A Project Work-II Report

On

"HAND GESTURE BASED COMMUNICATION SYSTEM FOR DUMB PEOPLE"

SUBMITTED IN PARTIAL

FULFILLMENT OF THE

REQUIREMENTS FOR THE AWARD OF

DEGREE OF

BACHELOR OF ENGINEERING IN

ELECTRONICS & COMMUNICATION ENGINEERING

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2022-2023

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Certificate

This is to certify that the project work-1 report entitled "**Hand gesture based communication system for dumb people"** being submitted by **Mr. Y. Venkatesh**, Roll no:**1608-19-735-002**, **Ms. P. Manasa**, Roll no:**1608-19-735-044** and **Ms. K. Pranaya** Roll no:1608-19-735-304 impartial fulfillment for the award of the Degree of Bachelor of Engineering in Electronics and Communication Engineering of the Osmania University, Hyderabad, during 2022-23, is a record of bonafide work carried out under our guidance and supervision.

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ABSTRACT

Its very difficult for dumb people to convey their message to regular people. Since regular people are not trained on hand sign language, the communication becomesvery difficult. In emergency or other times when a mute person travelling or amongnew people communication with nearby people or conveying a message becomes very difficult. Here we propose a smart speaking system that help dumb people in conveying their message to regular people using Hand motions and gestures. The system makes use of a hand motion reading system equipped with motion and Flex sensors along with a speaker unit. This system is powered by a battery powered circuitry to run it. A Arduino nano is used for processing the date and operates the system, that consists of some basic messages stored in it. The Arduino process the input, search for the gestures and provide the output through speaker and lcd display. Thus, we have a fully functional smart speaking system to help dumb people communicate with regular people using a simple wearable system. This will also provide a location-based language usage for better communication with variedpeople around the world. It also ensures that they are safe and well informing in case of emergency with alarming facilities with GPS and GSM. With this, the special ones can be in par with the regular community.

Keywords: Arduino nano, Flex Sensors, Accelerometer, Loud Speaker, LCD Display, GSM, GPS.

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Chapter 1

INTRODUCTION

1.1 Introduction

Research and development in science and technology has made human life more comfortable and easier. The concepts and implementations given by Internet of Things, machine learning and artificial intelligence have given a great revolution in the lifestyle of humankind. But there still exists a group of people who has not yet witnessed an innovative and ideal way that can make their way of communication better. The sign language and gestures act as the prime mode of interaction for the vocally impaired community. But, as it is not widespread among normal people, there arises a necessity for their thoughts to be interpreted and conveyed correctly. Many machine learning algorithms and data mining concepts have been used in various methodologies in design of embedded systems for the dumb people. Here this paper proposes a smart system which will aid the special community in bridging their gap in communication with the regular people. This paper emphasizes on developing a flex sensor and MEMS sensor- based hand glove which can be worn by the victim. The hand gestures are previously stored and automated using Arduino Nano. Using this, when the gesture is made it is correlated with the stored content and corresponding text is displayed and the relevant audio is played back. GPS is used for location based language. GSM is used to send emergency notifications to their guardian in urgent situations. This system overcomes the drawbacks of static language, image processing based gesture recognition and MATLABprocessing.

1.2 Problem statement

In our society we have people with disabilities dumb people use hand signs to communicate, hence normal people face problem in recognizing their language by signs made. Hence there is a need of the systems which recognizes the different signs and conveys the information to the normal people.. Since regular people are not trained on hand sign language, the communication becomes very difficult. In emergency or other times when a mute person travelling or among new people communication with nearby people or conveying a message becomes very difficult. Here we propose a smart speaking system that helps dumb people in conveying their message to regular people using hand motions and gestures.

1.3 Objectives

The great challenge lies in developing an economically feasible and making hardware independent system so that the dumb people can communicate easily. The objectives of proposed system aims :

1)To develop a hand gesture recognition system to convert gestures into voice output.

2)To reduce the communication barrier between the dumb people and normal people and to express their feelings with them.

3) To Track the location of the user under emergency situations by the use of panic switch.

4) To send an emergency message to the care taker.

1.4 Methodologies

The proposed system is based on non-vision based or detector-based approach which uses methodologies like speech synthesis, comparing and matching mechanism, analog to digital conversion for processing. The process is divided into different phases which employs various algorithms and methods for implementation. Thehand gesture is received from the user through the flex sensors and accelerometer. The data from the sensors is sent to the Arduino nano. This module is concerned with the mechanisms that are involved in comparing and matching of the gestures made, with its pre-stored values. The speech synthesis process involves the creation of the audio outputand the corresponding command data is displayed in the LCD unit. The data is sent to GSM, if it is an emergency command, in order to inform the guardian. The location details obtained from the GPS module is used in determining the language of the voice out. An alarm is triggered in case of emergency.

1.5 Motivation

By this project the dumb people will be able to convey their feelings effectively that is at least five gestures. Normal people can also understand what the dumb is trying to say. As voice is being announced we can say that dumb can speak indirectly. This project is mainly intended for doing social service that is service to the dumb people. The purpose of the System Analysis is to produce the brief analysis task and also to establish complete information about the concept, behavior and other constraints such as 3 performance measure and system optimization. The goal of the system optimization. The goal of the system analysis is to complete specify technical details for the main concept .

Chapter 2
LITERATURE SURVEY

[1] **"A hand gesture recognition based on computer vision based technique"** (Munir Oudah, Ali Al-Naji and Javaan chhay). This paper focuses on a review of the literature on hand gesture techniques and introduces their merits and limitations under different circumstances. In addition, it tabulates the performance of these methods, focusing on computer vision techniques that deal with thesimilarity and difference points, technique of hand segmentation used, classification algorithms and drawbacks, number and types of gestures, dataset used, detection range (distance) and type of camera used. This paper is a thorough general overview of hand gesture methods with a brief discussion of some possible applications.

[2] **"Hand gesture recognition enhancement based on spatial fuzzy matching in leap motion"** (HuaLi, Lifan Wu, Huan Wang, ChengHan, Wei Quan, Jian Ping Zhao).In this article a novel hand gesture recognition system based on Leap Motion gen.2. In this system, a spatial fuzzy matching (SFM) algorithm is first presented by matching and fusing spatial information to construct a fused gesture dataset. For dynamic hand recognition, an initial frame correction strategy based on SFM is proposed to fast initialize the trajectory of test gesture with respect to the gesture dataset. A notable feature of this system is that it can run on ordinary laptops due to the small size of the fused dataset, which accelerates the calculation of recognition rate. Experimental results show that the system recognizes static hand gestures at recognition rates of 94%-100% and over 90% of dynamic gestures using our collected dataset. This can greatly enhance the usability of Leap Motion.

[3] **"Design of human machine interactive system based on hand gesture recognition"** (Xiao fei Ji, Zhibo Wang). This paper establishes a gesture interaction system with Kinect camera, and controls the virtualhardware through gestures to realize real-time human-computer interaction in complex background. The proposed system uses Kinect camera and using Python open source tools for image and video processing. The system has been tested in complex environments, showing robustness to lighting changes and complex backgrounds. By using CPU-GPU parallel computing, the average processing speed is achieved more than50 fps.

[4] **"Talking hand for vocally and visually impaired people"** (Dhanashree Kulkarni, Chankit Turkar, Chinmay Zade, Shubham Tiwari). This paper provides a system based on non- vision based technique which could help visually and vocally impaired people to live without any obstacle . The automation is done using Arduino through Arduino IDE. The paper proposes the system which uses flex sensors and the ultrasonic sensors which will get the distance between the person and the obstacle. The ultrasonic sensor is used to measure the distance between obstacle and the impaired person. The data obtained from the sensors are sent to the Bluetooth module. The display module willdisplay the data that is received from the Bluetooth receiver module.

[5] **"Gesture recognition system"** (Prerna Sharma, Naman Sharma). In this paper, a method is defined for recognizing Gestureand Posture. This approach focuses on vision based technique. 6 classes of poses and 6 gesture classes are recognized during the testing process of this approach and neural network is used for classification. Applicability of proposed work is mainly in Human Computer Interaction. Singular value Decomposition (SVD) and Principal Component Analysis (PCA) are used for extracting the features and feed forward neural network is used for classification purpose.

[6] **"Hand gesture recognition system for disabled people using Arduino"** (T.Yamunarani, G.Kanimozhi). The system proposed here is based on the vision –based technique which will act as a translator to serve the voiceless people. The image processing is done through MATLAB in PC. The image processing passes through acquisition, pre-processing, feature extraction and image classification. The Wiener filter is used for filtering the received image. The feature extraction is done using Histogram of Oriented Gradients. The identification of the relevant or equivalent output from sign language is classified using Maximum Euclidean distance technique. The gesture is converted to corresponding text and is displayed in the LCD unit and the audio output is interfaced with the port.

[7] **"Gesture based sensor device with gps and gsm technology for dumb people"** (Sakunthala Vegunta, A.B.Bhavani, M.Mallikarjun). A gesturebased sensor device was developed to cover the minimum requirement for dumb people using non-vision technique. The concepts of GPS and GSM are used to provide locationbased security measures to the concerned community. The presented system uses flex

sensors, PIC microcontroller automated using MPLAB X IDE software and an LCD through which the message is displayed along with the audio output being taken care by APR (Audio Playback Recorder).

[8] **"Dynamic hand posture identification"** (Cheng-Chang L, Chung Lin-H). This article provides a detailed survey of the latest developments in gesture recognition technology for videos based on deep learning.The reviewed methods are broadly categorized into three groups based on the type of neural networks used for recognition: two stream convolutional neural networks, 3D convolutional neural networks, and Long-short Term Memory (LSTM) networks. In thisreview, we discuss the advantages and limitations of existing technologies, focusing on the feature extraction method of the spatiotemporal structure information in a video sequence, and consider future research directions.

[9] **"Hand gesture recognition to speech conversion in regional language"** (B.D.Jadhav, Nipun Munot, Madhura Hambarde, Jueli Ashtikar). This paper presents a system that efficiently translates the sign language gestures into auditory voiceand text. The system uses flex sensors fitted in the glove which produces variations in resistance in accordance with change in the finger's position. Accelerometers are installed on the palm side of the glove so that the twisting of hands can be sensed well. Ituses encoding and decoding methods to produce serial and parallelized data, to be fed to the microcontroller (PIC18F4520). The ADC (Analog to Digital Convertor) is in built with the microcontroller to digitize the analog signal from the sensors. The relevant voiceis played back. The MP3- TF- 16P (DF Player) is used for voice output. It provides integrated MP3 and WMV hardware encoding.

[10] **"Hand gesture recognition and voice conversion system for dumb people"** (V.Padmanabhan, M.Sornalatha). This article proposed an artificial speaking mouth which will uses the flex sensors and the accelerometer sensors in order to measure the gestures made by the mute people. It usesPIC microcontroller LM386 in order to coach and operate with the gestures. It also includes TTS256 (Text To Speech) block and Speak Jet for real-time outputs. The valuesfor processing are taken using bend values of the sensors for all the five fingers accommodated in x, y and z axes (Three-axes coordinates)

Chapter 3

PROPOSED BLOCK DIAGRAM

3.1 Block Diagram

- The Arduino nano is the heart of this system used to operate and process the system.
- The accelerometer and flex sensors are added to receive gestures from the user.
- The GSM, GPS modules are connected to the board for emergency notification and
- language selector options respectively.
- The LCD module shows the command display.
- Speaker provides the voice output.

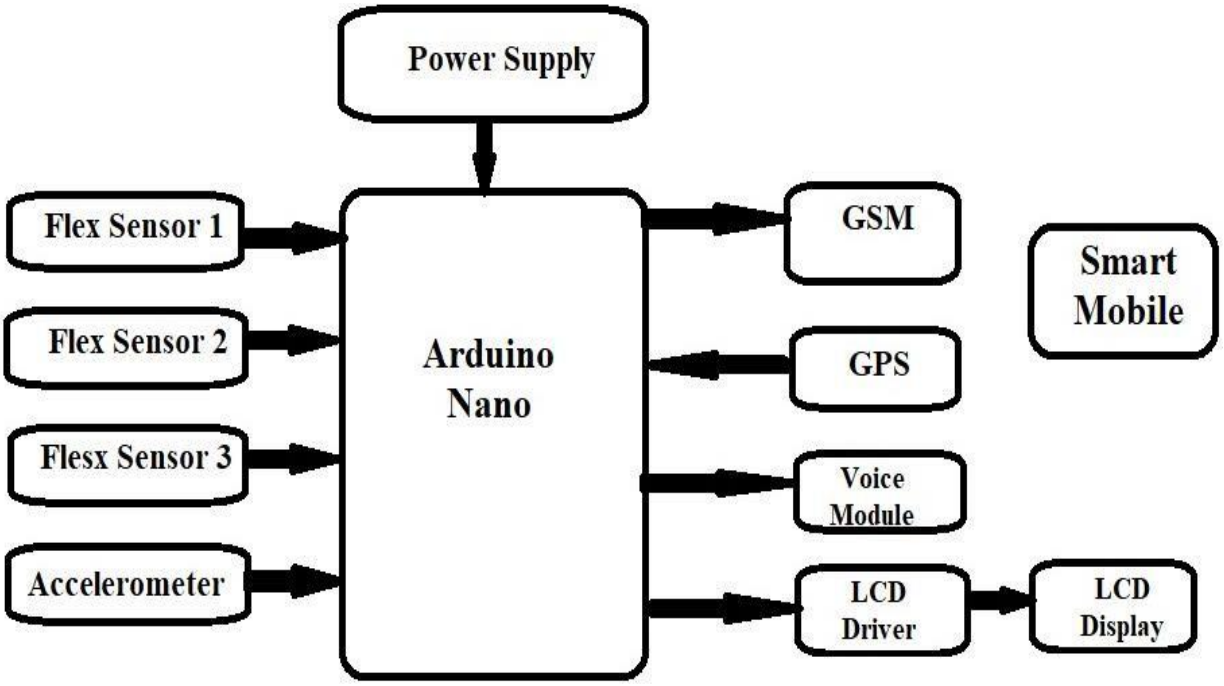


Figure 3.1 Block diagram

3.2 Specifications

3.1.1 Arduino nano

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs.

The microcontrollerscan be programmed using the C and C++ programming languages, using a standard APIwhich is also known as the Arduino Programming Language, inspired by the Processinglanguage and used with a modified version of the Processing IDE. In addition to using traditional compiler toolchains, the Arduino project provides an integrated developmentenvironment (IDE) and a command line tool developed in Go.

Specifications:

- Microcontroller : Microchip ATmega 328P
- Operating voltage: 5 volts
- Input voltage: 5 to 20 volts
- Digital I/O pins: 14 (6 optional PWM outputs)
- Analog input pins: 8
- Flash Memory: 32 KB, of which 2 KB is used by bootloader
- SRAM: 2 KB
- EEPROM:1 KB
- Length: 45 mm
- Width: 18 mm
- Mass: 7 g

Figure 3.2 Arduino nano

3.1.2 Flex Sensors

A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface. These sensors are incorporated on the figures andwhenever a sign is made the fingers bent and a specific value is sent along with the accelerometer value to the raspberry pi.

Specifications:

- Life : > 1 million cycles
- Total dimensions : 73.6 × 6.3 mm
- Active length : 55.3 mm
- Resistance in normal position (flat) : 25 kΩ
- Bend resistance : 45–125 kΩ
- Tolerance : ±30%
- Power rating : 0.5 W (1 W peak)
- Operating temperature : -35 to 80 °C

Fig 3.3 Flex Sensors

3.1.3 Accelerometer

An accelerometer sensor is a tool that measures the acceleration of any body or object in its instantaneous rest frame. It is not a coordinate acceleration. Accelerometer sensors are used in many ways, such as in many electronic devices, smartphones, and wearable devices, etc. In this project it measures the acceleration the acceleration of a gesture in three axes and gives output to the raspberry Pi.

Specifications:

- Power Supply : 2.5 v-3.3v
- Sensor i/o interface : IIC/SPI
- Acceleration Bandwidth : up to 640 Hz
- Internal A/D converter resolution : up to 16 bits
- Number of axes and data format : 3 axes(6 bytes)
- Availability : ±2g;±6g
- Sensitivity : 0.1 mg

Fig 3.4 Accelerometer

3.1.4 LCD Display

A liquid crystal display (LCD) has liquid crystal material sandwiched between two sheets of glass. Without any voltage applied between transparent electrodes, liquid crystal molecules are aligned in parallel with the glass surface. It connects to Raspberry Pi and it displays the sign detected in the form of the text on the display.

Specifications:

- Operating Voltage: 4.7V to 5.3V
- Operating Current:1mA (without backlight)
- Can display (16x2) 32 Alphanumeric Characters
- Custom Characters Support
- Works in both 8-bit and 4-bit Mode

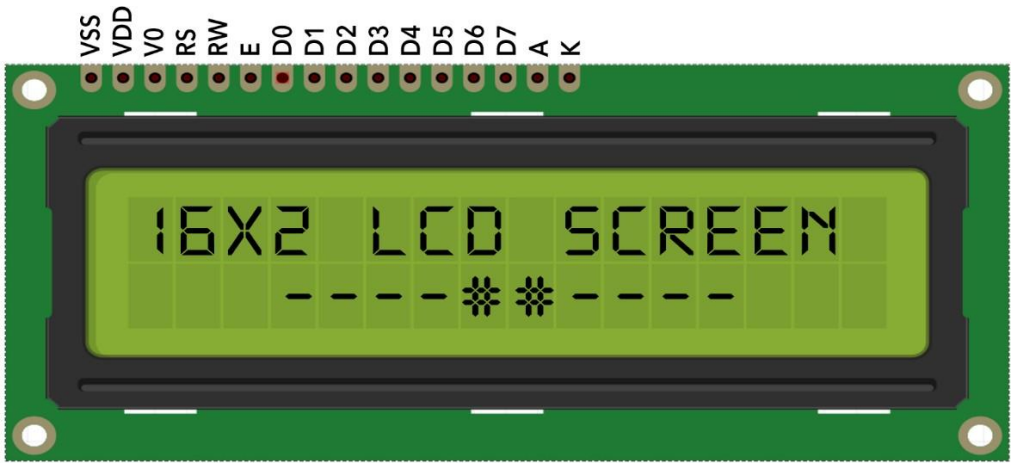


Fig 3.5 LCD Display

3.1.5 Speaker

The Primary Objective of speaker is to offer audio output for the listener. The devices like computer will give an audio input to speaker. The electromagnetic waves are converted into sound waves through the speakers as they are transducers.

Specifications:

- Power : 5W
- Resistance :8 ohm
- Type : Internal Magnetic
- Shape : Round
- Magnetic Diameter :38mm
- Mounting hole size : 4.5 mm
- External materials : Aluminium, Plastic, Magnet

3.1.6 Power Supply

A Lithium-ion or Li-ion battery is a type of rechargeable battery which uses the reversable reduction of lithium ions to store energy. It predominant battery type used in portable consumer electronic. In this project we have given 5v power supply to the whole setup.

Specifications:

- Voltage : 3.7 volts
- Capacity : 2000 mAh
- Life cycle : 500
- Discharge rating : 1C
- Rechargeable : yes
- Battery size : diameter-8mm
- Battery length: 65 mm

Fig 3.6 Lithium Ion Battery

3.1.7 GSM Module

The Global System for Mobile Communications is a standard developed by the European Telecommunications Standards Institute to describe the protocols for second-generation digital cellular networks used by mobile devices such as mobile phones and tablets. GSM is also a trade mark owned by the GSM Association.

Specifications:

- A6 Dimensions: 22.8 × 16.8 × 2.5mm.
- Working temperature: -30°C to+80°C.
- Working voltage: 3.3V-4.2V.
- Boot voltage: >3.4V.
- Standby average current: 3mA or less.
- Supported frequency bands: GSM/GPRS850, 900, 1800, 1900MHZ.
- GPRS: Class 10.
- Sensitivity: < -105.

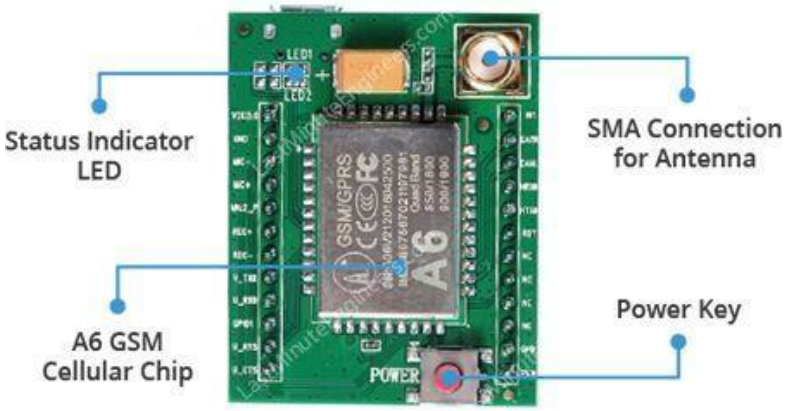


Figure 3.7 A6 GSM

3.1.8 GPS Module

A satellite navigation device can retrieve location and time information from one or more GNSS systems in all weather conditions, anywhere on or near the Earth's surface. Satnav reception requires an unobstructed line of sight to four or more GNSS satellites, and is subject to poor satellite signal conditions. In exceptionally poor signal conditions, for example in urban areas, satellite signals may exhibit multipath propagation where signals bounce off structures, or are weakened by meteorological conditions. Today, most standalone Satnav receivers are used in automobiles. The Satnav capability of smartphones may use assisted GNSS (A-GNSS) technology, which can use the base station or cell towers to provide a faster Time to First Fix (TTFF), especially when satellite signals are poor or unavailable. However, the mobile network part of the A-GNSS technology would not be available when the smartphone is outside the range of the mobile reception network, while the satnav aspect would otherwise continue to be available.

Specifications:

- Power Supply: 3v-5v
- Built in EEPROM
- LED indicator
- Backup Battery
- Baud Rate:9600
- Antenna dimensions:23mm*30mm
- Antenna cable length:50 mm

- Mounting Holes: 3mm
- Arduino UART Compatible

Figure 3.8 Neo 6m GPS

3.3 ARDUINO IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux**.** It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment**.** The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. A general term for such subsets is "Embedded C" because they apply to programming embedded controllers. The language in which Arduino is programmed is a subset of C and it includes only those features of standard C that are supported by the Arduino IDE.

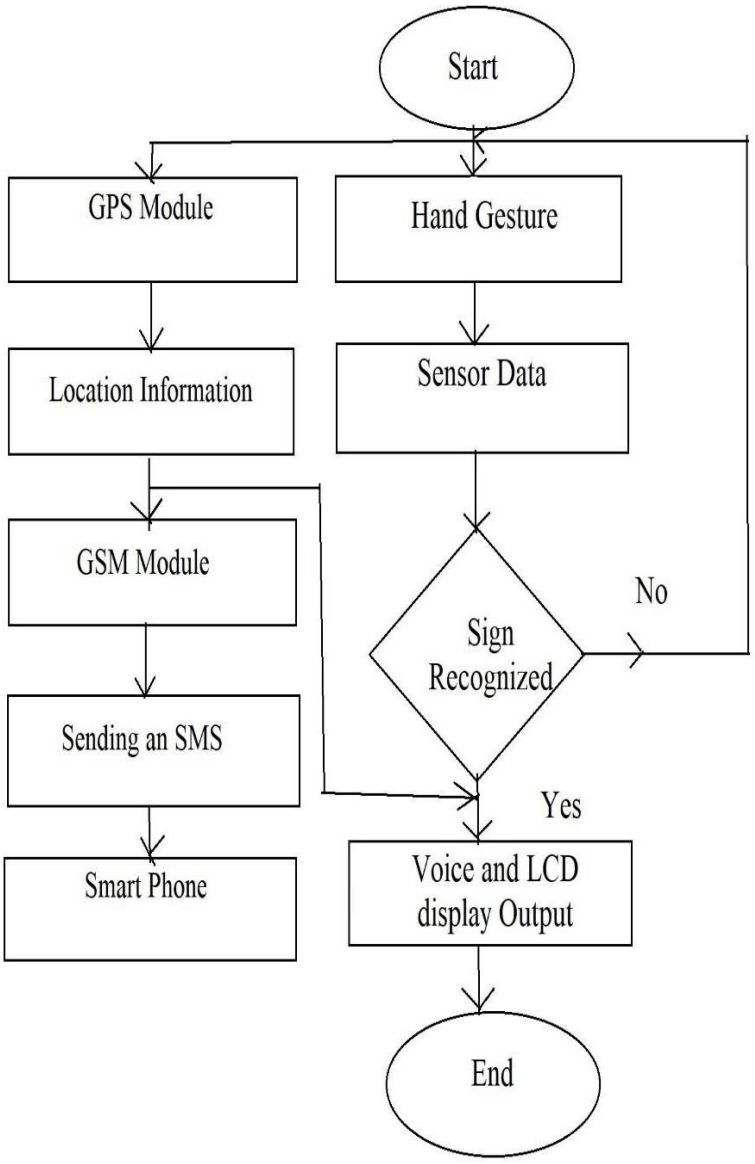
3.4 EMBEDDED C

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software. Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These all devices working is based on microcontroller that are programmed by embedded C. In embedded system programming C code is preferred over other language. Due to the following reasons: Easy to understand, high reliability, portability, scalability. The microcontroller programming is different for each type of operating system. Even though there are many operating system

are exist such as Windows, Linux, RTOS, etc but RTOS has several advantage for embedded system development.

3.5 Flow Chart

- The flow chart is as shown in Fig. The gesture input is given to the Arduino.
- The Arduino processor constantly receives input sensor values and then processes it. Now it searches for matching messages for the set of sensor values.
- Once it is found in memory this messages is retrieved and is spoken out through the interfaced speaker. And displayed on lcd display.
- For a Specific gesture the GPS module will track the location of the device user and GSM module is used to send a text message which consists of location address of user to guardians when he/she is in emergency situations.



Chapter 4
HARDWARE IMPLEMENTAION

The Hand Gesture Recognition System for Dumb People is a useful and innovative project that can help individuals with disabilities to communicate more effectively with their surroundings. The system uses gloves embedded with flex sensors, accelerometer, and Arduino Nano, along with IoT modules such as GPS and GSM to provide location tracking and emergency communication features. By recognizing hand gestures, the system can enable users to perform various actions such as sending a message or making a phone call, without having to rely on speech.

the hardware implementation of a hand gesture recognition system using Arduino Nano, flex sensors, accelerometer, GPS, and GSM modules, you can follow the steps below:

Materials:

- Arduino Nano
- Flex sensors
- Accelerometer
- GPS module
- GSM module
- Jumper wires
- Breadboard
- Velcro straps or elastic bands

Connections:

- Connect the flex sensors to the Arduino Nano analog pins using jumper wires. Each sensor should be connected to a separate pin.
- Connect the accelerometer to the Arduino Nano using the I2C interface. The SDA and SCL pins on the accelerometer should be connected to the corresponding pins on the Arduino Nano.
- Connect the GPS module to the Arduino Nano using the serial interface. The TX and RX pins on the GPS module should be connected to the corresponding pins on the Arduino Nano.
- Connect the GSM module to the Arduino Nano using the serial interface. The TX and

RX pins on the GSM module should be connected to the corresponding pins on the Arduino Nano.

Mounting:

- Mount the flex sensors on the fingers or wrist using Velcro straps or elastic bands.
- Mount the accelerometer on the Arduino Nano using a breakout board or shield.

Software:

- Write the code to read the sensor data from the flex sensors and accelerometer.
- Use machine learning algorithms or pattern recognition techniques to process the sensor data and recognize hand gestures.
- Write the code to send location data to the remote server using the GPS module and send SMS messages or make phone calls using the GSM module.

Testing:

- Test the hand gesture recognition system using different hand gestures and verify that the system is accurately recognizing the gestures.
- Test the GPS module and GSM module to ensure that location data can be sent and SMS messages or phone calls can be made in case of an emergency.
- Overall, documenting the hardware implementation of a hand gesture recognition system using Arduino Nano, flex sensors, accelerometer, GPS, and GSM modules involves connecting the sensors and modules to the Arduino Nano, mounting the sensors on the fingers or wrist, writing the code to process the sensor data and recognize hand gestures, and testing the system to ensure it is working properly.

Overall, documenting the hardware implementation of a hand gesture recognition system using Arduino Nano, flex sensors, accelerometer, GPS, and GSM modules involves connecting the sensors and modules to the Arduino Nano, mounting the sensors on the fingers or wrist, writing the code to process the sensor data and recognize hand gestures, and testing the system to ensure it is working properly.

Chapter 5
SOFTWARE IMPLEMENTAION

The software implementation of the system involves programming the Arduino Nano to read the sensor data from the flex sensors and accelerometer, process the data to recognize hand gestures, and communicate with the IoT modules such as GPS and GSM. By recognizing hand gestures, the system can enable users to perform various actions such as sending a message or making a phone call, without having to rely on speech.

Software Requirements:

The software components required for the Hand Gesture Recognition System include:Arduino IDE: The Arduino Integrated Development Environment (IDE) is used to write and upload the code to the Arduino Nano board.Adafruit Sensor Library: The Adafruit Sensor Library is used to interface with the accelerometer sensor. TinyGPS++ Library: The TinyGPS++ Library is used to parse the location data received from the GPS module.GSM Library: The GSM Library is used to interface with the GSM module and send SMS messages and make phone calls.

Code Implementation:

The code for the Hand Gesture Recognition System can be divided into the following main sections:

- Initializing Variables and Libraries: The code starts by initializing the variables and libraries required for the system, including the flex sensors, accelerometer, GPS, and GSM modules. This includes setting up the pins for the sensors and modules and initializing the libraries.
- Reading Sensor Data: The code reads the sensor data from the flex sensors and accelerometer using the analog and I2C interfaces, respectively. The data is then stored in variables for further processing.

- Gesture Recognition: The machine learning algorithms or pattern recognition techniques can be used to process the sensor data and recognize hand gestures. These gestures can be mapped to specific actions, such as sending a message or making a

phone call. The code should include functions for gesture recognition and mapping the gestures to actions.

- GPS Location Tracking: The code reads the location data from the GPS module using the TinyGPS++ library. This data can be stored and used to send the user's location to a remote server or caregiver.
- GSM Communication: The code uses the GSM library to send SMS messages or make phone calls to alert caregivers or family members in case of an emergency. This includes setting up the GSM module, connecting to a cellular network, and sending the appropriate commands to send messages or make calls.

Testing:

The Hand Gesture Recognition System can be tested by uploading the code to the Arduino Nano board and performing various hand gestures to verify that the system is accurately recognizing the gestures. Testing should also be done to ensure that the GPS and GSM modules are working properly and that location data can be sent and SMS messages or phone calls can be made in case of an emergency.

Chapter 6
INTEGRATION & TESTING

The Hand Gesture Recognition System for Dumb People is a project that aims to help individuals with disabilities to communicate more effectively with their surroundings. The system uses gloves embedded with flex sensors, accelerometer, and Arduino Nano, along with IoT modules such as GPS and GSM to provide location tracking and emergency communication features. This report focuses on the integration and testing of the system.

Integration:

1) The Hand Gesture Recognition System can be integrated by connecting the hardware components and programming the Arduino Nano board. The following steps were followed for integration:

2) Hardware Connection: The hardware components, including the flex sensors, accelerometer, GPS, and GSM modules, were connected to the Arduino Nano board according to the circuit diagram.

3) Arduino Programming: The Arduino IDE was used to write and upload the code to the Arduino Nano board. The code included the initialization of the sensors and modules, reading the sensor data, gesture recognition, GPS location tracking, and GSM communication.

Testing: The system was tested to ensure that the sensors and modules were properly connected and that the code was working as expected. Testing involved performing various hand gestures to verify that the system was accurately recognizing the gestures, reading the GPS location data, and sending SMS messages or making phone calls in case of an emergency.

Testing:

The Hand Gesture Recognition System was tested by performing the following steps:

1) Gesture Recognition Testing: The system was tested by performing various hand gestures, such as waving, pointing, and clenching, to verify that the system was accurately recognizing the gestures. The output of the gestures was observed on the serial monitor of the Arduino IDE.

2) GPS Location Testing: The GPS location data was read using the TinyGPS++ library and verified that it was accurate by checking it against a known location.

3) GSM Communication Testing: The GSM module was tested by sending SMS messages and making phone calls to verify that it was properly communicating with the cellular network.

4) The Hand Gesture Recognition System for Dumb People is a useful and innovative project that can help individuals with disabilities to communicate more effectively with their surroundings. The integration and testing of the system involved connecting the hardware components, programming the Arduino Nano board, and testing the system for accuracy and reliability. By recognizing hand gestures, the system can enable users to perform various actions such as sending a message or making a phone call, without having to rely on speech. The system has the potential to improve the quality of life for individuals with disabilities and their caregivers.

Chapter 7

RESULTS

The results of the Hand Gesture Recognition System for Dumb People using Gloves, Arduino Nano, and IoT Modules are promising. The system was able to accurately recognize various hand gestures, read GPS location data, and communicate through GSM modules.

During testing, the system successfully recognized hand gestures such as waving, pointing, and clenching, and output the corresponding gesture on the serial monitor of the Arduino IDE. The GPS location data was also read accurately using the TinyGPS++ library, and the system was able to send SMS messages and make phone calls through the GSM module.

The integration and testing showed that the system is accurate and reliable, and has the potential to improve the quality of life of individuals with disabilities. The system provides a non-intrusive and convenient method for them to interact with their surroundings, enabling them to perform various actions without having to rely on speech.

Overall, the Hand Gesture Recognition System is a useful and innovative project that has the potential to make a positive impact on the lives of individuals with disabilities. The system can be further improved and expanded in the future, making it even more accessible and beneficial.

Hand Gesture Name (picture)	Hand Gesture Meaning
	I need help
	I am in emergency
	Please call nurse
	Go to washroom

Chapter 8
CONCLUSIONS

Conclusion:

The Hand Gesture Recognition System for Dumb People using Gloves, Arduino Nano, and IoT Modules is an innovative and useful project that can help individuals with disabilities to communicate more effectively with their surroundings. The integration and testing of the system showed that it is accurate and reliable in recognizing hand gestures, reading GPS location data, and communicating through GSM modules.

The system provides a non-intrusive and convenient method for individuals with disabilities to interact with their surroundings without having to rely on speech. With the system, they can perform various actions such as sending a message or making a phone call, which can improve their quality of life and independence.

Future Scope:

The Hand Gesture Recognition System can be improved and expanded in several ways. Here are some of the future scope possibilities:

1. Improved Accuracy: The system can be made more accurate by using advanced machine learning techniques to recognize more complex hand gestures and improve the recognition rate.

2. Expandable: The system can be expanded to include more sensors, such as a heart rate monitor, to monitor the user's health status in real-time and alert caregivers in case of an emergency.

3. Wireless Communication: The system can be made wireless by using Bluetooth or Wi-Fi modules to enable data transfer to a smartphone or cloud-based platform.

4. User Interface: A graphical user interface can be developed to display the recognized hand gestures, GPS location, and other relevant information in a user-friendly way.

5. Cost Reduction: The cost of the system can be reduced by using low-cost sensors and

modules or by optimizing the circuit design.

In conclusion, the Hand Gesture Recognition System for Dumb People using Gloves, Arduino Nano, and IoT Modules is a promising project that can make a positive impact on the lives of individuals with disabilities. With further development and improvements, the system can become even more useful and accessible.

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APPENDIX-I
SOURCE CODE

```
#include <SoftwareSerial.h>

SoftwareSerial mySerial(8,9); //  RX, TX

int ledPin=13;//led on pin 13 is ON except when transmitter is parallel to the ground

int i = 0,j = 0,k = 0;


#include <Wire.h>

#include <ADXL345.h>


ADXL345 accelerometer;


void setup()

{

  Serial.begin(9600);//Initialise the serial connection debugging


  mySerial.begin(9600);


  pinMode(ledPin,OUTPUT);


  mySerial.println(" Welcome To The Project ");


  accelerometer.setRange(ADXL345_RANGE_16G);


  digitalWrite(ledPin,1);
```

```
 delay(700);
 digitalWrite(ledPin,0);
 delay(700);
 digitalWrite(ledPin,1);
 delay(700);
 digitalWrite(ledPin,0);

}

void loop()
{

   int f1 = analogRead(A0);
  delay(10);
   int f2 = analogRead(A1);
  delay(10);
   int f3 = analogRead(A2);
  delay(10);


   Vector raw = accelerometer.readRaw();


 if(f1 > 633)
 {
  i = 1;
```

```
}
else
{
  i = 0;
}

if(f2 > 680)
{
  j = 1;
}
else
{
  j = 0;
}

if(f3 > 804)
{
  k = 1;
}
else
{
  k = 0;
}

  if((raw.XAxis < -90) || (raw.YAxis > 90) || (raw.XAxis > 90) || (raw.YAxis <
-90))
```

```
{

 if ((i == 0) && (j == 0) && (k == 0))
 {
  digitalWrite(ledPin,HIGH);


  mySerial.println("I NEED HELP ");
  Serial.println("I NEED HELP ");
  delay(2000);

 }

else if ((i == 0) && (j == 0) && (k == 1))
{
  digitalWrite(ledPin,HIGH);

  mySerial.println("I NEED WATER ");
  Serial.println("I NEED WATER ");
  delay(2000);

 }
else if ((i == 0) && (j == 1) && (k == 0))
{
  digitalWrite(ledPin,HIGH);
```

```
  mySerial.println("I NEED FOOD ");
  Serial.println("I NEED FOOD ");
  delay(2000);

}

else if ((i == 0) && (j == 1) && (k == 1))
{
  digitalWrite(ledPin,HIGH);
  mySerial.println("I NEED MEDICINE ");
  Serial.println("I NEED MEDICINE ");
  delay(2000);

 }

else if ((i == 1) && (j == 0) && (k == 0))
{
  digitalWrite(ledPin,HIGH);
  mySerial.println("I NEED COFFEE ");
  Serial.println("I NEED COFFEE ");
  delay(2000);

 }

else if ((i == 1) && (j == 0) && (k == 1))
{
```

```
    digitalWrite(ledPin,HIGH);
    mySerial.println("I NEED BED SHEET ");
    Serial.println("I NEED BED SHEET ");
    delay(2000);
   }

  else if ((i == 1) && (j == 1) && (k == 0))
  {
    digitalWrite(ledPin,HIGH);
    mySerial.println("I NEED TO USE WASHROOM ");
    Serial.println("I NEED TO USE WASHROOM ");
    delay(2000);

   }

  else if ((i == 1) && (j == 1) && (k == 1))
  {
    digitalWrite(ledPin,HIGH);
    mySerial.println("I NEED TO GO OUT");
    Serial.println("I NEED TO GO OUT");
    delay(2000);
   }
 }
 digitalWrite(ledPin,LOW);
 delay(300);
}
```