Embedded Human Control of Robots using MEMS Technology

Ninisha Antony, Prathyusha. K, Sneha. K. Suresh, Chandra Kumar H. S
Department of ECE, R R institute of Technology, Bengaluru- 560090, India

Abstract: The paper describes the MEMS based Gesture Controlled Robot. The robot can be controlled by human hand gestures relatively than an ordinary switches. The operation is based on the moment of the hand gesture action signs made through hand movement. The MEMS sensor with the Myoelectric interface is used for the convenient operations. The interface between these sensors are controlled by a software program which is interfaced with a microcontroller system. The experimentations proves that the gesture recognition formula is very competent and it improves the recognition in a better way and is placed in a small cabinet. This technique used in robots can interact with humans in a natural way. Hence our interest is in the hand motion based robust MEMS gesture controlled robot interface.

I. INTRODUCTION

Present advancement technologies cannot conclude until the influence the user purpose. The technology has played significant role in improving the quality of the life. The automating the tasks using complex logic to simplify the work. The gesture control robots are extensively used in non verbal communication and in addition to this some situation they can be used in a deaf people and police traffic coordination in the absence of the traffic lights. Gesture control is also used in military purpose for controlling the missiles using radar. Controlling the robots in traditional way is a risk when it comes to the battlefields. Using hand gestures as a control mechanism in virtual reality [6]. In our work, a miniature MEMS accelerometer based recognition system which can recognize eight hand gestures in 3-D space is built. The system has potential use to control the robots by hand movement is an effective and efficient approach to overcome the limitations such as unexpected delay and improper functioning of robot with manual control. A Micro Inertial Measurement Unit is utilized in this project to detect the accelerations of hand motions in three dimensions. The proposed recognition system is implemented based on MEMS acceleration sensors. Since heavy computation burden will be brought if gyroscopes are used for inertial measurement [10], our current system is based on MEMS accelerometers only and gyroscopes are not implemented for motion sensing. Fig.1.a and Fig 1.b shows the system architecture of the proposed gesture recognition system based on MEMS accelerometer. The details of the individual steps are described below.

II. SYSTEM DESIGN MODEL

A. Software design module

For the operation purpose, the user application instructions are written programming code by using embedded c. The application program is compiled by using KEIL-C compiler and converts the source file into .hex file. For the dumping codes into microcontroller ROM memory, we use flash magic. The μVision4 screen provides us with a menu bar for command entry, a tool bar where we can rapidly select command buttons, and windows for source files, dialog boxes, and information displays. μVision4 lets us simultaneously open and view multiple source files. A project contains enough information to take a set of source files and generate exactly the binary code required for the application. Because of the high degree of flexibility required from the tools, there are many options that can be set to configure the tools to operate in a specific manner. It would be tedious to have to set these options up every time the application is being built; therefore they are stored in a project file. Loading the project file into
KEIL informs KEIL which source files are required, where they are, and how to configure the tools in the correct way. The user of KEIL centers on “projects”. A project is a list of all the source files required to build a single application, all the tool options which specify exactly how to build the application, and—if required—how the application should be simulated. The project can then be saved to preserve the settings. The project is reloaded and the simulator or debugger started, all the desired windows are opened. KEIL project files have the extension.

**B. Hardware design module**

In cases there is a requirement of a mechanism where in the robot should be controlled without any physical contact. Therefore gesture is our choice in order to achieve this primary goal. Gesture is a nonverbal and easier physical action. A sensor that takes gesture as its input can do this job. The Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis. The ADXL335 is available in a small, low profile, 4 mm x 4 mm x 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP_LQ). The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. ZigBee standard 802.15.4/Multipoint network topologies with 2.4 GHz for worldwide deployment & 900 MHz for long-range deployment. Fully interoperable with other Digi Drop-in Networking products, including gateways, device adapters and extenders. Common zigBee footprint for a variety of RF modules like Low-power sleep modes, Multiple antenna options. It has Industrial temperature rating of (-40°C to 85°C) & Low power and long range are variants available. Here we are using DC motors with 60rpm and 12V dc supply. DC motors are used for the movement of the robots.

Transmitting section: It is also known as the robotic section. The wireless camera captures the images and videos in it & sent to laptop/pc. The RFID reader allows the authorized person to use the robot. Then using MEMS sensors the hand gestures are read and sent to the microcontroller. The microcontroller sends this to zigbee and it is transmitted to the receiving section.

Receiving Section- It is also known as the controlling section. The zigbee receives the information and sends it to the microcontroller. The microcontroller sends the information to the DC motors and then DC motors are used for the movement of the robot. These robots then work according to the hand gestures and the direction of movement is displayed in LCD display.

**III. EXPERIMENTAL RESULTS**

In the area of safety, for example, many machines require to place robot in remote places so that the robot is capable of capturing images and videos in places like near borders, hill stations and remote places where human beings are not able to enter. this robots are able to control and monitor with help of hand gestures. Instead of having operators move their hands to special switches, why not simply let them hold up their hands with a gesture sensor? This type of control could improve productivity, reduce the effects of repetitive motions, and improve safety.

**IV. CONCLUSION**

We proposed a fast and simple algorithm for hand gesture recognition for controlling robot. We have demonstrated the effectiveness of this computationally efficient algorithm on real images we have acquired. In our system of gesture controlled robots, we have only considered a limited number of gestures. Our algorithm can be extended in a number of ways to recognize a broader set of gestures. The gesture recognition portion of our algorithm is too simple, and would need to be improved if this technique would need to be used in challenging operating conditions. Reliable performance of hand gesture recognition techniques in a general
setting require dealing with occlusions, temporal tracking for recognizing dynamic gestures, as well as 3D modeling of the hand, which are still mostly beyond the current state of the art.

REFERENCES


