ISSN(Online) : *2456-8910*
International Journal of Innovative Research in Applied Sciences and Engineering (IJIRASE)
Volume 2, Issue 10, DOI: 10.29027/IJIRASE.v2.i10.2019, 335-338 , April 2019

Hand Gesture based Robot Motion Control Built using Accelerometer and Microcontroller

Bhargavi Raguraman
Department of Electronics and Communication Engineering
SRM IST
Ramapuram, Chennai
bhargavi123087@gmail.com

Shravani K
Department of Electronics and Communication Engineering
SRM IST
Ramapuram, Chennai
gundlatemp@gmail.com

Aishwarya S K
Department of Electronics and Communication Engineering
SRM IST
Ramapuram, Chennai
aiswaryask23@gmail.com

Shivani Jaiswal
Department of Electronics and Communication Engineering
SRM IST
Ramapuram, Chennai
jaiswal.shivani12@gmail.com

M.Rajesvari
Department of Electronics and Communication Engineering
SRM IST
Ramapuram, Chennai
sanra1230@gmail.com

Abstract- Hand gesture recognition, in the recent years, has been developed to be an independent technology on its own due to its efficiency and user friendly features. This paper presents the recent advancements of the said domain. It highlights the drawbacks of other potential gesture recognizing technologies which are overcome by hand gesture sensing. The execution is carried out using an accelerometer which keeps tracks of the axes, thereby guiding the robot. The conventional approach of utilizing joysticks or even buttons for controlling can be replaced by this algorithm for identifying gestures.

Index Terms – Hand gesture recognition, Accelerometer, Robotics, Microcontroller, Arduino

I. INTRODUCTION

The main aim of creating hand gesture recognition system is to enhance the interaction between human beings and robots. Gestures are one of the most popular communication methods, and those gestures can be delivered by face, fingers, hands or even whole body movements. To increase the human penetration in uncertain terrains like war zones, rescue situations, these robots that follow the gestures of the human controller can be used. This paper present presents an amalgam of gestures and its corresponding recognition, which can be of benefit as the interface between human beings and machines.

The hand gesture based robot is enabled by two sections- The transmitting section and Receiving section. The transmitting section holds the accelerometer that detects the hand movements and relays the signal to the microcontroller. This information is then sent to the encoder in order to encode and transmit the 4-bit data. This data will then be transferred by the RF transmitter module. In the receiver part, the encoded data that has been received in the RF receiver module is decoded using the decoder. This is then interpreted by the microcontroller and relayed to the motor driver in accordance to the direction in which the robot is to be moved [2].

As depicted in the Fig.1, the varied movements of the hand that are utilised are: Stop, Left, Right, Forward and Backward. The traditional methods of input do not provide an instinctive communication between the humans and machines and thereby making it essential to develop models for interpretable communication between human beings and machines.

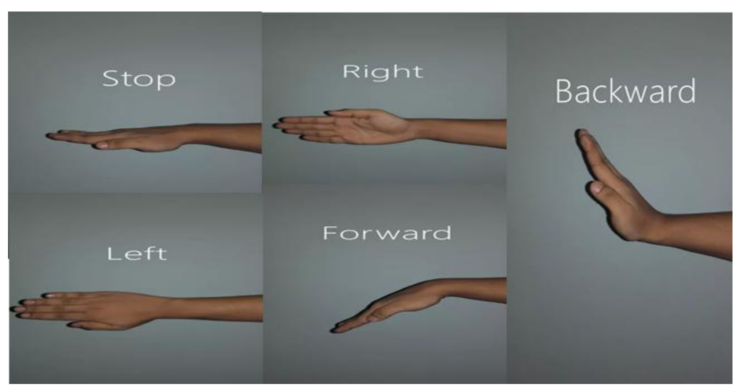

Fig 1. Different hand gestures

II. LITERATURE SURVEY

Controlling a robot and using a Teach box for enabling programming, is quite challenging as well as a long procedure demanding technical knowledge. Therefore the goal is to have less sophisticated methods for controlling and programming. But the technologies such as touch screens and joysticks are not accurate and efficient enough and also provide a

ISSN(Online) : *2456-8910*
International Journal of Innovative Research in Applied Sciences and Engineering (IJIRASE)
Volume 2, Issue 10, DOI: 10.29027/IJIRASE.v2.i10.2019, 335-338 , April 2019

comparatively slow response rate. Using a gesture recognizing algorithm it is possible to overcome these obstacles and offer a high degree of sensitivity for varying applications. Over the last decade the gesture recognition that is based on the accelerometer is increasingly becoming popular in comparison to the vision based recognition. The major factors that helps in making it an effective tool for detection and recognition of the human gestures are the relatively low or moderate cost and the smaller size of the components.

III. HARDWARE REQUIREMENTS

A .Accelerometer Sensor

TheADXL33 is a compact, low power three axis device which helps in measuring the acceleration with a full range of scale that has a minimum of ±3g in addition to the measurement of the static acceleration due to gravity in tilt application along with the dynamic acceleration that is created due to motion, shock or even vibration. An accelerometer when tilted with respect to its measured axis, gives the relative force due to gravitation to the magnitude of tilt.

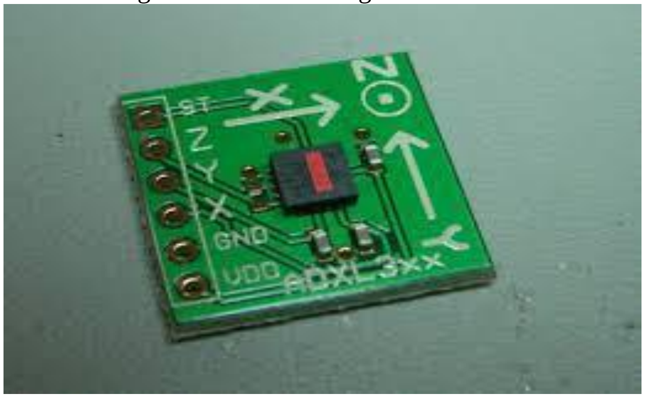

Fig 2: Accelerometer

As shown in Fig.2, X, Y and Z are the labeled three axes that are generally measured by the accelerometer, and each axes represents a degree of freedom (DOF) and data corresponding to each axes is converted into its analog form. This is quite useful in mobile devices, gaming setups, disk drive protection, and also applications involving health devices.

B. RF Module:

The radio frequency module consists of further two parts namely, Transmitter and Receiver. It is an electronic device used to transmit or receive signal between two individual devices. It is operational in different frequencies and has varying operating ranges. An Encoder and decoder circuit when used along with the transmitter and receiver can be used for signal transmission efficiently. As depicted in the Fig.3 , the RF module operating in the frequency range of 315MHz with a operational range of about 400 to 500 mts. The main advantage that the RF transmission has over IR is that it can cover long ranges whereas IR operates in the line-of –sight only. RF signals can relay signals despite of obstacles in its path. Therefore it is considered to be much more stronger and reliable.

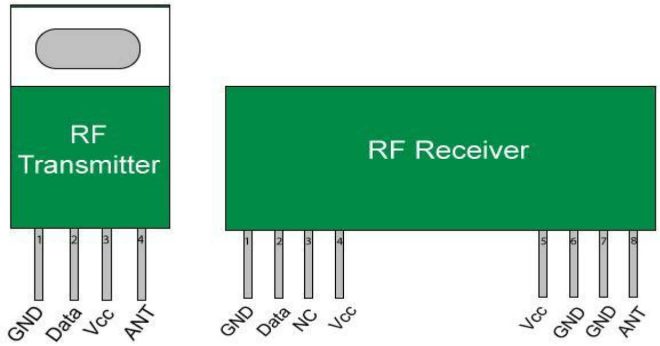

Fig.3: RF Module

C. Microcontroller

The microcontroller is used in this hardware and is the main controlling block to which all other components are linked. Its lower voltage and higher performance enables the execution of most of the commands in just one machine cycle. The maximum frequency that it can work is 16MHz. It has 40 pins and 32 separate input/output lines. The device gives an output of 16 MIPS and also operates within 4.5-5.5 volts.

D. Motor Driver

The main requirement by is to supply power to the motors, as this is not doable by microprocessors. The L293D has 16-pins for the motor control. The low power motors are generally controlled using the H- bridge circuits. The H-bridge has 4 switches that control the motor rotation in the clockwise and anticlockwise directions.

IV. SOFTWARE REQUIREMENTS

For the implementation of software we are making use of two different software – WIN AVR STUDIO 4.0 along with PROTEUS.

A. WINAVR STUDIO 4.0

In the WINAVR, the AVR chips are transformed into 8-bit platform of Arduino and separate memories which have differing addresses are used to read the information stored in these memory spaces.

ISSN(Online) : *2456-8910*
International Journal of Innovative Research in Applied Sciences and Engineering (IJIRASE)
Volume 2, Issue 10, DOI: 10.29027/IJIRASE.v2.i10.2019, 335-338 , April 2019

B. PROTEUS

- The proteus is a programming language that is not only functional but also procedural. The primary purpose of this language is the transfer of data to different forms.

- The major features are its practicality, readability and consistency. The data types that proteus supports are as follows: integers, floating points, strings.

V. BLOCK DIAGRAM

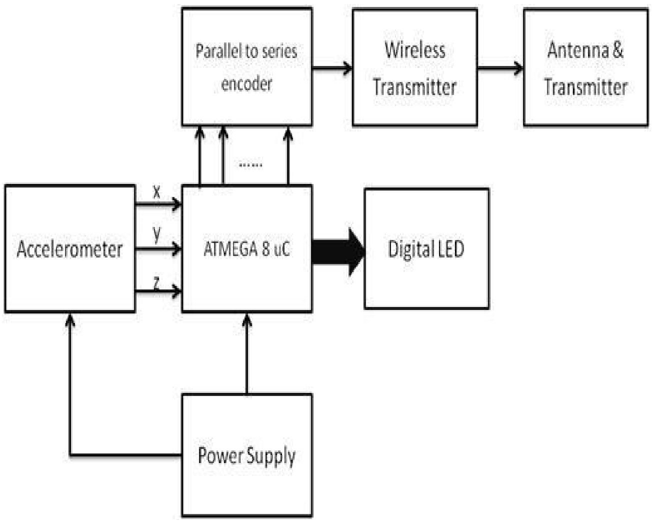

Fig 4: Transmitting Section

As depicted in Fig 4, the data in the analogous form at the three axes from the accelerometer is sent as an input towards the microcontroller where the processing results in an 8 bit data.The received data is now encoded in the form of 4 bit data. It is finally transferred through an antenna towards the RF module. All of this is controlled by a common power source. The presence of data in the corresponding pin is indicated using a digital led.

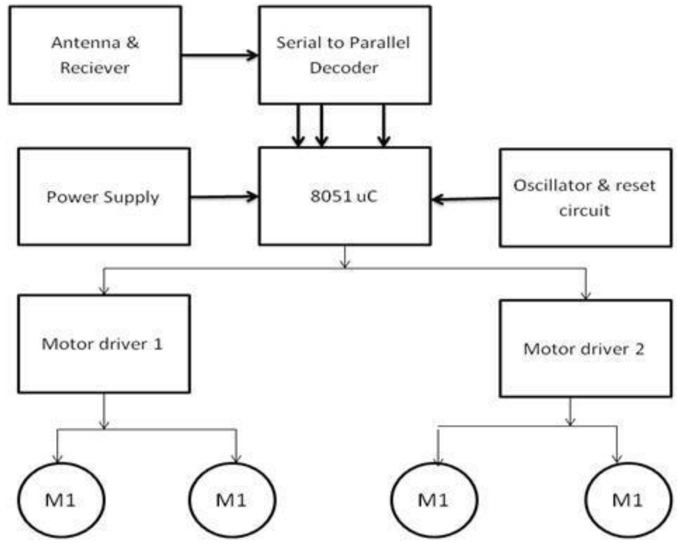

Fig. 5: Receiving Section

As can be seen in Fig.5, the data that is being received is now decoded and then finally processed to the microcontroller. This data is used for operating the motor driver IC for motor rotation in the required direction.

The motor can actually rotate in both clockwise as well as anticlockwise direction which is decided by the terminals of the motor that is linked to the motor driver IC.

VI. RESULTS DISCUSSION AND ANALYSIS

As depicted in the given below figure, Fig.6, this is the primary PCB Layout of the transmitter part. This accommodates the different components such as the accelerometer, antenna, RF modules etc and other parts such as capacitors and voltage regulators.

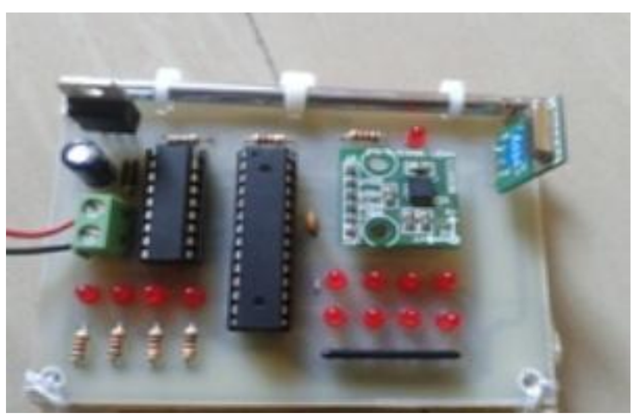

Fig.6 : PCB Layout of transmitting part

ISSN(Online) : *2456-8910*
International Journal of Innovative Research in Applied Sciences and Engineering (IJIRASE)
Volume 2, Issue 10, DOI: 10.29027/IJIRASE.v2.i10.2019, 335-338 , April 2019

This layout which is equipped with various components is mounted on the user's hand and this captures the hand movements of the human and correspondingly moves the robot in the desirous direction, thereby enabling the man-machine interaction.

Fig. 7: Top View of Robot

As given in Fig.7, the person controlling robot makes the hand gestures in order to direct the wheels of the robot. The comparative analysis of the different technologies employed in gesture recognition is given and proves that accelerometer based recognition entirely overcomes the effect of the rest of the technologies.

Vision based gesture recognition is used in service robotics, but the major drawback is the high level of sophistication and lack of accuracy involved in this method.

In finger gesture sensor the slower response rate and the difficulties in the detection makes it relatively lesser efficient in comparison with hand gestures.

VII.CONCLUSION AND FUTURE WORK

In the race between man and machine, hand gesture control is an example of a technology that enhances to wireless gesture control. The three axis based accelerometer is formed to be the input device and captures the gestures. On comparing with the rest of the input devices, this is easy to operate and provides the facility to control the robot wirelessly. The instances which might have physical hardships can be overcome with the help of this technology.

Future work might involve the improvement of more number of sophisticated gestures. One of the better approach might be implementing the gyroscope along with the system, thereby enabling the separation of the acceleration created due to gravity and the acceleration due to inertia. The second approach is that a GPS can be installed in the system in order to track the robot's position. Increasing the number of accelerometers attached is also one of the other possibilities.

REFERENCES

[1] International Journal of Advanced Technology in Engineering and Science Volume No.02, IssueNo.05, May2014

[2] http://research.ijcaonline.org/volume9/number3/c386.pdf

[3]http://ijsetr.org/wp-content/uploads/2013/07/ IJSETR-VOL-2-ISSUE-3-749-755.pdf

[4] ttp://researchtrend.net/ijet41/3%20DIKSHA%20NGF.pdf

[5] International Journal of Computer Applications (0975 – 8887) Volume 79 – No 13, October 2013