately, the

concentration of K+ must be carefully monitored in real-time. This project aims to develop an all-solid-state potassium ion-selective electrodes (AS-KISEs) using reduced graphene oxide-poly(3,4-ethylenedioxythiophene):polystyrene sulfonate (rGO:PSS-PEDOT:PSS) composite as transducer and ion-selective membrane (ISM) for measurements of K+ in biofluids. Performance of transducers was studied via cyclic voltammetry in 100 mM K3Fe(CN)6, and potentiometric measurements in 0.1 mM - 1000 mM KCl were performed on AS-KISEs.This research is also to test the developed AS-KISEs by quantifying K+in extracellular fluid of aedes larvae. Transducer rGO:PSS-PEDOT:PSS revealed combinatory benefits of rGO:PSS and PEDOT:PSS where rGO:PSS is highly reversible as illustrated by the small shift in peak potential (Ep) and PEDOT:PSS resulted in a high peak current (Ip) thus having fast electron transfer kinetics at the electrode-analyte interface.The Ip of rGO:PSS-PEDOT:PSS/SPCE showed a 92.4 % increase compared to Ip of rGO:PSS alone, with a smaller shift in Ep of 180 mV compared to Ep of PEDOT:PSS of 240 mV.Calibrations in KCl solutions demonstrated that the AS-KISEs can monitor K+ over a wide linear range of 4.2×10-5 - 3.3×10-3 M. The AS-KISEs displayed an instantaneous response of 3-10 s toward increasing K+ concentrations with a near-Nernstian slope 58.0 mV/decade. The detection limit of the AS-KISEs reached as low as 4.2×10-5 M, capable of accommodating sub-millimolar changes of K+ concentration specifically in a complex fluid.The potentiometric signal generated by aedes larvae will be measured in real-time by the developed AS-KISEs, and compared to deionized water and acontrol solution without larvae.This study essentially offers a scalable platform to develop AS-KISEs, which is particularly useful for monitoring K+ concentrations for physiological and environmental applications.

**ID: NN003**
**Title: MOBISENS: MOBILE SENSOR FOR REAL-TIME WATER QUALITY MONITORING INTEGRATED WITH IOTS**
**Abdelmohsen Benoudjita, Wan Wardatul Amani Wan Salima.**

Abstract: With the recent increase in the occurrence of pollution at the water surface due to Urbanization and economic development, it is necessary to monitor water quality continuously to prevent that. However, conventional method used for water quality monitoring requires either sample transport to laboratories which are laborious and time-consuming processes, or by on-site measurements using bulky and stationary sensors that limit the coverage zone, and often do not provide continuous measurements. The sensors leverage the internet of things (IoT) for data collection, analysis, and data transfer from the field to the end-user. We developed MobiSENS, a mobile platform that can be integrated with multiple sensors and IoT. At the proof-of-concept, we tested sensor performance by measuring temperature, conductivity, and turbidity in a mobile platform. Sigfox network and Losant IoT Platforms are used with the mobile platform to provide real-time data from the field and displayed in a visual format on a PC or handphone. Furthermore, MobiSENS can be customised to provide an early warning when the water quality parameters value exceeds a critical threshold. The integrated IoT system can be programmed to alert the end-user by providing real-time data through emails. We envision deployment of MobiSENS at rivers to act as a warning system for water pollution as it requires fewer human interventions, real-time measurements, mobile platforms that cover large areas, while maintaining low cost and low power consumption. Therefore, our proposed technology will help to monitor the quality of water efficiently and continuously to reduce water pollution.

**ID: NN004**

**Title: CHITIN NANOPAPER FROM OYSTER MUSHROOM: EFFECT OF PRE-TREATMENT PROCESS ON ITS MECHANICAL PROPERTIES**

**Mizan Izzati binti Mat Zin and Wan Mohd Fazli Wan Nawawi**

Abstract: Chitin nanofiber has become an interest as a component for nanocomposite material due to its excellent properties such as biodegradability, biocompatibility and non-toxicity. Aside from crustacean shells, chitin nanofiber could also be found in the cell wall of mushrooms. Chitin nanofiber from the mushroom is covalently linked with glucan which can contribute to higher mechanical properties compared to conventional animal-based chitin. This study aimed to evaluate the effect of the pre-treatment process (freezing and drying) of oyster mushroom on the mechanical properties of chitin nanopaper. The chitin nanofibre was extracted from oyster mushroom (P. ostreatus) without acidic extraction step and further fabricated as chitin nanopaper. With freezing pre-treatment, the nanopaper exhibits the highest toughness compared to that of no pre-treatment and drying pre-treatment. With regards to drying pre-treatment, chitin nanopaper shows reduced performance as a result of fiberhornification effect. This study suggested that frozen pre-treatment of oyster mushroom promotes mechanical properties enhancement and has the potential to be used as a good reinforcing element in bio-based composite manufacturing processes.

**ID: OTH004**

**Title: CONSTRAINED DEVICE VIRTUALIZATION FOR INTEROPERABILITY, DEVICE DISCOVERY AND MANAGEMENT IN INTERNET OF THINGS(IOT)**

**Shariq Haseeb, Aisha Hassan A. Hashim, Othman O. Khalifa and Ahmad Faris Ismail**

Abstract: Global IoT deployments consist of various constrained IoT devices such as sensors and actuators. As IoT deployments become mainstream, the number of such constrained IoT devices are increasing rapidly. It has been predicted by Statista that, there will be up to 21.5 billion such devices by 2025 . Constrained devices operate on heterogeneous communication stacks because of their limited capabilities, alliance to certain standards or simply because of device manufacturer's preference towards certain protocols. Heterogeneity of constrained devices leads to interoperability and device isolation issues between them and renders them unable to communicate with each other through a common protocol. As a result, IoT deployments become silo and extremely expensive to generate any tangible value. To date there have been various research attempts in trying to unify the communication stack at different layers to enable interoperability and reduce cost of IoT deployment. Amongst all the different proposals, the most promising and emerging one proposes virtualization of sensor data by abstracting sensor data from the physical device. Although this is the first step toward reinventing constrained device communication, this technique does not really solve the interoperability issues. Our research extends the concepts of virtual sensor by incorporating it with software defined network architecture to propose an algorithm for constrained device virtualization that not only virtualizes the constrained device but also its underlying network protocols. Virtualized constrained devices leverage on the computational ability of the Cloud and can then host full version of the TCP/IP protocol stack and complimentary protocols such as SNMP for device management and SSDP for

service discovery. Hence, enabling the constrained devices to communicate with each other without requiring major changes to the physical device. We propose a mathematical scheme for building the discrete event models, that are simulated in a widely used CloudSim based simulator with iFogSim extensions, under various operational modes and topologies. The obtained results successfully demonstrate virtualization of a constrained device in a Cloud by abstracting the device parameters, its data, its network and communication protocols. The results further show that during the setup phase, it is best to have 15 physical constrained devices in a single virtual cluster to obtain latency values that are suitable for real-time applications. However, once the initial setup of the constrained device virtualization algorithm is completed, more physical constrained (up to 60) device per cluster can be easily supported by the algorithm. These results show a very promising approach towards eventually commoditizing IoT, so that its benefits can be felt by humans.

**ID: PP001**

**Title: INTEGRATION OF HYBRID BIOMASS-SOLAR PV-WIND TURBINE IN MICROGRID APPLICATION**

**Saidatul Haneen Badruhisham and Mohd Shahrin Abu Hanifah**

Abstract: Building a sustainable energy platform for growth is one of Malaysia National key Economic area. Microgrid is vital exploring coordination of standalone renewable energy source in achieving a single producer of electrics energy. This is to avail the full advantages of renewable energy resources in a consistent and manageable way especially for civilian in the rural area where electricity is hard to obtain. To achieve proper integration of renewable energy sources, the development of effective integrated hybrid solar photovoltaic-wind turbine-biomass is desired. However, since solar, wind and biomass are intermittent, uncontrollable, stochastic and highly variable, their integration in electric power grid poses challenges to its effective operations, especially at higher penetration level. Hence, the objective of this study is to assess the feasibility of integration of hybrid solar PV-wind turbine-biomass in microgrid application and to develop strategy to effectively integrate hybrid solar PV-wind turbine-biomass microgrid capabilities to run as an island or part of a bigger power system. The three renewable energy system will be numerically simulated. From this, the hourly output power of each system will be calculated. These understanding are important in designing an efficient and reliable integrated hybrid microgrid thus mitigating the load mismatch and voltage instability problem. Modelling will be deduced from the novel algorithm that represents the reliability of integrated PV-WT-BM microgrid by using MATLAB/Simulink. The methodology will include numerical simulation of integrated PV-WT-BM microgrid and modelling of the reliability of the integrated PV-WT-BM microgrid system using the written program based on MATLAB/Simulink. The outcome of this research is a unique algorithm of integrated PV-WT-BM microgrid system using the written program based on MATLAB/Simulink. Better design of integrated PV-WT-BM microgrid in long-term will serve to alleviate the aforementioned problems, to increase the penetration of renewable energy sources of electric power grid This will benefit civilian to obtain electricity based on renewable energy wherever they are especially in the remote area.

**ID: PP002**

**Title: CRITICAL PREDICTION MODELLING FOR INTEGRATED CIRCUITS (IC) ELECTROMAGNETIC COMPATIBILITY (EMC) IN SMART AUTOMOTIVE INDUSTRY**

**Tamana, Nurul Arfah Che Mustapha and Nurul Fadzlin Hasbullah.**

Abstract: Over the decades of revolution in the world of electronics, from disjunct devices to todays integrated circuit technology where billions of transistors are combined on a single chip, the proper functioning of the IC in an impeding Electromagnetic environment has always been a major concern. Automotive industry in particular, the smart vehicle, is facing design challenges such as susceptibility towards Electromagnetic Radiation Interference (EMI). EMI causes electronics control units to calculate wrong output and sensors to give false readings. The disruption can degrade the circuit 's performance or even stop it from working. These effects can vary from an increase in the error rate to a complete loss of data in the case of a data path. Nowadays, smart automotive industry has employed extensive electronic components in its system. The growing numbers of IC's on the electronic modules in smart automotive industry creates demand on electromagnetic compatibility (EMC) compliance. This EMC is driven by preventing electromagnetic interference (EMI) malfunctions within a vehicle. Failure to prevent this could cause loss both financially and in worst cases human life can also be lost. There have been efforts to evaluate the EMI conditions in ICsand ways to establish EMC. The conventional test set up for checking EMI is quite elaborate and expensive. Thus, this project proposes to investigate techniques for checking EMC in ICs and developing modelling and simulation techniques which could be used to predict the EMI situations in an IC. Thus, this study is extremely crucial for sustainable development that can allow the use of integrated circuit technology to the fullest in the field of automotive industries and at the same time keep in mind the proper functioning and prevention of malfunctioning of automotive products resulting from Electromagnetic Interferences so that ultimately a safer and smarter automotive industry could be established.

**ID: PP003**

**Title: RELATIVE HUMIDITY SENSOR BASED ON TAPERED FIBRE WITH FULL- AND SPIRAL-PATTERNED AGAROSE GEL COATING**

**Farah SakiinahRoslan, Norazlina Saidin, Aliza 'Aini Md Ralib, Sulaiman Wadi Harun**

Abstract: A relative humidity sensor based on plastic optical fibre (POF) is constructed by using chemical etching method. Agarose gel was chosen as the sensing layer with two different patterns which are fully coated pattern and spirally coated pattern. The agarose gel acts as a moisture absorbent due to its hydrophilic property. Full and spirally agarose coated fibre synthesis will be compared in terms of their sensitivity and limit of detection. The measured result shows that the spirally agarose-coated fibre has better sensitivity compared to the fully agarose-coated fibre. The increment in relative humidity percentage affected the refractive index of the cladding and contributed to higher leakage of transmitted light. As the relative humidity percentage (RH%) of magnesium chloride (MgCl2) inside the chamber varies from 50 RH% to 85 RH%, the output voltage of the spiral patterned fibre decreases linearly from 9.1 mV to 8.4 mV. It demonstrates the better linearity slope of over 80.95%

and highest sensitivity of 0.0162 mV/% compared to the full patterned fibre. Hence, humidity sensor based on spirally agarose-coated POF demonstrates a high-resistant and reliable sensitivity towards the relative humidity of the ambient.

**ID: PP004**

**Title: EFFECT OF IRRADIATION UPON SINGLE LAYER GRAPHENE ON SiO2/Si SUBSTRATE BY ELECTRON BEAM IRRADIATION (EBI)**

**Ahmad Syahmi Zamzuri, Nur Idayu Ayob and Yusof Abdullah**

Abstract: The scaling down of Metal Oxide Semiconductor Field Effect Transistor (MOSFET) leads to serious challenges in the silicon-based field effect transistor (FET). MOSFET used in radiation detector suffers slow response of detection of high energy particles and poor reliability as it degrades fast in extreme radioactive environment. To overcome these challenges, graphene is of particular interest in utilizing it as new channel material in FET to replace silicon due to its remarkable electrical, physical and mechanical properties. Hence, the understanding of radiation damage mechanism in graphene is crucial for applications in radiation harsh environments. In this study, the influence of high energy (MeV) electron beam irradiation on structural and electrical properties of single layer graphene (SLG) prepared by Chemical Vapor Deposition (CVD) on SiO2/Si substrate is investigated. The characterizations used are Raman Microscopy, Current-Voltage (I-V) measurement and FESEM with EDX. The samples were irradiated with 3 MeV electron beam irradiation at 50 kGy, 100 kGy and 200 kGy dose. It was found that as irradiation dose increases to 100 kGy, the 2D bands and G bands shift to lower frequency energy and surprisingly no appearance of D band. As dose increases to 200 kGy, the G band shifts to higher frequency energy and 2D band shifts slightly to higher frequency. Only a small D band appears at 1349 cm-1 after 200 kGy irradiation. This shows that only small number of defects formed in SLG structure after irradiated at higher electron energy (MeV). This indicates stability of the SLG used in this study. I-V analysis represents non-monotonic behaviour of graphene which electrical conductance increase at 50 kGy, decrease at 100 kGy and increase significantly at 200 kGy. The major mechanism is probably related to the charge-transfer doping due to the high dose of electron irradiation and low defect scattering. In conclusion, the present study shows that SLG can retains its crystallinity under certain dose of high energy irradiations. The results demonstrate applicability of graphene-based devices in radiation harsh environments and its importance towards the development of high radiation resistance graphene FET devices.

**ID: RE001**

**Title: COIL PAIR DESIGNS FOR INDUCTIVE WIRELESS POWER TRANSFER**

**Nadia Nazieha binti Nanda and Siti Hajar Yusoff**

Abstract: The inductive power transfer (IPT) has contributed to the fast growth of theelectric vehicle (EV) market. The technology to recharge the EV battery hasattracted the attention of many researchers and car manufacturers indeveloping green transportation. In IPT charging system, the coil design isindispensable in enhancing the EV battery charging process performance. Besides, with the population growth, estimated at 82 million people

per year, people will consume more energy resources in the future since the number of vehicles will also increase. This increment will contribute to the depletion of energy resources, especially petroleum. This depletion phenomenon has given quite a headache to many countries, including Malaysia. Many countries realize that this issue is crucial to be given attention promptly. As the number of vehicles is growing worldwide, oil supplies are not enough to handle all of them. However, the unprecedented growth of the EV seems to give way out of this unpleasant complication. The ability to recharge the vehicle battery through inductive coupling has introduced a much more sustainable and environmentally friendly vehicle to replace the existing petroleum-powered vehicle. The static wireless power transfer (WPT) charging station has been hugely implemented in developed countries. However, due to the arising problems of range limitation and time-consuming to recharge the battery, a dynamic WPTconcept has been proposed recently to make the charging process possible while the vehicle is moving. So, "stop and park" is not required for the EV owner to recharge their vehicle battery. Therefore, this research aims to design the coil pairsthat are suitable for dynamic wireless charging to overcome any limitations arise.

**ID: RE002**
**Title: DEVELOPMENT OF FERRITE CORE CROSS GEOMETRY**
**Nur Amelia Shafina Roszaidie and Siti Hajar Yusoff.**

Abstract: Wireless power transfer (WPT) has drawn a wide variety of subjects in different fields and has also been a highly active research field because of its ability to provide our everyday lives with high technology. In the near future, wireless power transfer will be mandatory, since this technology allows electrical energy to be transferred from a power source to an electrical load through an air gap without connecting wires. This project introduces a new ferrite core architecture consisting of radial geometry-positioned ferrite bars. In inductive wireless power transmission, the latest core design is used where the ideal ferrite bar design has been analysed.Three optimal designs of none, two and four ferrite bars geometries were used for parameterization of geometric parameters. Both simulations of two and four ferrite bars geometries were verified by measurements. Three different coil pair with ferrite are tested to find the most suitable coil pair for the primary and secondary pads that has the maximum power transfer and is least sensitive to misalignment.Optimal design of four ferrite bars geometry is proposed for use in wireless power transfer because of low consumption of ferrite material.

**ID: RE003**
**Title: RESONANT FREQUENCY ESTIMATION OF INDUCTIVE RESONANT WIRELESS POWER TRANSFER**
**Ismail Adam, Mashkuri Yaacob, Sheroz Khan, Anis Nurashikin Nordin, and Hasmah Mansor.**

Abstract: The efficiency of wireless power transfer (WPT) depends on the distance of the transmitter and receiver coils affected by the coupling coefficient and the system operating frequency. Therefore, the ability to estimate the coupling coefficient and/or the resonant frequency of the WPT in ensuring that the highest power is transferred efficiently is paramount important. This study proposes a simple but new method for estimating the

resonance frequency of the series-to-series inductive resonant WPT by using a combination of Total Harmonic Distortion (THD) and RMS voltage (VRMS) evaluated on the transmitter side. Using this method, the computation of Fast Fourier Transform (FFT) on the voltage deduced at the transmission coil is performed to obtain the THD and VRMS. Using the calculated THD and VRMS, the resonance frequency is estimated by finding the lowest THD point and the highest VRMS point. This work confirms that the resonance frequency of the inductive resonant series-to-series WPT can be localized by finding the lowest THD and the highest VRMS of the coupled coils at the transmitting part. The study shows promising results in evaluating the WPT resonance frequency to maximize power transfer thus pave the way for the establishment of the inductive resonant WPT applications that suggests power efficiency depends on the separation between the transmitting and receiving coils such as in the move-and-charge WPT application. In addition to the simplicity of the methods presented, the novelty of this paper is in the possibility and practicality of applying the methods presented into real-world applications.

**ID: SE001**
**Title: DeePalmFruit: A DEEP LEARNING BASED SYSTEM FOR GRADING PALM FRUITS**

**Rashidah Funke Olanrewaju, and Mohamed Faiz Mohamed Iqbal**

Abstract: Palm oil production is a vital backbone contributor to Malaysia's overall economy. Significant employment and income from Palm oil and its products exports have been keeping Malaysia's economy in good shape. The demand for Palm oil and its related product is increasing with time. Meanwhile, the extraction of oil from the palm fruit is determined based on the ripeness of the fresh fruit bunches (FFB), as ripe FFB yield higher oil production compared to the unripe, underripe and overripe FFB. Currently, the mode of grading the FFB is by manual human vision. This method reduces the accuracy in grading, time-consuming as well as labour intensive as it is a subjective judgement based on perspective, as well as increase the labour cost for a trained worker to be hired for better grading. We develop a grading system accompanied by an optimal software- using computer vision, that applies the concept of deep learning in recognizing and grading the palm oil FFB which decreases the labour cost significantly (automated) and maximize oil extraction. Two-stack of a different model developed using Convolutional Neural Network (CNN), The system developed consists of two different models: Binary CNN model to recognize if its a Palm or Not Palm and Multi-class CNN model to grade the palm oil FFB into the category; ranging from ripe, unripe, underripe and overripe. Since there is no database available to obtain palm oil FFB dataset, the dataset is self-collected. The dataset is collected from a palm industry in Malaysia. A total of 40,000 images was obtained during collected, where each category from overripe, ripe, underripe and unripe. Data augmentation was performed to expand the dataset by performing rotation, scaling, and noise addition. A total of 80,000 images were formed. The images were split to 80:20 ratio for training and testing, yielding 64,000 images for training and 16,000 images for testing. The training dataset is then further split during training, using the same 80:20 ratio, yielding 51,200 images for training and 12,800 images for validation. The images are resized on 256 x 256 pixel to ensure all the details of the palm oil FFB feature remains. The system is tested with existing pre-trained CNN model and compared with existing work, including the conventional system and system used to solve a similar problem. Our DeePalmFruit model provides the best accuracy

with an average of 98.71% recognition and 95.70% grading of palm oil FFB. The system is also able to grade a large number of images instantly.

**ID: SE002**

**Title: POTENTIALS OF FINTECH IN ATTAINING FINANCIAL INCLUSION: A CASE OF KELANTAN LOCAL COMMUNITY**

**Rashidah Funke Olanrewaju, Hafis Bello, Binyamin Adeniyi Ajayi and Mashkuri Yaacob**

Abstract: Financial inclusion is a determinant of a nation's prosperity. When people are included in formal financial system, they are able to access financial services, loans and participate in investment programmes which positively affect their overall living standards. While the government of Malaysia has introduced different programmes to facilitate financial inclusion across the States in Malaysia, Kelantan is one of the States with low FI rate, hence a research that gathered data through primary and secondary sources was carried out to assess the situation. Primary data was gathered through semi-structured questionnaires on residents of the rural areas of Kelantan between September 10 to October 30 2020. A total of 65 questionnaires were administered out of which 46 were complete and used for the research. On the reason for not having a bank account, 87 percent indicated lack of enough money to save at the bank as the responsible factor. Other factors indicated include distance to the bank (54.3%), lack of necessary documentation (50%), required minimum operating balance (30%), lack of trust in banks (19.6%) and banks are too expensive to operate (10.9%). The research recommended increased deployment of financial technology to bring financial services closer to the residents of the community so as to improve the financial inclusion level in Kelantan.

**ID: SE003**

**Title: RECOGNIZE IT & AVOID ACCIDENT: A DRIVER ASSISTANT SYSTEM**

**Rashidah Funke Olanrewaju, Mohammad Ashraaf Omar, and Mistura L. Sanni**

Abstract: Transportation is one of the main aspects of human life development. To smoothen transportation, improve safety and uniformity, the traffic sign was developed and implemented on the road. However, the human is often forgotten, distracted or neglect the signboards, especially when driving. A lot of accidents that lead to injuries, death and even loss of property occurred on a daily basis, currently, the World Bank reported that traffic accidents caused an estimated 1.25 million people killed and between 20 and 50 million people injured each year. Distracted and tired drivers are the leading cause here. One of the methods to curb this is by sending an alert to the driver when the camera of the ADAS system detects the presence of the traffic road signs. This research focused on the improvement of the existing system accompanied by an optimal software- using computer vision that applies the concept of the deep learning algorithm, a Convolution Neural Network (CNN) in detection and recognition of road signage. The proposed method considered conditions such as changes in lighting, weather raining/ cloudy etc. data set plays a huge role in CNN experimentation, data set are from Kaggle website used for a single image and multiple classifications. We improve the efficiency by considering several evaluation metrics, such

as data augmentation and balancing, architecture tunning and creation of model with different parameters and configurations during the experiment. The training process of the network model is done on the Google Colab, a cloud service for specifications of 12GB Nvidia Tesla K80 graphic processing unit to accelerate the training session. The input layer of each model is set to match the size of the images in the class of a 30 x 30 RGB image. This means our model considers all colours in the image. Each model is trained and tested with a dataset of 43 classes traffic sign images (20:10:70) for validation test and training respectively. General Caution, turn right, roundabout, Pedestrian, Speed limit, Traffic light, stop signage, etc. formed the sample images. Our model is tested on a dataset with the same classes but not trained during the training phase to avoid bias. Convolutional layers, dense layers, max pool layers, normalizer layers with dropout and data augmentation have used to achieve the best result. The accuracy of this model is 96.9%. The high accuracy works on 3 RGB matrices of the images. Hence the system is suitable to assist the driver by giving an appropriate alert to raise caution.

**ID: SE004**

**Title: MOBILE APPLICATION BASED SMARTTEMPERATURE CONTROL MECHANISM USING PARTICLE PHOTON MICROCONTROLLER**

**Hunain Altaf, Rashidah Funke Olanrewaju and S. Noorjannah Ibrahim**

Abstract: Smart Cooling mechanism is a way to remotely connect your home air conditioning system with a mobile application for monitoring and controlling the home temperature and humidity.This work aims at switching ON the home Air-Conditioning using a Mobile application after the room temperature reaches a minimum threshold value. User can also remotely access the temperature and humidity data anytime and the notification is being sent whenever the temperature value crosses the threshold value and it is up to the user to Switch ON the home air conditioning system. Sometimes having a cold room prior to one's arrival into the room is what one wishes, and this project can be utilized for that extra comfort. The system design is based on the Particle Photon as a Microcontroller, mobile application,temperature, and humidity sensors and the cloud services for remote monitoring. This work presents the hardware implementation of the smart temperature control mechanism with the system results validating the safety, flexibility, reliability, and ease of using the mechanism.Temperature and Humidity data gets stored in the datasheets and can be further utilized for Data Analytics.

**ID: SE005**

**Title: DETECTION OF COMMON HEART DISEASES BASED ON CLASSIFICATION OF ECG SIGNALS USING CONTINUOUS WAVELET TRANSFORM AND DEEP NEURAL NETWORKS**

**Hunain Altaf, S. Noorjannah Ibrahim and Rashidah Funke Olanrewaju**

Abstract: According to WHO report an estimated 17.9 million lives are being lost each year due to cardiovascular diseases (CVDs) and is the top contributor to the death causes. 80% of the Cardiovascular cases include heart attacks and strokes. This work is an effort to accurately predict the common heart diseases such as Arrhythmia (ARR) and Congestive Heart Failure (CHF) along with the Normal Sinus Rhythm (NSR) based on the integrated model developed using Continuous Wavelet Transform (CWT) and Deep Neural Networks.

The proposed method used for this research analyses the time-frequency features of an ECG signal by first converting these 1D ECG signals to 2D Scalogram images and then the images are being used as an input to the 2D Deep Neural Network Model - AlexNet. The concept behind converting the ECG signals to images is that AlexNet only accepts images for training purpose and it is much easier to extract deep features from images rather than from the raw data. The dataset used for this research was obtained from MIT-BIH Arrhythmia Database, MIT-BIH Normal Sinus Rhythm Database and BIDMC Congestive Heart Failure Database. The proposed strategy could successfully predict the common heart diseases with an accuracy of 98.7%. This work is also being compared with the recent research done in the field of ECG Classification for detection of heart conditions and proves to be an effective technique for the classification.

**ID: SE006**

**Title: DETECTION OF SWEETNESS LEVEL FOR FRUITS (WATERMELON) WITH MACHINE LEARNING**

**Wan Nurul Suraya and Ani Liza Asnawi.**

Abstract: The inspection and grading of the watermelon are done manually but it is a tedious job and it is difficult for the graders to maintain constant vigilance. Thus, the image processing has widely been used for identification, detection, grading and quality evaluation in the agricultural field. The objective of this work is to investigate the sweetness parameter for the fruit's detection and classification algorithm in machine learnings. This study applies image processing techniques to detect the color and shape of watermelon's skin for grading based on the sweetness level using K-means clustering method via the Python platform. 13 samples of watermelon images are used to test the functionality of the proposed detection system in this study. Then, each watermelon is grouped into Grade A (high level of sweetness), Grade B (medium level of sweetness), and Grade C (low level of sweetness) based on its color and shape detection results. At the end of this research, the proposed technique resulted in an inaccurate prediction for 2 watermelon samples out of 13 samples which indicates the system has an 84.62% accuracy in detecting the watermelon sweetness level.

**ID: SE007**

**Title: STANDALONE SCALABLE MOBILE-BASED HYBRID OTP AUTHENTICATION FOR SECURING INTERNET BANKING ACCESS**

**Rashidah Funke Olanrewaju, Burhan ul Islam Khan and Farhat Anwar**

Abstract: The advent and popularity of the Internet has rendered the banking sector with challenges as well as opportunities. The opportunity lied in "taking the bank directly to the customer's place" whereas the challenge was to change the customers' mindset, beginning with "trust" and accepting the system. Foolproof user authentication becomes imperative in such applications for confirming customer legitimacy. One pragmatic solution for user authentication is that of employing One Time Password (OTP) with validity for a single transaction or session. Two authentication models for internet banking include i.) Receiving OTP via SMS, ii.) Generating OTP over a hardware token. SMS OTPs are the most common however, the password generated remains afloat in an unsecured cellular network.

Additionally, users need to maintain two active communication channels (Cellular & Internet). Other inherent problems include delay-in-delivery, unavailability of service, roaming restrictions, dependency on government regulations, etc.The research focussed on developing a standalone authentication framework for generating unique OTPs from trusted handheld devices using a hybrid approach to eradicate dependence over additional cellular communication channels and extra hardware tokens without compromising the security traits of the system. The framework generates time-based dynamic authentication components (OTPs) in an offline manner on user's smartphones by invoking possession, knowledge, and inherence factors of legitimate users. This is achieved by asynchronously operating secure random challenge formations as hash counters upon dynamic seeds, comprising of varying current timestamps, distinct device and identity profiles.This approach drastically reduces the operational costs, improves upon security, scalability, and convenience factors. Additionally, the system has been equipped to generate OTPs as three Bahasa Malaysia words as the usage of native language could help clients to feel more confident and secure. The system has been implemented and examined for leading mobile/desktop platforms to ascertain its technical adoptability. The results of performance metrics obtained employing the confusion matrix with Accuracy = 98.55%, Error rate = 1.45%, Specificity = 100%, Alarm rate = 0%, Recall = 98.40% and Precision = 100% validate the authentication robustness. Furthermore, the system is comprehensively analysed for its ability to thwart common authentication attacks over the internet.

**ID: SE008**

**Title: CLASSIFICATION OF STRESS LEVEL USING DEEP LEARNING ALGORITHM BASED ON ELECTROENCEPHALOGRAPH (EEG) SIGNALS**

**Ali Nirabi, Asst. Prof. Faridah Binti Abd. Rahman, Prof. Mohamed Hadi Habaebi**

Abstract: Stress is a feeling we all experience when we are challenged or overwhelmed, but more than just an emotion, stress is a hardwired physical response that travels throughout your entire body, in a short term, stress can be advantageous or positive eg. Love, joy, pride hope, and happiness, or negative eg. Hate, fear, anger, shame, guilt or sadness[1] but when activated too often or too long it may consider as a risk factor cause depression and considered a risk factor for many health conditions such as cardiovascular diseases[2]. Electroencephalography EEG used to measure the electric activity of the brain, electrodes are most commonly placed on the scalp of patient, primary to detect the cerebral cortex. EEG doesn't record the activity in signal neurons, but rather detect the signals created when populations of neurons are active at the same time, it mostly records signals from small areas of the brain surrounding each electrode, EEG primarily measuring postsynaptic potentials or change in membrane potential that are elicited b neurotransmitter binding to receptors to on the postsynaptic membrane, EEG provides an image of electrical activity in the brain represented as waves of varying can be used to measure brain activity and detect the stress level. So in this research will build a classification algorithm using and deep learning to detect stress levels using EEG signals (the electric activity of the brain).

**ID: SE009**
**Title: OSCentIS: ONE STOP CENTRE (OSCent) INVENTORY SYSTEM**

**Rashidah Funke Olanrewaju, Ahmad IrhamBin Dollah and Binyamin Adeniyi Ajayi**

Abstract: With the revolution of technology every day, daily life has become easier and efficient. The same concept also applied to the inventory system where there is more modern inventory system has been introduced to the related organizations. However, One Stop Centre (OSCent), Kuliyyah of Engineering in International Islamic University Malaysia is facing the problem in managing its inventory as the members in OSCent are student on shift basis (not full-time staff)as well as using the manual inventory system. Unrecorded item sold, mismanagement, forget to restock are result of manual system. In order to overcome the problem, this study proposed a Cloud-Based Integrated Inventory System which uses the application of Hypertext Preprocessor (PHP) as the main programming language and My Structured Query Language (MySQL) as the database. The design of the interface is constructed by using Hypertext Markup Language (HTML), JavaScript, and Cascading Style Sheets (CSS). To make it more convenient, the usage of barcode scanner has been integrated to the proposed system. The complete system has been released to OSCent, the data from the feedback form is collected from nine respondents (Users) during the released day, and they have rated the system according to its functionality, interface, security level and performance. Scale 1 to 5, where scale 1 represents very poor level and scale 5 is very good level. criteria being measured to examine system functionality are: how capable is the system to meet the requirements, how efficient is the system to solve the problem, and what is the impact of the system to inventory management in OSCent. 55% rated the system to be very good, 23% believe it good while 17% rated it average. 56% of the respondents admit the interface is developed with a good creativity as the usage and location for each icon and button is aligned with its function as. Besides that, 67% admits that the interface is well designed by optimizing the available pages and arrange the pages according to their main function which are for order transaction, sale transaction, user registration, and item registration. For security, registered password needs to be more than 6 characters, CFRS is embedded to prevent cross-site request forgery, Besides that, the validator is assigned at login controller to ensure correct input. Efficiency was tested based on timing, OscentiS recorded 95% faster than manual method. While similar solutions for the inventory system already available in the commercial market, the proposed system provides an open-source software, low cost-solution that are affordable for OSCent specifically and generally for small and medium enterprises.

**ID: SMD001**
**Title: DAMAGE ASSESSMENT ON NUMERICAL MODELLING OF ROTATING ENGINE BLADES SUBJECTED TO BIRD STRIKE**

**Sharis-Shazzali Shahimi, Nur Azam Abdullah, Meftah Hrairi and Ahmad Faris Ismail**

Abstract: This study presents a numerical modelling of rotating engine blades subjected to bird strike using SPH modelling. Several assumptions have been made to model the bird as a gelatine structure and geometry and material model is utilised in this study. The bird model itself is modelled as a Smoothed Particle Hydrodynamics (SPH) to accurately represent a real bird impact especially during take-off and landing. The bird is also modelled as a

gelatine structure as the bird innards are accurately modelled as water to simulate a liquid of bird bones, flesh, and blood which has the same density as a real bird. The engine blades impacted by the bird is modelled as a tetrahedron elements in commercial software of LS-DYNA consisting of 18 equally spaced (20°) blades. The engine is rotating in the z-axis at 200 rad/s counter-clockwise and the bird impacts the blade at 120 m/s. The material of the blade is modelled with a Johnson-Cook failure constants. The numerical framework is validated with previous literature. The computational results are presented as effective stresses and shows that the structural damage due to impact is significant such that the bird strike causes deflection that will damage the engine blades and also damage the subsequent blades as the engine rotates, the rotation of the blade is such that as the bird strikes the leading edge, the bird is sliced and part of the bird is then impacted towards the subsequent blade behind, causing more damage. As the bird is swept away, the blade still shows deformation due to the impact as it rotates due to centrifugal forces, even though part of the bird is still no longer on the blade.

**ID: SMD002**

**Title: ELECTROMECHANICAL IMPENDENCE AND SMART MATERIALS APPLICATIONS FOR DAMAGE DETECTION IN PV SOLAR CELLS**

**Sabir Beroual and Abdul Aabid.**

Abstract: Monitoring and detecting the exact fault position are necessary and very essential to maintain the optimal performance of photovoltaic (PV) systems. In early analyses and detection of a fault in solar panels can help to reduce serious accidents. In the last few years, it has been found that the durability of PV cells emerged as an important issue to be debated by the scientific community. International organizations and agencies are interested in the interpretation of laboratory and field degradation data of PV cells coming from different producers and installed in different climate zones. For this reason, the understanding of the possible sources of losses in the energy production and the quantification of the degradation of a PV system are fundamental issues. In this project, we focus our attention on adding a new technique, the electromechanical impedance (EMI) based on the smart materials, to detect the faults in PV solar cells. Furthermore, damage identification and location will be developed based on pattern recognition algorithms. The model will be trained on simulation-generated data and tested on experiments for estimating the damage location and identification by using the smart materials. Later the numerical results will be validated experimentally using laboratory equipment. Also, by using damage indicators calculated from the impedance signature of a pristine and damaged cell, an EMI technique coupled with a pattern recognition algorithm will be developed for damage detection, location, and identification of different damages in solar cells. Hence, a complete EMI based structural health monitoring system will be developed and used for continuous monitoring of solar cells, thus, enhancing the reliability and accuracy of structural health monitoring systems and maintaining the performance of solar cells. With the extensive expansion of solar panels and the absence of integrated monitoring, EMI is a monitoring technique that can be integrated at the lowest cost and obtain the most advanced information we need about the PV system. Indeed, integrate different domains to treat the issues is one of the most prominent and fastest ways to find solutions with minimal costs and less damage.

**ID: T001**

**Title: IMPACT OF CROSS-WIRE ON MIXING AND CORE LENGTH USING MACH 2.0 SUPERSONIC JET**

**Mohammed Faheem and Aqib Khan**

Abstract: In the aerospace industry, supersonic jets are commonly used.They have a significant role in turbojet engines for commercial and military air transport, hypersonic cruise vehicle, ram / scram-jet engines, air-to-space rocket engines, etc.The performance of theseengines depends mainly on the nozzle designand the exhaust gases interaction with the structural components in the close vicinity.Shear layer growth and large-scale structural dynamics play a vital role in the behaviour of jets.The aerodynamic and aeroacoustics features of supersonic jets primarily rely on the dynamics of the coherent structures and the shock waves within the supersonic jet core.To improve the mixing characteristics of a supersonic jet, it is essential to alter the shape and structure of the waves prevailing in the near field by introducinglarge and small-scalevortices.This can be achieved by using control devices such as tabs or cross-wires as vortex generators.The objective of the present work is to investigate the feasibility of cross-wire as passive control to boost the efficiency of multiple supersonic jets in terms of mixing characteristics (jet mixing, interaction with the neighbouring jet, core length, infrared plume) which have important implications for the aerospace industry.Besides this, unlike a single circular nozzle, twin jets and triple jets can have different flowfields depending on their orientation like horizontal wire and vertical wire. The goal is to explore the mixing characteristics of multiple jets in Mach number 2.0. Reduced core length helps minimise infrared plume in military and defence applications. The mixing of the high-speed jet with the ambient and core length is interconnected and enhanced mixing results in a better reduction of core lengthand associated jet noise.Up to27% and 45% reduction in core lengthconcerningthe uncontrolled jet is seen in case of control 1 (horizontal wire) and control 2( vertical wire), respectively. Hence this study would be a conceptual idea on implementingcross-wire control technique for multiple jets in close vicinity to examine the suitability of triple jets in aerospace applications.

**ID: VL001**

**Title: LOW-COST AND RAPID PROTOTYPING OF ELECTROCHEMICAL MICROFLUIDIC BIOSENSOR**

**Mohd Afiq Mohd Asri, Siti Azizah Norazman, Nabilah Ramli and Anis Nurashikin Nordin**

Abstract: Electrochemical microfluidic biosensor is a widely used category of bioanalytical microdevices, with applications ranging from home-use glucometers to advanced blood analysis devices. They enable powerful microscale analyses in biology, physics and chemistry. Conventional methods to fabricate these devices are dependent on either screen-printing techniques which lack rapid iteration times; inkjet printing methods involving expensive instrumentation; or photolithography approaches requiring facilities that are expensive and are limited in access. We have developed a low-cost, accessible and rapid fabrication process of electrochemical microfluidic biosensors. This work leverages consumer-grade electronic craft cutters as the primary tool for patterning of sensor electrodes and microfluidic circuits. Easily accessible commodity materials such as gold leaf, hobbyist conductive silver pen, double-sided tapes, vinyl sticker, plastic transparency films, and fabric adhesives are used as its base structural materials. The rapid process allows an iterative

design-build-test cycle in less than 2 hours. Most of its materials can be acquired online, or from hardware, craft and gadget stores. This method is applicable in typical university laboratories and costs less than RM2100 to set up, enabling lower access barriers into the biosensor field for academic and industry researchers in low-resource settings.

**ID: VL002**

**Title: POLYMER COATED ACOUSTIC WAVE SENSOR FOR VOLATILE ORGANIC COMPOUNDS (VOCs) GAS SENSING APPLICATION**

**Nurul Liyana Lukman Hekiem and Aliza Aini Md Ralib**

Abstract: Mass sensitive devices such as quartz crystal microbalance (QCM) sensor has been considered for gas sensing application for various field. Sensing layer plays a crucial role in detecting the analyte gases. Intensive work on optimizing the sensing layer used for gas sensing purposes is required. Chitosan is a naturally occurring biopolymer which is biodegradable with good mechanical strength and has the ability to be functionalized with different types of materials. Thus, chitosan has the potential to be developed into a good sensing layer to improve the sensor performance. This work emphasizes the use of chitosan thin film as the sensing layer on a QCM sensor in detecting isopropyl alcohol (IPA) – a type of volatile organic compound (VOC). Characterization work on chitosan thin film at different acetic acid concentrations are implemented by using XRD, FTIR and FESEM. Drop casting method was chosen to deposit the chitosan thin film on the QCM sensor for further study on the effect to QCM sensor performance. The change in mass was detected by the chitosan sensing layer on the QCM sensor by observing the shift of the resonance frequency. This indicates that chitosan has a potential in adsorbing analyte gas as a shift in frequency was measured by the QCM sensor.

**ID: WCS001**

**Title: WI-SENSE: RSSI-BASED INTEGRATED PHYSICAL INTRUSION ALARM AND INDOOR AUTOMATION**

**Rafhanah Shazwani Rosli and Prof. Dr. Mohamed Hadi Habaebi**

Abstract: In recent years, the Internet of Things technology has advanced rapidly across the technological world. One of the unique applications under the domain of Internet of Things is Wi-SENSE, which is an integrated physical intrusion alarm and indoor automation system based on Received Signal Strength Indicator values as proposed and developed in this research. Existing solutions rely heavily on network protocols that build on single expensive hardware dedicated solely for a single implementation; thus, it is inefficient in terms of cost and hardware. On the contrary, the innovation of this research depends on the existing network infrastructure. It efficiently harvests the radiofrequency energy available from a cheap transmitter pre-installed in the local indoor setting. Furthermore, it is implemented using an integrated module consisting of off-the-shelves electronics with the minimum number of hardware. The system detects intrusion based on the analysis of interferences in Received Signal Strength Indicator readings that are affected by human crossings at the Line of Sight between the main device and nodes of the system; nevertheless, only a few minutes of offline training phase is required, then the system is ready to operate with high accuracy.

Whenever the system detects an intrusion where a crossing of an unknown human subject is detected, it will trigger an alarm and automate the system of any circuit connected to it. In addition, the system is integrated with a mobile application interface as a mechanism of intrusion alarm and for the ease of access to the intrusion detection log. Above all, the viability of the system developed was investigated through a series of experimentations and the outcomes have shown that the sensitivity, which is the ability of the system to detect the crossing of unregistered subjects as an intrusion is averaging at 93.33%. Specificity, which is the ability of the system to detect the crossing of only unregistered subjects as an intrusion, is on average at an optimum level of 100%. The accuracy or the degree to which the system detects an intrusion correctly is averaging at 94%. Hence, the invention is highly viable. In fact, it is highly competitive and offers various solutions to different areas of homes and industries. A survey conducted on 150 potential consumers shows that the majority are looking forward to using the system device in their daily lives. The system is highly feasible and would bring a positive impact on the society and economy.

**ID: WCS003**

**Title: A MERSENNE NUMBER BASED ONE-WAY LIGHTWEIGHT CRYPTO-HASH FUNCTION FOR INTERNET OF THINGS**

**Nubila Nabeel**

Abstract: In the domain of Internet of Things (IOT), data integrity is one of the major contributors to the security of the exchanged communication transactions. There are many methods that have been proposed for maintaining the integrity of data during transmission and hash function are one of the most popular methods used to ensure message integrity and authentication. However, eventhough many crypto function algorithms have been proposed to ensure data integrity, almost all of them proved to be either breakable, or time inefficient and almost all of them require intensive computational resources rarely available in IOT devices. Furthermore, recently introduced lightweight hash functions are having fixed-length key-size rendering them suitable for a specific type of IOT applications and devices only. This research aims at investigating andassessing the potential of introducing a new generic adaptive one-way lightweight crypto hash functions suitable for a variety of IOT devices and applications based on newly introduced Mersenne Number Transform. The methodology involves firstly investigating the power consumption, computational and memory resources needed for different IOT devices and applications. This is followed by developing a new Mersenne number transform based crypto function that has a variable key size to accommodate the different IOT requirements. Then, a simulation model will be developed to analyze its performance and finally the performance is evaluated and benchmarked using our IOT laboratory test bed against other existing hash functions to demonstrate its superiority. The property of variable key-size length is expected to provide increased protection against current known attacks and to simplify algorithm implementation. The developed crypto-function, however, is expected to be used in a variety of IOT devices. The research significance lies in paving the way towards future smart devices and applications that go beyond traditional schemes and materializes the national industry 4.0 blueprint.

**ID: WCS005**
**Title: A REVIEW OF REMOTE BABY CRYING DETECTION DEVICES**
**Mahfuza Sultana, Dr. Khairul Azami Sidek and Dr. Rashidah Funke Olanrewaju**

Abstract: The Advent of Automatic infant cry detection devices has rendered a great opportunity/relief for caregivers, parents as well as medical officers during continuous infant health monitoring. If the cry can be detected from remote places then it will give the caregiver room for free spaces for a while though it is not advisable to keep a baby alone for a long time. To come up with a solution, Researchers have worked on various algorithms to improve the accuracy of detection for more than thirty years. On the other hand, lots of experiment has been carried out to develop a noise-free and robust system in several environmental conditions such as in-home, garden, hospital, etc. In this paper, a review has been done about existing remote cry detection devices and algorithms which might be helpful to develop an embedded system that can analyze the infant cry signal with cry reason. This can alert the concerned person with the crying reason automatically from remote places without any interruption.

**ID: WCS007**
**Title: MODIFICATION OF DISTANCE FACTOR IN RAIN ATTENUATION PREDICTION FOR SHORT RANGE MILLIMETER WAVE LINKS**
**Asma Ali Budalal, Md Rafiqul Islam, Khaizuran Abdullah**

Abstract: Prediction accuracy of rain attenuation on short-range millimetre-waves terrestrial links is of the utmost importance for signal strength prediction and link budget of 5G systems and beyond. This poster contributes to the prediction of rain attenuation over millimetre-wave frequencies for a short-range path (less than 1 km). Interestingly, rain-induced attenuation predicted by utilizing ITU-R P.530-17 largely overestimates the measured data at 26GHz and 38 GHz with 300 m path length in Malaysia. This is due to the inclusion of the distance factor, the value of which ranges between 2.5 (f = 38 GHz) to 2.54 (26GHz). The behaviour of the distance factor is investigated thoroughly and found the maximum values of the distance factor inconsistent for the path lengths less than 1 km. Consequently, a modification for the distance factor r in ITU-R P530.17 has been proposed. The measured rain attenuation data are utilized to validate and improve the proposed modifications. Besides, available rain attenuation measurements at 25 GHz for 223 m path length in Japan and 75 GHz for 100 m path length in Korea are also utilized for validation. Subsequently, several available measurements from different locations are used to validate the accuracy of the proposed model and found good agreement. The proposed model and measured data have been applied to investigate the impact of rain fade on path loss model using NYUSIM channel model software package (Version 2.0), considering the weather conditions of Kuala Lumpur city. Simulation results show that the attenuation by rain has a significant impact on path loss. At cell radii of ~ 200 m, the difference in path loss with and without considering rain fade is more than 10 dB, and a realistic cell radius up to ~ 200 m did not preserve outdoor coverage of (PR≥ –75 dBm). The cell radii of ~ 200 m is still a challenge to offer a high probability of coverage and ultra-reliable communication (URC) requirements for outdoor and outdoor to indoor applications during rain in a tropical climate for 5G wireless systems operating at 38 GHz.