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Technology Based Learning System in Internet of Things (IoT) Education (Conference Paper)

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Abstract

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In this decade, Internet of Things (IoT) technologies are motivating nations for digital transformation. This transformation is part of Fourth industrial revolution (Industry 4.0). Several challenges are obstacle in the digitalization, one of them is talent in this field. There are not many available automation or control labs equipped with advance automation technologies in the educational institutions. To produce more force for IoT, engineering intuitions need to improve their curriculum and engineering lab facilities. In this paper, a technology-based learning system is proposed for learning IoT. The design of this system purposely developed for control lab for undergraduates and postgraduate students. This system offers a low-cost development using industrial standard controller, which is suitable for industrial and enterprise applications prototyping. Three modules are prepared to train the students; 1) Introduction to IoT Industry 4.0, 2) controller programming, configuration and machine to machine (M2M) communication and 3) design and development of web and mobile applications. All students implemented and tested the industrial standard IoT application in the end of Session. The design and implementation result shows the learning experience of students has been improved and motivates the institutions to apply this low-cost system to fulfil the future talent demand in this field. © 2018 IEEE.

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Author keywords

Automation Control Lab Engineering Education Internet of Things (IoT) Technology based learning.

Indexed keywords

Engineering controlled terms: Automation Controllers Costs Engineering education Industry 4.0 Laboratories Learning systems Software prototyping Students

Engineering uncontrolled terms: Design and Development Design and implementations Educational institutions Enterprise applications Industrial revolutions Internet of Things (IoT) Machine to machine (M2M) Technology-based learning

Engineering main heading: Internet of things

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(2017) *MobiSys 2017 - Proceedings of the 15th Annual International Conference on Mobile Systems, Applications, and Services*

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- ☐ 1 Lasi, H., Fettke, P., Kemper, H.-G., Feld, T., Hoffmann, M.

### Industry 4.0

(2014) *Business and Information Systems Engineering*, 6 (4), pp. 239-242. Cited 361 times.

<http://www.springerlink.com/content/121294>

doi: 10.1007/s12599-014-0334-4

[View at Publisher](#)

- ☐ 2 Ning, H.S., Liu, H.

### Cyber-physical-social-thinking space based science and technology framework for the Internet of Things

(2015) *Science China Information Sciences*, 58 (3). Cited 21 times.

<http://www.springer.com/computer/information+systems+and+applications/journal/11432>

doi: 10.1007/s11432-014-5209-2

[View at Publisher](#)

- ☐ 3 Kortuem, G., Bandara, A.K., Smith, N., Richards, M., Petre, M.

### Educating the internet-of-things generation

(2013) *Computer*, 46 (2), art. no. 6357164, pp. 53-61. Cited 70 times.

doi: 10.1109/MC.2012.390

[View at Publisher](#)

- ☐ 4 Ashton, K.

That 'internet of things' thing

(2009) *RFID J.* Cited 951 times.

- ☐ 5 Sundmaeker, H., Guillemin, P., Friess, P., Woelfflé, S.

(2010) *Vision and Challenges for Realising the Internet of Things the Meaning of Things Lies Not in the Things Themselves, but in Our Attitude Towards Them. Antoine de Saint-Exupéry*. Cited 418 times.

- ☐ 6 Atzori, L., Iera, A., Morabito, G.

### The Internet of Things: A survey

(2010) *Computer Networks*, 54 (15), pp. 2787-2805. Cited 5482 times.

doi: 10.1016/j.comnet.2010.05.010

[View at Publisher](#)

- ☐ 7 Gubbi, J., Buyya, R., Marusic, S., Palaniswami, M.

### Internet of Things (IoT): A vision, architectural elements, and future directions

(2013) *Future Generation Computer Systems*, 29 (7), pp. 1645-1660. Cited 3365 times.

doi: 10.1016/j.future.2013.01.010

[View at Publisher](#)

- 
- ☐ 8 Hodges, S., Taylor, S., Villar, N., Scott, J., Bial, D., Fischer, P.T.  
**Prototyping connected devices for the internet of things**  
  
(2013) *Computer*, 46 (2), art. no. 6357162, pp. 26-34. Cited 59 times.  
doi: 10.1109/MC.2012.394  
  
[View at Publisher](#)
- 
- ☐ 9 Johnson, L., Adam, S., Cummins, M.  
(2012) *The NMC Horizon Report: 2012 Higher Education Edition*. Cited 1399 times.  
Texas
- 
- ☐ 10 Qi, A.-Q., Shen, Y.-J.  
**The application of internet of things in teaching management system**  
  
(2011) *Proceedings - 2011 International Conference of Information Technology, Computer Engineering and Management Sciences, ICM 2011*, 2, art. no. 6113511, pp. 239-241. Cited 3 times.  
ISBN: 978-076954522-6  
doi: 10.1109/ICM.2011.238  
  
[View at Publisher](#)
- 
- ☐ 11 O'Connor, M.C.  
Northern Arizona university to use existing RFID student cards for attendance tracking  
(2010) *RFID Journal*. Cited 3 times.  
[Accessed: 28-May-2018]  
<http://www.rfidjournal.com/articles/view?7628>
- 
- ☐ 12 Texas tech university health sciences center in el paso deploys campus-wide RFID asset tracking  
(2011) *Radiant RFID*  
Radiant RFID [Accessed: 28-May-2018]  
<https://radiantrfid.com/2011/02/05/texas-tech-university-healthsciences-center-in-el-paso-deploys-campus-wide-rfid-assettracking/>
- 
- ☐ 13 Bolton, W.  
(2015) *Programmable Logic Controllers*. Cited 123 times.  
Sixth. Elsevier Ltd
- 
- ☐ 14 Graven, O.H., Bjork, J.  
**The use of an Arduino pocket lab to increase motivation in Electrical engineering students for programming**  
  
(2016) *Proceedings of 2016 IEEE International Conference on Teaching, Assessment and Learning for Engineering, TALE 2016*, art. no. 7851800, pp. 239-243. Cited 3 times.  
ISBN: 978-150905598-2  
doi: 10.1109/TALE.2016.7851800  
  
[View at Publisher](#)
- 
- ☐ 15 Mhatre, L., Rai, N.  
**Integration between wireless sensor and cloud**  
  
(2017) *Proceedings of the International Conference on IoT in Social, Mobile, Analytics and Cloud, I-SMAC 2017*, art. no. 8058285, pp. 779-782.  
ISBN: 978-150903243-3  
doi: 10.1109/I-SMAC.2017.8058285  
  
[View at Publisher](#)
-

- 
- ☐ 16 Byrne, J.R., O'Sullivan, K., Sullivan, K.  
An IoT and Wearable Technology Hackathon for Promoting Careers in Computer Science  
  
(2017) *IEEE Transactions on Education*, 60 (1), art. no. 7755808, pp. 50-58. Cited 2 times.  
doi: 10.1109/TE.2016.2626252  
  
[View at Publisher](#)
- 
- ☐ 17 Dobrilovic, D., Zeljko, S.  
Design of open-source platform for introducing Internet of Things in university curricula  
  
(2016) *SACI 2016 - 11th IEEE International Symposium on Applied Computational Intelligence and Informatics, Proceedings*, art. no. 7507384, pp. 273-276. Cited 5 times.  
ISBN: 978-150902379-0  
doi: 10.1109/SACI.2016.7507384  
  
[View at Publisher](#)
- 
- ☐ 18 Stephen, H.  
(2015) *Why Gateways and Controllers Are Critical for IoT Architecture-RTInsights*  
[Accessed: 02-May-2018]  
<https://www.rtinsights.com/why-gateways-and-controllers-arecritical-for-iot-architecture/>
- 
- ☐ 19 Siemens, A.G.  
(2016) *The Intelligent Gateway*
- 
- ☐ 20 (2016) *SIMATIC IOT2020*  
[Siemens](#)
- 
- ☐ 21 (2013) *Node-RED*  
IBM Emerging Technology  
<https://nodered.org/>
- 
- ☐ 22 Hunkeler, U., Truong, H.L., Stanford-Clark, A.  
Performance evaluation of MQTT and CoAP via a common middleware  
(2008) *2008 3rd International Conference on Communication Systems Software and Middleware and Workshops (COMSWARE '08)*, pp. 791-798.  
April
- 
- ☐ 23 *MQTT Dash (IoT, Smart Home)*  
Routix Software  
<https://play.google.com/store/apps/details?id=net.routix.mqtttdash>
- 
- ☐ 24 Mell, P., Grance, T.  
The NIST definition of cloud computing  
(2011) *Natl. Inst. Stand. Technol*, 800, p. 145. Cited 990 times.
- 
- ☐ 25 (2015) *Overview of Adafruit IO*  
[Accessed: 29-Apr-2018]  
[Adafruit](#)
-

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