ARC '16

مؤتمر مؤسسة قطر
السنوي للبحوث
QATAR FOUNDATION
ANNUAL RESEARCH
CONFERENCE

Towards World-class
Research and Innovation

Health and Biomedical Pillar

http://dx.doi.org/10.5339/qfarc.2016.HBSP2914

Reflex System for Intelligent Robotics

Ahmad Yaser Alhaddad, John-John Cabibihan

Qatar University, QA

Email: a.yaser@qu.edu.qa

Background and Purpose

Great advances have occurred in the field of robotics in the past few years. The integration of robotics in our daily life became not only limited to manufacturing or industrial usage, but also in health care delivery, aerospace, humanitarian aids and others. Most of the existing robots systems rely on the programmer to set the rule it plays within the working environment or rely on a trainer to teach the system what should and need to be done and where they are ought to move. Other robotic systems might involve more intelligent systems to explore and handle tasks within their environment. Most of these systems are usually situated to work within well organized and planned environment. Having modifications on any of the parameters of the environment might produce unpredictable consequences. Depending on the complexity of the system and how intelligent it is, the consequences might be unfavorable in achieving the goals intended and reducing oneself-damages.

Species in nature represents rich source of innovative ideas and creative concepts that can be investigated by researchers. Nature has been inspiring scientists into developing new ways of looking at things, by observing the various living organisms' behaviors in their own habitats. Behavior-based roboticists are concerned with the development of robots based on observing and the studying of neuroscience, psychology and ethology of animals in nature. Humans, animals and plants physiology is yet another rich source of researching potential (Figure 1). For example, reflexes in living organisms represent a means of survival in the outer environment and means of regulating internal body operations. If we could observe and try to mimic some of the reflex behaviors, we could end up with a machine (E.g. Robots) that has the ability to avoid dangerous situations and keep the outer structure intact.

Figure 1: The potential of reflex systems in intelligent robotics.

Cite this article as: Alhaddad AY, Cabibihan J-J. (2016). Reflex system for intelligent robotics. Qatar Foundation Annual Research Conference Proceedings 2016: HBSP2914 http://dx.doi.org/10.5339/qfarc.2016.HBSP2914.

Objective

Adopting an intelligent reflex system in the robot system similar to that found in humans, animals, and plants can have significant advantages on the overall behavior of the system. A reflex system can improve the risk avoiding capabilities in the unfavorable scenarios.

Design

The approach toward reflex based robotic system involves the intensive investigation and review of the fundamental concepts found in the reflex systems of human, animals, and plants. Attention to details, such as the behavior of the organism when subjected to a certain stimulus and the latency it takes for the reflex arc to execute the right response, are among the most important things to consider when trying mimicking the behavior of a living organism. A deduced conceptual model should be based on the distinguishing components found in the reflex arc. An actual design based on this proposed model, will include the basic components that can be achieved by using electronic/mechanical components that are at the same time analogous in function to the ones found in the reflex arc. For example, to mimic the temperature sensing capabilities of a human hand, a simple one-point temperature sensor will not be sufficient to give a desirable realistic result. Instead, a sophisticated flexible array that is capable to sense the temperature at any point must be used. Another design consideration is the controlling method to be used. Will it be centralized or decentralized or a mix of both? Regardless of the answer the controlling mechanism involved should be independent of a central controller (i.e. the brain) and it must be localized to achieve the desirable fast response as that founded in the reflex arc.

Conclusion

The reflex based robotic system will be unique and innovative for the applications intended. The system can be incorporated with pre-existing systems to add value especially in the field of medical robotics and more specifically in prosthetics. Artificial reflex systems will add great value, protective feature and life-like sensation for a smarter prosthetic artefacts. With the implementation of the reflex arc at the right latencies and order, the gap between artificial and the actual hand should get narrower.

Acknowledgment

This publication was made possible by the support of an NPRP grant from the Qatar National Research Fund (NPRP 7-673-2-251). The statements made herein are solely the responsibility of the authors.

Keywords

Intelligent Robotics, Reflex System, Prosthetics