Hand Gesture Recognition Using Embedded

Nasreen Fathima[1], Jayashree M[2], Madhushree B R[3], Megha M[4], Meghana P[5]
[12345]*ATME College of Engineering, Mysuru, Karnataka, India*

Abstract- Hand Gesture recognition system provides an innovative, natural, user friendly way of interaction with the computer which is more familiar to the human beings. Gesture Recognition has a wide area of application including human machine interaction, sign language, immersive game technology etc. By keeping in mind the similarities of human hand shape with four fingers and one thumb, Glove-based systems are an important option in the field of gesture recognition. They are designed to recognize meaningful expressions of hand motion. This paper serves the purpose of controlling the home appliances by physically handicapped patients without the need of a helper. Here accelerometer and flex sensors are attached to a palm glove of the patient. Just by the movement of the palm, the patient can control the home appliances.

Keywords- Glove, Hand Gestures, Renesas Microcontroller, flex sensor, accelerometer sensor, GSM and MP3 audio files.

I. INTRODUCTION

Communication is an essential part of human life. If communication is disturbed or impossible, the consequences are loneliness and isolation. It is well known that speech plays a key role in communication and it explains why humans also want to have speech as a means of communication/interaction with computers. Although human-like speech dialogue with computers is still far off, even with current state-of- the-art technology, the benefits and potential of speech processing are obvious. The communication between a deaf and general public is to be a thoughtful issue compared to communication between visually impaired and general public. Along with this people from different places are suffering from different diseases and illness. As a result people visiting the health center's and some patients are not able to communicate their feelings due to illness. Sign language is the non-verbal form of intercommunication used by deaf, mute and patients in the hospital that uses gestures instead of sound to convey. A gesture in a sign language is a particular movement of the hands with a specific shape made out of them.

People make use of different languages to express their thoughts in a different way. But, it is difficult for the people who are affected, partially, by paralysis and stroke. Hence, there is a need to develop a platform for those people who are physically challengeable. An Embedded device shall address the above said problems. Paralysis is a life-changing condition, especially if the injury prohibits the person from going about the daily routines or jobs the way got used to doing it. Our goal is to provide these people an affordable solution that can make them independent for most of their day and enable them to work, create, and feel useful in the society.

II. RELATED WORK

Many researchers have proposed numerous methods for hand gesture recognition system. Abhinav has proposed a wearable gestural interface which lets the user to use natural hand gestures to interact with the information. The main advantage in this is it integrates digital information into the physical world and its objects and uses hand gestures to interact with digital information, supports multi- touch and multi-user interaction. Some drawbacks are the use of color markers and it is not used in 3D gesture tracking. Saikat et al has proposed a gesture interpretation system capable of controlling the computer mouse using thermal camera. The efficiency of the system is minimized and can be dramatically improved by background subtraction but it is designed only with two hand gestures which is a limited input systems. Shiguo et al has proposed an automatic user state recognition model to control the TV system. Reduced power consumption and computational cost and its limitations are ultrasonic sensor is used for detection. Experimental results has shown that it is an effective method to use Raspberry Pi board to actualize embedded image capturing system. Dynamic gestures which are performed in complex background can be identified by hand gesture recognition system. Thermal cameras can be integrated along with web camera to identify the hand gestures but in addition to it calibration of thermal camera has to be done periodically. A framework is designed which is a low cost yet effective gesture interpretation system. By using a camera and a tiny projector the system can be controlled using hand gestures during presentations. The gesture recognition system is an embedded system with less power consumption and efficient image capturing system. This system is more advantageous than PC based systems in terms of cost and portability. Renesas controller which is a mini computer is an embedded system which is more efficient in controlling a system through gestures. Operating system provides many software choices in order to do a specific task which adds additional functionality in choosing Renesas.

III. PROPOSED SYSTEM

Gesture recognition is a challenging task that is often addressed with complex sensors and methods, such as the use of depth sensors and multiple classifier systems, under controlled acquisition conditions. In this system which aid in the communication of a dumb person is the flex sensor. the flex sensor consists of a metal strip attached to the fingers which senses the orientation of the fingers. As the fingers are moved, the resistance of these metal strip changes thus the gestures are found with

corresponding resistance values. The flex sensors are attached to the gloves and wires are drawn from flux sensor through these gloves.

IV. IMPLEMENTATION

SOFTWARE USED

The program is written on CUBESITE++ in EMBEDDED C.

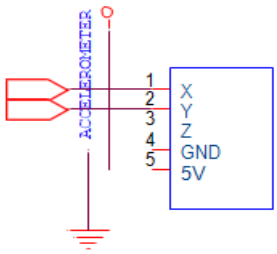
HARDWARE USED:

Microcontroller

The RENESAS microcontroller RL78_G13_R5F100LE is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. Renesas microcontroller surpasses its predecessor i.e..,8051 family of microcontrollers, with various in-built features. It is a 16 bit microcontroller, minimum instruction time can be changed from ultra-low speed to high speed. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. 10 bit resolution A/D converter (6 to 26 channels depending upon the series). Totally 0-7 channels for timer with built-in PWM features. Cost of Renseas microcontroller is comparatively less and operates with 5v power supply. R5F100LE is used in many projects. R5F100LE also have many application in digital electronics circuits.

Accelerometer Sensor

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. In this project this sensor is used to recognize the movement of the palm. It has 6 pins. 3 pins is for X, Y, Z axis. First pin for power supply (VCC), second pin for ground (GND) and the last one for selftest (ST). It operates on 3.3V. The X-axis and Y-axis is connected to the port 20 and port 21. This ports is for ADC converter.



X_ADC Y _ADC

ACCELEROMETER

FLEX sensor

Flex sensors is basically a variable resistor whose terminal resistance increases when the sensor is bent. They are usually in the form of strip 5‖ long that vary in resistance. They work as variable voltage analog dividers. Inside the flex sensor carbon resistive elements within a thin flexible substrate is present. When the flex sensor is bent, the resistance gradually increases. Resistance vary between few ohms and kilo ohms. The flex sensor's operating temperature is -30 to 80 degree Celsius. So this sensor is used to recognize the movement of palm. Whenever the sensor is bent, the resistance either increases or decreases.

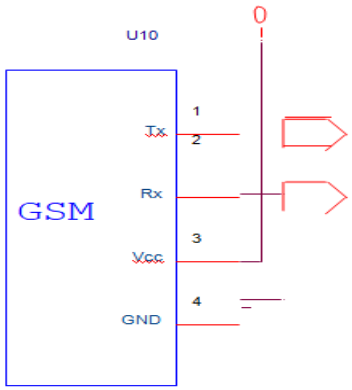
As shown in figure, R1 here is a constant resistance and flex sensor which acts as a variable resistance. Vo being output voltage and also the voltage across the flex sensor.

Here, Vo=VCC(Rx/(R1+Rx)).

Rx - FLEX SENSOR resistance

Now, when the flex sensor is bent the terminal resistance increases. This increase also appears in voltage divider circuit. With that the drop across the flex sensor increases so is Vo. So with increase in bent of flex sensor Vo voltage increases linearly. With that we have voltage parameter representing the flex. We can take this voltage parameter and feed it to ADC to get the digital value which can be used conveniently.

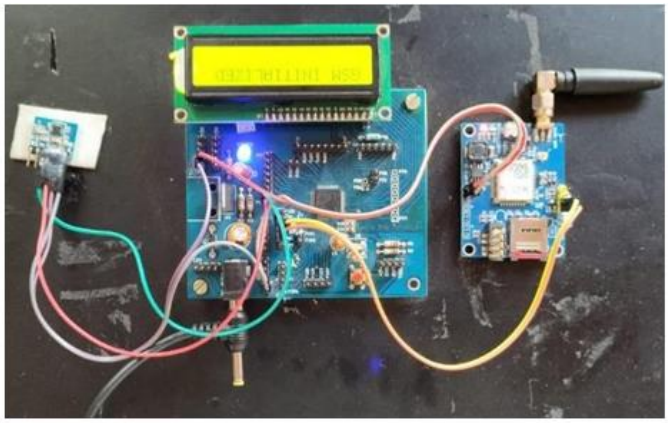
GSM



SIM900 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900

MHz. SIM900 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. AT Commands are used to get information in SIM card. The SIM interface supports the functionality of the GSM Phase 1 specification and also supports the functionality of the new GSM Phase 2+ specification for FAST 64 kbps SIM (intended for use with a SIM application Tool-kit). Both 1.8V and 3.0V SIM Cards are supported. The SIM interface is powered from an internal regulator in the module having nominal voltage 2.8V. All pins reset as outputs driving low. There are 4 pins RX, TX, GND, power supply.

V. RESULTS



N-M16P MP3 AUDIO MODULE

FN-M16P module is a serial MP3 module that is with a perfect integrated MP3 and WMV decoder chip. It provides micro SD card driver, and supports FAT16 and FAT32 file systems. It is able to play back specified sound files and realize other functions through simple serial commands. In the mean time, this module supports AD key control mode that facilitates users to develop their jobs in some simple applications. Without the cumbersome underlying operating, easy to use, stable and reliable are the most important features of this module.

LCD

A liquid crystal display (**LCD)** is a flat panel display, electronic visual display, based on Liquid Crystal Technology liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present information. Is terminal connected to GND. Alpha numeric LCD (ALCD) is used to backlight led cathode display information about project. The LCD used is 16x2, 2 rows and 16 columns. So in each row we can display 16 characters. The 1 byte data line of lcd is connected to the Port 3.0 to Port 3.1 of the microcontroller. The enable pin of lcd is connected to the Port 0.6 of the microcontroller. The RS pin of the lcd is connected to the Port 0.5 of the microcontroller. Pin 1 of lcd is +5V power supply, pin 2 is GND, pin 3 is for contrast adjustment, pin 5 is for read or write operation. In this project, we are only doing write operation to the lcd. So, pin 5 is GND. Pin 15 is the backlight led anode terminal connected to +5V.

movement includes right, left , front and backwards. And the output message is displayed on LCD. The right movement of palm displays the person needs “to use washroom”. The left palm movements displays a message “need water”. Similarly front movement for emergency and backwards movement displays “need food”. The flex sensor is attached to hand gloves which recognizes the gesture of fingers which includes breathing problem, to switch on electrical appliances, refreshment and need of medicine and informs it to renesas microcontroller then the message is displayed on LCD and also through voice output. The GSM connected to renesas exports the message to mobiles .

```
ADC64_Start(0x01); Accel_Y_Volt = Volt_Temp;
Disp_Line1[4] = Volt_Value[0]; Disp_Line1[5] = Volt_Value[1];
Disp_Line1[6] = Volt_Value[2];
ALCD_Message( 0x80, Disp_Line1); MSDelay(100);
if( Accel_Y_Volt >= 180 )
{
ALCD_Message( 0xC0, "WANT WATER " ); MSDelay(3000);
GSM_Send_SMS( Mb_Num1,"ALERT!!
PATIENT WANT WATER" ); MSDelay(6000);
  ALCD_Message( 0xC0, "   SMS SENT          " );
       MSDelay(2000);
       ALCD_Message( 0xC0, "                " );
  Rx_ST_Flag1 = 0;
  Rx_count1 = 0;
  }
  else if( Accel_Y_Volt <= 145 )
  {
  ALCD_Message( 0xC0, "WASHROOM " ); MSDelay(3000);
       GSM_Send_SMS( Mb_Num1,"ALERT!! PATIENT
  WANT TO USE WASHROOM" );
       MSDelay(6000);
  ALCD_Message( 0xC0, "   SMS SENT          " );
       MSDelay(2000);
       ALCD_Message( 0xC0, "                " );

  Rx_ST_Flag1 = 0;
  Rx_count1 = 0;
  }

  }
```

Using this code remaining gestures can be implemented.

VI. CONCLUSION

From the above obtained results, we conclude that the developed palm gesture based control of Home utilities and basic emergency commands to the care taker is tested and works satisfactorily. It has a good response with MEMS activating and deactivating the

Bulb and Fan connected to the Microcontroller. The response time is quite good compare to other systems and can be further improved. In future we would work on this concept to improve the response and embedded more sensors like proximity, ultrasonic, even under outdoor conditions.

VII. REFERENCES

[1]. International Journal of Advanced Technology in Engineering and Science Volume No.02, IssueNo.05, May2014
[2]. http://research.ijcaonline.org/volume79/number13/ pxc3891906.pdf
[3]. http://ijsetr.org/wpcontent/uploads/2013/07/IJSETR- VOL-2-ISSUE-3-749-755.pdf
[4]. http://researchtrend.net/ijet41/3%20DIKSHA%20NG F.pdf
[5]. International Journal of Computer Applications (0975 – 8887) Volume 79 – No 13, October 2013
[6]. http://arxiv.org/ftp/arxiv/papers/1309/1309.2090.pdf
[7]. Shahrukh Javed, Ghousia Banu , Wireless Glove for Hand Gesture Acknowledgment: Sign Language to Discourse Change Framework in Territorial Dialect, June 2018
[8]. Geraldine Shirley N. and S. Jayanthy, Virtual Control Hand Gesture Recognition System Using RASPBERRY PI, April 2015
[9]. Hand gesture recognition based on shape parameters, 2012 international conference.
[10]. Abhijith Bhaskaran K, Anoop G Nair, Smart Gloves for Hand Gesture Recognition Sign Language to Speech Conversion System, 2016
[11]. Xiao Han and M A Rashid, Gesture and Voice Control of Internet of Things, 2016
[12]. Anna YANG*, Detection and Recognition of Hand Gesture for Wearable Applications in IoMTW, 2017