A

Project Report on

"Home Automation And Health Monitoring For Paralyzed People Along With Voice Assistance"

Submitted in fulfilment for the award of the degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

B. Sai Vinay

20P31A04J1

Under the esteemed guidance of

Dr. I.RAMESH RAJA, M.E., Ph.D.

Associate Professor

ADITYA COLLEGE OF ENGINEERING & TECHNOLOGY

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PSO2: Acquire the required ability and knowledge to design, test, verify and develop innovative electronics projects through theoretical and laboratory practice.

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.

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PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, give and receive clear instructions.

PO11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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Upon completion of the course, students will be able to:

CO#	Course Outcomes	Blooms Taxonomy level
CO1	Identify the problem by applying acquired knowledge.	Remember
CO2	Use literature to identify the objective, scope and the concept of the work.	Apply
CO3	Analyze and categorize executable project modules after considering risks.	Analyze
CO4	Choose efficient tools for designing project modules.	Evaluate
CO5	Integrate all the modules through effective team work after efficient testing.	Create
CO6	Explain the completed task and compile the project report.	Understand

CO-PO/PSO MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	2	3	3	-	3	2	-	-	2	3
CO2	2	3	-	-	-	2	2	2	2	3	-	-	2	-
CO3	2	-	2	2	2	-	2	-	2	3	-	2	-	2
CO4	3	2	3	2	2	-	2	2	2	2	2	-	-	2
CO5	2	-	2	2	2	-	-	2	3	2	3	-	-	2
CO6	3	-	-	-	-	2	-	2	-	3	2	2	2	2
Course	2.5	1.1	1	1.3	1.3	1.1	1.5	1.3	2.0	2.5	1.5	0.6	1	1.8

Signature of the Guide

CO-PO Justification

	PO/PSO	CL	Justification
CO1	PO1	3	Highly mapped as we applied engineering knowledge to identify complex problems.
	PO2	2	Moderately mapped as we analyzed literature to identify the objective, scope, and concept of the work.
	PO3	2	Moderately mapped as we need to have knowledge on research methods.
	PO5	2	Moderately mapped as we need to apply modern tools.
	PO6	3	Highly mapped as our project is for society to help paralyzed people.
	PO7	3	Highly mapped as we need to understand on how project works on different conditions.
	PO9	2	Moderately mapped as we functioned effectively in a team for developing our project.
	PSO1	2	Moderately mapped as we acquired industry readiness in electronics & communication for developing this project.
	PSO2	2	Moderately mapped as we require the required ability knowledge.
CO2	PO1	2	Highly mapped as we applied engineering knowledge to analyze and categorize executable project modules.
	PO2	2	Moderately mapped as we used literature to identify and analyze complex engineering problems.
	PO6	2	Moderately mapped as we will able to apply our concept of work to society.
	PO7	2	Moderately mapped as we will able to identify the objectives with respect to environment.
	PO8	2	Moderately mapped as we applied ethical principles in literature review and research.
	PO9	2	Moderately mapped as we functioned effectively in a team for conducting literature review and research.
	PO10	2	Highly mapped as we will communicate objective, scope which we have identified for better understanding.
	POSO1	2	Moderately mapped as we need
	PSO2	2	Moderately mapped as we acquired the ability to design, test, verify, and develop innovative electronics projects.

CO3	PO1	2	Moderately mapped as we should have some knowledge on designing solutions.
	PO3	2	Moderately mapped as we will be able to design it considering risk factors.
	PO4	2	Moderately mapped as we will be able to analyze the project modules.
	PO5	2	Moderately mapped as we will be able to make the tools perfect after considering risks.
	PO7	2	Moderately mapped as we are considering project modules after risks and how they will going to impact in environment.
	PO9	2	Moderately mapped as we are considering project modules after risks which requires teamwork.
	PO10	3	Highly mapped as we need to communicate about the working status of the tools.
	PO11	2	Moderately mapped as we require management skills to do project after risks.
	PO12	2	Moderately mapped as we are considering risks which have ability in life long learning.
	PSO2	2	Moderately mapped as we utilized laboratory infrastructure for practical applications.
CO4	PO1	3	Highly mapped as we need knowledge on design and working.
	PO2	2	Moderately mapped as we require analysis of efficient tools required.
	PO3	3	Highly mapped as we have to design the system with appropriate components.
	PO4	2	Moderately mapped as we require research knowledge on designing.
	PO5	2	Moderately mapped as we are using some modern tools for designing the system.
	PO7	2	Moderately mapped as we need to know how the tools are working on environmental conditions.
	PO8	2	Moderately mapped as we know the rules which are followed while designing the project.
	PO9	2	Moderately mapped because for the designing system, it requires teamwork as well as individual.
	PO10	2	Moderately mapped as designing requires team work as well as individual work.
	PO11	2	Moderately mapped as the managing the designing process is require.
	PSO2	2	Moderately mapped as we aquire the required ability and knowledge on design.

CO5	PO1	2	Moderately mapped as need to apply our knowledge to integrate the components.
	PO3	2	Moderately mapped as we need to design system components for integration.
	PO4	2	Moderately mapped as we need to do an investigation on the integrating process.
	PO5	2	Moderately mapped as we are using modern tools for integrating.
	PO8	2	Moderately mapped as we follow some rules for integrating the components.
	PO9	3	Highly mapped as we need to integrate all modules through effective teamwork.
	PO10	2	Moderately mapped as we have better communication while integrating the components for effective results.
	PO11	3	Highly mapped as we need project management and finance.
	PSO2	2	Moderately mapped as we utilized laboratory infrastructure for practical applications.
CO6	PO1	3	Highly mapped as we have full knowledge on the working and the project report.
	PO6	2	Moderately mapped as our entire report will be useful to society related one.
	PO8	2	Moderately mapped as we need to work together to make the project better understandable.
	PO9	3	Highly mapped as we have to communicate our project to all with effectiveness.
	PO11	2	Highly mapped as the team needs to work on project management.
	PO12	2	Moderately mapped as our entire report have ability to engage in life long and technological change.
	PSO1	2	Moderately mapped as we applied reasoning informed by contextual knowledge in assessing societal issues.
	PSO2	2	Moderately mapped as we utilized laboratory infrastructure for practical applications

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Email: office@acet.ac.in
Website: www.acet.ac.in

Department of Electronics and Communication Engineering

CERTIFICATE

This is to certify that the project report entitled "**Home Automation And Health Monitoring For Paralyzed People Along With Voice Assistance**" is being submitted by **B. Sai Vinay (20P31A04J1)** has been carried out in the partial fulfillment of the requirement for the award of the degree of **Bachelor of Technology** in **Electronics and Communication Engineering**, **Aditya College of Engineering & Technology** , Surampalem , affiliated to **JNTUK, Kakinada** is a record of bonafide work carried out by them under my guidance and supervision during the academic period 2023-2024.

Project Guide

Dr. I.RAMESH RAJA,M.E,Ph.D.

Associate Professor

Dept of ECE

Head of the Department

Dr.R.V.V.KRISHNA,M. Tech, Ph.D.

Professor & HOD

Dept of ECE

EXTERNAL EXAMINER

DECLARATION

I hereby declare that the project entitled "**HOME AUTOMATION AND HEALTH MONITORING FOR PARALYZED PEOPLE ALONG WITH VOICE ASSISTANCE**" has been undertaken by our batch, and the project part report is submitted to **ADITYA COLLEGE OF ENGINEERING AND TECHNOLOGY**, Surampalem in partial fulfillment of the requirements for the award of degree of **BACHELOR OF TECHNOLOGY** in **ELECTRONICS AND COMMUNICATION ENGINEERING**

I also hereby declare that this project part have not been submitted in partial orfull to any other university for any degree.

Submitted by

B. Sai Vinay (20P31A04J1)

ACKNOWLEDGEMENT

It gives me immense pleasure to express a deep sense of gratitude to my guide **Dr. I.RAMESH RAJA, M.E.,Ph.D.** Associate Professor, Department ECE for whole hearted and invaluable guidance throughout the project work. Without his sustained and sincere effort, this project work would not have taken this shape. He encouraged and helped me to overcome various difficulties that I have faced at various stages of our project work.

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I would like to thank **all the faculty members** and the **non-teaching staff** of the Department of Electronics and Communication Engineering for their direct or indirect support for helping me in completion of this project work.

Finally, I would like to thank all our **friends** and **family members** for their continuous help and encouragement.

Yours Sincerely,

B. Sai Vinay (20P31A04J1)

ABSTRACT

Physically challenged, and paralyzed people are unable to speak. they have to use only sign language which may be difficult for common peoples. We Proposed an Innovative Solution for paralyzed People, to generate Voice using Hand Gestures along with Home automation using Hand Glove. Here the user can control home appliances like fan and bulb using glove. This System also provides health monitoring to the patients by using sensors like temperature and heartbeat sensors. Here user is provided with a Hand glove that is connected wirelessly to Hardware kit. When user move his hand fingers attached with flex sensors and Accelerometer, Hardware kit receives this signal wirelessly and process this data and Generate Audio Output along with Text message on LCD. This Glove is also interfaced with Switches to control the Light and Fan. The Temperature and heartbeat sensors monitors patient condition.

Key words: Arduino uno, Arduino nano, Temperature sensor, pulse sensor, flex sensor.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Paralyzed people are unable to control the home appliances and struggle to communicate with other in their day-to-day life and also, They have health problems more and every time we need to monitor the paralyzed persons. People with disabilities generally use sign language to communicate with each other but this sign language is difficult for normal people to understand. Not only normal people, but people with disabilities find it hard to learn these sign languages. It is also difficult for them to socialize and they will not be able to voice out their opinions. This is the same case with paralyzed people. They will not be able to move or communicate. So, the gloves allows the person with disabilities to communicate what he/she wants without anyone's help. Based on the movement which is done by the fingers, the flex sensors detect the bend made by the finger and the output is varied in terms of resistance. Due to its flexibility and large range of resistance, many commands can be fed into it. We have used Arduino uno for more storage and faster response.

In designing a electrical automation system, one or more suitable platforms are used in order to build a dependable and flexible system that can be easily operated and adapted for a new electrical appliance. Therefore, for the purpose of this project some specific deliberate choices were made on the type of platforms, hardware components and process mode of domestic automation system. RF based domestic automation is a project based on controlling of domestic appliances using RF module, microcontroller, and RF Remote. The designed domestic automation system uses ATMEGA328 microcontroller, and the RF 433 MHZ module of the domestic automation' system. Voice based alert message system with Gesture control automation is developed in this system. This system is also equipped with Patient Monitoring System using Heart beat and Temperature sensor. This type of system can be used for Dumb and parlayed people.

1.2 Aim

Automation is a trending topic in 21st century making an essential part in our daily lives. Automation decreases the human labor, time, work and some human error.

The key objective of our project is to design a system for physically handicapped people to control and activate home appliances by their Hand Gesture and also generate Voice message using Finger Movements. For physically challenged, deaf and dumb peoples there are no such devices are available to pass their needs and emergency intimations in hospitals, homes and many public places. Sometimes they have to use only sign language which may be difficult for common peoples. In our country around 2.78% of peoples are not able to speak (dumb). Their communications with others are only using the motion of their hands and expressions. This system is also interfaced with Patient monitoring and Alert system using Wireless communication medium of 433 MHZ Frequency.

1.3 Objective

The essential aim of this project is to extend a home automation for Elderly people using Wireless Technology and Hand Glove. As technology is advancing so houses are also getting smarter. Modern houses are progressively transferring from conventional switches to centralized control system, regarding far-flung controlled switches. Using this system, we are trying to make the life of Paralyzed and Old people by making it convenient using Technology.

1.4 Existing Technology

Earlier this system was designed using Bluetooth or RF Based Home automation system for old people. But there was a problem to control the Light and Fan, user has to use a Android Application for its operation. As old and paralyzed people cannot correctly coordinate with application and operation of this device was difficult. Flex sensor is a resistive sensor changing its resistance according to the change in bend or curvature of the finger into analog voltage. This is a haptic based technology using flex sensors to take in physical values for processing output values.

1.4.1 Limitations

Only applicable for voice assistance. LCD display and voice assistance are in only English language so that some of the village people can’t understand.

1.5 Proposed System

In this proposed system, we have solved the above problem in existing system using Wireless Glove using 433 MHz Frequency. User is provided with a Glove that is embedded with a Accelerometer and Flex sensor. Using Gesture and Finger Movements user can control lights and generate Audio Messages in Received Kit. This system is also interfaced with Temperature sensor to measure the body temperature of the Old People and generate High alert is Value crosses the threshold level. Heart Beat sensor also interfaced a Receiver kit. The proposed method is combination of the Home automation, voice assistance and health monitoring through glove for the patients. The finger gesture is captured by the flex sensor and a corresponding output is displayed in the form of text in the LCD and also in the form of audio. The proposed system having two languages: LCD display in English language, Voice assistance in Native language. The Automation is also added so that the persons can easily operate home appliances. Proposed system block diagram as shown in below Fig. 1.1.

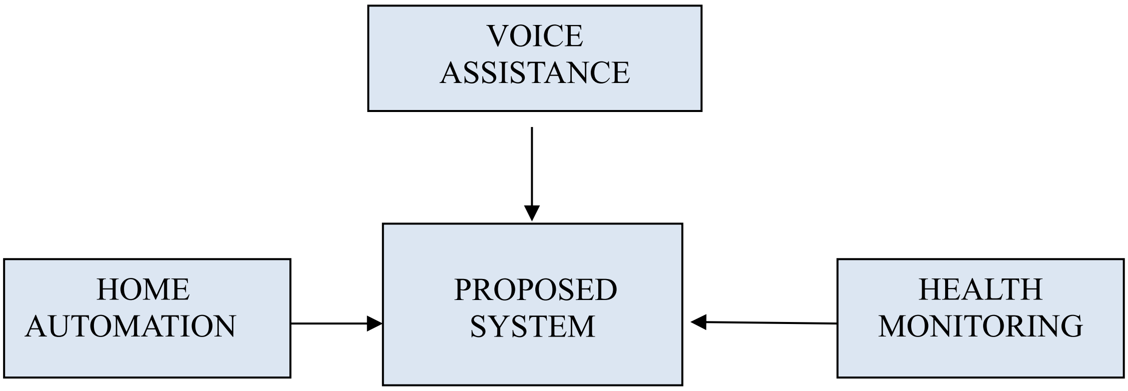

Fig. 1.1: Proposed system block diagram

1.6 Area Identified

Embedded systems are specialized computing systems designed to perform dedicated functions within a larger mechanical or electrical system. They typically consist of a microcontroller or microprocessor that is programmed to execute specific tasks. Embedded systems are used to control, monitor, or assist the operation of machinery, equipment, vehicles, appliances, and other devices.

An embedded system comprises hardware (like microcontrollers, sensors, actuators, and interfaces) and software (the program that runs on the hardware to perform the intended functions). Many embedded systems are designed to respond to events or inputs within specific time constraints. Real-time systems must meet strict timing and performance requirements. Embedded systems are found in a wide range of industries, including automotive (engine control units), consumer electronics (smartphones, wearables), healthcare (medical devices), industrial automation (PLCs), and IoT (Internet of Things) devices. Specialized tools and languages are used to develop embedded systems. This includes IDEs (Integrated Development Environments), compilers, debuggers, and simulators tailored for specific microcontrollers and architectures. Embedded systems must often be efficient in terms of power consumption, memory usage, and processing speed. They also need to be reliable, durable, and sometimes operate in harsh environments. Embedded systems can be programmed using various languages such as C, C++, or assembly language, depending on the system's requirements and constraints. Embedded systems play a crucial role in modern technology, enabling automation, intelligence, and connectivity in a vast array of devices and applications.

1.7 Applications

1. Domestic Houses
2. Commercial Building
3. Gesture based Home Automation
4. Old Age Homes
5. Hospitals and Clinics for Old People

1.8 Advantages

1. Low cost and Easy to Implement
2. Voice Commands using Hand Gesture of Accelerometer
3. Flex Sensor are used to control the Home Automation
4. LCD based Text message display
5. Heart Beat and Temperature Monitoring
6. Wireless and Reliable communication

CHAPTER 2

LITERATURE SURVEY

Kavitha, in their paper presented a system that can efficiently translate American Sign Language gestures to both text and auditory voice. The interpreter here makes use of a glove based technique comprising of flex sensor, tactile sensors and accelerometer. For each hand gesture made, a signal is produced by the sensors corresponding to the hand sign. The controller matches the gesture with pre-stored inputs. The evaluation of Deaf-mute communication interpreter was carried out for ten beginners for letters ‘A’ ‘B’ ‘C’ ‘D’ ‘F’ ‘I’ ‘L’ ‘O’ ‘M’ ‘N’ ‘T’ ‘S’ ‘W’. Word formation from letters is also performed using an end signal. The overall gesture recognition for the letters showed accuracy of about 90% [1].

Harshalatha, et al in their paper proposed a system using the data glove technique. It consists of flex sensors , Accelerometer that used to detect finger gestures and transmit the information to a microcontroller. He also used gyro sensors for providing a signal corresponding to the orientation of the motion of the hand. PIC microcontroller processes the gesture of the user and plays the audio file corresponding gesture. The voice signals are stored in APR9600. It is a single chip used to store high quality voice recording and Non-volatile flash memory, playback capacity for 40 to 60 seconds. APR provides random and sequential multiple messages and designers can adjust storage time depending upon user needs. Basically, he used pre-recorded voice and for communication between the transmitter and receiver side and used RF module [2].

Manduca K, et al in their paper presented a system in which a pair of gloves with flex sensors along each finger, thumb and arm is used to capture the movement of user. With the help of flex sensors, degree of fingers, thumb and arm are calculated in voltage terms using voltage divider rule. PIC microcontroller is used for various functions like analog to digital conversion of data from flex sensors. Then digitized data is encoded in encoder and transmitted. Received data is decoded by decoder and gesture recognition system matches the incoming data with preferred data [3] .

Deaf Mute Communication Interpreter: This paper aims to cover the various prevailing methods of deaf-mute communication interpreter system. The two broad classification of the communication methodologies used by the deaf –mute people are

- Wearable Communication Device and Online Learning System. Under Wearable communication method, there are Glove based system, Keypad method and Touch-screen. All the above mentioned three sub-divided methods make use of various sensors, accelerometer, a suitable micro-controller, a text to speech conversion module, a keypad and a touch-screen. The need for an external device to interpret the message between a deaf –mute and non-deaf-mute people can be overcome by the second method online learning system. The Online Learning System has different methods. The five subdivided methods are- SLIM module, TESSA, Wi-See Technology, SWI_PELE System and Web-Sign Technology [4].

An Efficient Framework for Indian Sign Language Recognition Using Wavelet Transform: The proposed ISLR system is considered as a pattern recognition technique that has two important modules: feature extraction and classification. The joint use of Discrete Wavelet Transform (DWT) based feature extraction and nearest neighbour classifier is used to recognize the sign language. The experimental results show that the proposed hand gesture recognition system achieves maximum 99.23% classification accuracy while using cosine distance classifier [5].

Hand Gesture Recognition Using PCA in: In this paper authors presented a scheme using a database driven hand gesture recognition based upon skin color model approach and thresholding approach along with an effective template matching with can be effectively used for human robotics applications and similar other applications. Initially, hand region is segmented by applying skin color model in YCbCr color space. In the next stage thresholding is applied to separate foreground and background. Finally, template based matching technique is developed using Principal Component Analysis (PCA) for recognition [6].

Hand Gesture Recognition System For Dumb People: Authors presented the static hand gesture recognition system using digital image processing. For hand gesture feature vector SIFT algorithm is used. The SIFT features have been computed at the edges which are invariant to scaling, rotation, addition of noise [7].

CHAPTER 3

BLOCK DIAGRAM AND DESCRIPTION

3.1 Glove Block Diagram

This project is the combination of glove and hardware kit. The glove is wirelessly connected t the kit. Below are the block diagrams of both glove and hardware kit for this project. This project is based on the Radio Frequency (RF) technology so they both are connected wirelessly. Therefore below are the individual glove and hardware kit block diagrams and circuit diagrams of the project. Block diagram of the glove as shown in below Fig. 3.1.

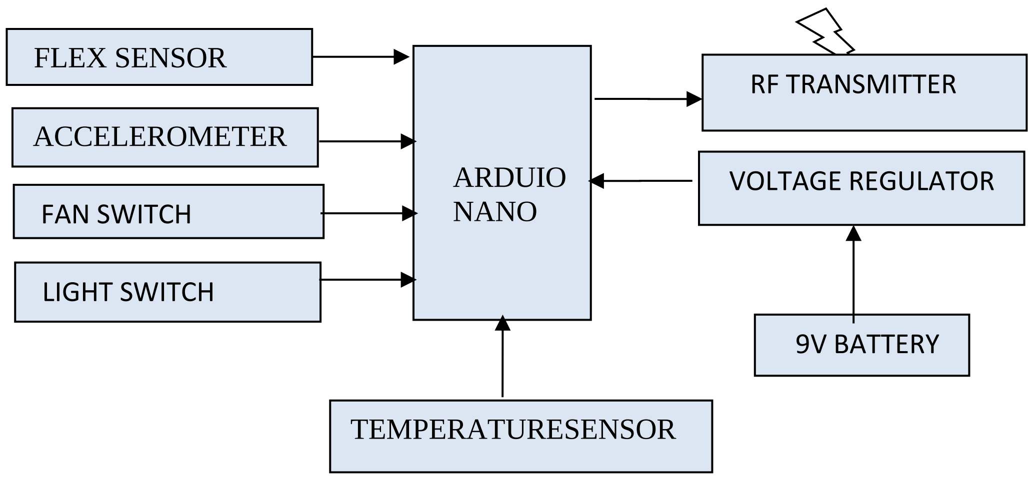

Fig. 3.1 Block Diagram of Glove

In the glove part, the main component for all operations is the Arduino Nano. A battery is provided to power the Arduino Nano within the glove. The Arduino Nano is connected to various sensors including flex sensors, MEMS accelerometer, temperature sensor, fan switch, and light switch. This project utilizes Radio Frequency (RF) technology, so an RF transmitter is connected to the output of the Arduino Nano which helps for wireless communication.

3.2 Pin Diagram Of Hand Glove

The Arduino Nano is the main component responsible for all operations in this project. Pin diagram of the hand glove as shown below Fig. 3.2. It is powered by a 9V battery. Two flex sensors are connected to analog pins A0 and A1 of the Arduino Nano. Switches for controlling the fan and bulb are connected to digital pins 5 and 6 of the Arduino. The outputs of digital pins 9, 10, 11, and 12 of the Arduino Nano are connected to the RF transmitter.

The accelerometer is connected to analog pins A2 and A3. The temperature sensor is connected to analog pin A4. An analog-to-digital converter (ADC) is used to convert the analog sensor data into digital signals, which are then transmitted to the Arduino Nano for processing in below Fig. 3.2.

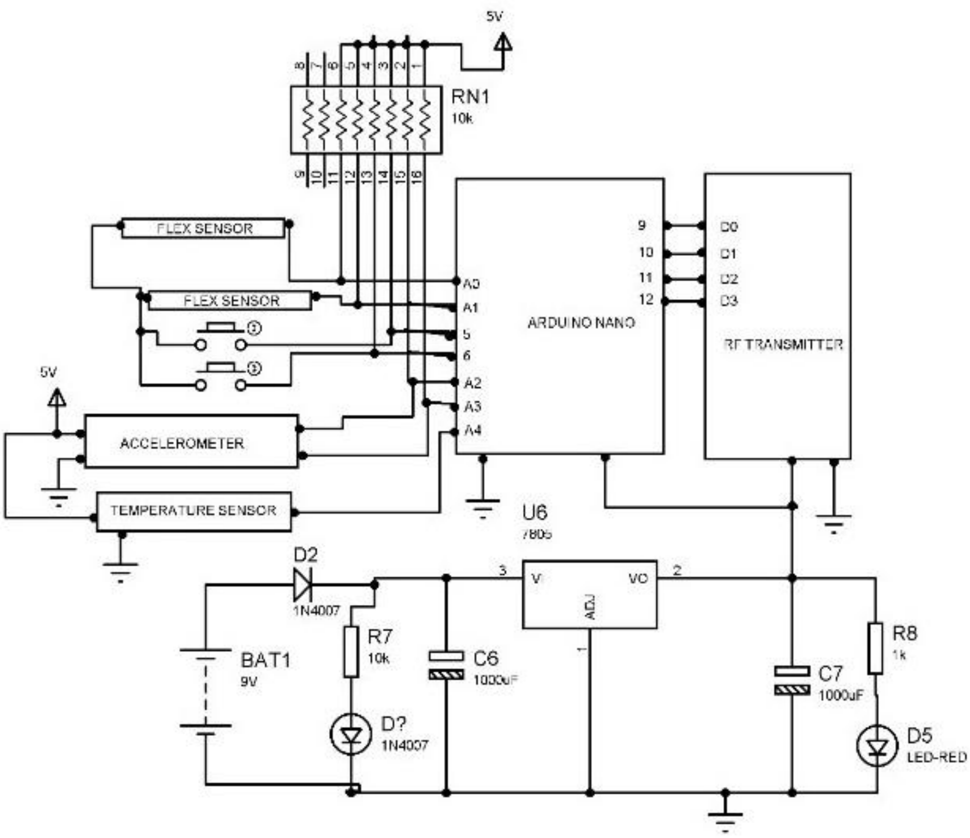

Fig. 3.2 Pin diagram of hand glove

3.3 Hardware Kit Block Diagram

In this project, the hardware kit includes an Arduino controller responsible for specific operations. To power the Arduino controller, a 12V transformer is connected to a full-wave rectifier and voltage regulators are used for stable power supply. An RF receiver is used to receive signals as input to the Arduino Uno.The outputs of the Arduino controller are connected to an LCD module and a voice module. The receiver wirelessly receives input signals transmitted from the glove (via the RF transmitter). Depending on the received signal, corresponding operations are executed such as displaying information on the LCD or producing voice output through a speaker. Block diagram of the kit as shown below Fig. 3.3.

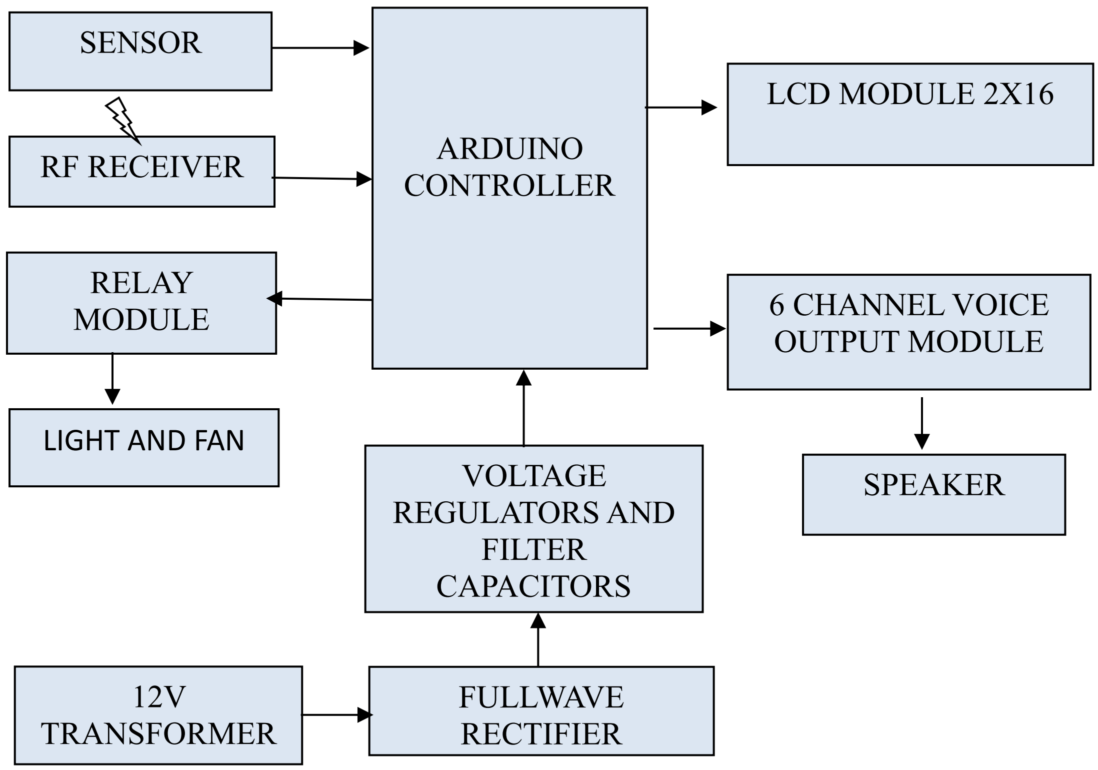

Fig. 3.3 Block diagram of Kit

3.4 Pin Diagram Of Hardware Kit

In the hardware setup, the RF receiver pins D0, D1, D2, D3 are connected to pin 10 (PB2/OC1B), A2, A3, A1 respectively. The pin diagram of the hardware kit as shown in below Fig. 3.4. The heart rate sensor is connected to analog pin A0. Analog pins A4 and A5 are connected to the LCD display. Pin 13 is connected to the buzzer. Digital pins 2, 3, 4, 5, 6, 7 are connected to the voice module. Digital pins 8 and 9 are connected to the dual-channel relay. Power is supplied to all components via a transformer and voltage regulators.

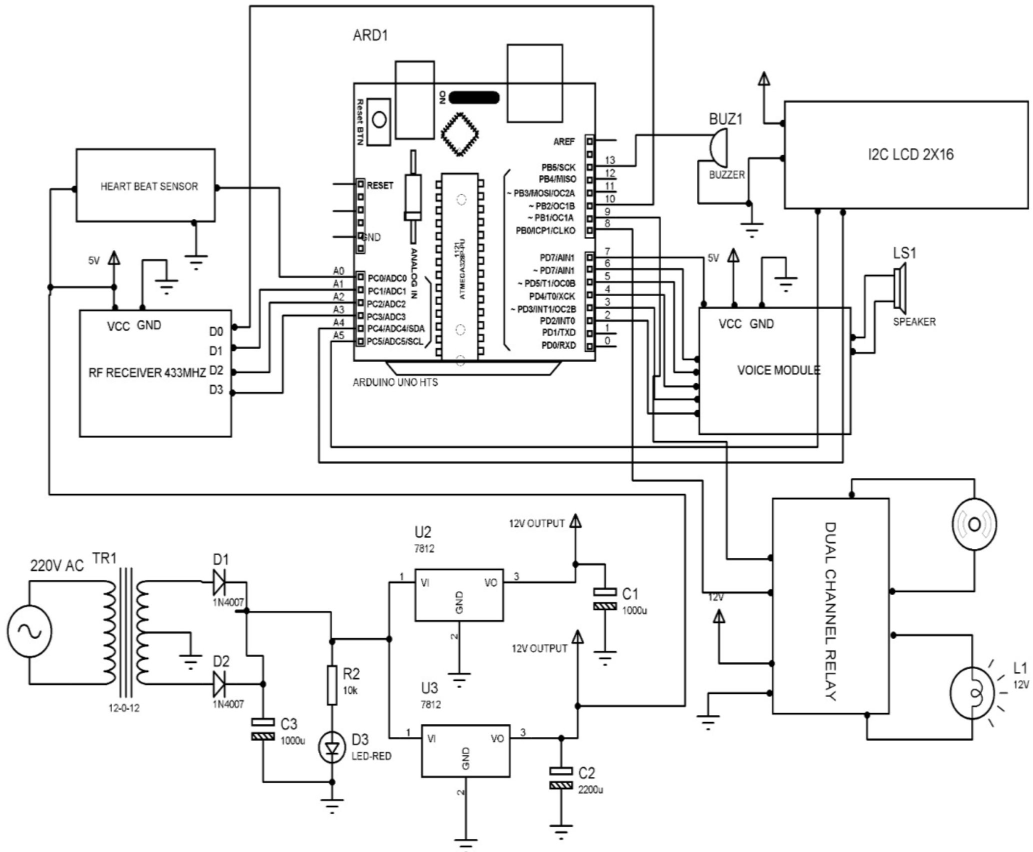

Fig. 3.4: Pin diagram of Hardware kit

CHAPTER 4

HARDWARE REQUIREMENTS

Hardware components used in this project are

1. Arduino Uno
2. Arduino nano
3. MEMS (Accelerometer)
4. Flex sensor
5. Temperature sensor
6. Pulse sensor
7. RF Module
8. LCD Module
9. Relay Module
10. DC Fan and light
11. Voice module
12. Speaker
13. Buzzer
14. Transformer
15. 9v Battery
16. PCB Boards
17. Other components

4.1 Arduino Uno

The Arduino Uno is a widely used microcontroller board based on the ATmega328P chip. It features a simple yet powerful design that makes it accessible for beginners and versatile for advanced users. Arduino uno as shown in below Fig.4.1.

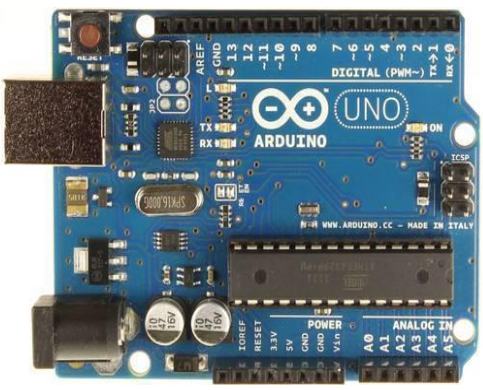

Fig. 4.1: Arduino uno

The board includes 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, USB connection, power jack, ICSP header, and a reset button. It can be programmed using the Arduino IDE (Integrated Development Environment), making it easy to write and upload code to control electronic circuits.

4.1.1 Working

The Arduino Uno functions as the brain of electronics projects. It reads inputs (like sensors and buttons), processes data using its microcontroller, and then controls outputs (such as LEDs, motors, and displays) based on the programmed instructions. The board can communicate with other devices via serial communication (USB or UART) and supports various communication protocols like I2C, SPI, and UART.

4.1.2 Applications

1. Arduino Uno is commonly used for prototyping new electronic devices and systems due to its simplicity and ease of use.
2. Hobbyists and makers use Arduino Uno to create custom gadgets, robots, and interactive artworks.
3. It's widely used in educational settings to teach electronics, programming, and robotics
4. Arduino Uno can be part of home automation projects for controlling lights, temperature, and security systems.

4.1.3 Key Features

1. Open-source hardware and software.
2. Cross-platform compatibility (Windows, Mac, Linux).
3. Extensive community support with a large library of pre-written code (libraries).
4. Expandability with shields and modules to add functionalities like Wi-Fi, Bluetooth, motor control, and more.
5. Low-cost and readily available, making it accessible to hobbyists and professionals alike.

4.1.4 Programming

Arduino Uno is programmed using a simplified version of C/C++ language. Users write sketches (programs) in the Arduino IDE and upload them to the board via USB. The board comes with a bootloader that allows easy uploading of new sketches without the need for additional hardware.

Overall, the Arduino Uno is a versatile and beginner-friendly platform for exploring electronics, programming, and creative projects, making it a staple in the world of makers and inventors.

The first step in programming the Arduino board is downloading and installing the Arduino IDE. The open source Arduino IDE runs on Windows, Mac OS X, and L+inux. Download the Arduino software (depending on your OS) from the official website and follow the instructions to install.

4.1.5 Arduino Uno Details

Below Table 4.1 represents Arduino uno details.

Microcontroller	Atmega328P
Operating voltage	5v
Input voltage (recommended)	7-12v
Input voltage limit	6-20v
Digital I/O pins	14
Analo pins	6
DC current per I/O	20mA
DC current for 3.3v pin	50mA
Flash memory	32KB
SRAM	2KB
EEPROM	1KB
Clock speed	16MHZ
length	68.6 mm
width	53.4 mm
weight	25 g

Table 4.1: Arduino uno details

4.2 Arduino Nano

The Arduino Nano is a compact and versatile microcontroller board based on the ATmega328P chip, similar to the Arduino Uno but in a smaller form factor. It offers similar capabilities to the Uno while being ideal for projects where space is limited. Below Fig. 4.2 represents Arduino Nano.

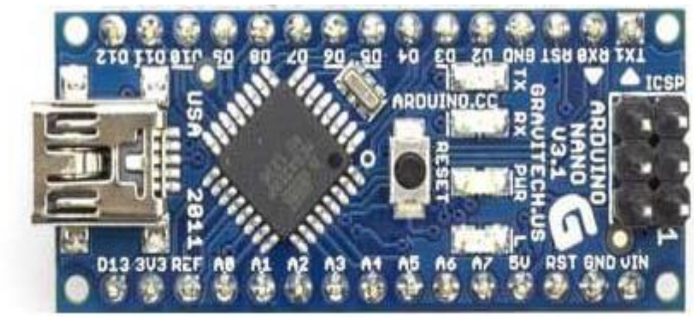

Fig. 4.2 : Arduino Nano

4.2.1 Working

The Arduino Nano operates similarly to the Arduino Uno. It can be programmed using the Arduino IDE and supports the same libraries and code as the Uno. The Nano can interface with various sensors, actuators, and modules through its digital and analog I/O pins, making it suitable for a wide range of applications.

4.2.2 Applications

1. Due to its compact size, the Nano is ideal for embedded electronics projects where space is limited.
2. Used in wearable electronics such as smart clothing, health monitoring devices, and gesture-controlled gadgets.
3. Suitable for prototyping small-scale projects and proof-of-concept designs.
4. Can be integrated into IoT (Internet of Things) devices for sensing and data processing.
5. Widely used in educational settings for teaching electronics, programming, and robotics.

4.2.3 Arduino Nano Details

Below Table 4.2 represents the Arduino nano details.

Microcontroller	Atmega328P
Flash memory	32KB
SRAM memory	2KB
EEPROM	1KB
Operating voltage	5V
Input voltage	7-12V(via pin) or 5v (via USB)
Digital I/O pins1	14
PWM pins	6
Analog pins	8
Interfaces	USB
Dimesions	18X45 mm

Table 4.2 : Arduino nano details

4.3 MEMS Accelerometer

A MEMS accelerometer designed to detect four directions refers to an accelerometer that can measure acceleration along three orthogonal axes (X, Y, Z) and also determine the orientation of these axes relative to gravity. By combining acceleration measurements with orientation data, the accelerometer can determine tilt and movement in four different directions (front, back, left, and right). An accelerometer is a device that measures proper acceleration. MEMS Accelerometer is shown in below Fig. 4.3.

Fig. 4.3 : MEMS accelerometer

4.3.1 Working

The accelerometer measures linear acceleration along the X, Y, and Z axes using microelectromechanical systems (MEMS) technology. Each axis is equipped with a sensing element that responds to changes in acceleration. In addition to acceleration, the accelerometer incorporates orientation sensing capabilities. This can be achieved using algorithms that analyze the gravitational force vector relative to the sensor's axes. By determining the direction of gravity, the sensor can infer its orientation in space.

4.3.2 Applications

1. Used for screen rotation and gesture recognition.
2. Enables motion-based controls and gesture inputs.
3. Provides orientation data for augmented reality (AR) applications and GPS navigation.
4. Used in robotic systems for orientation sensing and motion control.
5. Integrated into fitness trackers, smartwatches, and health monitoring devices for activity tracking and posture analysis.

4.3.3 MEMS Accelerometer Details

Below Table 4.3 represents MEMS Accelerometer details.

Type	Magnetic field
Interface	Analog quantity
Operating temperature	-40 to +85 C
Dimension	0.59 in x 0.59 in x 0.43 in
weight	5 gm
Operating voltage	5 v

Table 4.3 : MEMS accelerometer details

4.4 Flex Sensor

A flex sensor or bend sensor is a sensor which detects 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. Flex Sensor as shown in below Fig. 4.4. Since the resistance is directly proportional to the amount of bend it is used as goniometer, and often called flexible potentiometer.

Fig. 4.4 : flex sensor

4.4.1 Types of Flex Sensors

These sensors are classified into two types based on its size namely 2.2-inch flex sensor & 4.5-inch flex sensor. The size, as well as the resistance of these sensors, is dissimilar except the working principle. Therefore the suitable size can be preferred based on the necessity. Here this article discusses an overview of 2.2-inch flex-sensor. This type of sensor is used in various applications like computer interface, rehabilitation, servo motor control, security system, music interface, intensity control, and wherever the consumer needs to modify the resistance throughout the bending.

4.4.2 Pin Configuration

The pin configuration of the flex sensor is shown below. It is a two-terminal device, and the terminals are like p1 & p2. This sensor doesn't contain any polarized terminal such as diode otherwise capacitor, which means there is no positive & negative terminal. The required voltage of this sensor to activate the sensor ranges from 3.3V -5V DC which can be gained from any type of interfacing.

4.5 LM35 – Temperature Sensor

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a Thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature, *i.e.*, its scale factor is 0.01V/ ^{o}C. LM35 Temperature sensor as shown in below Fig. 4.5.

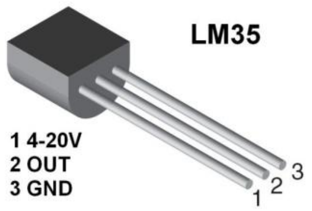

Fig. 4.5 : LM35 Temperature Sensor

4.5.1 LM35 SENSOR CONNECTIONS

Here is a commonly used circuit. In this circuit, parameter values commonly used are V_c = 4 to 30v **.**

5v or 12 v are typical values used

.$R_{\mathbf{a}} = V_{\mathbf{c}} /10^{\mathbf{-6}}$

Actually, it can range from 80 K**W** to 600 K**W**, but most just use 80 K**.**

4.5.2 Pin Description Of LM35

Below Table 4.4 . Represents LM35 details.

Pin No	Function	Name
1	Supply voltage; 5V (+35V to -2V)	VCC
2	Output voltage (+6V to -1V)	Output
3	Ground (0V)	Ground

Table 4.4 : LM35 details

4.6 Pulse Sensor

Pulse Sensor is a reflection type photoelectric analog sensor used to measure pulse and heart rate. It is shown in below Fig. 4.6. Having been worn around the finger or earlobe, the sensor can transmit the collected analog signal to MCU. And then the analog signal will be converted into digital signal. With simple calculation finished, the MCU gets heart rate values and uploads them to computer. There are three traditional pulse measurement methods: the first one is to extract from ECG signal; the second way is to calculate pulse rate from the fluctuation measured by pressure sensor during blood pressure measurement; the third one is photoelectric volume method. The first two methods of signal extraction will limit the activity of the patient, long-time using will increase the patient's physical and psychological discomfort. As one of the most common methods in monitoring and measuring, photoelectric volume pulse measurement has the characteristics of simple method, convenient to wear and high reliability

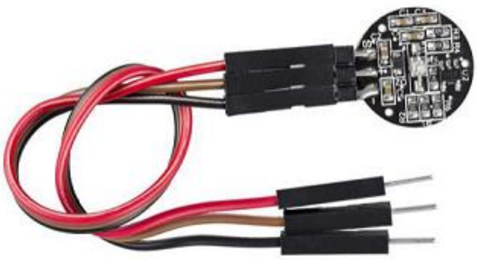

Fig. 4.6 : Pulse sensor

4.6.1 Working

The basic principle of the photoelectric volume method is to take advantage of the different light transmittance of the human body caused by beating blood vessels, and the pulse measurement is carried out by this means. The used sensor is composed of a light source and a photoelectric converter, and is fixed on the finger or the earlobe of a patient through a strap or a clamp. The light source generally employs a light-emitting diode having a certain wavelength (500-700 nm) that is selective for oxygen and hemoglobin in the arterial blood. When the light beam is transmitting through the peripheral blood tube of the human body, the light transmittance of the beam is changed due to the change of the volume of the arterial pulse and the volume of the blood. And the photoelectric transducer receives the light reflected by the human body, converts the light into an electric signal, amplifies and outputs the electric signal. Output signal is connected to A0 of the Arduino uno.

4.6.2 Pulse Sensor Details

Below Table 4.5 represents Pulse sensor details.

Supply voltage	3.3V or 5V
Output	Analog signal
Current Range	Less than 4mA
LED wavelength	609 nm
Output signal range	0-3.3V

Table 4.5 : Pulse sensor details

4.7 RF Module

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 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 Module is shown in below Fig. 4.7.

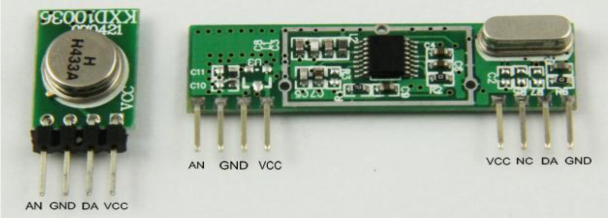

Fig. 4.7 : RF Module

The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

4.7.1 Working

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHZ. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

RF Modules are used wireless transfer data. This makes them most suitable for remote control applications, as in where you need to control some machines or robots without getting in touch with them (may be due to various reasons like safety, etc). Now depending upon the type of application, the RF module is chosen.

For short range wireless control applications, an ASK RF Transmitter-Receiver Module of frequency 315 MHz or 433 MHz is most suitable.

4.7.2 Pin Description of RF Transmitter

Below Table 4.6 represents RF Transmitter Pin description.

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage; 5V	VCC
4	Antenna output pin	ANT

Table 4.6 : RF Transmitter Pin description

4.7.3 Pin Description of RF Receiver

Below Table 4.7 represents RF Receiver details

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data output pin	Data
3	Linear output pin; not connected	NC
4	Supply voltage; 5V	VCC
5	Supply voltage; 5V	VCC
6	Ground (0V)	Ground
7	Ground (0V)	Ground
8	Antenna input pin	ANT

Table 4.7 : RF Receiver details

RF Modules are used wireless transfer data. This makes them most suitable for remote control applications, as in where you need to control some machines or robots without getting in touch with them (may be due to various reasons like safety, etc).
For short range wireless control applications, an ASK RF Transmitter-Receiver Module of frequency 315 MHz or 433 MHz is most suitable.

4.8 LCD 2X16 Module

A liquid-crystal display (LCD) is a flat-panel display or other electronic visual display that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCD display as shown in below Fig. 4.8. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as DVD players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in nearly all applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burn-in.

The LCD screen is more energy-efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment more efficiently than CRTs. It is an electronically modulated optical device made up of any number of segments controlling a layer of liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome.

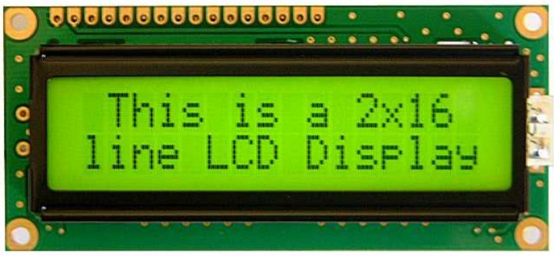

Fig. 4.8 : LCD display

4.8.1 Working

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

4.8.2 LCD Display Details

Below Table 4.8 represents LCD display details.

Pin No	**Function**	**Name**
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	VCC
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0

8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Table 4.8 : LCD display details

VEE pin is meant for adjusting the contrast of the LCD display and the contrast can be adjusted by varying the voltage at this pin. This is done by connecting one end of a POT to the VCC (5V), other end to the Ground and connecting the center terminal (wiper) of of the POT to the VEE pin.

High logic at the RS pin will select the data register and Low logic at the RS pin will select the command register. R/W pin is meant for selecting between read and write modes. High level at this pin enables read mode and low level at this pin enables write mode. E pin is for enabling the module. A high to low transition at this pin will enable the module. DB0 to DB7 are the data pins. The data to be displayed and the command instructions are placed on these pins. LED+ is the anode of the back light LED and this pin must be connected to VCC through a suitable series current limiting resistor. LED- is the cathode of the back light LED and this pin must be connected to ground.

4.8.3 LCD Display Commands

The commonly used commands and their function are given in the table 4.9.

Command	Function
0F	LCD ON, Cursor ON, Cursor blinking ON
01	Clear screen
02	Return home
04	Decrement cursor

06	Increment cursor
0E	Display ON, Cursor blinking OFF
80	Force cursor to the beginning of 1st line
C0	Force cursor to the beginning of 2nd line
38	Use 2 lines and 5×7 matrix
83	Cursor line 1 position 3
3C	Activate second line
08	Display OFF, Cursor OFF
C1	Jump to second line, position1
OC	Display ON, Cursor OFF
C1	Jump to second line, position1
C2	Jump to second line, position2

Table 4.9: LCD display details

Function Set (0x38): Sets 8-bit data length, 2 display lines, and 5x8 dot font. Display ON/OFF Control (0x0C): Turns on display, cursor off, and cursor blink off. Clear Display (0x01): Clears the display and returns cursor to home position. Entry Mode Set (0x06): Sets cursor to increment mode, no display shift. 16×2 LCD module has a set of preset command instructions. Each command will make the module to do a particular task.

4.8.4 LCD Initialization

The steps that has to be done for initializing the LCD display is given below and these steps are common for almost all applications.

1. Send 38H to the 8 bit data line for initialization
2. Send 0FH for making LCD ON, cursor ON and cursor blinking ON.
3. Send 06H for incrementing cursor position.
4. Send 01H for clearing the display and return the cursor.

4.8.5 Sending Data To LCD.

The steps for sending data to the LCD module is given below. I have already said that the LCD module has pins namely RS, R/W and E. It is the logic state of these pins that make the module to determine whether a given data input is a command or data to be displayed.

1. Make R/W low.
2. Make RS=0 if data byte is a command and make RS=1 if the data byte is a data to be displayed.
3. Place data byte on the data register.
4. Pulse E from high to low.

4.9 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically Operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. Relay Module as shown in below Fig. 4.9. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching.

Fig. 4.9 : Relay Module

Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

4.9.1 Relay module design and Operation

A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board (PCB) via the yoke, which is soldered to the PCB.

When an electric current is passed through the coil it generates a magnetic field that activates the armature, and the consequent movement of the movable contact(s) either makes or breaks (depending upon construction) a connection with a fixed contact. If the set of contacts was closed when the relay was de-energized, then the movement opens the contacts and breaks the connection, and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly. In a low-voltage application this reduces noise; in a high voltage or current application it reduces arcing.

When the coil is energized with direct current, a diode is often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a voltage spike dangerous to semiconductor circuit components. Such diodes were not widely used before the application of transistors as relay drivers, but soon became ubiquitous as early germanium transistors were easily destroyed by this surge. Some automotive relays include a diode inside the relay case.

If the relay is driving a large, or especially a reactive load, there may be a similar problem of surge currents around the relay output contacts. In this case a snubber circuit (a capacitor and resistor in series) across the contacts may absorb the surge. Suitably rated capacitors and the associated resistor are sold as a single packaged component for this commonplace use.

If the coil is designed to be energized with alternating current (AC), some method is used to split the flux into two out-of-phase components which add together, increasing the minimum pull on the armature during the AC cycle. Typically this is done with a small copper "shading ring" crimped around a portion of the core that creates the delayed, out-of-phase component,[9] which holds the contacts during the zero crossings of the control voltage.

Pole and Throw

Relays have the exact working of a switch. So, the same concept is also applied. A relay is said to switch one or more poles. Each pole has contacts that can be thrown in mainly three ways. They are

1. **Normally Open Contact (NO)** – NO contact is also called a make contact. It closes the circuit when the relay is activated. It disconnects the circuit when the relay is inactive.
2. **Normally Closed Contact (NC) –** NC contact is also known as break contact. This is opposite to the NO contact. When the relay is activated, the circuit disconnects. When the relay is deactivated, the circuit connects.
3. **Change-over (CO) / Double-throw (DT) Contacts** – This type of contacts are used to control two types of circuits. They are used to control a NO contact and also a NC contact with a common terminal. According to their type they are called by the names **break before make** and **make before break** contacts.

Relays are also named with designations like

1. **Single Pole Single Throw (SPST)** – This type of relay has a total of four terminals. Out of these two terminals can be connected or disconnected. The other two terminals are needed for the coil.
2. **Single Pole Double Throw (SPDT)** – This type of a relay has a total of five terminals. Out f these two are the coil terminals. A common terminal is also included which connects to either of two others.
3. **Double Pole Single Throw (DPST)** – This relay has a total of six terminals. These terminals are further divided into two pairs. Thus they can act as two SPST's which are actuated by a single coil. Out of the six terminals two of them are coil terminals.
4. **Double Pole Double Throw (DPDT)** – This is the biggest of all. It has mainly eight relay terminals. Out of these two rows are designed to be change over

terminals. They are designed to act as two SPDT relays which are actuated by a single coil.

4.9.2 Relay Applications

1. Relays are used to realize logic functions. They play a very important role in providing safety critical logic.
2. Relays are used to provide time delay functions. They are used to time the delay open and delay close of contacts.
3. Relays are used to control high voltage circuits with the help of low voltage signals. Similarly they are used to control high current circuits with the help of low current signals

4.10 DC Fan And DC Light

4.10.1 DC Fan

A DC (Direct Current) fan is an electromechanical device that converts electrical energy into mechanical airflow, providing cooling or ventilation in various applications. DC fans are widely used in electronics, appliances, automotive systems, and industrial equipment. A 5V DC fan is a compact electronic device that operates on 5 volts of direct current (DC) power. It consists of fan blades mounted on a motor that spins when connected to a 5V power source as shown in below Fig. 4.10. These fans come in various sizes and designs, with common options including axial fans and centrifugal blowers.

Fig. 4.10 : DC Fan

When DC voltage is applied to the fan motor, it generates a magnetic field that interacts with the permanent magnet or electromagnets, causing the rotor (fan blades) to rotate. The rotating fan blades draw air into the fan housing, creating airflow that can be used for cooling electronic components, dissipating heat, or providing ventilation.

They are widely used for cooling electronic components, dissipating heat, and improving airflow in a variety of applications

4.10.2 DC Fan Working

When DC voltage is applied to the fan motor, it generates a magnetic field that interacts with the permanent magnet or electromagnets, causing the rotor (fan blades) to rotate. The rotating fan blades draw air into the fan housing, creating airflow that can be used for cooling electronic components, dissipating heat, or providing ventilation.

4.10.3 DC Light

A DC (Direct Current) light refers to a lighting device that operates on DC power, typically powered by batteries, solar panels, or DC power supplies. DC lighting systems are commonly used in off-grid applications, portable devices, and renewable energy setups. DC light is shown in below Fig. 4.11.

Fig. 4.11: DC light

4.10.4 DC Light Working

When DC voltage is applied to the light, it energizes the light source (LED or bulb).The driver or ballast regulates the electrical current to ensure the light operates at the correct voltage and current levels. The light source emits visible light, providing illumination for indoor or outdoor applications.

4.11 Voice Module

A voice module, also known as a voice recognition or speech synthesis module, is an electronic device that enables audio input and output capabilities in electronic systems. Voice modules can process voice commands, generate speech output.

The Voice Module converts the text information coming from the Voice Application to audible commands for the operator to hear. There are a number of TTS converters that speak a programmed word to the operator.

Voice module shown in below Fig. 4.11.

Fig. 4.11 : Voice Module

4.11 .1 Working

Voice Recognition:

The microphone captures voice input from the user. The voice data is processed by the module's algorithms to identify and interpret spoken commands or words. Once recognized, the module triggers appropriate actions or responses based on the voice input.

Speech Synthesis:

The module receives text or data input that needs to be converted into speech. Speech synthesis algorithms generate audio signals that mimic human speech based on the input text. The synthesized speech is then output through the module's speaker or audio output.

4.11.2 Features And Specifications

It provides high quality recording and playback with 11 minutes audio at 8 KHZ Sampling rate with 16 bit resolution. The APR33A series C2.x is specially designed for simple key trigger, user can record and playback the message averagely for 1, 2, 4 or 8 voice message(s) by switch, it is suitable in simple interface or need to limit the length of single message.

1. Operating Voltage Range: 3V ~ 6.5V
2. Single Chip, High Quality Audio/Voice Recording & Playback Solution
3. User Friendly, Easy to Use Operation
4. 340-680 sec duration. Voice Recording Length in APR33A3
5. Powerful 16-Bits Digital Audio Processor

6. Nonvolatile Flash Memory Technology
7. External Reset pin

4.12 Speaker

A loudspeaker is an electroacoustic transducer, a device which converts an electrical audio signal into a corresponding sound. The most widely used type of speaker is the dynamic speaker. The sound source (e.g., a sound recording or a microphone) must be amplified or strengthened with an audio power amplifier before the signal is sent to the speaker.

Speakers are typically housed in a speaker enclosure or speaker cabinet which is often a rectangular square box made of several forms of wood, or sometimes plastic. The enclosure's materials and design play an important role in the quality of the sound.
The enclosure generally must be as stiff and non-resonant as practically possible. transducers are often mounted in the same enclosure, each reproducing a part of the audible frequency range (picture at right). In this case, the individual speakers are referred to as drivers and the entire unit is called a loudspeaker. Drivers made for reproducing high audio frequencies are called tweeters, those for middle frequencies are called mid-range drivers and those for low frequencies are called woofers. Smaller loudspeakers are found in devices such as radios, televisions, portable. Speaker is shown below in Fig. 4.12.

Fig. 4.12 : Speaker

Audio players, computers, and electronic musical instruments. Larger loudspeaker systems are used for music, sound reinforcement in theatres and concert halls, and in public address systems.

4.13 Buzzer

A buzzer is an electrical component that produces sound or tone when an electric current is passed through it. It is shown in below Fig. 4.13. Buzzers are used in various electronic devices and systems to provide audible alerts, notifications, or warning signals.

Fig. 4.13 : Buzzer

Its constitution is simple, it only has one electromagnet or piezoelectric disc (depending on the type of buzzer) and a metal sheet of steel. This is enough to emit the sound when current is supplied to the piezoelectric or electromagnet and this makes the metal foil vibrate.

4.13.1 Working

When an alternating current(AC) or Direct Current(DC) is applied to the piezoelectric crystal, it deforms or vibrates at a specific frequency. The vibrating crystal generates sound waves, producing an audible tone.

4.13.2 Applications

1. Used in security alarms, smoke detectors, and emergency notification devices.
2. Integrated into timers, appliances, and electronic gadgets to indicate operation or signal events.
3. Provides audible feedback in automotive systems, industrial equipment, and consumer electronics.
4. Included in games, toys, and novelty items to create sound effects.
5. Used in intercoms, doorbells, and communication systems for audible signaling.

4.14 Transformer

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Electromagnetic induction produces an electromotive force across a conductor which is exposed to time varying magnetic fields.

Commonly, transformers are used to increase or decrease the voltages of alternating current in electric power applications. A varying current in the transformer's primary winding creates a varying magnetic flux in the transformer core

and a varying magnetic field impinging on the transformer's secondary winding. This varying magnetic field at the secondary winding induces a varying electromotive force (EMF) or voltage in the secondary winding due to electromagnetic induction. A Transformer takes in electricity at a higher voltage and lets it run through lots of coils wound around an iron core. “. A single-phase Transformer can operate to either increase or decrease the voltage applied to the primary winding. Because the current is alternating, the magnetism in the core is also alternating. Also around the core is an output wire with fewer coils.

Fig. 4.14 : Step down Transformer

4.14.1 Working

A step-down transformer is a type of transformer that reduces the input voltage to a lower output voltage while maintaining the same frequency. In this case, it converts 230V AC to 12V AC. The step-down transformer consists of two sets of wire windings - primary winding and secondary winding - wound around a laminated iron core. 3. When 230V AC is applied to the primary winding, it creates a magnetic field in the iron core, inducing a voltage in the secondary winding based on the turns ratio. For a step-down transformer, the secondary voltage (12V AC) is lower than the primary voltage. The secondary winding of the transformer produces a reduced output voltage of 12V AC, which can be used to power devices requiring this voltage level.

4.14.2 Applications

1. Used in lighting systems requiring 12V AC power, such as outdoor landscape lighting or decorative lighting.

2. Powering devices and appliances that operate on 12V AC, including certain types of motors, pumps, and control systems.
3. Providing low-voltage AC power for specific equipment or circuits within larger electrical systems.
4. Some audio systems and amplifiers use 12V AC power for specific components.

4.15 9V Battery

A 9V battery is a type of compact, rectangular battery commonly used to power small electronic devices and circuits. It provides a convenient source of direct current (DC) voltage at a nominal voltage of approximately 9 volts. 9V Battery as shown in below Fig. 4.15

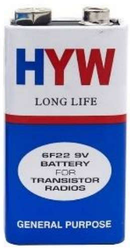

Fig. 4.15 : 9V Battery

4.15.1 Specifications

1. Battery type: Zinc Carbon battery
2. Dimension: 26.5mm x 48.5mm x 17.5mm
3. Nominal voltage: 9V
4. Cut-off voltage: 5.4V
5. Discharge Resistance(Ω): 620
6. Capacity : 600 MAH

4.15.2 Applications

1. Powering small devices such as smoke detectors, remote controls, handheld radios, and digital cameras.
2. Used to power guitar pedals and musical effects units due to their compact size and moderate current capacity.
3. Utilized in multimeters, voltage testers, and other electronic testing devices.

4. Ideal for hobbyists and electronics enthusiasts building small circuits and prototypes.

4.16 Voltage Regulators

A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Voltage regulator is shown in below Fig. 4.16.

Fig. 4.16 : Voltage Regulators

Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

The **78xx** (sometimes **L78xx**, **LM78xx**, **MC78xx**...) is a family of self-contained fixed linear voltage regulator integrated circuits. The 78xx family is commonly used in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. For ICs within the family, the *xx* is replaced with two digits, indicating the output voltage (for example, the 7805 has a 5-volt output, while the 7812 produces 12 volts). The 78xx line are positive voltage regulators: they produce a voltage that is positive relative to a common ground. There is a related line of **79xx** devices which are complementary negative voltage regulators. 78xx and 79xx ICs can be used in combination to provide positive and negative supply voltages in the same circuit.

78xx ICs have three terminals and are commonly found in the TO-220 form factor, although they are available in surface-mount, TO-92, and TO-3 packages. These devices support an input voltage anywhere from around 2.5 volts over the intended output voltage up to a maximum of 35 to 40 volts depending on the model, and typically provide 1 or 1.5 amperes of current (though smaller or larger packages may have a lower or higher current rating).

7805 is a **voltage regulator** integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The **voltage regulator IC** maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

4.16.1 Voltage Regulators Pin Description

Below Table 4.10 represents Voltage regulator description.

Pin No	Function	Name
1	Input voltage (5V-18V)	Input
2	Ground (0V)	Ground
3	Regulated output; 5V (4.8V-5.2V)	Output

Table 4.10 : Voltage regulator description

4.17 PCB Circuit Boards

A Printed Circuit Board (PCB) is a fundamental component in modern electronics, providing a mechanically supportive and electrically conductive platform for mounting and interconnecting electronic components. PCBs are essential for the construction of electronic circuits and are used in a wide range of devices, from simple household appliances to sophisticated industrial equipment and consumer electronics.

PCB Boards are shown in below Fig. 4.17.

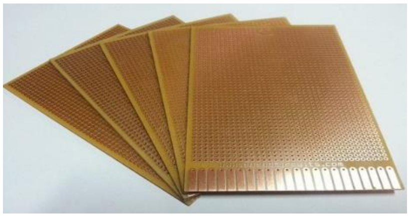

Fig. 4.17 : PCB Boards

4.18 Other Components Used

4.18.1 Switches

A switch is a fundamental electrical component used to control the flow of electricity in a circuit by opening or closing the circuit path. Switches can be manually operated (mechanical) or automatically controlled (electronic) and are essential for turning devices on or off, selecting different functions, or redirecting electrical currents.

Fig. 4.18 : Tactile micro switches

A push button is a momentary or non-latching switch which causes a temporary change in the state of an electrical circuit only while the switch is physically actuated. An automatic mechanism (i.e. a spring) returns the switch to its default position. Tactile switches are shown in above Fig. 4.18.

immediately afterwards, restoring the initial circuit condition. There are two types:

1. A push to make switch allows electricity to flow between its two contacts when held in. When the button is released, the circuit is broken. This type of switch is also known as a Normally Open (NO) Switch. (Examples: doorbell, computer case power switch, calculator buttons, individual keys on a keyboard)
2. A push to break switch does the opposite, i.e. when the button is not pressed, electricity can flow, but when it is pressed the circuit is broken. This type of switch is also known as a Normally Closed (NC) Switch. (Examples: Fridge Light Switch, Alarm Switches in Fail-Safe circuits)

Many Push switches are designed to function as both push to make and push to break switches. For these switches, the wiring of the switch determines whether the switch functions as a push to make or as a push to break switch.

4.18.2 Encoder

The most popular serial encoder/decoder used is the HT12D-HT12E pair. Their description is given below. It's okay if you don't understand what is written there. Just make sure you go through the pin configurations and the circuit implementation. Encoder is shown in below Fig. 4.18

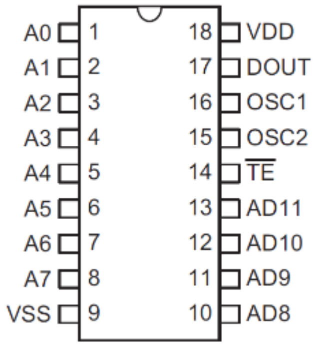

Fig. 4.18 : Encoder

They are capable of Encoding 12 bit of information which consists of N address bits and 12-N data bits. Each address/data input is externally trinary programmable if bonded out.

Features – Encoder

1. 18 PIN DIP
2. Operating Voltage: 2.4V ~ 12V
3. Low Power and High Noise Immunity
4. CMOS Technology
5. Low Standby Current and Minimum Transmission Word
6. Built-in Oscillator needs only 5% Resistor
7. Easy Interface with and RF or an Infrared transmission medium
8. Minimal External Components

4.18.3 Decoder

ICs are series of CMOS LSIs for remote control system applications. This ICs are paired with each other. For proper operation a pair of encoder/decoder with the same number of address and data format should be selected. The Decoder receive the serial address and data from its corresponding encoder, transmitted by a carrier using an RF transmission medium and gives output to the output pins after processing the data.It is shown in below Fig. 4.19

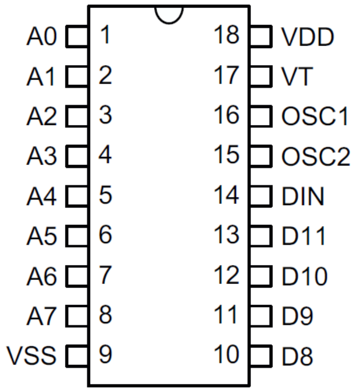

Fig. 4.19 : Decoder

Features – Decoder

1. 18 PIN DIP
2. Operating Voltage: 2.4V ~ 12.0V
3. Low Power and High Noise Immunity
4. CMOS Technology
5. Low Stand by Current
6. Ternary address setting
7. Capable of Decoding 12 bits of Information
8. 8 ~ 12 Address Pins and 0 ~ 4 Data Pins
9. Received Data are checked 2 times, Built in Oscillator needs only 5% resistor
10. VT goes high during a valid transmission

CHAPTER 5
SOFTWARE REQUIREMENTS

5.1 Arduino IDE Compiler

The Arduino IDE (Integrated Development Environment) compiler is a software tool that converts your Arduino sketch (code) written in the Arduino programming language (based on C/C++) into machine code that can be executed by an Arduino microcontroller.

The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

5.2 Software Implementation

After downloading, installing, and testing the Arduino software available at Arduino.cc (click on the Download link near the top of the page. This program is known as the Arduino IDE - short for Integrated Development Environment. Before you jump to the page for your operating system, make sure you've got all the right equipment. The programming environment outlined in this document is provided by Arduino.cc free of charge and is the recommended programming environment for your DuinoKit.

Requirements:

1. A computer (Windows, Mac, or Linux)

2. An Arduino-compatible microcontroller (DuinoKits use Arduino NANO w/ ATmega328 chip)
3. A USB cable is required to connect the NANO microprocessor to your computer for programming

5.2.1 Download the Arduino Software (IDE)

Get the latest version from the download page. You can choose between the Installer (.exe) and the Zip packages. We suggest you use the first one that installs directly everything you need to use the Arduino Software (IDE), including the drivers. With the Zip package you need to install the drivers manually. The Zip file is also useful if you want to create a portable installation. Installation items shown in below Fig. 5.1.

When the download finishes, proceed with the installation and please allow the driver installation process when you get a warning from the operating system.

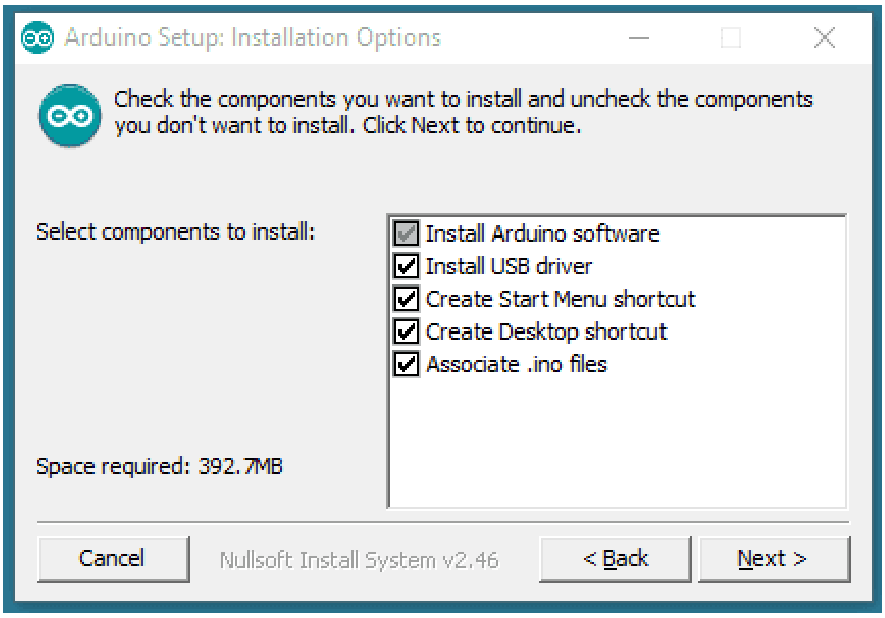

Fig. 5.1 : Install items

Choose the components to install. Select the folder as shown in below Fig. 5.2.

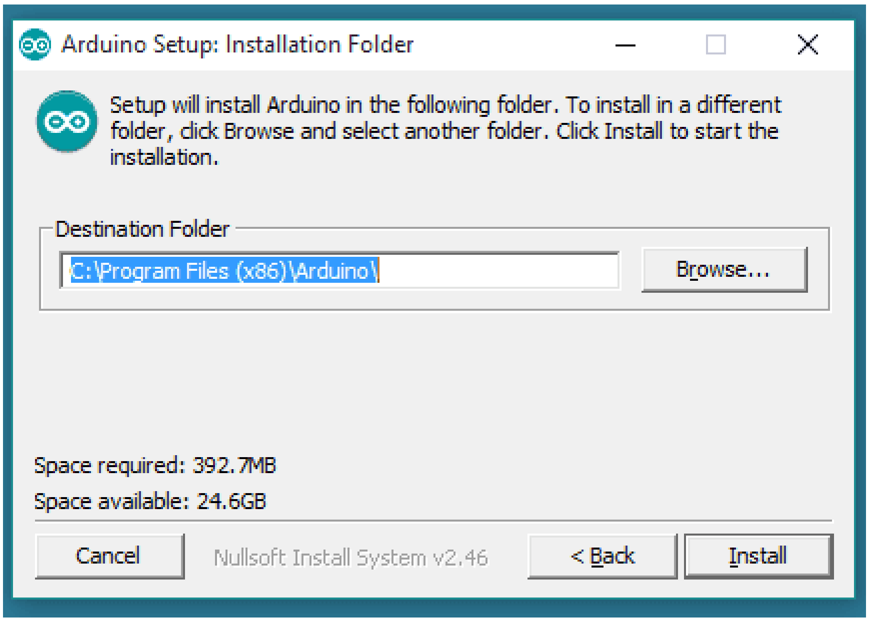

Fig. 5.2 : Folder selection

Choose the installation directory.

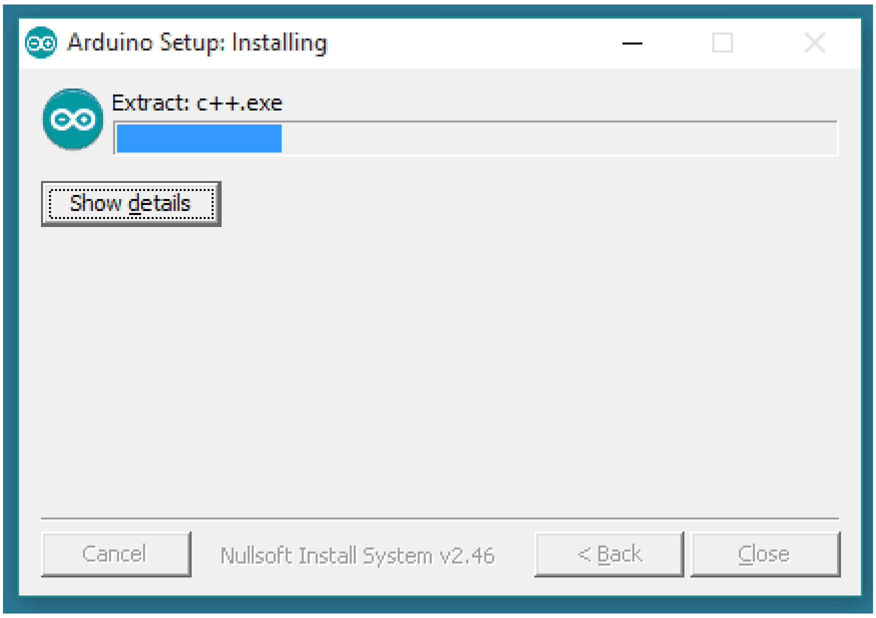

Fig. 5.3 : Installing

Installation in progress as shown in above Fig. 5.3.

The process will extract and install all the required files to execute properly the Arduino Software (IDE)

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5.2.2 Configuring The Arduino IDE

The next thing to do is to make sure the software is set up for your particular Arduino board. Go to the "Tools" drop-down menu, and find "Board". Another menu will appear, where you can select from a list of Arduino models as shown in below Fig. 5.4. we have the Arduino Uno R3, so we chose "Arduino Uno".

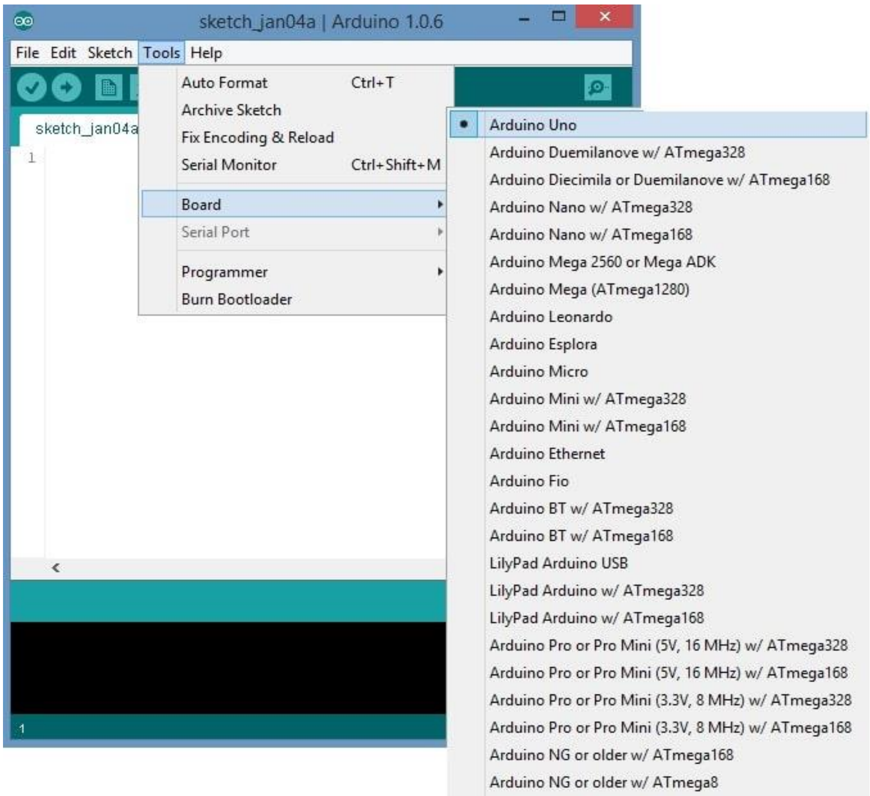

Fig. 5.4 : Configure the IDE

5.2.3 Exploring The Arduino IDE

If you want, take a minute to browse through the different menus in the IDE. There is a good variety of example programs that come with the IDE in the "Examples" menu. These will help you get started with your Arduino right away without having to do lots of research. It is shown in below Fig. 5.5.

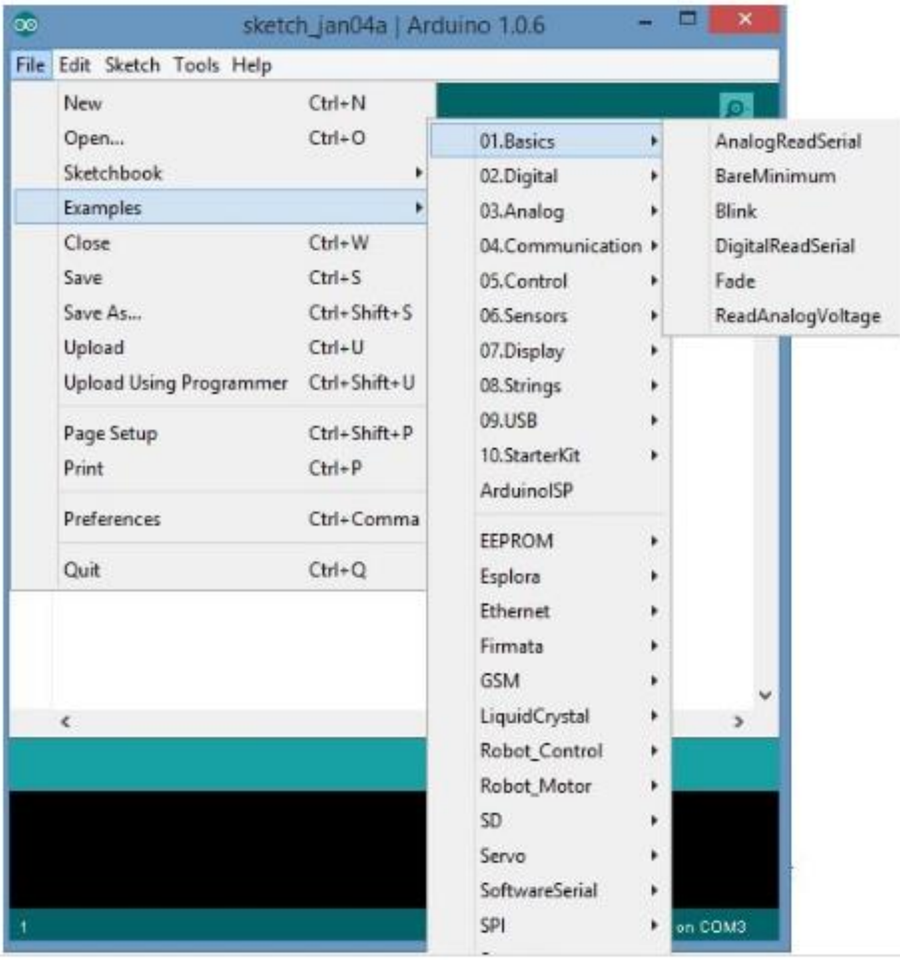

Fig. 5.5 : Exploring IDE

5.3 Embedded C

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems.

Embedded C programming typically requires nonstandard extensions to the C language in order to support enhanced microprocessor features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations. The C Standards Committee produced a Technical Report, most recently revised in 2008 and reviewed in 2013, providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as fixed-point arithmetic, named address spaces and basic I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main () function, variable definition, datatype declaration, conditional statements (if, switch case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc.

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 device working is based on microcontroller that are programmed by embedded C.

The Embedded C code written in above block diagram is used for blinking the LED connected with Port0 of microcontroller.

5.3.1 Basic Declaration

Function is a collection of statements that is used for performing a specific task and a collection of one or more functions is called a programming language. Every language is consisting of basic elements and grammatical rules. Basic structure shown in below Fig. 5.6. The C language programming is designed for function with variables, character set, data types, keywords, expression and so on are used for writing a C program.

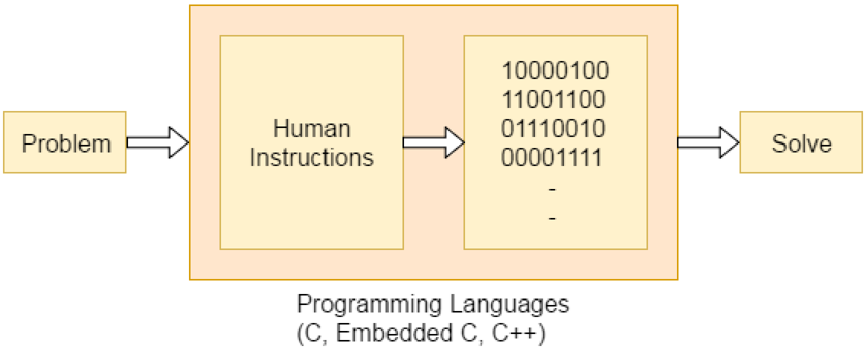

Fig. 5.6 : Basic c programming structure

The extension in C language is known as embedded C programming language. As compared to above the embedded programming in C is also have some additional features like data types, keywords and header file etc.

5.3.2 Basic Embedded C Programming Steps

Let's see the block diagram representation of Embedded C Programming Steps in below Fig. 5.7.

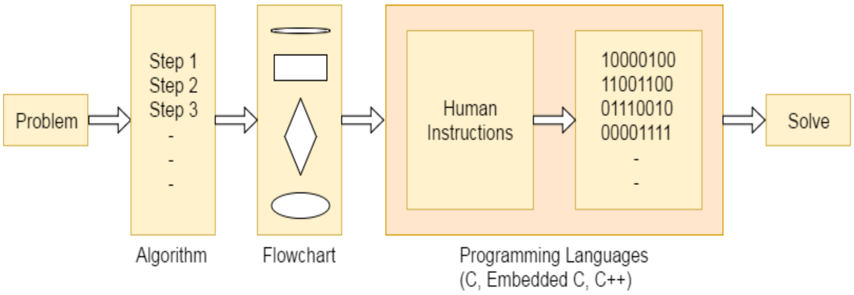

Fig. 5.7 Programming steps

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 develop.

5.4 Arduino IDE code Compilation processes

Arduino IDE contains two functions to code as shown in below Fig. 5.8.

1. Void setup()
2. Void loop()

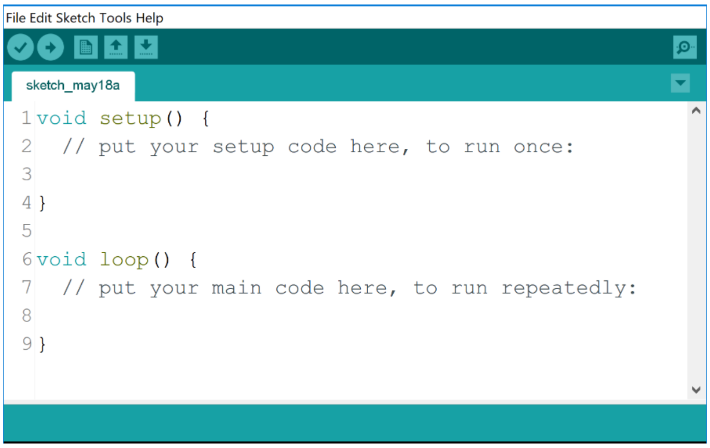

Fig. 5.8 : Arduino IDE Programming structure

1. You write your Arduino code, known as a sketch, using the Arduino IDE.
2. The sketch is written in the Arduino programming language, which is based on C/C++ and includes Arduino-specific libraries and functions.

3. When you click the "Verify" (checkmark) button or "Upload" (right arrow) button in the Arduino IDE, the IDE initiates the compilation process.
4. Compilation involves translating your human-readable Arduino sketch into machine-readable instructions (binary code) that the Arduino microcontroller can understand and execute.
5. The Arduino IDE compiler first runs a preprocessor on your sketch.
6. The preprocessor handles tasks such as including Arduino libraries, replacing macros (like #define statements), and managing conditional compilation (e.g., #ifdef, #ifndef).
7. The Arduino sketch is then translated into standard C/C++ code.
8. This process involves expanding Arduino-specific functions (like digitalWrite(), analogRead()), replacing them with underlying C/C++ code that interacts directly with the microcontroller's hardware registers.
9. The compiler optimizes the generated C/C++ code to improve efficiency and reduce the size of the resulting binary executable.
10. Common optimization techniques include removing unused code (dead code elimination), inlining functions, and optimizing variable usage.
11. The compiler produces a binary HEX file (.hex) containing the machine code instructions and data for the Arduino microcontroller.
12. This HEX file represents the compiled and optimized version of your Arduino sketch.
13. If you click the "Upload" button in the Arduino IDE, the IDE uses a tool called avrdude (or bossac for newer Arduino boards like the Arduino Due) to upload the compiled HEX file to the Arduino board.
14. It communicates with the Arduino bootloader (pre-installed on most Arduino boards) to write the compiled code onto the microcontroller's flash memory.

The Arduino IDE compiler simplifies the process of developing and uploading code to Arduino boards, making it accessible for hobbyists, students, and professionals to create interactive projects and prototypes using Arduino microcontrollers.

CHAPTER 6

PROCEDURE OF PROJECT

6.1 Discussing Project Concept and Working:

Define the project's objectives, functionalities, and desired outcomes. Identify the components and technologies needed to implement the project. Discuss project feasibility, scope, and requirements of the project. Home Automation and Health Monitoring For Paralyzed People Along With Voice Assistance is the project title.

6.2 Inventory Spares Buying:

Create a list of required components, tools, and materials based on the project concept. Purchase electronic components of this project those are Arduino uno. Arduino nano, MEMS Accelerometer, Flex sensor, Temperature sensor, Pulse Heart rate sensor, RF transmitter, RF receiver, Relay Module, DC fan, DC light, LCD display, Buzzer, Voice module, Speaker and other hardware. Ensure availability of all necessary items for the project implementation.

6.3. Installing Arduino IDE Software and Learning Basic Embedded Coding:

Download and install the Arduino IDE (Integrated Development Environment) software on your computer. Learn the basics of embedded programming using Arduino, including syntax, data types, variables, functions, and control structures. Practice writing and uploading simple programs to Arduino boards for LED blinking, sensor interfacing, etc.

6.4 PCB and Circuit Board Design

Use PCB design software to create schematics and layout for the circuit boards. Design PCBs considering component placement, signal routing, power distribution, and board dimensions. Ensure compatibility of PCB design with selected components and project requirements. Choose appropriate components based on the schematic design, considering factors such as electrical characteristics, package size, and availability. Place components on the PCB layout, optimizing placement for signal integrity, thermal management, and manufacturability. Transfer the schematic design to the PCB layout phase within the EDA software. Define the board outline and place components on the PCB layout, arranging them for efficient routing and space utilization. Route signal traces between components while adhering to design rules (trace width, clearance, via types) to ensure electrical performance and reliability. Perform signal integrity analysis to check for issues such as impedance mismatches, reflections, and crosstalk.

Use tools within the EDA software to optimize trace routing and minimize signal integrity problems. Run a Design Rule Check (DRC) to verify that the PCB layout meets specified design rules and constraints. Identify and resolve any design rule violations such as clearance violations or unconnected nets. Generate Gerber files, which contain the necessary information for PCB fabrication, including copper layers, solder mask, silkscreen, and drill files. Include fabrication notes and additional documentation required for PCB manufacturing. Send the Gerber files to a PCB manufacturer for fabrication.

PCB fabrication involves processes like layer etching, drilling, solder mask application, and copper plating to create the final PCB. Procure electronic components and assemble them onto the fabricated PCB. Use automated pick-and-place machines or manual soldering techniques to place and solder components onto the PCB. Conduct functional testing and validation of the assembled PCB to ensure proper functionality and performance. Verify circuit operation against design specifications and test for any potential issues or defects.

6.5 Coding Working Based on Project Working Logic:

Develop the main code (sketch) for the project based on the defined project concept and logic. Implement algorithms, control logic, and data processing routines in the Arduino sketch. Integrate sensor readings, user inputs, and output control functions as per the project requirements.

6.6 Circuit Board Wiring:

Wire the components on the PCB according to the schematic and layout design. Connect components using appropriate wiring techniques (point-to-point wiring, PCB traces, jumper wires). Ensure proper electrical connections, avoiding short circuits and loose connections.

6.7 Circuit Board Fixing:

Mount components securely on the PCB using soldering techniques or other assembly methods. Inspect the circuit board for any soldering defects, bridged connections, or component misalignment. Verify the correctness of component orientation and placement.

6.8 Upload Code:

Connect the Arduino board to your computer using a USB cable. Open the Arduino IDE, load the project code (sketch), and compile it to check for any errors. Upload the compiled code to the Arduino board using the IDE's upload feature.

6.9 Final Assembly:

Assemble the complete project by integrating the PCB, LCD display, power supply, and other components into the project enclosure or housing. Ensure proper fitting and alignment of all components within the enclosure.

6.10 Final Testing:

Power on the project and perform functional testing to verify its operation. Check all features and functionalities against the project requirements. Debug and troubleshoot any issues encountered during testing. Make necessary adjustments or modifications to improve performance or usability.

CHAPTER 7
WORKING OF THE PROJECT

This project is based on wireless communication through RF technology and consists of two parts: a glove and a hardware kit. The glove is provided to the user to operate all the functions of the kit. The user wears the glove on one hand and must remain conscious while using this project. The user is equipped with the glove, and the kit is positioned beside the user for operation. Project consists of three Operations those are Hand movements to speech, Home Automation and Health Monitoring. The Individual working process of these three functions are as follows.

7.1 Hand Movements to Speech

For voice assistance, the user needs to remember the voice commands associated with specific hand movements. There are six total movements: up, down, right, left, index finger, and middle finger. Each movement corresponds to a specific command that is communicated through the speaker when the user performs the corresponding hand gesture.

Fingers Directions

Hand glove index finger **: I want medicine**

Hand glove middle finger **: I am feeling Headache**

Palm Directions:

Right direction : **I want food**

Left direction **: I want water**

Down direction **: I need to go washroom**

Up direction **: I want to go outside**

7.2Home Automation

For home automation using the Arduino Nano, the user operates mini switches to control devices. Two switches are used: one for the fan and the other for the light. The user can toggle these switches to turn the fan or light on and off based on their preferences or needs. This setup allows for simple and direct control of household appliances using the Arduino Nano microcontroller.

Hand glove switch **: Fan on and off**

Hand glove switch **: Bulb on and off**

7.3Health Monitoring

The user is provided with two sensors: a temperature sensor and a pulse sensor. The temperature sensor detects the patient's temperature and triggers a buzzer sound when it exceeds a preset threshold value. Meanwhile, the pulse sensor displays the patient's heart rate on an LCD display, providing real-time monitoring of vital signs. This setup enables continuous monitoring of temperature and heart rate, with alerts for temperature spikes and visual display of heart rate readings for immediate assessment.

Temperature sensor**: Gives buzz sound when it cross threshold value**

Heart beat sensor **: Value displays on LCD display**

CHAPTER 8
PROJECT RESULTS

This project is the combination of Glove and Hardware kit. The user operates glove and perform corresponding operations on the hardware kit. Overview of the Glove as shown in below Fig.8.1. overview of the hardware kit as shown in below Fig.8.2.

Fig. 8.1 Glove

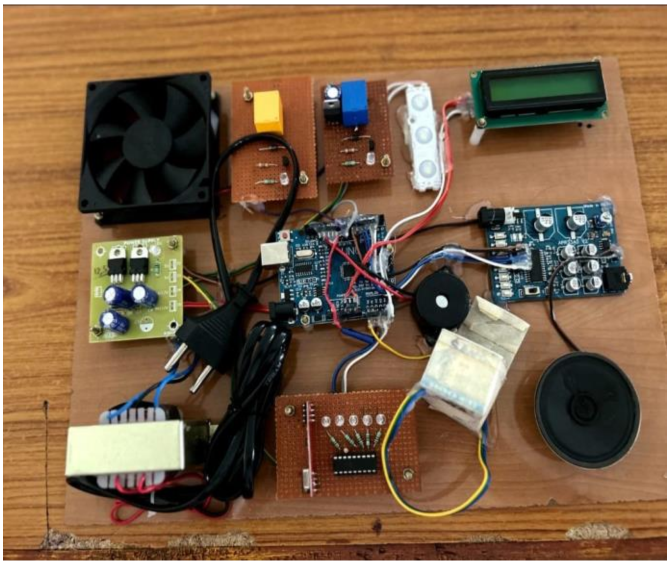

Fig. 8.2 Hardware Kit

Results

Fingers Movements:

Hand glove index finger : **I want medicine**

Hand glove middle finger : **I am feeling Headache**

Glove Directions:

Right direction : **I want food**

Left direction : **I want water**

Down direction : **I need to go washroom**

Up direction : **I want to go outside**

Automation Switches:

Hand glove switch : **Fan on and off**

Hand glove switch : **Bulb on and off**

Health Monitoring Sensors:

Temperature sensor: **Gives buzz sound when it cross threshold value**

Heart beat sensor : **Value displays on LCD display**

For the voice assistance system, the user needs to perform specific hand movements. To request medicine, the user should bend the index finger, which will trigger the command "I want medicine" to display on the LCD and produce a voice output. This is illustrated in Fig.8.3, showing the index finger input and corresponding output. Similarly, to indicate a headache, the user needs to bend the middle finger, causing the command "I am feeling headache" to be displayed on the LCD and voiced. This is illustrated in Fig.8.4, showing the middle finger input and corresponding output.

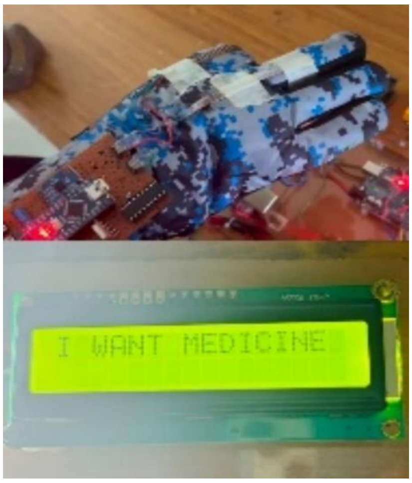

Fig. 8.3 Index finger output

Fig. 8.4 Middle finger output

Fig. 8.5 Left direction output

Fig. 8.6 Right direction output

For the voice output “I want to go washroom” user need to move the hand in down direction as shown in below Fig. 8.7. For the voice output “I want to go outside” user need to move hand in down direction as shown in below Fig. 8.8. Home Automation can be done with the help of switches in glove. Fan on and Fan off as shown in below Fig. 8.9 and Fig. 8.10.

Fig. 8.7 Down direction output

Fig. 8.8 Up direction output

Fig. 8.9 Fan on

Fig. 8.10 Fan off

In Automation Light on and off can be done with the help of switches on Arduino nano. Light on and off as shown in below Fig. 8.11 and Fig. 8.12. For Health Monitoring the user Heart beat readings displays on the LCD Screen as shown in below Fig. 8.13. Temperature readings observed by the temperature sensor as shown in below Fig. 8.14.

Fig. 8.11 Light on

Fig. 8.12 Light off

Fig. 8.13 Heart beat sensor output

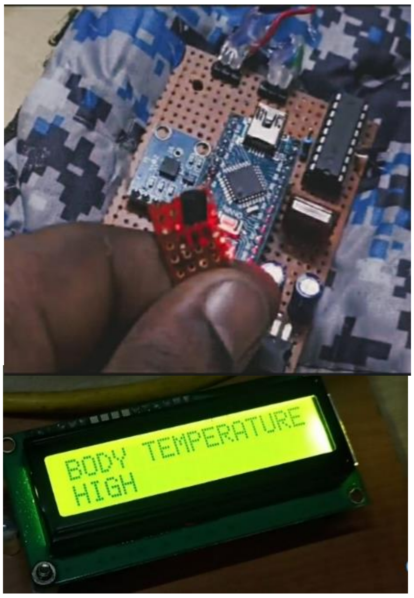

Fig. 8.14 Temperature sensor output

CHAPTER 9

CONCLUSION AND FUTURE SCOPE

Conclusion

In this project work a low cost and user friendly design for Paralyzed and Old age People based home automation system is presented. It provides a general approach for home automation which is not only suitable for elderly and handicapped people but it is also beneficial to reduce human labor and save energy with the help of sensors. Proposed system is analyzed and tested within the range of 5-10 meters and it achieved 100% accuracy. The system has many advantages and can be modified as user expectations. In this paper we have got brought the format and implementation of a low cost, flexible and wireless technique to the residence automation. Using Accelerometer based Gesture user can also generate 4 Voice commands for assistance purpose. Heartbeat and Temperature sensor is used to measure the vitals of the Old people.

Future Scope

Further this system can be interfaced with Gesture based Wheel Chair control system for Paralyzed people. Using L298Motor driver and DC Geared DC Motor this system can be designed. In future there will be lots of chances for this type of devices. It will be very much helpful for the people who are facing difficulties like Paralysis, deaf, dumb. In future lot of advanced technology will arises on basis of this concept.

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SOURCE CODE

```
int temp=0, swf=0, swl=0, f1=0, f2=0, x=0, y=0;

void setup()

{

pinMode(12,OUTPUT); // D0

pinMode(11,OUTPUT); // D1

pinMode(10,OUTPUT); // D2

pinMode(9,OUTPUT);  // D3

digitalWrite(12,HIGH); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,HIGH); // D2

digitalWrite(9,HIGH);  // D3

pinMode(6,INPUT);

pinMode(5,INPUT);

Serial.begin(9600);

}

void loop()

{

x=analogRead(A5);

y=analogRead(A4);

swf=digitalRead(5);

swl=digitalRead(6);

temp=analogRead(A3);
```

```
temp=temp/2;

f1=analogRead(A0);

f2=analogRead(A1);

//Serial.println(y);

Serial.println(f1);

//Serial.println(f2);

if(temp>40)

{

digitalWrite(12,HIGH); // D0

digitalWrite(11,LOW); // D1

digitalWrite(10,LOW); // D2

digitalWrite(9,HIGH);  // D3

delay(200);

digitalWrite(12,HIGH); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,HIGH); // D2

digitalWrite(9,HIGH);  // D3

}

else if(swf==HIGH) // FAN

{

digitalWrite(12,LOW); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,HIGH); // D2
```

```
 digitalWrite(9,HIGH);  // D3
 delay(200);
 digitalWrite(12,HIGH); // D0
 digitalWrite(11,HIGH); // D1
 digitalWrite(10,HIGH); // D2
 digitalWrite(9,HIGH);  // D3
 }
else if(swl==HIGH) // LIGHT
 {
 digitalWrite(12,HIGH); // D0
 digitalWrite(11,LOW); // D1
 digitalWrite(10,LOW); // D2
 digitalWrite(9,LOW);  // D3
 delay(200);
 digitalWrite(12,HIGH); // D0
 digitalWrite(11,HIGH); // D1
 digitalWrite(10,HIGH); // D2
 digitalWrite(9,HIGH);  // D3
 }
 else if(x<320) // VOICE 6
 {
 digitalWrite(12,LOW); // D0
 digitalWrite(11,HIGH); // D1
```

```
digitalWrite(10,HIGH); // D2

digitalWrite(9,LOW);  // D3

delay(200);

digitalWrite(12,HIGH); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,HIGH); // D2

digitalWrite(9,HIGH);  // D3

}

else if(x>390) // VOICE5

{

digitalWrite(12,LOW); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,LOW); // D2

digitalWrite(9,HIGH);  // D3

delay(200);

digitalWrite(12,HIGH); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,HIGH); // D2

digitalWrite(9,HIGH);  // D3

}

else if(y<300) // VOICE 3

{

digitalWrite(12,LOW); // D0
```

```
digitalWrite(11,LOW); // D1

digitalWrite(10,HIGH); // D2

digitalWrite(9,HIGH);  // D3

delay(200);

digitalWrite(12,HIGH); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,HIGH); // D2

digitalWrite(9,HIGH);  // D3

}

else if(y>380) // VOICE4

{

digitalWrite(12,LOW); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,LOW); // D2

digitalWrite(9,LOW);  // D3

delay(200);

digitalWrite(12,HIGH); // D0

digitalWrite(11,HIGH); // D1

digitalWrite(10,HIGH); // D2

digitalWrite(9,HIGH);  // D3

}

else if(f2<440) // VOICE2 - FLEX

{
```

```
    digitalWrite(12,LOW); // D0
    digitalWrite(11,LOW); // D1
    digitalWrite(10,LOW); // D2
    digitalWrite(9,HIGH);  // D3
    delay(200);
    digitalWrite(12,HIGH); // D0
    digitalWrite(11,HIGH); // D1
    digitalWrite(10,HIGH); // D2
    digitalWrite(9,HIGH);  // D3
    }
    else if(f1<440) // VOICE1 - FLEX
    {
    digitalWrite(12,LOW); // D0
    digitalWrite(11,LOW); // D1
    digitalWrite(10,HIGH); // D2
    digitalWrite(9,LOW);  // D3
    delay(200);
    digitalWrite(12,HIGH); // D0
    digitalWrite(11,HIGH); // D1
    digitalWrite(10,HIGH); // D2
    digitalWrite(9,HIGH);  // D3
    }
  }
```

```
#include <Wire.h>  // Comes with Arduino IDE

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);

int d0=0, d1=0, d2=0, d3=0;

int swf=0, swl=0;

//  Variables

int PulseSensorPurplePin = 0;  // Pulse Sensor PURPLE WIRE connected to
    ANALOG PIN 0

int Signal;         // holds the incoming raw data. Signal value can range from 0-
    1024

int Threshold = 580;

void setup()                    // ONE TIME INITIALIZATION / SETTINGS

{

  lcd.begin(16, 2); // START LCD - 16X2

  lcd.clear();                  // CLEAR LCD

  lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE

  lcd.print("HOME  AUTOMATION");  // PRINT ON LCD

  lcd.setCursor(0, 1);          // LCD POSITION - 2ND LINE

  lcd.print("HEALTH MONITORNG");  // PRINT ON LCD

  delay(1000);                  // DELAY 1000 ms = 1 SEC

  lcd.clear();                  // CLEAR LCD

  lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE
```

```
lcd.print("   WITH VOICE   ");  // PRINT ON LCD
lcd.setCursor(0, 1);           // LCD POSITION - 2ND LINE
lcd.print("   ASSISTANCE   ");
delay(1000);
pinMode(10,INPUT); // RF
pinMode(A1,INPUT);
pinMode(A2,INPUT);
pinMode(A3,INPUT);
pinMode(2,OUTPUT); // VOICE
pinMode(3,OUTPUT);
pinMode(4,OUTPUT);
pinMode(5,OUTPUT);
pinMode(6,OUTPUT);
pinMode(7,OUTPUT);
digitalWrite(2,HIGH);
digitalWrite(3,HIGH);
digitalWrite(4,HIGH);
digitalWrite(5,HIGH);
digitalWrite(6,HIGH);
digitalWrite(7,HIGH);
pinMode(8,OUTPUT); // LIGHT RELAY
pinMode(9,OUTPUT); // FAN RELAY
```

```
  digitalWrite(8,LOW);
  digitalWrite(9,LOW);
 pinMode(13,OUTPUT); // BUZZER
  digitalWrite(13,LOW);
  lcd.clear();                  // CLEAR LCD
  lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE
  lcd.print("HB: ");  // PRINT ON LCD
  delay(1000);
}
void loop()
{
d0=digitalRead(10);
d1=digitalRead(A1);
d2=digitalRead(A2);
d3=digitalRead(A3);
Signal = analogRead(PulseSensorPurplePin);
if(Signal > Threshold)
{                  // If the signal is above "550", then "turn-on" Arduino's on-Board
   LED.
  lcd.clear();                  // CLEAR LCD
  lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE
  lcd.print("HEART BEAT: ");  // PRINT ON LCD
  lcd.print(signal);
```

```
  delay(1000);
}
else
{
  lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE
  lcd.print("HEART BEAT:    ");
  lcd.setCursor(0, 1);          // LCD POSITION - 1ST LINE
  lcd.print("                ");
}
if((d0==LOW)&(d1==LOW)&(d2==LOW)&(d3==HIGH)) // 0001 // VOICE 1
    HEADACHE
{
  lcd.clear();                  // CLEAR LCD
  lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE
  lcd.print("I AM FEELING");
  lcd.setCursor(0, 1);          // LCD POSITION - 1ST LINE
  lcd.print("HEADACHE");
  digitalWrite(2,LOW);
  delay(1000);
 digitalWrite(2,HIGH);
delay(1000);
}
if((d0==LOW)&(d1==LOW)&(d2==HIGH)&(d3==LOW)) // 0010 - VOICE 2
```

```
      MEDICINE
 {
  lcd.clear();                  // CLEAR LCD
  lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE
  lcd.print("I WANT MEDICINE");
  digitalWrite(3,LOW);
 delay(1000);
 digitalWrite(3,HIGH);
 delay(1000);
 }
 if((d0==LOW)&(d1==LOW)&(d2==HIGH)&(d3==HIGH)) // 0011 - VOICE 3
      OUTSIDE
 {
  lcd.clear();                  // CLEAR LCD
  lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE
  lcd.print("I WANT TO GO");
  lcd.setCursor(0, 1);          // LCD POSITION - 1ST LINE
  lcd.print("OUTSIDE");
  digitalWrite(4,LOW);
  delay(1000);
 digitalWrite(4,HIGH);
 delay(1000);
 }
```

```
if((d0==LOW)&(d1==HIGH)&(d2==LOW)&(d3==LOW)) // 0100 - VOICE 4
    WASHROOM

{

 lcd.clear();                  // CLEAR LCD

 lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE

 lcd.print("I WANT TO GO");

 lcd.setCursor(0, 1);          // LCD POSITION - 1ST LINE

 lcd.print("WASHROOM");

 digitalWrite(5,LOW);

delay(1000);

digitalWrite(5,HIGH);

delay(1000);

}

if((d0==LOW)&(d1==HIGH)&(d2==LOW)&(d3==HIGH))//0101 - VOICE 5
    WATER

{

 lcd.clear();                  // CLEAR LCD

 lcd.setCursor(0, 0);          // LCD POSITION - 1ST LINE

 lcd.print("I WANT");

 lcd.setCursor(0, 1);          // LCD POSITION - 1ST LINE

 lcd.print("WATER ");

 digitalWrite(6,LOW);

delay(1000);
```

```
 digitalWrite(6,HIGH);

 delay(1000);

  }

if((d0==LOW)&(d1==HIGH)&(d2==HIGH)&(d3==LOW))//0110 - VOICE 6
       FOOD

{

  lcd.clear();                    // CLEAR LCD

  lcd.setCursor(0, 0);            // LCD POSITION - 1ST LINE

  lcd.print("I WANT");

  lcd.setCursor(0, 1);            // LCD POSITION - 1ST LINE

  lcd.print("FOOD");

  digitalWrite(7,LOW);

  delay(1000);

 digitalWrite(7,HIGH);

 delay(1000);

}

if((d0==LOW)&(d1==HIGH)&(d2==HIGH)&(d3==HIGH))//0111 - SW1 ON /
       OFF FAN

{

if(swf==0)

{

 lcd.clear();                    // CLEAR LCD

 lcd.setCursor(0, 0);            // LCD POSITION - 1ST LINE
```

```
 lcd.print("FAN ON");
digitalWrite(9,HIGH);
swf=1;
delay(1000);
}
else
{
swf=0;
digitalWrite(9,LOW);
 lcd.clear();                    // CLEAR LCD
 lcd.setCursor(0, 0);            // LCD POSITION - 1ST LINE
 lcd.print("FAN OFF");
delay(1000);
}
}
if((d0==HIGH)&(d1==LOW)&(d2==LOW)&(d3==LOW))//1000 - SW2 ON /
      OFF LIGHT
{
if(swl==0)
{
digitalWrite(8,HIGH);
swl=1;
 lcd.clear();                    // CLEAR LCD
```

```
 lcd.setCursor(0, 0);           // LCD POSITION - 1ST LINE
 lcd.print("LIGHT ON");
delay(1000);
}
else
{
swl=0;
digitalWrite(8,LOW);
 lcd.clear();                   // CLEAR LCD
 lcd.setCursor(0, 0);           // LCD POSITION - 1ST LINE
 lcd.print("LIGHT OFF");
delay(1000);
}
}
if((d0==HIGH)&(d1==LOW)&(d2==LOW)&(d3==HIGH))//1001 - TEMP ON
{
  lcd.clear();                   // CLEAR LCD
  lcd.setCursor(0, 0);           // LCD POSITION - 1ST LINE
  lcd.print("BODY TEMPERATURE");
  lcd.setCursor(0, 1);           // LCD POSITION - 1ST LINE
  lcd.print("HIGH");
  digitalWrite(13,HIGH);
```

```
 delay(3000);

 digitalWrite(13,LOW);

}

   }
```

A3 SHEET

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RELEVANCE TO PO's & PSO's :

Project Title : **HOME AUTOMATION AND HEALTH MONITORING FOR PARALYZED PEOPLE ALONG WITH VOICE ASSISTANCE**

Guide Name :**DR.I.Ramesh Raja M.E,Ph.D**

Students Name : **J.Chakraveni (20P31A04K1)**
B.Saivinay (20P31A04J1)
T.Naveen (21P35A0438)
P.Shyam (20P31A04M5)

ABSTRACT	PO's Mapping	PSO's Mapping
Physically challenged, and paralyzed people are unable to speak. they have to use only sign language which may be difficult for common peoples. We Proposed an Innovative Solution for paralyzed People, to generate Voice using Hand Gestures along with Home automation using Hand Glove. Here the user can control home appliances like fan and bulb using glove. This System also provides health monitoring to the patients by using sensors like temperature and heartbeat sensors. Here user is provided with a Hand glove that is connected wirelessly to Hardware kit. When user move his hand fingers attached with flex sensors and Accelerometer. Hardware kit receives this signal wirelessly and process this data and Generate Audio Output along with Text message on LCD. This Glove is also interfaced with Switches to control the Light and Fan. The Temperature and heartbeat sensors monitors patient condition and gives buzzer sound when it crosses threshold value.	PO1 PO2 PO3 PO4 PO5 PO6 PO8 PO9 PO10 PO11	PSO1 PSO2

PO1	To implement the knowledge of IOT to control home appliances and health monitoring for paralyzed people
PO2	To analyse the problems faced by the paralyzed people
PO3	To analyse and design the system using Aurdino and Multiple Sensors
PO4	Able to conclude that the proposed methodology provides better result.
PO5	To develop the model that can used to generate voice using Hand gestures along with home appliances using embedded and Arduino Uno.
PO6	Moderately Mapped as we will apply our concept of work to society
PO8	The basic rules have been followed while developing this project.
PO9	Able to work effectively as an individual ,and as a leader/member of team.
PO10	Good communication among members for better output.
PO11	The details of leadership are easily understood by students.
PSO1	Related to role of design & analysis tools to solve the real time problems.
PSO2	Acquire the knowledge to design, test, verify and develop theproject results

PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design &Development of Solution
PO4 Investigations	PO5 Modern tool usage	PO6 The Engineer& Society
PO7 Environment & Sustainability	PO8 Ethics	PO9 Individual &team work
PO10 Communication	PO11 ProjectManagement &Finance	PO12 Life-longLearning

PSO1 To train the students and make them industry ready in the fields of ECE and IOT	PSO2 To provide well equipped laboratory infrastructure where an individual is mentored to develop innovative electronics project

CONCLUSION: In this project work a low cost and user friendly design for Paralyzed and Old age People based home automation system is presented. It provides a general approach for home automation which is not only suitable for elderly and handicapped people but it is also beneficial to reduce human labor and save energy with the help of sensors. Proposed system is analyzed and tested within the range of 5-10 meters and it achieved 100% accuracy. The system has many advantages and can be modified as user expectations. In this paper we have got brought the format and implementation of a low cost, flexible and wireless technique to the residence automation. Using Accelerometer based Gesture user can also generate 4 Voice commands for assistance purpose. Heartbeat and Temperature sensor is used to measure the vitals of the Old people.