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Humanoid Robot Head

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ABSTRACT

One of the long term goals of the autonomous agent research group is to develop a "humanoid robot that is able to support human in broad variety of tasks alone or in corporation with humans". The development of such robots is a challenging task as it is very different from the design of industrial robots due to a totally different target system of requirements. One of the fundamental aspects of completing the broad variety of task is the ability to execute human to human like cooperation with a variety of ways to convey expressions. The communication requirement for a humanoid leads to complex design process and a design which has to be spatially integrated as well as functionally integrated. This leads to complex intricate interactions between system elements. The demands for mobility further add to the requirement of a lightweight design of a humanoid robot.

This paper reports on the design and development of the neck for a humanoid head. The neck will support the humanoid head to support the humanoid head in mimicking the human use of it to display expression when communicating. Specifications presented here are based on biological anatomical and behavioral data summarized as well as task constraints. Different concepts for the neck design (flexible, parallel and serial solutions) are analyzed and compared with respect to the anatomical specification. Some preliminary work on the face head design is also presented.

1. INTRODUCTION

Humanoid robot is a term that refers to a robot whose body structure resembles that of a human, other common terms used to describe such a robot are android and gynoid [1]. Humanoids are created to imitate some of physical and mental tasks that humans undergo daily, the main idea behind creating humanoids is to make human more comfortable in working with machines. Thus humanoid robots are expected to have the capabilities that are not possessed by conventional industrial robots such as self maintenance (recharge itself, swap batteries, etc), autonomous learning (learn or gain new capabilities without outside assistance, adjust strategies based on the surroundings and adapt to new situations), avoiding harmful situations (to people, property and itself), safe interacting with human beings and the environment with the ability to detect, understand and transmit natural human cues.

Dautenhahn and Billard further proposed the following definition for humanoid social robots: "Social robots are embodied agents that are part of a heterogeneous group: a society of robots or humans. They are able to recognize each other and engage in social interactions, they possess histories (perceive and interpret the world in terms of their own experience), and they explicitly communicate with and learn from each other." [2]. The characteristics of importance are such as the ability to express and/or perceive emotions, communicate with high-level dialogue, learn/recognize models of other agents, establish/maintain social relationships, use natural cues (gaze, gestures, etc), exhibit distinctive personality and character and may learn/develop social competencies.

Central to the success of social robots will be highly depended on interaction between humans and robots. Although it is important to continue enhancing autonomous capabilities, the improvement of human–robot interaction cannot be neglected. The improvement of human-robot interaction means the improvement of humanness of the robots. The perception of humanness in a social robot is heavily