SMART ASSISTANT WHEELCHAIR SYSTEM FOR DIASBLED: AN IOT BASED USER FRIENDLY WHEELCHAIR

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in

Electronics and Communication Engineering

By

SHAKTHI K (38130206)

YUVASREE R (38130247)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

APRIL 2022

SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of**SHAKTHI K** (Reg. No. 38130206) and **YUVASREE R** (Reg. No. 38130247) whocarried out the project entitled **"SMART ASSISTANT WHEELCHAIR SYSTEM FOR DISABLED:AN IOT BASED USER FRIENDLY WHEELCHAIR"** under our supervision from December 2021 to April 2022.

Internal Guide
(Dr.S.Barani)

Dr. T. RAVI, M.E., Ph.D.,
Head of the Department

Submitted for Viva voce Examination held on_____

Name:

Signature:

Internal Examiner **External Examine**

DECLARATION

We **SHAKTHI** (38130206) and **YUVASREE R** (38130247) hereby declare that the Project Report entitled **"SMART ASSISTANT WHEELCHAIR SYSTEM FOR DISABLED:AN IOT BASED USER FRIENDLY WHEELCHAIR"** done by us under the guidance of **Dr.S.Barani** at Sathyabama Institute of Science and Technology, Chennai-600119 is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

1.

2.

DATE:

PLACE: **SIGNATURE OF THE CANDIDATES**

ACKNOWLEGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of SATHYABAMA for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. N. M. Nandhita, Dean, School of Electrical and Electronics Engineering** and **Dr. T. RAVI, Head of the Department, Dept. of Electrical and Electronics Engineering** for providing us necessary support and details at the right time during the progressive reviews.

We would also like to express our sincere and deep sense of gratitude to our internal guide **Dr.S.Barani** for her valuable guidance and suggestions during the progressive reviews for our project.

ABSTRACT

Many people are suffering from temporary or permanent disabilities due to illness or accidents. For those people use of a wheelchair is very essential. Manual or electrical wheelchair are satisfying most of the low and middle level disability person where they can use the wheelchair independently. However, in severe cases, it is difficult or impossible to use wheelchair independently. A smart wheelchair is a power wheelchair (PWC) that collects information on driver behavior and interaction with their environment. This is done through the use of sensors and/or cameras positioned to provide feedback on a driver's ability to control the device and navigate their environment safely. This project involved in designing smart wheelchair to solve such problems. We have used Arduino UNO and sensors like DHT11 sensor, Eye blink sensor, HC Bluetooth sensor, Ultrasonic sensor, MEMS sensor to design smart wheelchair. It also provides an opportunity for visually or physically impaired persons with obstacle detection system, which minimize the chance of collision which using it. We tried to provide all the features required in a smart wheelchair at lowest price for the people to afford it without any difficulty and to use utmost independent on others.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVATIONS

PWC	- Power Wheelchair
MEMS	- Micro-electromechanical system
WHO	- World Health Organization
IoT	- Internet of Things
LCD	- Liquid Crystal Display
OCR	- Optical Character Recognition
RF	- Radio Frequency
IC	- Integrated Circuit
EOG	- Electrooculography
BT	- Business technology
HD	- High Definition
GSM	- Global System for Mobile Communications
IR	- Infrared
DC	- Direct Current
IDE	- Integrated Development Environment
SRAM	- Static Random Access Memory
EPROM	- Erasable Programmable Read-Only Memory
USB	- Universal Serial Bus
GND	- Ground
PWM	- Pulse-Width Modulation
TX	- Transmitter
RX	- Receiver
ALU	- Arithmetic Logic UNIT
CISC	- Complex Instruction Set Computer
RISC	- Reduced Instruction Set Computer
VDC	- Volts of Direct Current
SOC	- System-On- A-Chip
LED	- Light Emitting Diode
CPU	- Control Processing Unit

CHAPTER 1

INTRODUCTION

An idea to make the people life easier who are unable to walk alone due to accident, paralysis or old age. Mostly they depend on others for their needs. The one who use wheelchairs, have to depend on others for steering it, makes them to feel it difficult as they have to rely on others. An electrical wheelchair will give an independent feel for those who using the mechanical wheelchair. But, still most of the people don't use smart wheelchair thinking that it is costly.

Many devices in our homes and our life generally from begin called only by their name to inserting the word 'smart' as smartphones, smart TV and of course the traditional wheelchairs have taken a part of this word not only the name but also the software and hardware used to get what it is called today, smart wheelchair.

Smart wheelchair is the term commonly used to define a device that integrates technology and services through networking to enhance power efficiency and improve the quality of living. Smart wheelchair is known as a power wheelchair that is integrated into multiple sensors, assistive technology and computers that give the user with a disability such as impairment, handicaps and permanent injury, the required mobility to move freely and safely. These types of wheelchairs are gradually replacing the traditional wheelchair; however, their expensive costs are preventing a large size of disabled people from having one. According to world health organization (WHO) only 5 to 15% out of 70 million disabled people have access to wheelchairs. Therefore, we need to offer a cost effective smart that not only minimize the cost but also provides plenty of features that use the latest components and technologies. For many people, this appropriately designed wheelchair is the first step towards inclusion and participation in the society.

1.1 TYPES OF WHEELCHAIRS

There are wide variety of types of wheel chair, differing by propulsion method, mechanism of control and technology used. Some wheelchairs are designed for general everyday use, others for single activities, or to address specific access need. Those selecting wheel chairs in consultation with the user, need to understand the physical needs of the intended user.

1.1.1 Power wheelchair

Presently in market smart wheelchairs are available but are not affordable by common men. They are powered using high power battery and super torque motors so proportionally the cost of the product also increases. The motion provided to the chair is by the use of Joystick and Toggle switch and a person who is 90-95% handicapped cannot drive the wheelchair. So, these types of peoples require an attendee or a care taker with them.

1.1.2 Manual wheelchair

Manual or traditional wheelchair are the types of wheelchairs that are mostly used by a layman. A middle-class person cannot afford power wheelchair is so they use the traditional manual wheelchair. These chairs are to be manually powered and this creates a big problem for the disabled to loco mote from one place to another without an attendee. So, the necessity of superseding the power and traditional wheelchair up rises for providing more maneuverable motion to the wheelchair by the low-cost high functionality smart wheelchair up rises.

1.2 Proposed system

Basically, this system has consisted of two parts one for driving a wheelchair and other components for knowing the needs of the disabled person and checking their temperature frequently. The system has been controlled by HC Bluetooth module for changing the direction of wheelchair. This module is used to control the driving wheelchair in different directions by giving some keys like ‘Forward’, ‘Backward’ and detecting the obstacles and changing the direction of wheelchair. MEMS sensor is

used to know their needs and display their needs in IoT page using Nodemcu. And eye blink sensor is used to turn on the fan and light.

1.3 INTERNET OF THINGS

The term Internet of Things (IoT) was coined by industry researchers but has emerged into mainstream public view only more recently. IoT is a network physical device, including things like smart phones, vehicles, home appliances, and more, that connects to and exchange data with computers. Some claim the Internet of Things will completely transform how computer networks are used for the next 10 or 100 years, while others believe IoT is simply hype that won't much impact the daily lives of most people.

Internet of Things represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. Advances in technology are making possible a more widespread adoption of IoT, from pill-shaped micro-cameras that can pinpoint thousands of images within the body, to smart sensors that can assess crop conditions on a farm, to the smart home devices that are becoming increasingly popular.

1.3.1 Potential benefits of IoT

- Location tracking for individual pieces of manufacturing inventory.
- Fuel savings from intelligent environmental modelling of gas-powered engines.
- New and improved safety controls for people working in hazardous environments.

1.3.2 Network Devices and the Internet of Things

All kinds of ordinary household gadgets can be modified to work in an IoT system. Wi-Fi network adapters, motion sensors, cameras, microphones and other instrumentation can be embedded in these devices to enable them for work in the Internet of Things. Home automation systems already implement primitive versions of this concept for things like smart light bulbs, plus other devices like wireless scales

and wireless blood pressure monitors that each represents early examples of IoT gadgets. Wearable computing devices like smart watches and glasses are also envisioned to be key components in future IoT systems. The same wireless communication protocols like Wi-Fi and Bluetooth naturally extend to the Internet of Things also.

1.4 NOVELTY OF PROJECT

The percentage of people with disabilities has increased now a days. Disability may occur as a result of birth or due to some medical or accidental cause. The purpose of making a smart wheelchair is using an ultrasonic sensor to help physically handicapped people to move from one place to another without colliding with any obstacles. This wheelchair will add comfort and make people lives easier.

1.5 OBJECTIVE

- To facilitate the movement of people who are disabled or handicapped and elderly people who are not able to move alone.
- To reduce user effort in controlling the wheelchair and to ensure safety during movement.
- To know the needs of disables and measure their body temperature and display it in the IoT page and LCD display
- To turn on the fan and light just with their eye movement.
- To change the direction of the wheelchair using mobile application and detect the obstacle.

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL

The review of literature focuses on the past research studies that were conducted to assess the need for the disable and for their mobility without help from others. Various literatures related to smart wheelchair are being reviewed

2.2 LITERATURE REVIEW

Ranjith Kumar P, Sumathi K, Sri Prithvi V (2019) have developed Smart Assistance Library System for the disabled: To help the disables at free flow of navigation throughout the library and read the book by the OCR technology and also translates as needed by the user and help the disables to read the books, newspaper themselves. The proposed idea has a various features like voice recognition, automatic navigation through the library, audio output of the book content using many sensors. Using camera, the words in the book is captured and it is converted into audio form using sound sensor and L293D motor is used for the movement of the wheelchair in the library.

Nasif & Khan (2017) have developed Wireless Head Gesture Controlled Wheel Chair for disabled persons: To help the disable person to more around and to do their habitat without any help of other. To design the wheelchair which easily controlled by the head gesture command. The proposed device works based on head gesture recognition technique using acceleration sensor. Acceleration sensor used for head gesture recognition and RF (Radio Frequency) module used for smart wireless controlling. The data is sent wirelessly to microcontroller-based motor circuit to control movement of wheelchair in five different modes. Front, back, right, left and to stand.

Umar & Anas (2015) have designed a low-cost DIY moving wheelchair 1284P based retina movement for the persons disabled with quadriplegia: To design a real time model of low-cost wheelchair based on guiding movements of retina for person with quadriplegia. To benefit poor paralyzed people by providing low-cost model of wheel chair. The model is realized through MATLAB in serial communication with the special

purpose microcontroller IC (AT mega 1284-IC). The movement is detected by camera which in reality captured by a signal called EOG (Electro oculographic) signal.

P Shashikala (2020) have done a study on Human Machine Interface Wheel Chair by Using Wi-fi Communication for Disabled Person: The framework includes a smaller scale controls the servo engine for straight movements of the wheelchair. The opposite finish of the framework has a miniaturized scale controller controls the servo engine for direct movement of the wheelchair. Front-wheel drives are ideal for navigating snags. This is regularly in light of the fact that the 14-inch drive wheels are the essentials wheels to experience obstruction and they pull the rest of the wheelchair over them. The drive wheels are pushing the front casters over snags is a back wheel drive framework. Since pushing is hard for pulling, back wheel drives are not exactly as splendidly going over snags as front wheel chair.

Hamataniaa, Nozaki, Murakami (2016) have designed steering control in multi-degrees-of-freedom Two-Wheeled Wheel Chair on Slope Environment: The Two-Wheeled wheelchair doesn't have any caster and move and stabilize with only one wheels. Its pitch angle of the body is measured by the gyro sensor, and the two in-wheel motors are controlled to stabilize the body. With the caster-less Structure, the two-wheeled wheel chair has high mobility and go over a step easily. However, caster-less two-wheeled wheelchair system is unstable with pitch angle. Proposed System has two-wheel motors and two steering motors at each wheel. Two wheels re actuated independently by the 2WD2WS system. Encoders are attached to measure the rotation angle of each motor. And gyro sensor is used to measure the wheel chair body's pitch angle. In this section kinematics of the two-wheeled wheel chair is explained. In kinematics of the two-wheeled wheel chair does not move towards axis direction. Wheels does not slip.

Monali, Nayan, Pawar, Shete, Shenede, Warkad (2021) have designed Automation of E-Wheelchair for physically challenged people: Automation is the technique of making an apparatus, a process, or a system operate automatically. With respect to automation a smart idea is developed towards the handicapped people, and physically challenged people. This paper proposed an idea and model to ease those

persons, who cannot perform hand movement in a way that can move a wheelchair. Several studies have shown that both children and adult benefit substantially from access to a means of independent mobility. This paper describes the design of a smart, motorized voice-controlled wheelchair using embedded system. Proposed design supports voice activation system for physically disabled persons incorporating manual operation. This system consists of hand gesture-controlled wheelchair using image processing through web camera which not only recognize hand gesture but also control the wheelchair according to the hand movement. It includes HSV shading space method to discover hand motion thought picture preparing. This paper utilized the raspberry pi board and sensors to detect obstacles lying ahead in the way of the wheelchair that can hinder the passage of the wheelchair. This designed wheelchair in prototype form is tested and get accurate output and efficient framework for the users with low power consumption.

Lodhi, Vats, Varun (2016) have designed Smart Electronic Wheelchair Using Arduino and Bluetooth Module: This paper describes the design of a smart, motorized, voice-controlled wheelchair using embedded system. Proposed design supports voice activation system for physically differently abled persons incorporating manual operation. This paper represents the “Voice- controlled Wheel chair” for the physically differently abled person where the voice command controls the movements of the wheelchair. The voice command is given through a cellular device having Bluetooth and the command is transferred and converted to string by the BT Voice Control for Arduino and is transferred to the Bluetooth Module SR-04 connected to the Arduino board for the control of the wheelchair. For example, when the user says ‘Go’ then chair will move in forward direction and when he says ‘Back’ then the chair will move in backward direction and similarly ‘Left’, ‘Right’ for rotating it in left and right directions respectively and ‘Stop’ for making it stop. This system was designed and developed to save cost, time and energy of the patient. Ultrasonic sensor is also made a part of the design and it helps to detect obstacles lying ahead in the way of the wheelchair that can hinder the passage of the wheelchair.

Jesse, Hung, Luan (2016) have studied the Development of a smart wheelchair for people with disabilities: The intelligent power wheelchair is designed to assist people with mobility, sensory, and cognitive impairment lead a higher quality, more independent

lifestyle. The chair includes a power wheelchair (PW), laptop computer, laptop mount, multi modal input platform, and a custom plastic enclosure for the environmental sensor, made with a 3D printer. We have developed the configuration of sensors to facilitate scientific observation, while maintaining the flexibility to mount the system on almost any power wheelchair and remain easily removed for maintenance or travel. The first scientific observations have been used to compile ACCESS reports that quantify a location or event's level of accessibility. If barriers exist, we collect a 3D point cloud to be used as evidence and to make recommendations on how to remedy the problem. The chair will serve a wide variety of disability types by incorporating several input methods, voice, touch, proximity, switch, and head tracking camera. The HD camera and 3d scanner have been mounted in such a way as to provide reliable data with the precision necessary to detect obstacles, navigational assistance. We evaluate the human factors in the current prototype to ensure that the technology will be accepted by those it is designed to serve, and propose a wheelchair skills test for future trial participates.

Apsana, Renjitha (2016) have studied Voice controlled wheelchair using Arduino: The needs of many individuals with disabilities can be satisfied with traditional, manual or powered wheelchair. A segment of the disabled community finds it difficult or impossible to use wheelchairs. There is extensive research on computer-controlled chairs where sensors and intelligent control algorithms have been used to minimize the level of human intervention. This paper describes design of a smart, motorized, voice-controlled wheelchair for physically disabled people by using embedded system. Proposed design supports voice activation system for physically disabled persons incorporating manual operation. Arduino microcontroller and speaker dependent voice recognition processor have been used to support the navigation of the wheelchair. The wheelchair does not respond to a false speed command. Depending on the direction selected on the joystick, microcontroller controls the wheelchair directions. This can be controlled through the voice command also. By using ultrasonic sensors, we can avoid obstacles.

Shiva Prasad, Prince Kumar (2017) have designed Smart Wheel Chair: Smart Wheel chair is mechanically controlled devices designed to have self-mobility with help of the user command. This reduces the user's human effort and force to drive the wheels

for wheelchair. The wheelchair is also provided with obstacle detection system which reduces the chance of collision while on the journey. Smart wheelchair has gained a lot of interests in the recent times. These devices are useful especially in transportation from one place to another. The machines can also be used in old age homes where the old age persons have difficulty in their movements. Different types of smart wheelchair have been developed in the past but the new generations of wheelchair are being developed and used which features the use of artificial intelligence and hence leaves a little to tinker about to the user who uses the wheel chair. The project also aims to build a similar wheelchair which would have a sort of intelligence and hence helps the user on his/her movement.

Mohanraj, Siddharth (2017) have designed a framework for tracking system aiding disabilities: The limitation of the physically disabled affect the living quality of the person to a great extent. The impairments are of different types which are visual, auditory, mobility and cognitive. According to the causes of impairments they are classified as prenatal, postnatal and perinatal disabilities. The proposed system is fully autonomous for outdoor for indoor navigation and semi-autonomous for outdoor navigation. The framework has activation and localization modules. The activation module uses voice recognition or remote control to summon the chair. The method is chosen based upon the people's disability. The localization module has varied sub modules: Obstacle detection and obstacle avoidance. The localization is done using 3D modelling technique or emulation of the movement of normal people. The framework incorporates a memory unit in ATS which reduces the computational time and the response time has a marginal change than other tracking assistive system. The obstacle detection occurs with the depth image sensor which records the depth of the environment using the infrared projection. The obstacles are avoided using the motors in wheels of EPW to turn the wheelchair for a required angle and the wheelchair proceeds in free space. The records of DIS and detected obstacle's dimensions are loaded into cloud or local database.

Jainam, Sheryas (2020) have studied IoT Based Smart Wheelchair System: With maturity, weak bones and weakness these issues may lead to extend risk of falling. For this purpose, we've projected associate degree IoT based mostly good chair which can

work as Fall Detection System. This technique uses sensors like Wi-Fi module and a microcontroller that sends the overall info concerning fall. The microcontroller receives all the knowledge from the sensors and constantly transmits and monitors the acceleration and additionally the orientation of the person. Any quick movement or modification among the system which can result from a fall is taken into consideration as a 'fall' and can be reportable. A significant concern would be that not all quick movement might find you form a fall and can be thought as a matter of concern. To avoid this warning, we've provided to snooze the system, this button is pressed before a particular time of 15-30 seconds to stop the system from deed the alert, therefore avoiding any confusion and panic. Inaudible sensors area unit won't to discover obstacles.

Paul Mathews, Aparna Unnikrishnan (2018) have designed intelligent side's electronics wheelchair using Arduino and GSM module: The project presents a multifunctional smart wheelchair for movement of disabled people along with patient monitoring using Arduino. The wheel chair can move in left, right, forward directions. The movement is controlled by accelerometer and eye movement (IR module). Here the data sensed by IR or accelerometer is given to microcontroller. Microcontroller controls the movement of wheelchair by controlling the DC motors interfaced with motor driver. Patient monitoring is achieved temperature sensor and pulse sensor and data is given to microcontroller. Whenever the parameters rise above the threshold values an alert message is sent to doctor's phone using GSM module along with this, obstacle detection is also implemented using ultrasonic sensor.

Richard, Charan, Nadeem (2021) have studied Smart Navigation of wheelchair using human machine interface: This manuscript deals with smart navigation of wheelchair using human machine interface. Physically challenged people are those who suffer from different physical disabilities. In day-to-day life, physically challenged people are facing many problems and one of them being to move around without external support, being independent and the freedom to move around independently is an integral part of one's life. This project is carefully designed by keeping in mind the problem's faced by physically challenged people. To implement the manuscript, Arduino UNO is used to control the motor coupled to the wheel of the wheelchair which is controlled by voice

command from the android mobile phone through a Bluetooth module. Apart from moving the motor using voice command, the prototype also has an ultrasonic sensor which senses the obstacle on the way and controls the direction of the wheels accordingly. Apart from physically challenged people, aged people will also get benefited with this prototype.

Anil Kumar, Komal, Pooja (2020) have studied an ameliorated methodology of smart assistant to physically challenged person using IoT: Smart devices not only aid to people life but also are becoming a crucial part of physically challenged and aged people. Death ratio of handicap people raises rapidly the need for safe and independent mobility for the elderly and physical challenged people is of prime concern. The key issue of handicap people is, they cannot have instance help when they are in any trouble. In market there are many types of wheelchairs available but, they are only useful for move or travel one place to another. In our project we provide the primary need to the handicap people. Using the accelerometer sensor, we detect the fall of person. We also provide the help button to the wheelchair which is helpful to get instant help to the user or buzzer is provided to notify nearest people. Android application is use for the all types of notification. Using the GPS, the live location of wheelchair is track. The location is display on android application. The main purpose of system to get instant help to the handicap people and reduces the death ratio of this people.

2.3 INFERENCE FROM LITERATURE REVIEW

- There is extensive research on computer-controlled chairs where sensors and intelligent control algorithms have been used to minimize the level of human intervention.
- The key feature of system is to get instant help to the disable person.
- The devices serve as a boon for those who have lost their mobility.
- Several studies have shown that both children and adult benefit substantially from access to a means of independent mobility.
- The new generations of wheelchair are being developed and used which features the use of artificial intelligence

CHAPTER 3

HARDWARE AND SOFTWARE REQUIREMENT

3.1 ARDUINO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

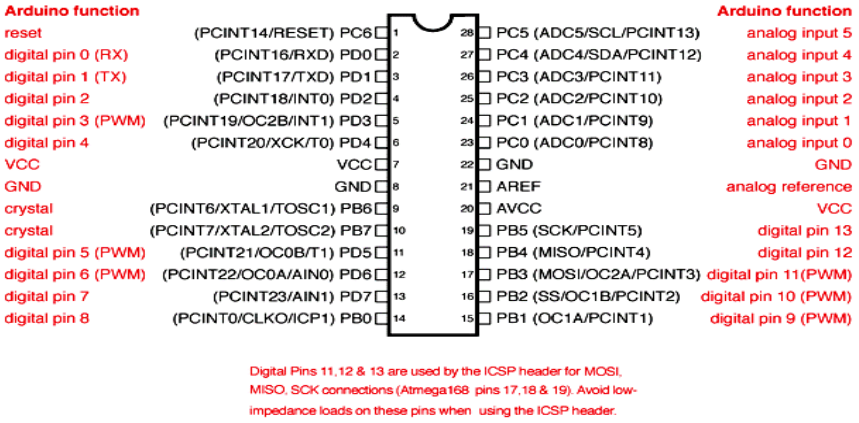


FIG 3.1 ARDUINO PIN DESCRIPTIONS

The above Fig 3.1 shows the Arduino pin descriptions. The below table 3.1 shows the specifications of Arduino UNO

TABLE 3.1 SPECIFICATIONS OF ARDUINO UNO

PINS IN ARDUINO UNO	DESCRPTIONS
Microcontroller	ATmega328P – 8-bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHZ

3.2 ARDUINO UNO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason.

Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible Package. The below Fig 3.2 shows the Arduino Uno Board. The Uno is one of the more popular boards in the Arduino family and a great choice for beginners.

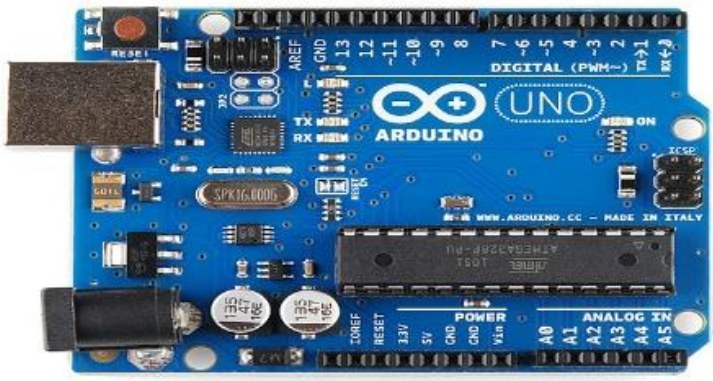


FIG 3.2 ARDUINO UNO BOARD

3.2.1 Power (USB / Barrel Jack)

Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply (like_this) that is terminated in a barrel jack. In the picture above the USB connection is labelled as 1 in fig 3.3 and the barrel jack is labelled

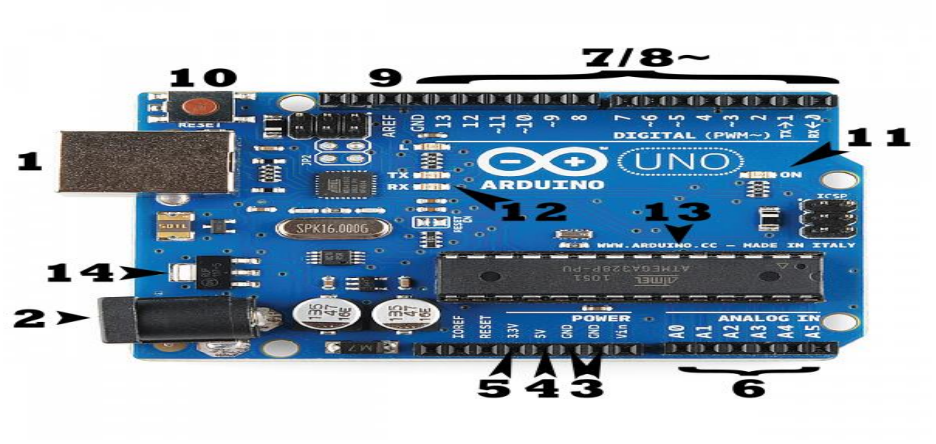


FIG 3.3 ARDUINO UNO PIN DESCRIPTION

The USB connection is also how you will load code onto your Arduino board. More on how to program with Arduino can be found in our Installing and Programming Arduino tutorial. Do not use a power supply greater than 20 Volts as you will overpower (and thereby destroy) the Arduino. The recommended voltage for most Arduino models is between 6 and 12 Volts.

3.2.2 Pins

The pins on your Arduino are the places where you connect wires to construct a circuit probably in conjunction with a breadboard and some wire. They usually have black plastic ‘headers’ that allow you to just plug a wire right into the board. The Arduino has several different kinds of pins, each of which is labelled as 2 in fig 3.3 on the board and used for different functions.

3.2.3 GND Pins

Short for ‘Ground’. There are several GND pins on the Arduino, any of which can be used to ground your circuit which is marked as 3 in the fig 3.3

3.2.4 5V & 3.3V

The 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts which is marked as 4 and 5 in fig 3.3

3.2.5. Analog

The area of pins under the ‘Analog In’ label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value which is marked as 6 in fig 3.3

3.2.6 Digital

Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED) which is marked as 7 in fig 3.3

3.2.7 PWM

The tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out) which is marked a 8 in fig 3.3

3.2.8 AREF

Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins which ia marked as 9 in fig 3.3

3.2.9 Reset Button

Just like the original Nintendo, the Arduino has a reset button. Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn’t repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn’t usually fix any problems which is marked as 10 in fig 3.3

3.2.10 Power LED Indicator

Just beneath and to the right of the word “UNO” on your circuit board, there’s a tiny LED next to the word ‘ON’. Which is marked as 11 in fig 3.3 This LED should light up whenever you plug your Arduino into a power source. If this light doesn’t turn on, there’s a good chance something is wrong. Time to re-check your circuit!

3.2.11 TX RX LEDs

TX is short for transmit RX is short for receive. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication. There are two places on the Arduino UNO where TX and RX appear once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs which is marked as 12 in fig 3.3 These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we’re loading a new program onto the board).

3.2.12 Main IC

The black thing with all the metal legs is an IC, or Integrated Circuit which is marked as 13 in fig 3.3**.** Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the AT mega line of ICs from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC’s, reading the datasheets is often a good idea.

3.2.13 Voltage Regulator

The voltage regulator which is marked as 14 in fig 3.3 is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it’s for. The voltage regulator does exactly what it says – it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it

will turn away an extra voltage that might harm the circuit of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts

3.3 ATMEGA328 MICROCONTROLLER

The Atmel AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The Boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega328/P is a powerful microcontroller that provides a highly flexible and cost-effective solution to many embedded control applications. The below fig 3.4 ATMEGA 328 Microcontroller.

FIG 3.4 ATMEGA328 MICROCONTROLLER

3.4 MEMS SENSOR

The term MEMS stands for micro-electro-mechanical systems. These are a set of devices, and the characterization of these devices can be done by their tiny size & the designing mode. The designing of these sensors can be done with the 1- 100-micrometer components**.** These devices can differ from small structures to very difficult

electromechanical systems with numerous moving elements beneath the control of incorporated micro-electronics. Usually, these sensors include mechanical micro actuators, micro-structures, micro-electronics, and micro-sensors in one package. This article discusses

MEMS are low-cost, and high accuracy inertial sensors and these are used to serve an extensive range of industrial applications. This sensor uses a chip-based technology namely micro-electro-mechanical-system. These sensors are used to detect as well as measure the external stimulus like pressure, after that it responds to the pressure which is measured pressure with the help of some mechanical actions. The best examples of this mainly include revolving of a motor for compensating the pressure change. The MEMS IC fabrication can be done with silicon, whereby slight material layers are placed otherwise fixed onto a Si substrate. After that selectively fixed away to leave microscopic 3D structures like diaphragms, beams, levers, springs, and gears.

FIG 3.5 MEMS SENSOR

The MEMS fabrication needs many techniques which are used to construct other semiconductor circuits like oxidation process, diffusion process, ion implantation process, low-pressure chemical vapor deposition process, sputtering, etc. Additionally, these sensors use a particular process like micromachining.

3.4.1 MEMS Sensor Working Principle

Whenever the tilt is applied to the MEMS sensor, then a balanced mass makes a difference within the electric potential. This can be measured like a change within capacitance. Then that signal can be changed to create a stable output signal in digital, 4-20mA or VDC. These sensors are fine solutions to some applications which do not

demand the maximum accuracy like industrial automation, position control, roll, and pitch measurement, and platform levelling.

3.4.2 Applications of MEMS

MEMS sensors are used in different domains which include automotive, consumer, industrial, military, biotechnology, space exploration, and commercial purposes which include inkjet printers, accelerometers within modern cars, consumer electronics, in personal computers, etc.

The best examples of MEMS devices mainly include adaptive optics, optical cross-connects, airbag accelerometers, mirror arrays for TVs & displays, steerable micro mirrors, RF MEMS devices, not reusable medical devices, etc.

3.5 Ultrasonic Sensor

Arduino project bat-powers with a HC-SR04 Ultrasonic Distance Sensor that can report the range of objects up to 13 feet away. Which is really good information to have if you're trying to avoid your robot driving into a wall! They are low power (suitable for battery powered devices), inexpensive, easy to interface with and are insanely popular among hobbyists. And as a bonus it even looks cool, like a pair of Wall-E Robot eyes for your latest robotic invention. The below fig 3.6 shows the ultrasonic sensor

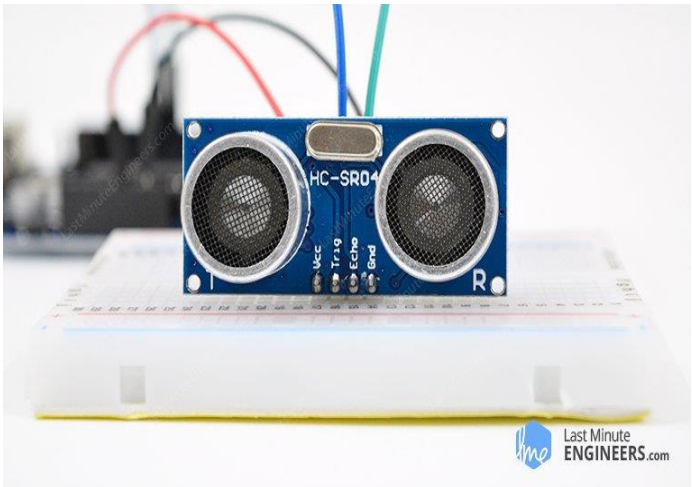


FIG 3.6 ULTRASONIC SENSOR

At its core, the HC-SR04 Ultrasonic distance sensor consists of two ultrasonic transducers. The one acts as a transmitter which converts electrical signal into 40 KHz ultrasonic sound pulses. The receiver listens for the transmitted pulses. If it receives them, it produces an output pulse whose width can be used to determine the distance the pulse travelled. Since it operates on 5 volts, it can be hooked directly to an Arduino or any other 5V logic microcontrollers. The table 3.2 below describes the specification of ultrasonic sensor.

TABLE 3.2 SPECIFICATIONS OF ULTRASONIC SENSOR

Operating Voltage	DC 5V
Operating Current	15mA
Operating Frequency	40KHz
Max Range	4m
Min Range	2cm
Ranging Accuracy	3mm
Measuring Angle	15 degree
Trigger Input Signal	10µS TTL pulse
Dimension	45 x 20 x 15mm

3.5.1 Working Principle of Ultrasonic Sensor

When a pulse of at least 10 µS (10 microseconds) in duration is applied to the Trigger pin. In response to that the sensor transmits a sonic burst of eight pulses at 40

KHz. This 8-pulse pattern makes the “ultrasonic signature” from the device unique, allowing the receiver to differentiate the transmitted pattern from the ambient ultrasonic noise. The eight ultrasonic pulses travel through the air away from the transmitter. Meanwhile the Echo pin goes HIGH to start forming the beginning of the echo-back signal.

If those pulses are not reflected back then the Echo signal will timeout after 38 mS (38 milliseconds) and return low. Thus a 38 mS pulse indicates no obstruction within the range of the sensor. If those pulses are reflected back the Echo pin goes low as soon as the signal is received. This produces a pulse whose width varies between 150 µS to 25 mS, depending upon the time it took for the signal to be received. The width of the received pulse is then used to calculate the distance to the reflected object. This can be worked out using simple distance-speed-time equation,

3.6 NODEMCU

When prototyping new IoT equipment, development boards such as Arduino and Raspberry Pi are popular options. These development boards are fundamentally mini-computers that a normal PC or Mac can connect to and program. The design boards can then connect and regulate sensors in the field after it has been programmed. The design boards need a way to connect to the internet because the "I" in IoT stands for internet. In the field, using wireless networks is the best way to connect to the Internet. However, wireless networks are not supported by Arduino and Raspberry Pi. In order to access the wireless module, developers will need to add a WIFI or cellular module to the board and write code. One of its most distinctive characteristics is that it has built-in WIFI connectivity assistance, making the development of IoT applications much easier.

The Nodemcu (Node Micro Controller Unit) is an open-source software and hardware development environment around the ESP8266, a very inexpensive system-on- a-chip (SoC) environment. The ESP8266, however, is also difficult to access and use as a chip. For the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip, you have to solder wires with the appropriate analog voltage. It is an

enormous burden on hobbyists, hackers, or learners who want to experiment with it in their own IoT projects.

FIG 3.7 NODEMCU DEVKIT BOARD

An open-source firmware ESP8266 constructed on top of the proprietary SDK of the chip manufacturer. The firmware offers an easy programming environment based on eLua (integrated Lua), which with an established developer community is a very easy and quick scripting language. The language of Lua scripting is simple to know for newcomers. A DEVKIT board that includes a conventional circuit board with the ESP8266 chip. The DEVKIT board is shown in Fig 3.7 and its buttons are shown in Fig 3.8 for a flexible IoT controller, the Arduino project produces an open-source hardware architecture and SDK software.

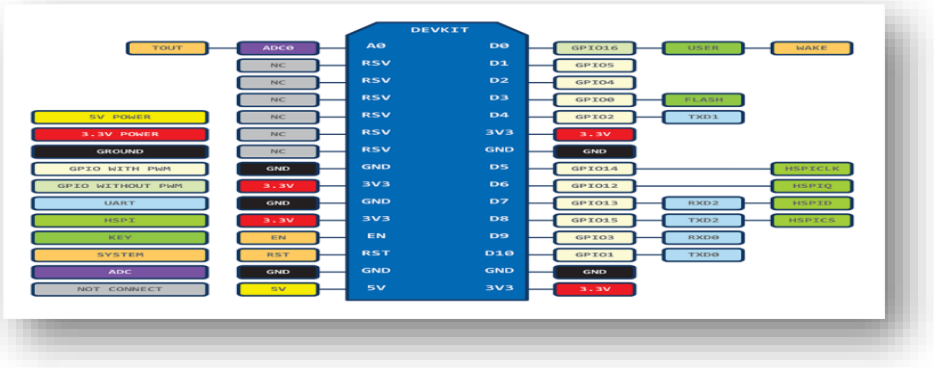


FIG 3.8 DISPLAY BUTTTONS IN DEVKIT BOARD

3.7 EYEBLINK SENSOR

The eye blink sensor illuminates the eye with infrared light and monitors the `changes in the reflected light. The infrared light reflected from the eye is used to determine the results. The sensor output is active high for eye close and can be given directly to microcontroller for interfacing application (e.g., Buzzer).The eye blink sensor is an infrared sensor. It contains two parts. A transmitter and a receiver. The transmitter continuously emits infrared waves onto the eye. While the receiver continuously looks for variations in the reflected waves which indicates that the eye has blinked. If the eye is closed that means it will give high output. If eye is open then it will give a low output. This sensor can be used in a very different variety of robotics and mechatronics projects as it provides excellent results and is very economical

3.7.1 Working principle of the eye blink sensing system

FIG 3.9 EYEBLINK SENSOR

The eye blinking system can be used for different purpose. The eye blink sensor constantly sends infrared waves which are reflected and detected by the receiver. As soon as the eye blinks, the output of the sensor goes high. This output is sent to the Arduino board. The Arduino sends the signal to the buzzer to make the noise. In this way, a blink is detected. This system can be used with all modes of transports be it trains, ships, planes, cars, etc. This can be very useful to avoid accidents. Another purpose of this system, it can be used in hospitals to check as the patient is unconscious. When the

output goes low i.e., when the eyes of the patient open, that is when the Arduino should command the buzzer to ring. The fig 3.9 shows the Eye blink Sensor.

DHT11 is a Humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability. The fig 3.10 shows the components of DHT11 sensor.

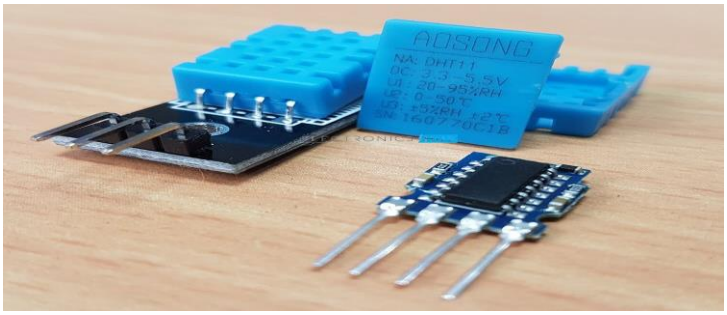


FIG 3.10 COMPONENTS OF DHT11 SENSOR

3.8 LIQUID CRYSTAL DISPLAY

LCD stands for **L**iquid **C**rystal **D**isplay. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons: The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters .Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.

FIG 3.11 LIQUID CRYSTAL DISPLAY

A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (Hitachi) and can display messages in two lines with 16 characters each. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own. Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.

3.8.1 LCD screen

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).

3.9 DC MOTOR

The relationship between torque vs speed and current is linear as shown left; as the load on a motor increase, Speed will decrease. The graph pictured here represents the characteristics of a typical motor. As long as the motor is used in the area of high efficiency (as represented by the shaded area) long life and good performance can be expected. The fig 3.12 shows the DC Motor.

FIG 3.12 DC MOTOR

If voltage in continuous applied to a motor in a locked rotor condition, the motor will heat up and fail in a relatively short time. Therefore, it is important that there is some

form of protection against high temperature rises. A motor's basic rating point is slightly lower than its maximum efficiency point.

3.10 HC BLUETOOTH MODULE

HC-05 Bluetooth Module is an easy-to-use Bluetooth SPP (Serial Port Protocol) module designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use either receiving or transmitting data. The fig 3.13 shows the HC Bluetooth module

HC-05 is normally used in embedded project, where data needs to be transmitted wirelessly over a small distance. We can transmit data between two HC-05 module and can also send data from HC-05 to any Bluetooth appliance i.e., mobile phone, laptop etc. In order to do so, first of all, we need to power up our HC-05 module. As we push the button connected to key pin, it will get low & HC-05 will start blinking. Now, if you check on your mobile phone or laptop, you will be able to find a new Bluetooth device named HC-05. Once you connected with this device, you will be able to send and receive data in a serial stream manner. This stream is then processed by a microcontroller attached with HC-05. However, do not expect this module to transfer multimedia like photos or songs; you might have to look into the CSR8645 module for that.

FIG 3.13 HC BLUETOOTH MODULE

3.11 ARDUINO IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems

such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment. The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuine and Arduino board with IDE to upload the sketch written in Arduino IDE software shown in fig 3.14. The sketch is saved with the extension'. ino'.

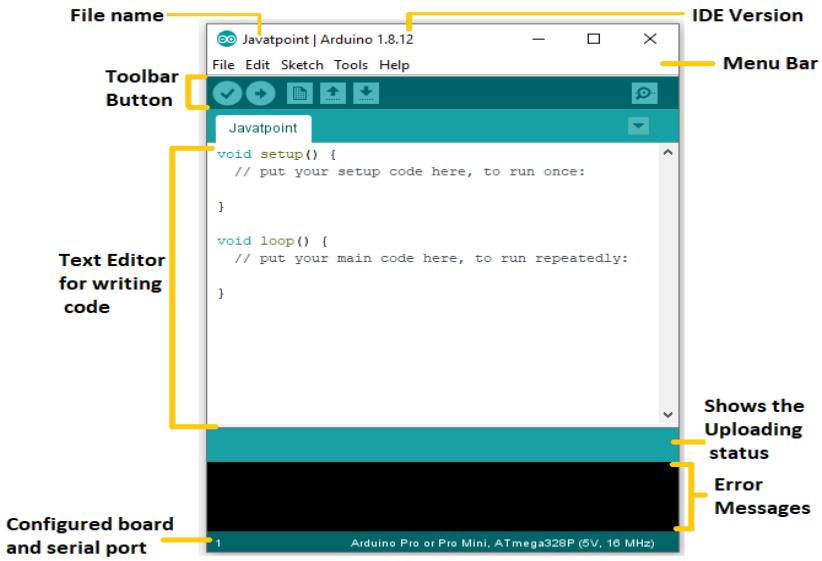


FIG 3.14 ARDUINO IDE SOFTWARE

3.11.1 Toolbar button

The icons displayed on the toolbar are New, Open, Save, Upload and Verify showed in fig 3.15.

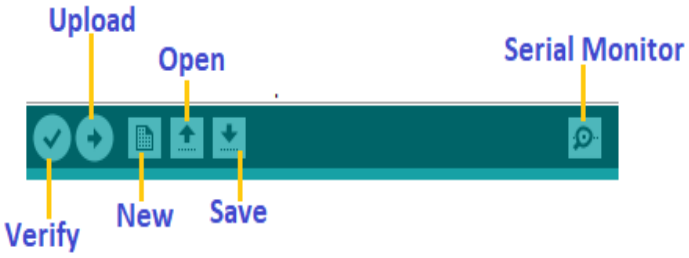


FIG 3.15 TOOLBAR BUTTON

- **New-** It is used to create a new sketch or opens a new window.

- **Open-** the Open button is used to open the already created file. The selected file will be opened in the current window.
- **Save-** The save button is used to save the current sketch or code.
- **Upload-** the Upload button compiles and runs our code written on the screen. It further uploads the code to the connected board. Before uploading the sketch, we need to make sure that the correct board and ports are selected. A Bootloader is defined as a small program, which is loaded in the microcontroller present on the board. The LED will blink on PIN 13.
- **Verify-** The verify button is used to check the compilation error of the sketch or the written code.
- **Serial Monitor-** The serial monitor button is present on the right corner of the toolbar. It opens the serial monitor. When we connect the serial monitor, the board will reset on the operating system Windows, Linux, And Mac OS X.

3.11.2 Menu Bar

- **File-** When we click on the File Button on the Menu bar, a drop-down list will appear. It is shown below:

- **New –** The new button opens the new window. It does not remove the sketch is already present.
- **Open** – It allows opening the sketch, which can be browsed from the folders and computer drivers.
- **Open Recent** – The open recent button contains the list of the recent sketches.
- **Sketchbook** – It stores the current sketches created in the Arduino IDE software. It opens the selected sketch or code in a new editor at an instance.
- **Close** – The close button closes the window from which the button is clicked.
- **Save** – The save button is used to save the current sketch. It also saves the changes made to the current sketch. If we have not specified the name of the file, it will open the ‘Save As’ window.

- **Save As** – We can save the sketch with a different name using the ‘Save As’ button. We can also change the name accordingly.
- **Page Setup** – It allows setting the page margins, orientation, and size for printing. The ‘Page Setup’ window will appear as.
- **Print** – According to the settings specified in the ‘Page Setup’, it prepares the current sketch for printing.
- **Preferences** – It allows the customization settings of the Arduino IDE.
- **Quit** – The Quit button is used to close all the IDE windows. The same closed sketch will be reopened when we will open the Arduino IDE.
- **Undo** – The Undo button is used to reverse the last modification done to the sketch while editing.
- **Redo** – The Redo button is used to repeat the last modification done to the sketch while editing.
- **Cut** – It allows us to remove the selected text from the written code. The text is further placed to the clipboard. We can also paste the text anywhere in our sketch.
- **Copy** – It creates a duplicate copy of the selected text. The text is further placed on the clipboard.
- **Copy for Forum** – The ‘Copy for Forum’ button is used to copy the selected text to the clipboard, which is also suitable for posting to the forum.
- **Copy as HTML** – The ‘Copy for HTML’ button is used to copy the selected text as HTML to the clipboard. It is desirable for embedding in web pages.
- **Paste** – The Paste button is used to paste the selected text of the clipboard to the specified position of the cursor.
- **Select All** – It selects all the text of the sketch.
- **Go to line** – It moves the cursor to the specified line number.
- **Comment / DE comment** – The Comment / DE comment button is used to put or remove the comment mark (//) at the beginning of the specified line.
- **Increase Indent** – It is used to add the space at the starting of the specified line. The spacing moves the text towards the right.

- **Decrease Indent** – It is used to subtract or remove the space at the starting of the specified line. The spacing moves the text towards the left.
- **Increase Font size** – It increases the font size of the written text.
- **Decrease Font Size** – It decrease the font size of the written text.
- **Find** – It is used to find the specified text. We can also replace the text. It highlights the text in the sketch.
- **Find Next** – It highlights the next word, which has specified in the 'Find' window. If there is no such word, it will not show any highlighted text.
- **Find Previous** – It highlights the previous word, which has specified in the 'Find' window. If there is no such word, it will not show any highlighted text.

3.11.3 Sketch

- **Verify/Compile** – It will check for the errors in the code while compiling. The memory in the console area is also reported by the IDE.
- **Upload** – The Upload button is used to configure the code to the specified board through the port.
- **Upload Using Programmer** – It is used to override the Bootloader that is present on the board. We can utilize the full capacity of the Flash memory the 'Upload Using Programmer' option.
- **Export compiled Binary** – It allows saving a .hex file and can be kept archived. Using other tools, .hex file can also be sent to the board.
- **Show Sketch Folder** – It opens the folder of the current code written or sketch.
- **Include Library** – Include Library includes various Arduino libraries. The libraries are inserted into our code at the beginning of the code starting with the #. We can also import the libraries from .zip file.
- **Add File** – The Add File button is used to add the created file in a new tab on the existing file. We can also delete the corresponding file from the tab by clicking on the small triangle -> Delete option.

3.11.4 Tools

- **Auto Format** – The Auto Format button is used to format the written code. For example, lining the open and closed curly brackets in the code.
- **Archive Sketch** – The copy of the current sketch or code is archived in the .zip format. The directory of the archived is same as the sketch.
- **Fix Encoding and Reload** – This button is used to fix the inconsistency between the operating system char maps and editor char map encoding.
- **Manage Libraries** – It shows the updated list of all the installed libraries. We can also use this option to install a new library into the Arduino IDE.
- **Serial Monitor** – It allows the exchange of data with the connected board on the port.
- **Serial Plotter** – The serial plotter button is used to display the serial data in a plot. It comes preinstalled in the Arduino IDE.
- **WiFI101 / WIFI NINA Firmware Updater** – It is used to check and update the Wi-Fi Firmware of the connected board.
- **Board** – We are required to select the board from the list of boards. The selected board must be similar to board connected to the computer.
- **Processor** – It displays the processor according to the selected board. It refreshes every time during the selection of the board.
- **Port** – It consisted of the virtual and real serial devices present on our machine.
- **Get Board Info** – It gives information about the selected board. We need to select the appropriate port before getting information about the board.
- **Programmer** – We need to select the hardware programmer while programming the board. It is required when we are not using the onboard USB serial connection. It is also required during the burning of the Bootloader.
- **Burn Bootloader** – The bootloader is present on the board onto the microcontroller. This option is useful when we have purchased the microcontroller without the bootloader. Before burning the bootloader, we need to make sure about the correct selected board and port.

The help section includes several documents that are easy to access, which comes along with the Arduino IDE. It consists of the number of the options such as Getting Started, Environment, Troubleshooting, Reference etc. We can also consider the image shown above, which includes all the options under the Help section. Some documents like Getting started, Reference, etc., can be accessed without the internet connection as well. It will directly link us to the official website of Arduino as shown in fig 3.16.

FIG3.16 WEBSITE OF ARDUINO

CHAPTER 4

METHODOLOGY

4.1 METHODOLOGY FLOWCHART

The methodology gives the stepwise procedure and simplified methods or techniques for the fulfilment of the objectives of the study. The fig 4.1 shows the flowchart of methodology adopted for this study.

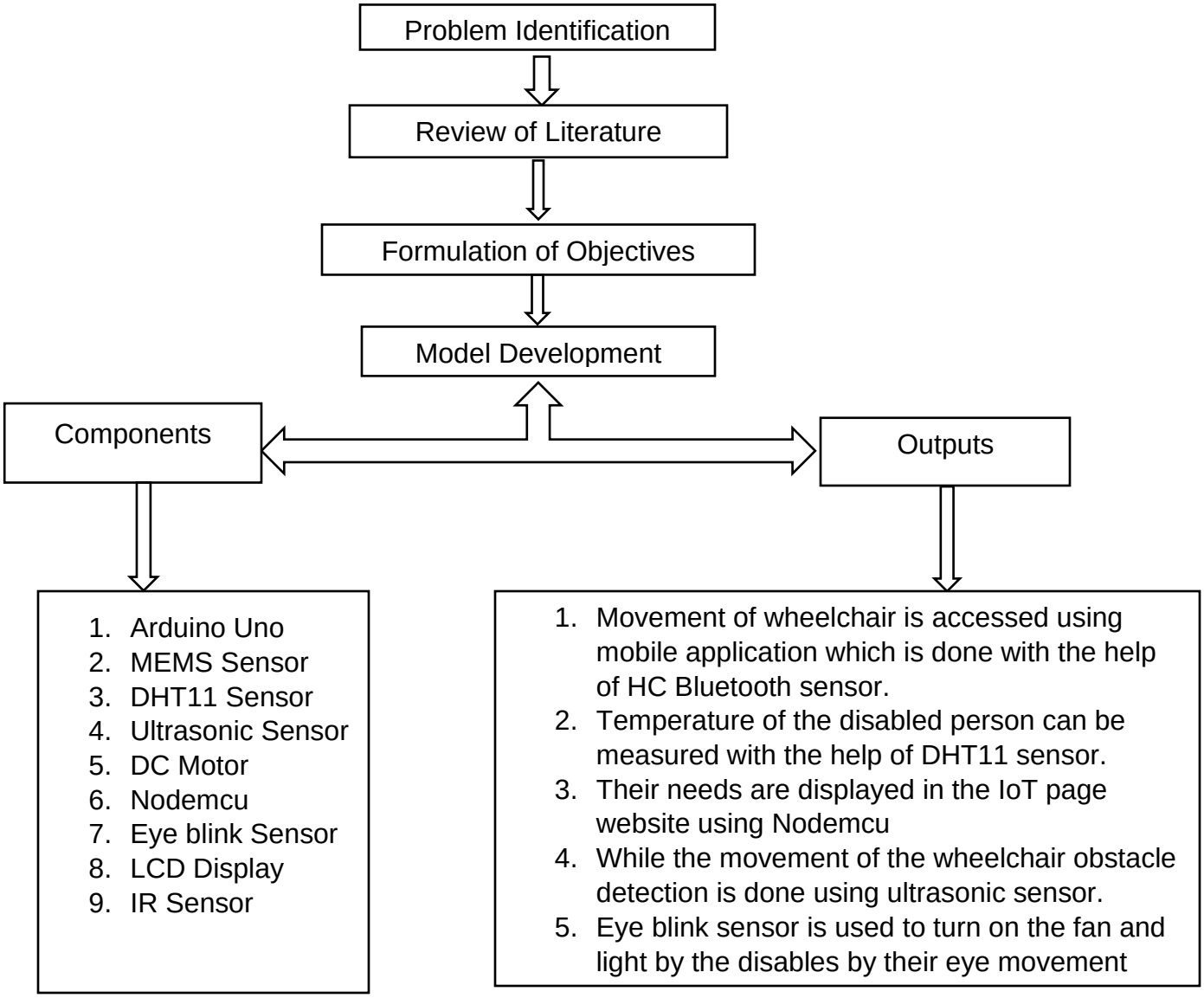


FIG 4.1 METHODOLOGY FLOWCHART

For any study, it is necessary to know about the need for the study to find out the major problems. The review of various literatures helped in framing the objectives of the study. In general, the wheelchair facilitates people with more disabilities in their daily lives by allowing them to independently move with the help of an assistive and straightforward interface. Using Arduino Uno this project offers movement of the wheelchair and change in the direction using mobile applications with the help of HC-Bluetooth sensor. Along with this ultrasonic sensor is used to detect the obstacle and change the direction of wheelchair. DHT11 sensor is used to measure the temperature of the disabled person, MEMS sensor is used to know the needs of the disabled person and display them in IoT page with the help of Nodemcu, Eye blink sensor is used to turn on the fan and light by the disables just with their eye movement.

4.2 BLOCK DIAGRAM

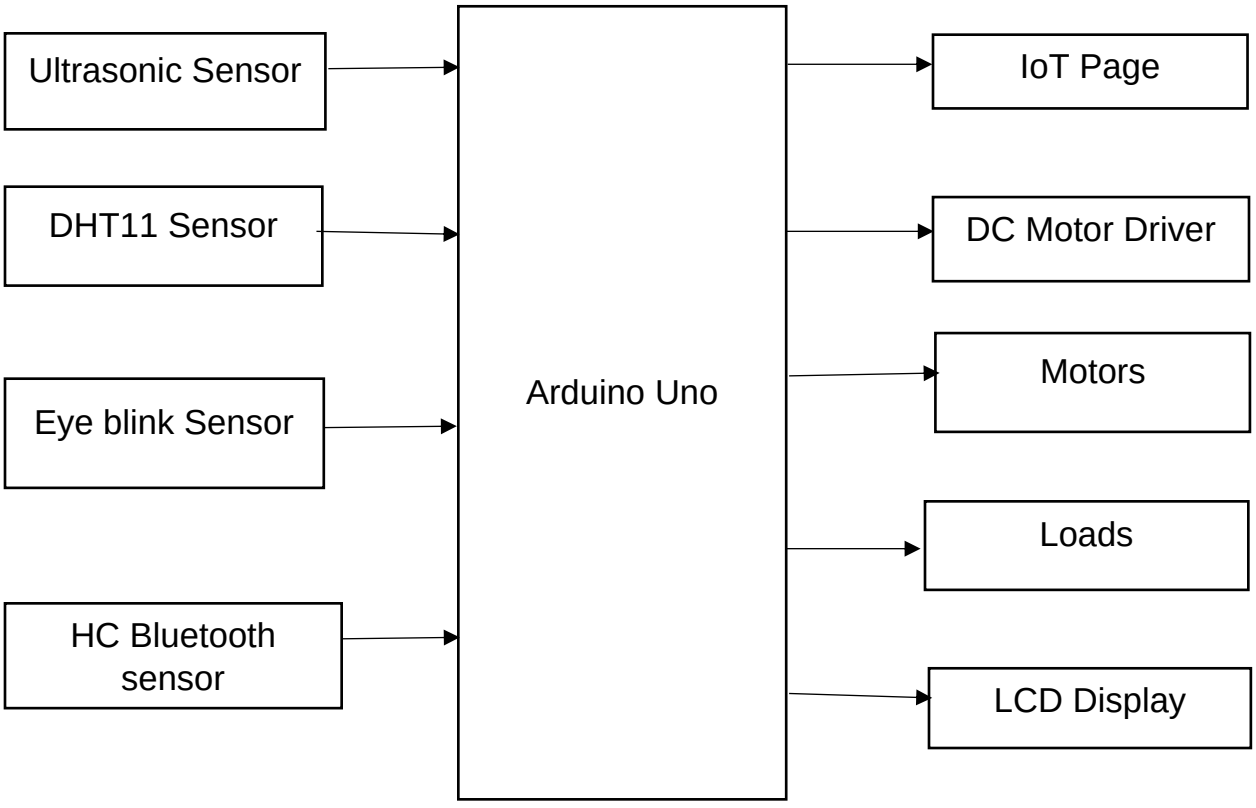


FIG 4.2 BLOCK DIAGRAM

The above fig 4.2 shows the block diagram of the proposed system. This wheelchair is an IoT based user friendly wheelchair. So, we have used an Arduino UNO and different type of sensors. Firstly, Ultrasonic sensor is used to detect the obstacle and change the direction of the wheelchair in the movement. DHT11 sensor is used to measure the temperature of the disable person. Eye blink sensor is used to turn ON the light and fan. For the demo we used DC fan and IR. HC Bluetooth sensor is used for to control wheelchair and change the direction of the wheelchair using mobile application. Mainly HC Bluetooth sensor is used to connect the wheelchair with the mobile application via Bluetooth. We have created an IOT page, which is used to display the temperature measured by DHT11 sensor and their needs. DC Motor driver is used for wheelchair movement.

4.3 CONNECTION

The fig 4.3 shows the component connection. Two Arduino UNO has been used to avoid connection traffic. In first Arduino, MEMS sensor, DHT11 sensor, Eye Blink sensor and Nodemcu are connected and in the second Arduino is completely used for the movement of the Wheelchair. The ultrasonic sensor and HC Bluetooth sensor is connected to the second Arduino for the wheelchair movement. The Output is obtained from first Arduino. Both the Arduino's are connected with each other. Liquid Crystal Display is attached to the first Arduino.

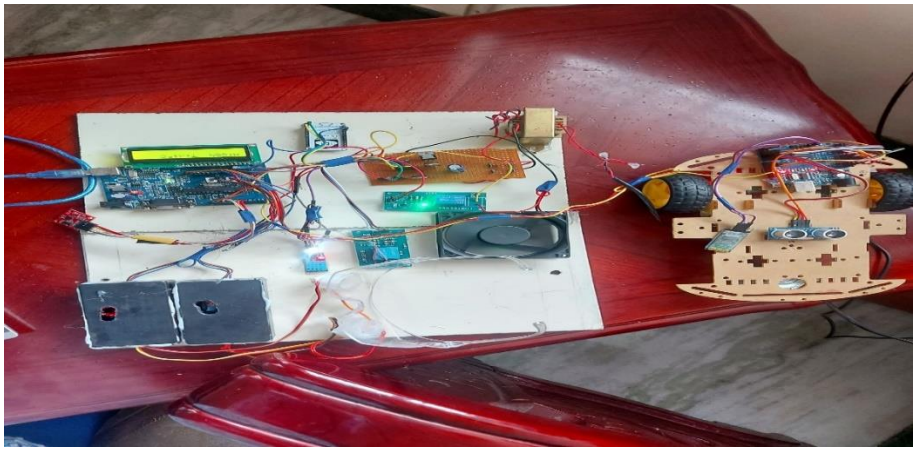


FIG 4.3 COMPONENT CONNECTION

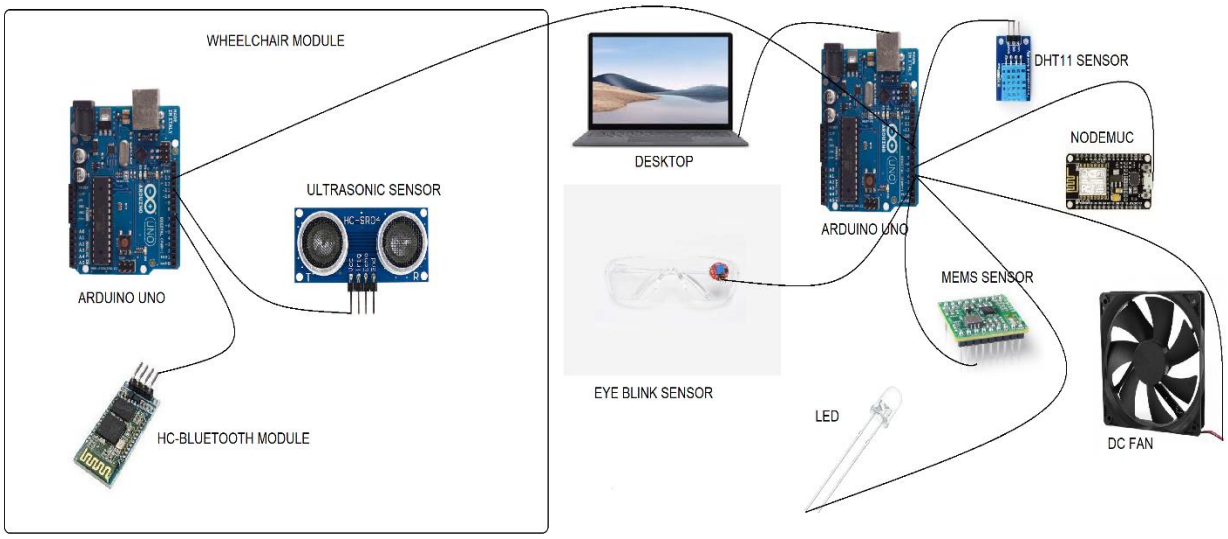


FIG 4.4 CONNECTION MODEL

4.4 OUTPUTS

The fig 4.4, 4.5 & 4.6 given below are the outputs from the IOT page. The output shows the needs and the temperature of the disabled person. It helps the attender to check their vitals and know their needs from any place and at any time. These outputs are obtained from changing the angle of MEMS sensor.

S.NO	TEMPERATURE	HUMIDITY	MEMS VALUE	STATUS
1623	30	73	375	
1617	30	76	366	
1626	30	75	379	
1621	30	74	374	
1618	30	76	367	
2575	31	69	473	Water
1622	30	76	375	
1620	30	73	371	
1619	30	73	366	
1624	30	73	375	

FIG 4.5 OUTPUT FOR NEED FOR WATER

S.NO	TEMPERATURE	HUMIDITY	MEMS VALUE	STATUS
1623	30	73	375	
1617	30	76	366	
1626	30	75	379	
1621	30	74	374	
1618	30	76	367	
2578	30	68	422	RestRoom
1622	30	76	375	
1620	30	73	371	
1619	30	73	366	
1624	30	73	375	

FIG 4.6 OUTPUT FOR NEED RESTROOM

S.NO	TEMPERATURE	HUMIDITY	MEMS VALUE	STATUS
1623	30	73	375	
1617	30	76	366	
1626	30	75	379	
1621	30	74	374	
1618	30	76	367	
2691	30	73	413	Food
1622	30	76	375	
1620	30	73	371	
1619	30	73	366	
1624	30	73	375	

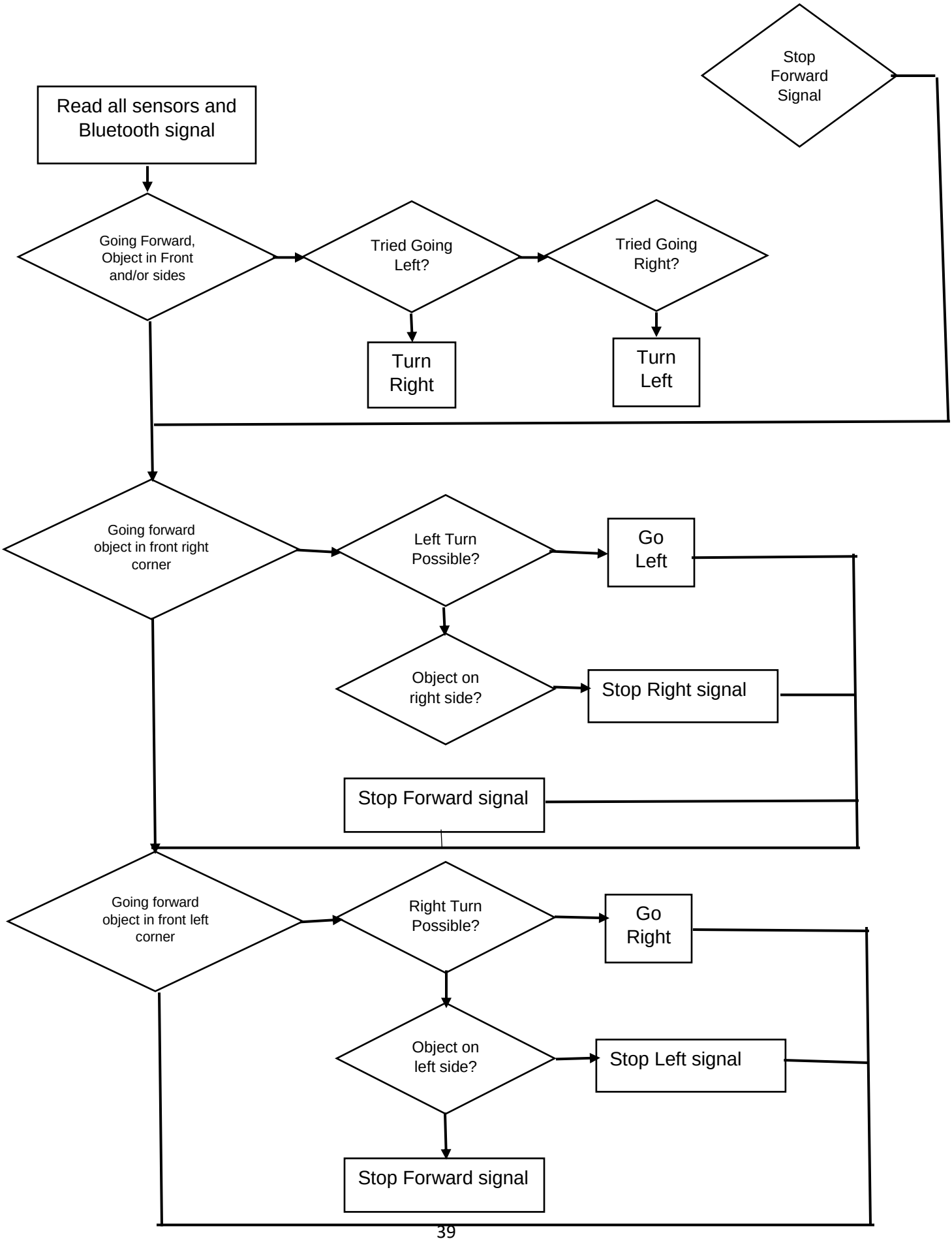
FIG 4.7 OUTPUT FOR NEED FOOD

The disable person can adjust the angle of MEMS sensor in order to convey their needs. Those angles are written as code in Arduino IDE and that is feed into MEMS sensor. As per the code when the angle is changed their needs will be displayed in IoT page.

4.5 Obstacle Detection

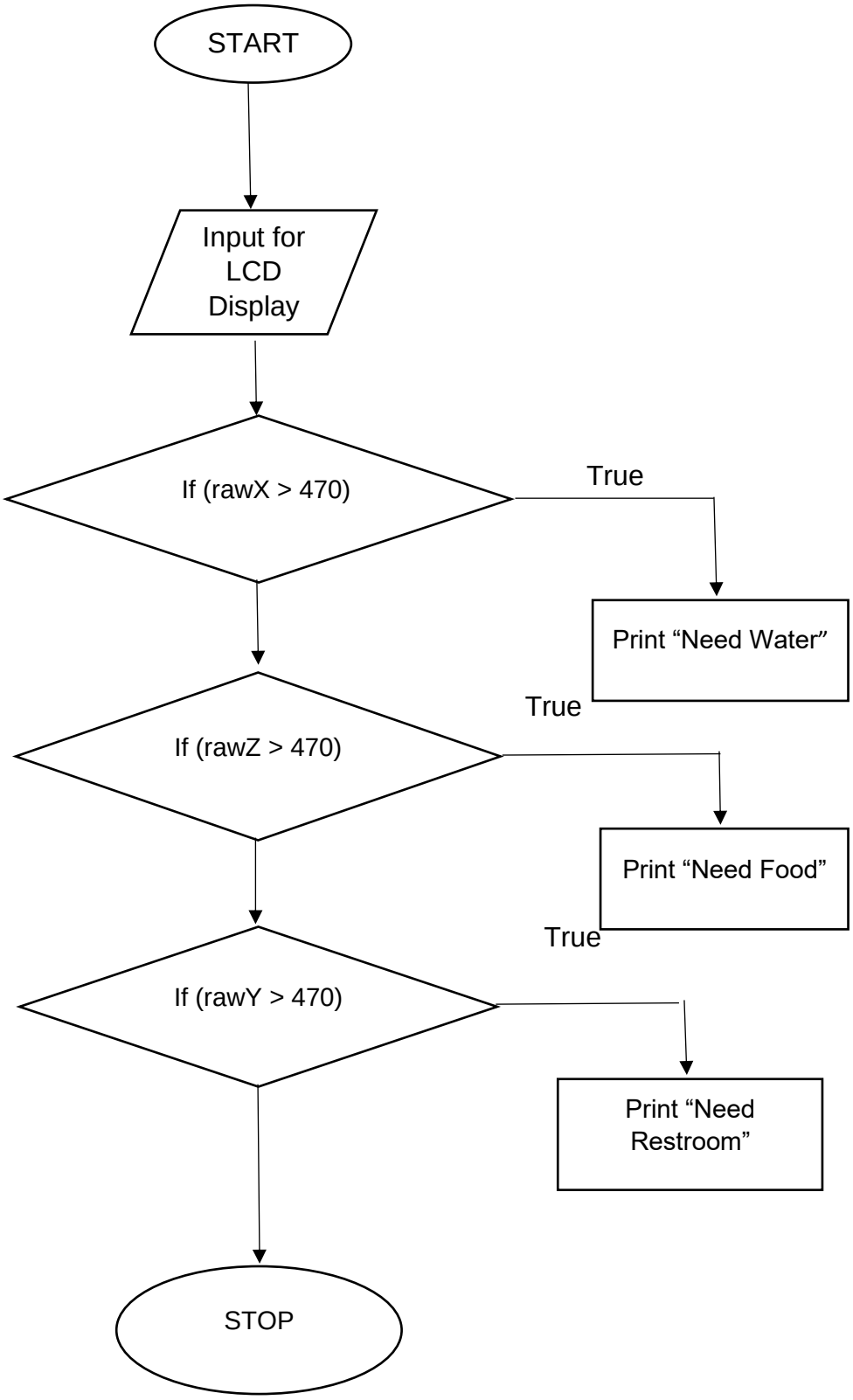
This flowchart is to represent the functionality of obstacle detection in our proposed system. As the below flow chart show when the wheelchair is in movement using ultrasonic sensor, we will detect the obstacle and change the direction of the wheelchair. If else there will be no change in the direction of wheelchair unless we change the direction of wheelchair. The two criteria address the safety of smart wheelchair are

- To maintain a safe distance from the obstacle.
- Detect obstacles of various size


Stop Forward Signal
Read all sensors and Bluetooth signal
Going Forward, Object in Front and/or sides
Tried Going Left?
Tried Going Right?
Turn Right
Turn Left
Going forward object in front right corner
Left Turn Possible?
Go Left
Object on right side?
Stop Right signal
Stop Forward signal
Going forward object in front left corner
Right Turn Possible?
Go Right
Object on left side?
Stop Left signal
Stop Forward signal

4.6 ALGORITHM

The below condition is to display the outputs in the LCD display and in the IoT page.



CHAPTER 5

CONCLUSION

5.1 GENERAL

This paper presents different smart technologies for wheelchairs. It focuses on two main properties: The human – machine interface and the navigation methods and devices. Also, it reviews other smart system like knowing their needs and safety systems. From the review of many published papers, it is concluded that researches are continuously trying to build a powerful and helpful wheelchair to ease the daily life activities and to give more independent mobility for people with different types of disabilities.

Unfortunately, there are very few commercialized wheelchairs with the smart technology available. One reason is because the robustness and safety of the technology is not 100% guaranteed yet in many researches. However, the main reason is maybe related to marketing and feasibility issues. Using high-tech smart wheelchair depends on the severity of the disability, the individual's overall moral and attitude towards his or her condition and the most important is the price of the technology. Moreover, smart wheelchairs are complicated for many users. Therefore, familiarization and training sessions are needed as after sales services. This makes the investment in smart wheelchair less interesting for stockholders.

5.2 FUTURE SCOPE

- Obviously, much future work remains to be completed before the smart wheel chair is ready for commercialization. This work includes developing hardware and software.
- We have planned the range of activities to evaluate the smart wheel chair as it is progress towards commercialization.
- Future work should maybe focus more on the add-on approach which gives flexibility in configurations of sensors, interface, and input devices based on each individual user's need and budget

- Other options for making the wheelchair friendlier can be added in future also. For example, entertainment and social communication facilities might be added to the wheelchair.
- First aid, muscle relaxing and rehabilitation tools might be considered as useful add-ons too.

REFERENCES

1. Ranjith Kumar P, Sumathi K, Sri Prithvi V(2019), Smart Assistance Library System for the Disabled, 5th International Conference Advanced Computing And Communication Systems(ICACCS).

2. Shayban Nasif, Muhammad Abdul Gaffar Khan (2017), Wireless Head Gesture Controlled Wheel Chair for Disabled Persons, Region 10 Humanitarian Technology Conference(R10-HTC).

3. Umar Mohammed, Mohammad Anas(2015), Design of a Low Cost DIY Moving Wheel Chair Using ATmega128P based on Retina Movement for the Persons Disabled with Quadriplegia, IEEE INDICON 1570186635.

4. Sasikala P(2020), Human Machine Interface Wheel Chair by using WI-FI Communication for Disabled Person, Fourth International Conference on Electronics Communication and Aerospace Technology(ICECA).

5. Sakurako HAMATANI, Takahiro NOZAKI, Toshiyuki MURAKAMI(2016), Steering Control in Multi-degrees-of-freedom Two-Wheeled Wheel Chair on Slope Environment, Grant-in-aid for Scientific Research(15H02235).

6. Monali Mundane, Nayan Garade, Vaishnavi Pawar, Vaishnavi Shete, Ujwal Shende, Dr.S.B.Warkad(2021), Automation of E-Wheelcair for physically Challenged People, International Journal of Innovative Research In Technology(IJIRT 151380).

7. Deepak Kumar Lodhi, Prakshi Vats, Addala Varun, Prashant Solanki, Ritakshi Gupta, Manoj Kumar Pandey(2016), Rajat Butola, Smart Electronic Wheelchair Using Arduino and Bluetooth Module, International Journal of Computer Science and mobile Computing(IJCSMC).

8. Jesse Leaman, Hung Manh La, IEEE Senior Member, Luan Nguyen(2016), Development of a Smart Wheelchair for People with Disabilities, International Conference on Multisensor Fusion and Intergration for Intelligent Systems(MFI).

9. Apsana S, Renjitha G Nair(2016), Voice Controlled Wheelchair Using Arduino, International Advanced Research Journal in science,Engineering And Technology, National Conference on Emerging Trends in Engineering and Technology(NCETET16).

10. K Shiva Prasad, Prince Kumar, E.V.N.Paradesi(2017), Smart Wheel Chair ,International Journal of Engineering Science and Computing (IJESC)

11. Mohanraj I, Siddharth S (2017), A Framework for Tracking System aiding Disabilities.

12. Nemil Panchamia, Shreyas Shah, Jainam Shastri, Archana Chaugule(2020),IOT Based Smart Wheelchair System, Journal of VLSI Design and its Advancement Volume 3 Issue 3.

13. Paul Mathews, Anjana R Krishnan, Aparna Unnikrishnan, Jithin Kuriakose, Thanku Renjit G Chelad(2018), Intelligent Sides Electronic Wheelchair Using Arduino and GSM Module, International Journal of Advanced Research in Electrical , Electronicsand Instrumental Engineering Vol.4 ,Issue.4.

14. Rithik Richard, Shaik Mohammed Noor, Sri Charan, Shaik Adil Nadeem, Jyothy S T(2021), Smart Navigation of Wheelchair Using Human Machine Interface, Turkish Journal of Computer and Mathematics Education,Vol.12 No.12.

15. Anil Kumar Hulsure, Komal Patil, Jyoti Chipade, Pooja Kamble(2020), An Ameliorated Methodology of Smart Assistant to Physically Challenged Person Using IOT, International Research Journal of Engineering and Technology(IRJET) Volume :7 Issue:01.