

VOICE CONTROLLED WHEELCHAIR USING BLUETOOTH

Submitted in partial fulfillment of the requirements for the award of
Bachelor of engineering degree in Computer Science and Engineering

by

Pagidimarry Nikhil (Reg.No. 37110879)

Yaswanth Chowdary Koduri (Reg. No. 37110870)



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SCHOOL OF COMPUTING
SATHYABAMA**

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC JEPPIAAR

NAGAR, RAJIV GANDHI SALAI,

CHENNAI – 600 119

MARCH - 2021



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with "A" grade by NAAC

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai – 600 119

www.sathyabama.ac.in



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this project report is the bonafide work of **Pagidimarry Nikhil(Reg. No. 37110879)** and **Yaswanth Chowdary Koduri (Reg. No.37110870)** who carried out the project entitled "**VOICE CONTROLLED WHEELCHAIR USING BLUETOOTH**" under my supervision from **DECEMBER 2020** to **March 2021**.

Internal Guide

Dr. Albert Mayan J, M.E.,Ph.D.,

Head of the Department

Submitted for Viva voce Examination held on_____

Internal Examiner

External Examiner

DECLARATION

I **Pagidimarry Nikhil** hereby declare that the Project Report entitled “**VOICE CONTROLLED WHEELCHAIR USING BLUETOOTH**” is done by me under the guidance of **Dr. ALBERT MAYAN J,M.E., Ph.D.**, Department of Computer Science and Engineering at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering.

DATE:

PLACE: CHENNAI

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **Board of Management of SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T. Sasikala, M.E., Ph.D., Dean**, School of Computing, **Dr. S. Vigneswari, M.E., Ph.D., and Dr. L. Lakshmanan, M.E., Ph.D., Heads of the Department** of Computer Science and Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Mr. ALBERT MAYAN J, M.E., Ph.D.**, for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Computer Science and Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT

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.

TABLE OF CONTENTS

ABSTRACT	v
-----------------	----------

LIST OF FIGURES	viii
------------------------	-------------

CHAPTER No.	TITLE	PAGE No.
1.	INTRODUCTION	1
	1.1 RESEARCH AND SIGNIFICANCE	1
	1.2 LITERATURE SURVEY	2
2.	AIM AND SCOPE	4
	2.1 AIM OF PROJECT	4
	2.1.1 OBJECTIVES	4
	2.2 SCOPES	4
	2.3 EXISTING SYSTEM	4
	2.3.1 DISADVANTAGES OF EXISTING SYSTEM	5
	2.4 PROPOSED SYSTEM	5
	2.4.1 ADVANTAGES OF PROPOSED SYSTEM	5
	2.5 SYSTEM REQUIREMENTS	5
	2.6 ARCHITECTURE DIAGRAM	6
3.	SYSTEM DESIGN & METHODOLOGY	7
	3.1 DESIGN	7
	3.1.1 CHARACTERSTICS	8
	3.1.2 APLPLICATIONS	9
	3.2 POWER MANAGEMENT	10
	3.3 AURDINO NANO	12
4.	SOFTWARE DEVELOPMENT METHODOLOGY	14
	4.1 GENERAL INTRODUCTION IOT	14

	4.1.1 OVERVIEW	15
	4.1.2 CHALLENGES	17
	4.2 INTRODUCTION TO ARDUINO IDE	18
	4.3 DC MOTORS	18
	4.3.1 CONSTRUCTION	19
	4.3.2 OPERATION	19
	4.3.3 BLUETOOTH MODULE HC-05	21
5.	RESULTS AND DISCUSSION	25
6.	CONCLUSION AND FUTURE WORK	27
	REFERENCES	28
	APPENDIX	29
	A. SOURCE CODE	

LIST OF FIGURES

FIGURE No.	FIGURE NAME	PAGE No.
2.1	ARCHITECTURE DIAGRAM	6
3.1	SYSTEM PROCESS	8
3.2	POWER SUPPLY	10
4.1	LAYERED ARCHITECTURE	16
4.2	HC-05 BLUETOOTH MODULE	22
4.3	BLUETOOTH MODULE SERIAL	23
5.1	WHEELCHAIR	25
5.2	APPLICATION	26
5.3	DATA IN APPLICATION	26
5.4	VOICE CONTROL	26

CHAPTER 1

INTRODUCTION

INTRODUCTION

With the decreasing birthrate and aging population, there have been many researches about electrical nursing robots, such as walking aid robots, muscle suit for nursing care, electric wheel chair, and so on. Among them, electric wheel chair is widely used because it can help elderly people who have difficulty with driving wheel chair by their hand-power, and in usual, it does not need much help by care workers. Therefore, electric wheel chair has been developed for a long time. However, there are some problems on electric wheel chair. Since the radius of caster wheels which support wheel chair's stability are small, wheel chairs cannot go over a step even 3cm. Also, wheel chairs cannot move lateral direction in general, and they sometimes fall down and cause into serious accidents. To solve these problems, many researches have been carried out. For example, Wada proposed a Four-wheel-Drive (4WD) robotic platform for wheelchairs with medium-sized Omni-wheels and enabled to climb single step. R. Morales et al. designed wheelchair's mechanical system to climb up stairs by grasping a step and going over it. However, because of a numbers of sensors, their cost of failure and maintenance are high and they are difficult to use in daily lives.

1.1 RESEARCH AND SIGNIFICANCE

To solve these problems, many researches have been carried out. For example, Wada proposed a Four-wheel-Drive (4WD) robotic platform for wheelchairs with medium-sized Omni-wheels and enabled to climb single step. R. Morales et al. designed wheelchair's mechanical system to climb up stairs by grasping a step and going over it. However, because of a numbers of sensors, their cost of failure and maintenance are high and they are difficult to use in daily lives. Therefore, a two- wheeled wheel chair is developed. The two-wheeled wheel chair was designed to realize "sensor less control". With few numbers of sensors, the two-wheeled wheel chair is superior in the view of cost reducing and high fault-tolerance, so it is suitable

for physically handicapped people to use as useful mobility. The two-wheeled wheel chair doesn't have any caster and move and stabilize with only two 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 wheel chair system is unstable with pitch angle. Therefore, control is necessary to stabilize pitch angle. Although the unstable nature, with its high mobility, many stabilization theory for under actuated two-wheeled robot have been studied. For example, Sheelu Treesa Mathew et al. designed H2 controller, Mahmood ul Hasan et al. used LQR controller. As for the two-wheeled wheel chair, Nakamura [6] realized the system stabilization by using the Lyapunov stabilizing theory, and enabled to move the two wheeled wheel chair forward and backward by the variation of user's center of mass. To improve the utility of the two wheeled wheel chair, many studies have done. Kuramats has implemented sensor less power assist of turning motion by introducing repulsive torque observer (RTOB)[8] to the two wheeled wheel chair. Kamatani has introduced joysticks to improve the operability of the two-wheeled wheel chair. Hirata has introduced backrest to improve the controllability by supporting human movement. However, there have been no research about lateral directional stability even though there are many reports about falling down accidents. One of the reasons of the accident is that wheel chairs cannot move lateral direction in general, so they are not be able to let a lateral force escape. In this paper, steering control method are proposed to solve this problem, and it enables two-wheeled wheel chair to move lateral direction. The validity of proposed method is checked through simulation compared with no steering control and changes of parameters.

1.2 LITERATURE SURVEY

Robotic Wheelchair Using Eye Blink Sensors and Accelerometer Provided with Home Appliance Control: Colleen Nelson, Nikitha S Badas, Saritha I G, Thejaswini S

According to a new report prepared jointly by the World Health Organization and the World Bank, 15 percent of the world's population is disabled. The use of powered wheelchairs with high navigational intelligence is one of the great steps towards the integration of severely physically disabled and mentally handicapped people. Driving a wheelchair is a tedious task for severely handicapped persons, unless they use the tongue to control the joystick.

Simultaneously blind and paraplegic people deal with two problems, which creates uneasy situation for them, i.e locomotion and localization. Different systems are being developed to overcome the problems described above, allowing the end-user to perform safe movements and accomplish some daily life important tasks.

Sensor Based Eye Controlled Automated Wheelchair: Ms. Kale Taibai D., Ms. Patil Aishwarya S., Ms. Kamble Madhuri H., Prof. S. A. Jagtap

The project discuss about a wheel chair based on eye gesture and hand gestures. This project is help to those people who are not able doing any moment due to their illness, injury, or disability. They can move the wheel chair left or right by just looking to the required direction, they can also start and stop the wheel chair, with other eye and hand gestures.

Robotic Wheelchair Controlled by Eye Blink and Face Orientation: Andreena Joseph¹, D Antonio Thapeetha

Content: This paper describes and evaluates intelligent robotic wheelchair mainly for quadriplegic patients. Each year huge number of people suffers with a spinal cord injury and approximately half of these injuries result in quadriplegia. The loss of personal mobility is one of the major life changes brought on by quadriplegia, mobility becomes a lifelong struggle. Quadriplegics rely on power wheelchairs for mobility, but the hands-free controller systems currently available are obtrusive and expensive. The objective of this project was to design a power wheelchair with a novel control system for quadriplegics with Face Orientations and eye blink. USB camera and eye blink sensor was fixed in front of user's face. Face area was detected based on Ada Boost learning algorithm. Then facial landmarks were detected using Flandmark Detector.

Electric wheelchair control by gaze direction and blinking: Djoko Purwanto, Ronny Mardiyanto, Kohei Arai

We propose an electric wheelchair controlled by gaze direction and eye blinking. A camera is set up in front of a wheelchair user to capture image information. The sequential captured image is interpreted to obtain the gaze direction and eye blinking properties. The gaze direction is expressed by the horizontal angle of the gaze, and this is derived from the triangle formed by the centers of the eyes and the nose. The gaze direction and eye blinking are used to provide direction and timing commands, respectively. The direction command relates to the direction of movement of the electric wheelchair, and the timing command relates to the time when the wheelchair should move

CHAPTER 2

AIM AND SCOPE

2.1 AIM

The main aim of the proposed system is that many elderly and disabled people depend on others in their daily especially in moving from one place to another on a wheelchair. The proposed system aims to make the elderly and disabled people independent to an extent. The system directs the wheelchair through Bluetooth connected to phone

2.1.1 OBJECTIVES

In order to assist physically handicapped persons, we developed a voice controlled wheelchair. The user can control the wheelchair by voice commands, such as “susume (run forward)” in Japanese. A grammar-based recognition parser named “Julian” is used in our system. Three type commands, the basic reaction command, the short moving reaction command, and the verification command, are given. We experimented speech recognition by Julian, and obtained a successful recognition rate 98.3%, 97.0% of the movement command and the verification command, respectively. The running experiment with three persons was carried out in the campus room and the utility of our system is shown.

2.2 SCOPE

This model will help in building the strategies to make the elderly and disabled people more independent which will also be helpful for the society. This model helps us to keep a track on the elderly people's health conditions and monitor them closely.

2.3 EXISTING SYSTEM

Recently, the old person and the physically handicapped person who use a wheelchair are increasing. However, only two type wheelchairs by the hand operating and operating with the help of joystick, have come into wide use. The former type needs muscular strength for the operation and the latter type needs the skill or somebody else with them to move the wheelchair. Therefore, there is a problem that it is difficult for the old and the handicapped person to use these interfaces.

2.3.1 DISADVANTAGES OF EXISTING SYSTEM:

You may require assistance to get around.

They require some strength to use.

They can result in repetitive strain issues, especially in the shoulders.

2.4 PROPOSED SYSTEM

This paper developed a voice controlled wheelchair using Bluetooth. Three type commands, the basic reaction command, the short moving reaction command, and the verification command, are given in our system. Speech recognition used an open-source software Julian. We obtained a successful recognition rate 98.3%, 97.0% of nine reaction commands and five verification commands, respectively. The running experiment with some persons is carried out in the campus corridor and room and the utility of our system is shown. Here we are going to control the wheelchair using the voice commands as well as remote control.

2.4.1 ADVANTAGES OF PROPOSED SYSTEM

Reduced man power

User friendly

Person can become more independent

2.5 SYSTEM REQUIREMENTS

Hardware required:

Arduino Nano

Bluetooth module

Motor driver

Motor

Software required:

Embedded C

Arduino IDE

2.6 ARCHITECTURE DIAGRAM

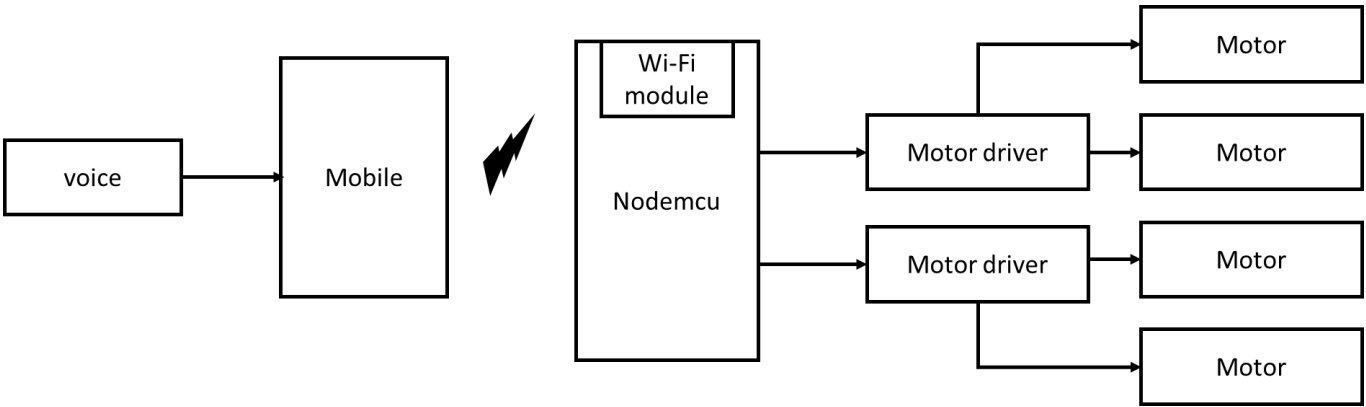


FIG 2.1 ARCHITECTURE DIAGRAM

CHAPTER 3

SYSTEM DESIGN & METHODOLOGY

3.1 DESIGN EMBEDDED SYSTEM

An embedded system is a microprocessor-based computer hardware system with software that is designed to perform a dedicated function, either as an independent system or as a part of a large system. At the core is an integrated circuit designed to carry out computation for real-time operations. In contrast, a general-purpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems have become very important today as they control many of the common devices we use.

Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

Physically, embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems — such as the operating systems and microprocessors which power them — but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected.

Embedded systems provide several functions :

Monitor the environment; embedded systems read data from input sensors. This data is then processed and the results displayed in some format to a user or users. Control the environment; embedded systems generate and transmit commands for actuators.

Transform the information; embedded systems transform the data collected in some meaningful way, such as data compression/decompression. Although interaction with the external world via sensors and actuators is an important aspect of embedded systems, these systems also provide functionality specific to their applications. Embedded systems typically execute applications such as control laws, finite state machines, and signal processing algorithms. These systems must also detect and react to faults in both the internal computing environment as well as the surrounding electro mechanical systems.

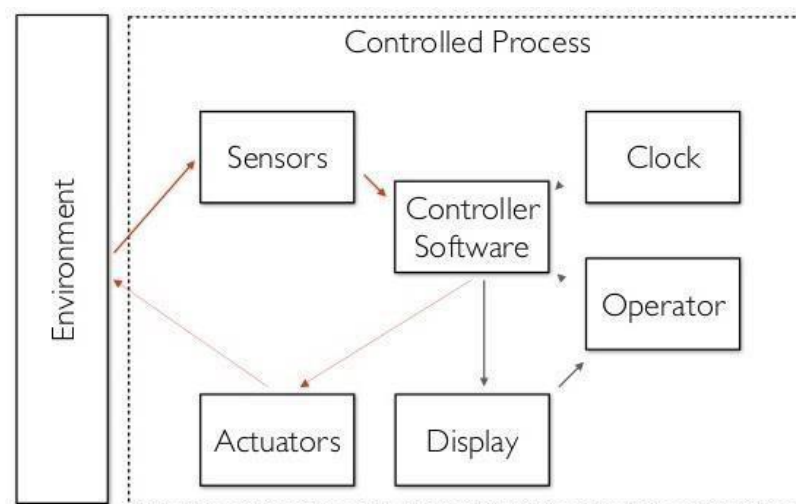


FIG 3.1: PROCESS

3.1.1 Characteristics of embedded systems

Embedded systems are characterized by a unique set of characteristics. Each of these characteristics imposed a specific set of design constraints on embedded systems designers. The challenge to designing embedded systems is to conform to the specific set of constraints for the application.

3.1.2 Application Specific Systems

Embedded systems are not general-purpose computers. Embedded system designs are optimized for a specific application. Many of the job characteristics are known before the hardware is designed. This allows the designer to focus on the specific design constraints of a well-defined application. As such, there is limited user reprogram ability. Some embedded systems, however, require the flexibility of reprogram ability. Programmable DSPs are common for such applications.

Harsh environment:

Many embedded systems do not operate in a controlled environment. Excessive heat is often a problem, especially in applications involving combustion (e.g., many transportation applications). Additional problems can be caused for embedded computing by a need for protection from vibration, shock, lightning, power supply fluctuations, water, corrosion, fire, and general physical abuse.

System safety and reliability:

As embedded system complexity and computing power continue to grow, they are starting to control more and more of the safety aspects of the overall system. These safety measures may be in the form of software as well as hardware control. Mechanical safety backups are normally activated when the computer system loses control in order to safely shut down system operation. Software safety and reliability is a bigger issue. Software doesn't normally "break" in the sense of hardware. However software may be so complex that a set of unexpected circumstances can cause software failures leading to unsafe situations. Discussion of this topic is outside the scope of this book, but the challenges for embedded designers include designing reliable software and building cheap, available systems using unreliable components. The main challenge for embedded system designers is to obtain low- cost reliability with minimal redundancy.

Small and low weight:

Many embedded computers are physically located within some larger system. The form factor for the embedded system may be dictated by aesthetics. For example, the form factor for a missile may have to fit inside the nose of the missile. One of the

challenges for embedded systems designers is to develop non-rectangular geometries for certain solutions. Weight can also be a critical constraint. Embedded automobile control systems, for example, must be light weight for fuel economy. Portable CD players must be light weight for portability purposes.

Cost sensitivity:

Cost is an issue in most systems, but the sensitivity to cost changes can vary dramatically in embedded systems. This is mainly due to the effect of computer costs have on profitability and is more a function of the proportion of cost changes compared to the total system cost.

3.2 POWER MANAGEMENT:

Embedded systems have strict constraints on power. Given the portability requirements of many embedded systems, the need to conserve power is important to maintain battery life as long as possible. Minimization of heat production is another obvious concern for embedded systems. All electronic circuits works only in low DC voltage, so we need a power supply unit to provide the appropriate voltage supply for their proper functioning .This unit consists of transformer, rectifier, filter & regulator. AC voltage of typically 230volts rms is connected to a transformer voltage down to the level to the desired ac voltage. A diode rectifier that provides the full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation . A regulator circuit can use this dc input to provide dc voltage that not only has much less ripple voltage but also remains the same dc value even the dc voltage varies some what, or the load connected to the output dc voltages changes.

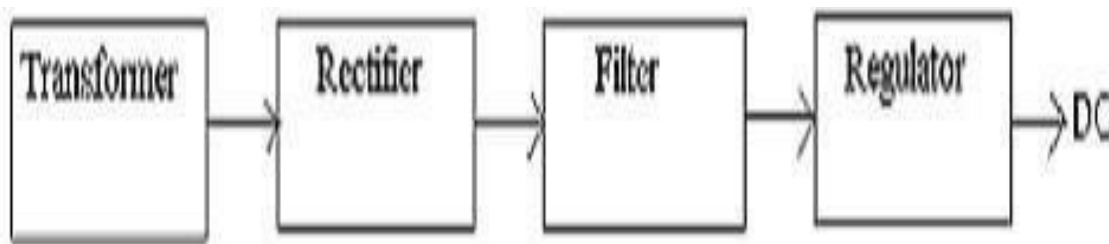


Fig 3.2.General Block Of Power Supply Unit

TRANSFORMER:

A transformer is a static piece of which electric power in one circuit is transformed into electric power of same frequency in another circuit. It can raise or lower the voltage in the circuit, but with a corresponding decrease or increase in current. It works with the principle of mutual induction. In our project we are using a step down transformer to providing a necessary supply for the electronic circuits. Here we step down a 230volts ac into 12volts ac.

RECTIFIER:

A dc level obtained from a sinusoidal input can be improved 100% using a process called full wave rectification. Here in our project for full wave rectification we use bridge rectifier. From the basic bridge configuration we see that two diodes(say D2 & D3) are conducting while the other two diodes (D1 & D4) are in off state during the period $t = 0$ to $T/2$. Accordingly for the negative cycle of the input the conducting diodes are D1 & D4. Thus the polarity across the load is the same. In the bridge rectifier the diodes may be of variable types like 1N4001, 1N4003, 1N4004, 1N4005, 1N4007 etc.... can be used. But here we use 1N4007, because it can withstand up to 1000v.

FILTERS:

In order to obtain a dc voltage of 0 Hz, we have to use a low pass filter. So that a capacitive filter circuit is used where a capacitor is connected at the rectifier output & a dc is obtained across it. The filtered waveform is essentially a dc voltage with negligible ripples & it is ultimately fed to the load.

REGISTERS:

The controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written, but not read by the MPU. When an address code is written to IR, the data is automatically transferred from the DD RAM or CG RAM to the DR. data transfer between the MPU is then completed when the MPU reads the DR. likewise, for the next MPU read of the DR, data in DD RAM or CG RAM at the address is sent to the DR automatically. Similarly, for the MPU write of the DR, the next DD RAM or CG RAM address is selected for the write operation.

REGULATORS:

The output voltage from the capacitor is more filtered & finally regulated. The voltage regulator is a device, which maintains the output voltage constant irrespective of the change in supply variations, load variations & temperature changes. Here we use fixed voltage regulator namely LM7805. The IC LM7805 is a +5v regulator which is used for microcontroller.

3.3 ARDUINO NANO:

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can be communicate with software running on your computer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

The application also smartly remembers your bluetooth module and will always try to connect automatically to the latest one you have used, so you won't have to select it every time you use it.

You can also use the application on your wearable device if you have any.

Metrics tool

This tool was optimized to receive data via the `println ()` function of arduino, which allows special processing of the data received, like in the "Metrics" tool. It allows you to receive only numbers and fix alarms to get notified about the variations of the value received. Once the alarm triggered, a stop button shows up, allowing you to stop it. Besides you can activate the shaking mode, that will allow you to send data simply by shaking your phone.

Arrow keys

This tool provides direction buttons that can fully customized with the data to send, and the sensitivity, which allows to send continuously data to the board by maintaining long press on them.

Terminal

This tool is just a classic terminal that receives and sends data to the board, displayed with the timestamp corresponding to each action.

Buttons and slider

In portrait orientation, this tool provides 6 buttons fully customized, that will allow you to send specific data when pressed. When you rotate your device, a slider view shows up, to which you can set the range of the data to be sent.

Accelerometer

This tool permits you to interpret the gesture commands of your phone, and send the corresponding data to your board, and so , your phone can be the steering wheel of your robot. You can of course set the sensitivity of it through the settings interface.

1. Voice Control

Have you ever dreamed of talking to you robots? well now your dream is becoming true ! With Arduino Bluetooth Control, you can customize your own vocal commands and use them to control all your microcontroller-based boards! If you encounter any problem with the application,or need some specific feature to control you board, we will be pleased to help you out with it. We also provides app customization service if you which to have your own custom Bluetooth control app, tailored to your needs.

CHAPTER 4

SOFTWARE DEVELOPMENT METHODOLOGY

4.1 GENERAL INTRODUCTION OF INTERNET OF THINGS (IOT)

The Future Internet goal is to provide an infrastructure to have an immediate access to information about the physical world and its objects. Physical objects can be applicable to different application domains, such as e-health, warehouse management, etc. Each application domain may have different types of physical devices. Each physical device can have its own specifications, which is required to use in order to interact with it. To achieve the future Internet goal, a layered vision is required that can facilitate data access. Internet of Things (IoT) is a vision that aims to integrate the virtual world of information to the real world of devices through a layered architecture.

The term Internet of Things consists of two words, namely Internet and Things. Internet refers to the global network infrastructure with scalable, configurable capabilities based on interoperable and standard communication protocols. Things are physical objects or devices, or virtual objects, devices or information, which have identities, physical attributes and virtual personalities, and use intelligent interfaces. For instance, a virtual object can represent an abstract unit of sensor nodes that contains metadata to identify and discover its corresponding sensor nodes. Therefore, IoT refers to the things that can provide information from the physical environment through the Internet. Middleware is as an interface between the hardware layer and the application layer, which is responsible for interacting with devices and information management. The role of a middleware is to present a unified programming model to interact with devices. A middleware is in charge of masking the heterogeneity and distribution problems that we face when interacting with devices.

4.1.1 OVERVIEW

Internet of Things (IoT) has increasingly gained attention in industry to interact with different types of devices. IoT can have influence on industry and society by integrating physical devices into information networks. IoT impacts can be on different perspectives, namely for private and business users. From the perspective of a private user, IoT has effect on both working and personal fields, such as smart homes and offices, e-health and assisted living. From the aspect of a business user the impacts would be in fields such as automation and industrial manufacturing, logistics, business process management, intelligent transportation of people and goods.

IoT integrates physical things into information networks. IoT covers the overall infrastructure, including software, hardware and services, which is used to support these information networks. The integrated physical things can exchange data about the physical properties and information that they sense in their environment. To identify devices, we can use identification technologies like for example RFID, which allow each device be uniquely identified.

IoT has a layered architecture designed to answer the demands of various industries, enterprises and society shows a generic layered architecture for IoT that consist of five layers, which are discussed, in the following:

Edge Technology layer :

This is a hardware layer that consists of embedded systems, RFID tags, sensor networks and all of the other sensors in different forms. This hardware layer can perform several functions, such as collecting information from a system or an environment, processing information and supporting communication.

Access Gateway layer :

This layer is concerned with data handling, and is responsible for publishing and subscribing the services that are provided by the Things, message routing, and hovelling the communication between platforms.

Middleware layer :

This layer has some critical functionality, such as aggregating and filtering the received data from the hardware devices, performing information discovery and providing access control to the devices for applications.

Application layer :

This layer is responsible for delivering various application services. These services are provided through the middleware layer to different applications and users in IoT-based systems. The application services can be used in different industries such as, logistics, retail, healthcare, etc.

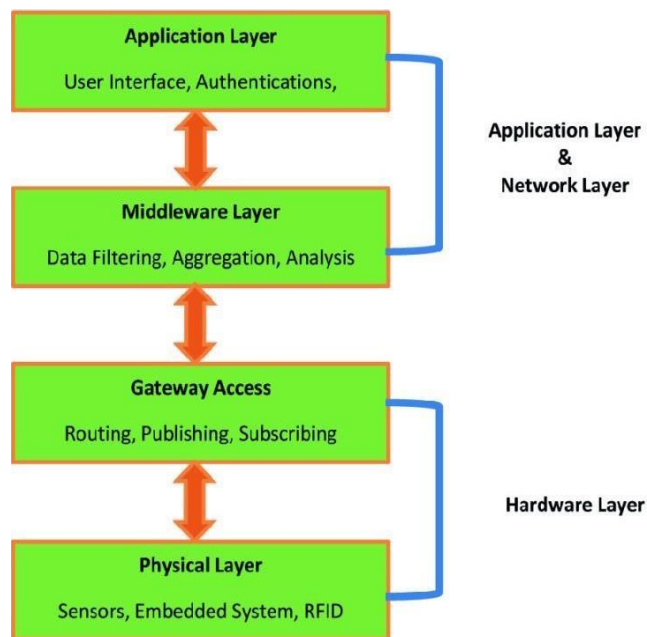


Fig 4.1 Layered architecture of the Internet of Things (IoT)

4.1.2 CHALLENGES:

IoT-based systems can be used for different purposes and areas, so that, we have to face different challenges. In this section, we explain some of the challenges that need to be considered in research activities:

Edge technology:

At the hardware level, more research efforts are required to develop the technology of embedded devices, sensors, actuators and (passive and active) identification, since an IoT-based system must be able to gather sufficient information about the real world by employing a large variety of devices and environments. Thus, there more work is still required to connect heterogeneous devices and deploy them in IoT applications, and to provide support for new devices.

Networking technologies :

In IoT, things are connected through different kinds of networks, i.e. mobile, wired and wireless network. These networks support bi-directional communication at different levels among the real world objects, applications and services that are employed by the IoT applications. This highly distributed structure should provide interconnection with low energy consumption, while distributed data can cause privacy issues.

Middleware system :

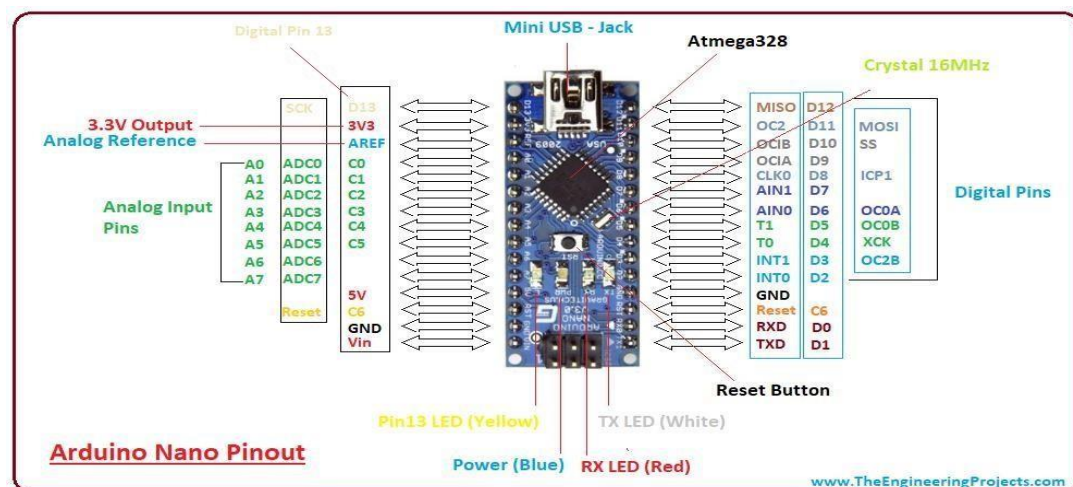
In IoT, we have heterogeneous devices and networks. Their heterogeneity can potentially increase with new technologies. To facilitate the use of these devices by IoT applications, we should shield their heterogeneity. Therefore, we need to develop a secure, scalable and semantically enriched service-oriented middleware to cope with the heterogeneity of devices.

Platform services :

They support a superior management of all involved devices in an integrated way, ensuring scalability, high availability, and the safe and secure execution of the requested functionality from devices.

4.2 INTRODUCTION TO ARDUINO IDE

The Arduino IDE (Integrated Development Environment) is used to write the computer code and upload this code to the physical board. The arduino IDE is very simple and this simplicity is probably one of the main reason arduino became so popular. We can certainly state that being compatible with the arduino IDE is now one of the main requirements for a new microcontroller board. Over the years, many useful features have been added to the arduino IDE and can now be managed by third-party libraries and boards from the IDE, and still keep the simplicity of programming the board. The arduino board is connected to a computer via USB, where it connects with the IDE. The user writes the arduino code in the IDE, and then uploads it to the microcontroller which executes the code, interacting with inputs and outputs sensors, motors and lights.



4.3 DC MOTORS

A DC motor is used to drive a mechanical load. In this lab, a separately excited DC generator provides the load. The load on the motor is adjusted by varying the generator field current. By increasing the field current of the DC generator, the load on the DC motor increases and thus the armature current

increases. In general, DC motors are characterized by their torque-speed curves as shown in Figure 9.1. Since the measuring equipment for shaft torque is not available in the lab it is necessary to use alternative means of characterizing the DC motor. One alternative is to plot shaft speed versus armature current since torque is directly proportional to the armature current ($T \propto I_a$) with a constant field current supplied to the motor. Shaft speed is also a function of the field current in a DC motor while maintaining a constant armature voltage ($E_a \propto \Phi$) as field current is directly proportional to the direct axis flux produced in the machine.

4.3.1 Construction:

Devices are created automatically in Ubidots the first time a dot is received to a user's private TOKEN or an Organizational TOKEN.

Clicking the "+" icon in the top right corner of any single device's screen.

Creating a Device Type which then creates a new device with pre-determined device properties, appearance, and variables and automate the on-boarding of thousands of devices.

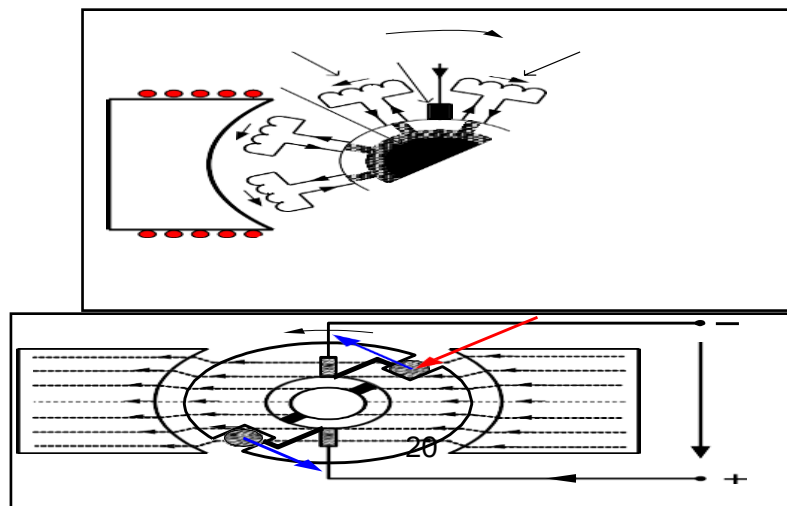
4.3.2 Operation:

The stator of the dc motor has poles, which are excited by dc current to produce magnetic fields. In the neutral zone, in the middle between the poles, commutating poles are placed to reduce sparking of the commutator. The commutating poles are supplied by dc current. Compensating windings are mounted on the main poles. These short-circuited windings damp rotor oscillations. The

poles are mounted on an iron core that provides a closed magnetic circuit. The motor housing supports the iron core, the brushes and the bearings. The rotor has a ring-shaped laminated iron core with slots. Coils with several turns are placed in the slots. The distance between the two legs of the coil is about 180 electric degrees. The coils are connected in series through the commutator segments. The ends of each coil are connected to a commutator segment. The commutator consists of insulated copper segments mounted on an insulated tube. Two brushes are pressed to the commutator to permit current flow. The brushes are placed in the neutral zone, where the magnetic field is close to zero, to reduce arcing. The rotor has a ring-shaped laminated iron core with slots. The commutator consists of insulated copper segments mounted on an insulated tube. Two brushes are pressed to the commutator to permit current flow. The brushes are placed in the neutral zone, where the magnetic field is close to zero, to reduce arcing. The commutator switches the current from one rotor coil to the adjacent coil, the switching requires the interruption of the coil current. The sudden interruption of an inductive current generates high voltages. The high voltage produces flashover and arcing between the commutator segment and the brush.

DC Motor Operation:

In a dc motor, the stator poles are supplied by dc excitation current, which produces a dc magnetic field. The rotor is supplied by dc current through the brushes, commutator and coils. The interaction of the magnetic field and rotor current generates a force that drives the motor. The magnetic field lines enter into the rotor from the north pole (N) and exit toward the south pole (S). The poles generate a magnetic field that is



perpendicular to the current carrying conductors. The interaction^a between the field and the current produces a Lorentz force; the force is perpendicular to both¹ the magnetic field and conductor. The generated force turns the rotor until the coil reaches⁷ the neutral point between the poles. At this point, the magnetic field becomes practically zero together with the force. However, inertia drives the motor beyond the neutral zone where the direction of the magnetic field reverses. To avoid the reversal of the force direction, the commutator changes the current direction, which maintains the counterclockwise rotation. Before reaching the neutral zone, the current enters in segment 1 and exits from segment 2. Therefore, current enters the coil end at slot a and exits from slot b during this stage. After passing the neutral zone, the current enters segment 2 and exits from segment 1, this reverses the current direction through the rotor coil, when the coil passes the neutral zone. The result of this current reversal is the maintenance of the rotation.

4.3.3 Bluetooth Module HC-05:

Introduction

It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.

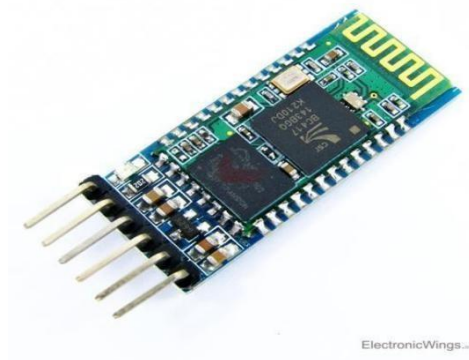
It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.

It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.

It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

HC-05 Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.



4.2 HC-05 Bluetooth Module

Pin Description



Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

It has 6 pins,

Key/EN: It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

Data mode: Exchange of data between devices.

Command mode: It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.

VCC: Connect 5 V or 3.3 V to this Pin.

GND: Ground Pin of module.

TXD: Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)

RXD: Receive data serially (received data will be transmitted wirelessly by Bluetooth module).

State: It tells whether module is connected or not.

red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.

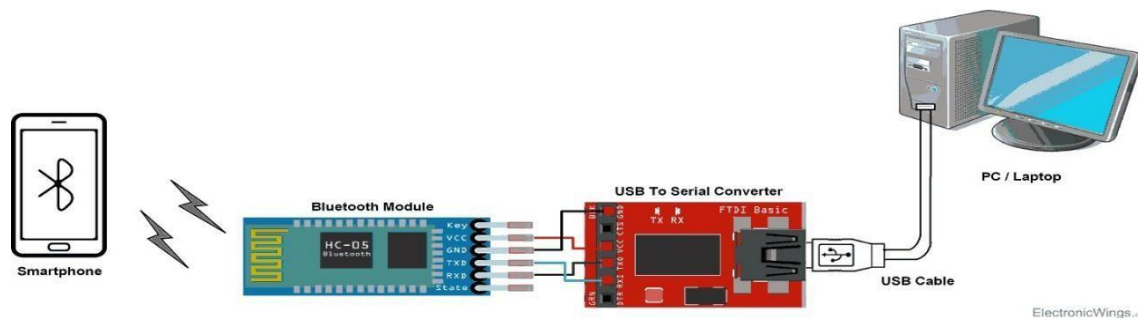
This module works on 3.3 V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator.

As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.

Bluetooth communication between Devices

E.g. Send data from Smartphone terminal to HC-05 Bluetooth module and see this data on PC serial terminal and vice versa.

To communicate smartphone with HC-05 Bluetooth module, smartphone requires Bluetooth terminal application for transmitting and receiving data. You can find Bluetooth terminal applications for android and windows in respective app. store.



4.3 Bluetooth Module Serial Interface

So, when we want to communicate through smartphone with HC-05 Bluetooth module, connect this HC-05 module to the PC via serial to USB converter.

Before establishing communication between two Bluetooth devices, 1st we need to pair HC-05 module to smartphone for communication.

Pair HC-05 and smartphone:

Search for new Bluetooth device from your phone. You will find Bluetooth device with “HC-05” name.

Click on connect/pair device option; default pin for HC-05 is 1234 or 0000.

After pairing two Bluetooth devices, open terminal software (e.g. Teraterm, Realterm etc.) in PC, and select the port where we have connected USB to serial module. Also select default baud rate of 9600 bps.

In smart phone, open Bluetooth terminal application and connect to paired device HC-05.

It is simple to communicate, we just have to type in the Bluetooth terminal application of smartphone. Characters will get sent wirelessly to Bluetooth module HC-05. HC-05 will automatically transmit it serially to the PC, which will appear on terminal. Same way we can send data from PC to smartphone.

Command Mode

When we want to change settings of HC-05 Bluetooth module like change password for connection, baud rate, Bluetooth device's name etc.

To do this, HC-05 has AT commands.

To use HC-05 Bluetooth module in AT command mode, connect "Key" pin to High (VCC).

Command	Description	Response
AT	Checking communication	OK
AT+PSWD=XXXX	Set Password e.g. AT+PSWD=4567	OK
AT+NAME=XXXX	Set Bluetooth Device Name e.g. AT+NAME=MyHC-05	OK
AT+UART=Baud rate, stop bit, parity bit	Change Baud rate e.g. AT+UART=9600,1,0	OK
AT+VERSION?	Respond version no. of Bluetooth module	+Version: XX OK e.g. +Version: 2.0 20130107 OK
AT+ORGL	Send detail of setting done by manufacturer	Parameters: device type, module mode, serial parameter, passkey,etc.

CHAPTER 5

RESULT AND DISCUSSION

5.1 RESULTS

Here we created a mobile controlled wheelchair robot which consists of a 12V battery, are connected with wires.

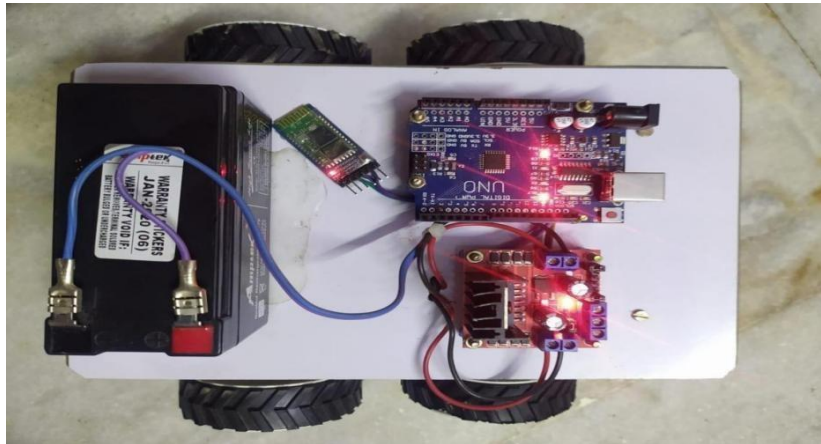


FIG 5.1 WHEELCHAIR

The arduino is controlled by a wifi controlled application which should be downloaded on the person's mobile. When the user gives instruction as forward the wheelchair robot moves forward and same for backward, left, right and stop.

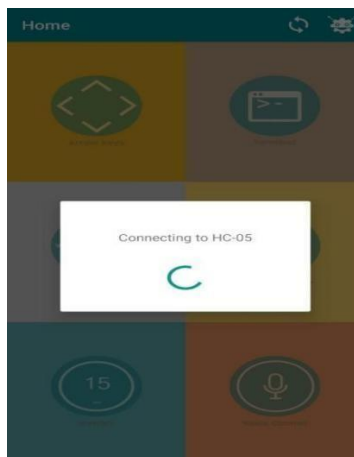


FIG 5.2 APPLICATION

All the targets which we have in the mind can be moved towards, left, right or backwards can be done with this application.. This device will be connected to the Bluetooth and it can be controlled through the phone or mobile and the application should be downloaded in the mobile itself in order to operate the wheelchair according to the wish of the user

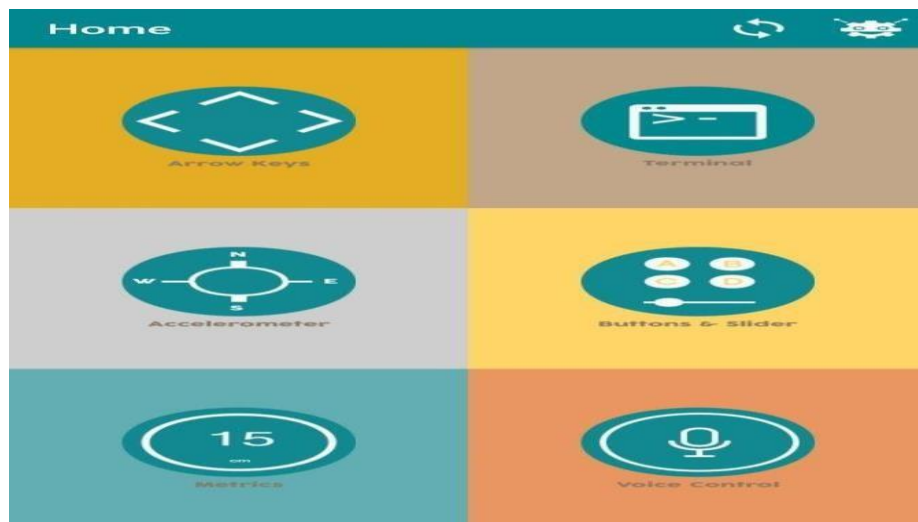


FIG 5.3 DATA IN APPLICATION

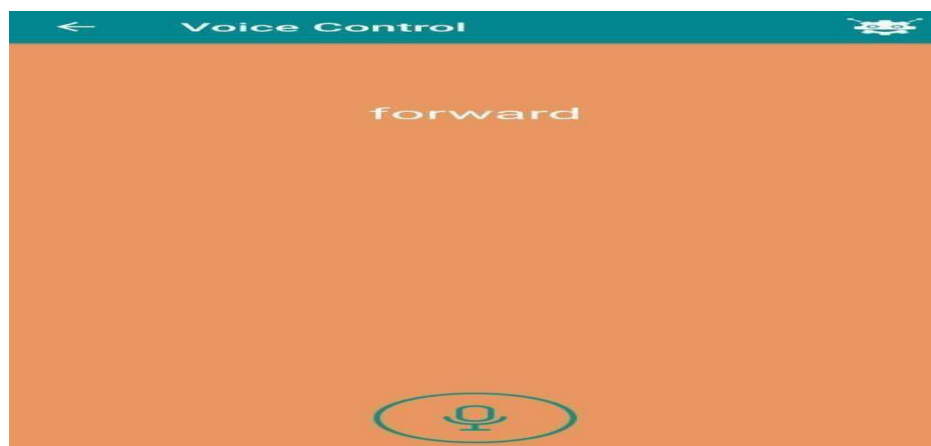


FIG 5.4 VOICE CONTROL

CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 CONCLUSION

The main aim of this project implementation is to help all the people who are dependent on wheelchair for their mobility. Wheelchair is simple to operate and does not need any external help. The objectives of this project have been achieved successfully. This project was able to develop an android system that can control the movement of the wheelchair. The application built can be useful for many android phones. This is an design of android application that can direct the movement of a wheelchair, to develop the movement mode which help the elder lies and physically disabled people to move their wheelchairs independently and to provide the elder lies and physically disabled people with the ability to control the movement of the wheelchairs by using android smart phones. The system designed has undergone a few tests and successfully completed the basic performance. The objectives were achieved as the software and hardware implementation work well as expected. This system will helps the elderlies and physically disabled people to control wheelchairs by themselves; therefore this success is to serve many people with disabilities. From the conducted research, it can be seen clearly that a mobile controlled wheelchair will have a bright future. It should be continued and developed in the future as it has a huge potential to improve its performance, reliability and safety.

6.2 FUTURE WORK

For future work, it is suggested to use a more powerful and lighter weight motor to support various weights of users. This project elaborates the design and construction of Smart Electronic Wheelchair with the help of Bluetooth Module. The wheelchair works properly to move as the command given by the user. After this design the physically disabled to control their wheel using an android application in their smartphones and it also reduces human effort. The detection of any obstacle may be the future scope. As the person switches on it starts moving in all the four directions which also helps the disabled person to do their works independently.

6.3 REFERENCES

1. J. Waleed, A. M. abduldaim, T. M. Hasan, and Q. S. Mohaisin, "Smart Home as a New Trend, a Simplicity Led to Revolution" in 2018 1st International Scientific Conference of Engineering Sciences – 3rd Scientific Conference of Engineering Sciences (ISCES), pp. 30-33.
2. C. Z. Yue, and S. Ping. "Voice Activated Smart Home Design and Implementation" in 2017 2nd International Conference on Frontiers of Sensors Technology, pp. 489-492.
3. H. Basanta, Y. Huang, and T. Lee, "Assistive Design for Elderly Living Ambient using Voice and Gesture Recognition System" in 2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC), Banff Center, Banff, Canada.
4. A. Iqbal, M. Arifin, and A. Hossain, "Smart Home Appliance Control System for Physically Disabled People using Kinect and X10", in 2016 5th International Conference on Informatics, Electronics and Vision (ICIEV), pp. 891-896.
5. D. H. Stafanov, Z. Bien, and W. Bang, "The Smart House for Older Persons and Persons with Physical Disabilities: Structure, Technology Arrangements, and Perspectives. IEEE Transaction on Neural Systems and Rehabilitation Engineering, vol, 12, no. 2, pp. 228-250, June 2004.
6. D. Sunehra, and V. Tejaswi, "Implementation of Speech Based Home Automation System using Bluetooth and GSM" in International Conference on Signal Processing, Communication, Power and Embedded System (SCOPES)-2016, pp. 807-813.

APPENDIX

SOURCE CODE

```
int M11 = 2; int M12 = 3; int M21 = 5; int M22 = 4; String c;
const int trigPin = 11; const int echoPin = 10;
// defines variables long duration;
long distance;

void setup() {
// put your setup code here, to run once: pinMode(M11,OUTPUT); pinMode(M12,OUTPUT);
pinMode(M21,OUTPUT); pinMode(M22,OUTPUT);
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output pinMode(echoPin, INPUT);

Serial.begin(9600);
}

void loop() {
int temp = analogRead(A1); int smoke = analogRead(A0); pinMode(trigPin, OUTPUT);
digitalWrite(trigPin, LOW); delayMicroseconds(2); digitalWrite(trigPin, HIGH);
delayMicroseconds(10); digitalWrite(trigPin, LOW); pinMode(echoPin, INPUT);
duration = pulseIn(echoPin, HIGH); distance = (duration/2) / 29.1;
Serial.print("Distance : ");
```

```

Serial.print(distance); Serial.print("cm"); Serial.println(); Serial.print("Temperature : ");
Serial.print(map(temp,0,1023,100,0) + 25); Serial.println();
Serial.print("Smoke : "); Serial.print(map(smoke,0,1023,0,100)); Serial.println();
delay(1000);
if (Serial.available() > 0)
{
c = Serial.readString(); Serial.println(c);

if (c == "1")
{
digitalWrite(M11,HIGH); digitalWrite(M12,LOW);

digitalWrite(M21,HIGH); digitalWrite(M22,LOW); Serial.println("forward");
}
else if (c == "2 ")
{
digitalWrite(M11,LOW); digitalWrite(M12,HIGH);

digitalWrite(M21,HIGH); digitalWrite(M22,LOW); Serial.println("left");
}
else if (c == "3")
{
digitalWrite(M11,HIGH); digitalWrite(M12,LOW);

digitalWrite(M21,LOW); digitalWrite(M22,HIGH); Serial.println("left");
}
}

```

```

}
else if (c == "4")
{
digitalWrite(M11,LOW); digitalWrite(M12,HIGH);

digitalWrite(M21,LOW); digitalWrite(M22,HIGH); Serial.println("backward");
}
else if (c == "5")
{
digitalWrite(M11,LOW); digitalWrite(M12,LOW);

digitalWrite(M21,LOW); digitalWrite(M22,LOW); Serial.println("stop");
}
}
if (distance < 25)
{
digitalWrite(M11,LOW); digitalWrite(M12,LOW);

digitalWrite(M21,LOW);    digitalWrite(M22,LOW);    Serial.println("stop");    delay(1000);
digitalWrite(M11,LOW); digitalWrite(M12,HIGH);

digitalWrite(M21,LOW);    digitalWrite(M22,HIGH);    Serial.println("reverse");    delay(2000);
digitalWrite(M11,LOW); digitalWrite(M12,LOW);

digitalWrite(M21,LOW); digitalWrite(M22,LOW);

```

```
Serial.println("stop");  
}  
  
}
```