Android Phone Controlled Robot Using Bluetooth

Arpit Sharma[1], Reetesh Verma[2], Saurabh Gupta[3] and Sukhdeep Kaur Bhatia[4]

[1]*Student, Dept. of Instrumentation & Control Engg,*
J.S.S. Academy of Technical Education Noida, India
[2]*Student, Dept. of Instrumentation & Control Engg,*
J.S.S. Academy of Technical Education, Noida, India
[3]*Student, Dept. of Instrumentation & Control Engg,*
J.S.S. Academy of Technical Education, Noida, India
[4]*Dept. of Instrumentation & Control Engg,*
J.S.S. Academy of Technical Education, Noida, India

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 analyses the motion technology to capture gestures through an android smartphone with an inbuilt accelerometer and Bluetooth module to control the kinetics of a robot. The signals of the Bluetooth Module are controlled by the Microcontrollers.

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

1. Introduction

Robots are smart machines that can be programmed and used in many areas such as industry, manufacturing, production lines, or health, etc [1]. These robots perform hard, dangerous, and accurate work to facilitate our life and to increase the production because they can work 24 hours without rest , and can do works like human but more

precisely and with less time. Assistive mobile robots that perform different kinds of work over everyday activities in many areas such as industry, manufacturing, production lines, or health, etc. are very commonly used to improve our life. The idea of this research is to exploit robotics usage on healthcare field to help mobility disabled people.

A smartphone is a mobile phone built on a mobile computing platform, with more advanced computing ability and connectivity than a feature phone. Smartphones are a more affordable and efficient hand held devices which can be used to support collaborative activities in a community. It is a result of a huge advancement in mobile phones technology. 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 [2,7,10]. 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 [4,6]. 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.

2. Background

This section takes a brief look at Android smart phones and its features, how smart Phones will help to develop a community in the environment it is used in. Hardware, software and communication protocols are evaluated for their suitability to this application. Finally, we take a brief look on existing systems.

2.1 Android Platform

Android devices are powerful mobile computers and they become more and more popular smart phones used worldwide. They becomes more and more popular for software developers because of its powerful capabilities and open architecture, also it's based on the java programming language. Because Android uses the Java programming language getting started with the Android API is easy; the API is open and allows easy access to the hardware components. Android devices provide numerous communication interfaces like USB, Wi-Fi and Bluetooth, that can be used to connect to the robot. We think it is a great platform for a robotic system control, because it's much cheaper than any other ARM-based processing unit. We use android platform because it is the widest used in the word and runs the largest number of smartphones worldwide.

2.2 Connectivity and Communication

For the communication of the robot with the cell phone or a mobile we are using the Bluetooth device. The Bluetooth device (HC-05) is attached to the robot that receives the data from the mobile and also can transmit the data.

Bluetooth: Bluetooth is a wireless communications protocol running at 2.4 GHz, with client-server architecture, suitable for forming personal area networks. It is designed for low power devices such as mobile phones [3,5].

Bluetooth now comes as standard on the majority of mobile phones, and desktop computers. It can be easily fitted with a module to allow Bluetooth communication. Bluetooth is the only appropriate communications protocol because there is no fear of getting the frequency interference. Bluetooth uses the MAC Address of the device. The Bluetooth gives the connectivity between two devices using their MAC Address.

3. Design

The Android app is generally developed using JAVA language but this Android app can also be build without knowing the Java language. This app was developed in "App Inventor" developed by MIT [8].

This app inventor is designed specifically for Non – Computer Science students those who don't know the JAVA language. The figure shown below is the block diagram back- hand design for the application. The app shown below has 5 buttons and all the buttons gives 5 different bytes in the output that has to be fed to the Microcontroller to process [9]. For eg. if we press forward button ,the Bluetooth Module will give 1 byte at its output as shown in the figure. The app consists of the option in the main screen whether to use the accelerometer of the phone or to use the buttons to control the Robot. This app inventor brings out the revolution in the Embedded Systems & Robotics. The app invented by this searches for the Bluetooth devices along with their MAC addresses. The user just has to select the particular MAC Address.

When a particular MAC is selected , the status shown on the screen is "Connected". Now all the buttons are active and the app is now connected with the robot and mobile phone can control the robot.

Fig. 1: Android App Development.

3.1 System Architecture

Fig. 1 shows the overall architecture of the system, and with which components the different types of users will interact.
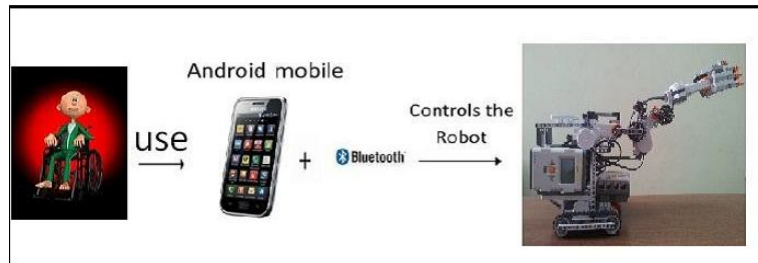

Fig. 2: System Architecture.

3.2 Mobile Application

The Mobile application consists of 5 buttons viz. Right, Left, Forward, Reverse ,Stop.

Fig. 3: Status- Not Connected.

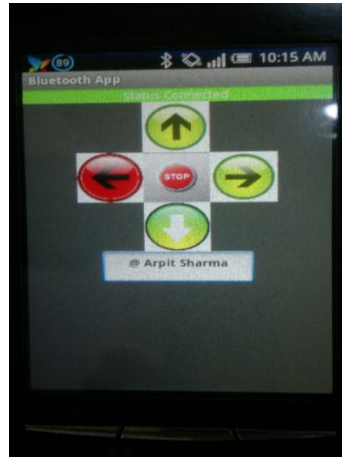The above screen consists of an overlook of the app. Right now all the 5 buttons are disabled until the Bluetooth is connected.

Fig. 4: Status- Connected.

Now since the Bluetooth of the mobile is connected to another Bluetooth Module , the status shown is "Connected".

4. 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.

5. Acknowledgement

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