



WIRELESS GESTURE CONTROL ROBOT: AN ANALYSIS

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ABSTRACT: Today human-machine interaction is moving away from mouse and pen and is becoming pervasive and much more compatible with the physical world. With each passing day the gap between machines and humans is being reduced with the introduction of new technologies to ease the standard of living. Gestures have played a vital role in diminishing this abyss. In this paper, a rigorous analysis of different techniques of “Human-Machine Interaction” using gestures has been presented. Gestures can be captured with the help of an accelerometer, however, with the evolution of smartphone its independent usage has been rendered useless. This paper analyzes the motion technology to capture gestures through an android smartphone with an inbuilt accelerometer and a Bluetooth module to control the kinetics of a robot.

Keywords: Gesture, Android OS, Smartphone, Bluetooth, Accelerometer.

I. INTRODUCTION

Humans are anxiously working on finding new ways of interacting with machines. However, a major breakthrough was observed when gestures were used for this interaction. A gesture is a form of non-verbal communication in which visible bodily actions communicate particular messages. It comprises of sound, light variation or any type of body movement. Based upon the type of gestures, they have been captured via Acoustic (sound), Tactile (touch), Optical (light), Bionic and Motion Technologies through still camera, data glove, Bluetooth, infrared beams etc. Motion Technology has succeeded in drawing the attention of researchers from different parts of the world.

Smartphone, a small yet powerful device is rapidly changing the traditional ways of human-machine interaction. Modern smartphones are embedded with accelerometer sensor, Bluetooth module and are powered by different operating systems such as Symbian, Bada, Android OS etc. Among all available mobile operating systems Android OS has gained significant popularity after being launched in 2008, overtaking all previous competitors due to its open architecture. Android platform has revolutionized the

application development field for cellphone, opening new doors for technical exploration.

The smartphone can be freely rotated in space, temporarily varying 3-dimensional signal data is obtained from the phone's 3-axis acceleration sensor. This data is transmitted to a robot via Bluetooth module of smartphone using an android app. Further, it is processed by a microcontroller embedded on the robot for its desirable motions. In this context, a robot is an analogy for any machine that is controlled by man varying from a simple toy to heavy machinery. Robots have even replaced humans in performing various tasks that they are unable to perform due to physical disability, size limitation or extreme environments.

For past two decades, researchers from around the world have shown keen interest in gesture technology and its possibilities in various fields making it a powerful tool for humans. Smartphones have proved to be of much more aid than being a device just for making calls. The large world is merging together into the palms of humans in the form of a smartphone. A lot of research work in this context has been explored and presented in the next section.



II. LITERATURE SURVEY

The emergence of service robots in early 90's (Helpmate Robots and Robo-Caddy) followed by the development of natural language interface through keyboard has been given by Torrance in 1994[1]. Speech recognition evolved as an upgradation of the past work to communicate with machines but it lacked the standardization of commands due to varying languages, pitch and accent of different users. Hence, researchers [1]-[2] proposed vision-based interface that included gesture recognition through camera to provide geometrical information to the robots. They developed mobile robot systems that were instructed through arm positions but those robot systems couldn't recognize gestures defined through specific temporal patterns. Other limitation faced by the cameras was the poor illuminations at night and in foggy weather [3]-[4].

Motion technology facilitates humans to interact with machines naturally without any interventions caused by the drawbacks of mechanical devices. Using the concept of gesture recognition, it is possible to move a robot accordingly [5]. Gyroscope and Accelerometers are the main technologies used for human machine interaction that offer very reasonable motion sensitivity, hence, are used in large array of different applications [6].

A lot of work has been done on motion technology using accelerometers [7]. In 2008, Chinese traffic police system used two 3-axis accelerometers fixed on the back of their arms that were synchronized with traffic lights. However, data could only be extracted while the arms would be steady [3].

In 2010, Sauvik Das et al have used an accelerometer as a potential spying device to show locations and activities of user without one's knowledge [9]. One of the limitations was that inbuilt accelerometer smartphone would have to be in the same place as was in the training mode to make accurate predictions [7]. In late 90's the smartphones started gaining popularity. The usage of mechanical accelerometer was cumbersome as it possessed the complexity of connections and also portability was a major challenge. With the emergence of smartphone, the technology became lucid as it was equipped with several accessories in concised form [8]. In 2010, Smartphones were used to control Universal Robot Control System by the students of Kyungpook National University, Korea, to design a real time robot control system in ubiquitous environment. However, gestures involved were complex and an extra robot control manager unit was required [9].

Similar work has been done using Symbian [10] and iOS [11] platforms. However, parallel work on Android OS by Google became more popular because of its powerful capabilities and open architecture [12]. Also, it has a large community of developers writing applications that could enhance the functionality of device, written primarily in a customized version of JAVA [13]. Android OS based Smartphone was being interfaced with LEGO Mindstorm RCX and later with NXT to control robot. The usage of NXT eased the integration of sensors [12]. Based on Android OS, Craig J. Mouser et al [14] built an application to control and view a live video stream from the remote robot.

Smartphones have an inbuilt Bluetooth module that is a wireless technology in a short range communication system that aims to replace cables connecting portable devices. Keeping the above features in view, Nasereddin and Abdelkarim proposed controlling of robots through bluetooth using Direct Drive and Map-based models [15]. The present work envisages the use of Android Smartphone for the controlling of robot using Bluetooth Wireless Technology.

III. CONCLUSION

Enormous amount of work has been done on wireless gesture controlling of robots. In this paper, various methodologies have been analyzed and reviewed with their merits and demerits under various operational and functional strategies. Thus, it can be concluded that features like user friendly interface, light weight and portability of android OS based smartphone has overtaken the sophistication of technologies like programmable glove, static cameras etc., making them obsolete. Although recent researches in this field have made wireless gesture controlling a ubiquitous phenomenon, it needs to acquire more focus in relevant areas of applications like home appliances, wheelchairs, artificial nurses, table top screens etc. in a collaborative manner.

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