PROJECT REPORT FOR BACHELOR OF TECHNOLOGY IN ELECTRONICS & COMMUNICATION ENGINEERING

Prepared By-

Mr. Arjun Srivastava (1802931041)
Mr. Ayush Bhardwaj (1802931050)
Mr. Dhanesh Shukla (1802931056)
Ms. Sakshmika Agrawal (1802931133)

Department Of Electronics & Communication Engineering
KIET GROUP OF INSTITUTIONS, GHAZIABAD, UP, INDIA

KIET Group of Institutions, Ghaziabad

Electronics and Communication Engineering

REPORT

ON

B. TECH FOURTH YEAR PROJECT

Project Title: - Smart Gloves Based Wheelchair

Team Members:

i) Arjun Srivastava (1802931041)

ii) Ayush Bhardwaj (1802931050)

iii) Dhanesh Shukla (1802931056)

iv) Sakshmika Agarwal (1802931133)

Project Guide: - Dr. Shubham Shukla

Certificate

Certified that **Arjun Srivastava, Ayush Bhardwaj, Dhanesh Shukla and Sakshmika Agrawal** has carried out the project work presented in this project report entitled **"Smart Gloves Based Wheelchair"** for the award of **Bachelor of Technology** in **Electronics & Communication Engineering** from **KIET GROUP OF INSTITUTIONS, Ghaziabad (Dr. A P J Abdul Kalam Technical University, Lucknow)** under my supervision. The project report embodies result of original work and studies carried out by Student himself and the contents of the report do not form the basis for the award of any other degree to the candidate or to anybody else.

(Dr. Shubham Shukla)
Designation: Assist. Professor

Dr. Vaibhav Sachan
HOD (ECE)

Date:

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Arjun Srivastava (1802931041)

Ayush Bhardwaj(1802931050)

Dhanesh Shukla (1802931056)

Sakshmika Agarwal (1802931133)

(B.Tech VIII SEM)

Department of Electronics & Communication Engineering

KIET GROUP OF INSTITUTIONS GHAZIABAD

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1. INTRODUCTION

1.1 DESCRIPTION IN BRIEF

Physically disabled people frequently find it difficult to navigate through their homes without the support of others. However, navigating through one's own home without the assistance of anyone might be discouraging. In the lives of disabled and elderly people, wheelchairs are a way of summoning the purpose 1f life. Here are several effective and efficient ways of offeringa cost-effective and economical wheelchair to the general public that is not only up to date with current technology, but also much easier to use. With advancement in technology in today’s world, there should be assistive technology for old and disabled people to help them in daily life activities like traveling etc. There is assistive robotic technology which is progressing daily to improve the mobility of people. Several challenges are also there to make this technology to be used truly by humans. There are different types of wheelchairs including basic, lightweight, folding, multi-function, powered, fully/partially autonomous etc. and there are many types of control design to manipulate the functionality of the wheelchair, from basic drive to fully controlled wheelchair using Brain-controlled interface. As the powered wheelchair frequently reports accidents, therefore our focus is on how to reduce those accidents with the use of IoT, Robotic technology with sensor-based detection and tracking using smart wheelchair.

Our project “IoT based smart gloves wheelchair” has been proposed for the handicapped and old people, who have less movement in their fingers. It is automatic and reduces human’s effort to control the wheel chair. It prevents collision automatically and also helps in enabling the virtual monitoring of the person sitting on the wheel chair which will help in notify the guardian about the person’s health. It will also help in tracking the live location of the wheelchair of the person’s guardian or caretaker. In case of any accident, an emergency message will be sent to the person's caretaker with a live location. So, it is an Autonomous smart wheelchair which is controlled by the human user interface. Furthermore, it also provides an opportunity for physically impaired persons to move from one place to another.

1.1.1 Objectives and Proposed Approach

Traditionally, there are wheelchairs which need human support for movement. These wheelchairs require-

- Full hand movement
- Extra force
- No regular monitoring
- No automatic collision avoidance system

Our objective is to solve the above issues that the disabled people or aged people face. To fulfil the objective, the framework involves-

- A collision avoiding system - to control the wheelchair without the interference of the person using it, helping them to reduce their efforts and be safe.

- Reducing human effort- automatic processing & controlling of the wheelchair mechanically controlled device can be designed in a manner to have self- mobility with the help of user command. This reduces human effort to drive the wheels of the wheelchair. This also aims to build a wheelchair which would have a sort of intelligence and hence helps the user in the movement.

- Virtual monitoring System- GPS/GSM enabling live location tracking of the person, virtual monitoring of health of the patient and informing the caretaker in emergency conditions, message alert to the person in charge or the doctor.

- In case of any Accident- The force sensor on the wheel chair will impact the force on the wheel chair and will help in triggering the GPS/GSM system which will inform the caretaker with a message that will include the location tracking.

1.1.2 Working Methodology

Our wheelchair will be controlled by the people who have less movements in their fingers as it will be controlled by touch sensors embedded on gloves with the help of wireless communication to control the chair means wheelchair movements will be control by touching the touch sensors on which different moments has been defined like forward, stop, backward, left and right. It has quick response during the accident with obstacle detection system and also have special features of GPS and GSM enabled with the force sensor to sense the force in case of any accident and help the person's caretaker to inform about the live location tracking and also helps in keeping the track of the health of the person sitting on wheelchair in case of any emergency.

1.2. LITERATURE SURVEY

Many disabled people in today's environment find it difficult to walk or carry out daily chores. This group of people is primarily reliant on the help of others. With the support of assistive gadgets, they can become self-sufficient and conduct some everyday activities on their own. Wheelchairs are the most commonly used assistive equipment. Wheelchairs are simply chairing with wheels that can assist those who are unable to walk due to disease, disability, or injury. The user sits in a wheelchair, which is an automotive control equipment. Manually or by various automated processes, the item is propelled. People with walking disabilities frequently require the use of a wheel chair. However, many disabled people with weak limbs and joints are unable to move around in their wheelchair. As a result, Smart Wheelchair can be extremely beneficial to them as well as the rest of society. Smart Wheelchairs are electric-powered wheelchairs with a variety of supplementary features, such as a computer and sensors, that assist the user or caregiver in navigating the wheelchair easily and efficiently. Recent advancements in the fields of artificial intelligence, sensor technology, and robotics have aided the creation of novel wheelchair functions.

According to research papers which have been reviewed, there are numerous approaches to develop a quality wheelchair. Voice-activated wheelchairs, tongue- activated wheelchairs, joystick-activated wheelchairs, and gesture-activated wheelchairs have all been developed. There was a wheelchair that could be operated from a mobile device. All of these wheelchairs have the same goal in mind: to be as simple to use as possible while avoiding crashes. The study and analysis of motorized wheelchairs has a long history, with different scientists and researchers evaluating various ways that have been presented for vastly enhancing their quality of life. The developed systems are far more advanced than the previous traditional systems in terms of completely replacing them. For onboard processing, many self-driving wheelchair platforms use a laptop computer. Using merely a single laptop computer, on the other hand, can severely limit a smart wheelchair's real-time processing capabilities. Cloud computing could be used as an option to offload real-time data processing from smart wheelchair hardware.

This proposed wheelchair is different from them in many aspects like special glove has been designed on which touch sensors are placed to control the movement of wheel chair by touching and we have GPS and GSM based tracking system connected with force sensor which will help in detecting the impact of force in case of any accident and send message to person's relative in case of emergency.

1.3 EMBEDDED SYSTEM

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market.

It is a small or large non-computer device with integrated software based on microcontrollers and microprocessors for performing a dedicated function or a limited set of functions. It may or may not have a screen and a keyboard, be either programmable or non-programmable, perform a single function in isolation, or work as a part of a large system.

An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc. Lower end embedded systems - Generally 8,16 Bit Controllers used with a minimal operating systems and hardware layout designed for the specific purpose. Examples Small controllers and devices in our everyday life like Washing Machine.

1.3.1. EMBEDDED SYSTEM DESIGN CYCLE

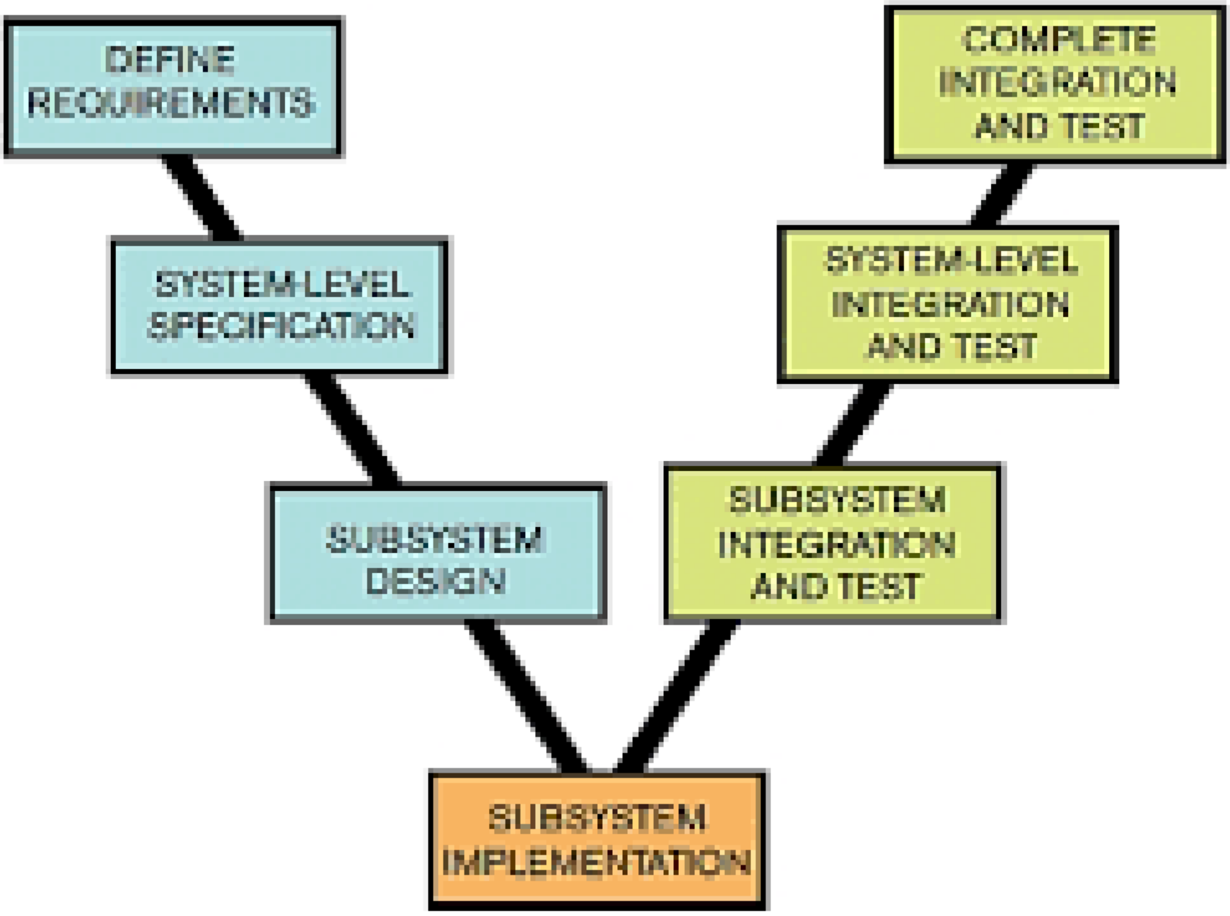


Figure 1: Embedded System Design Cycle

1.3.2. SYSTEM DESIGN CALLS

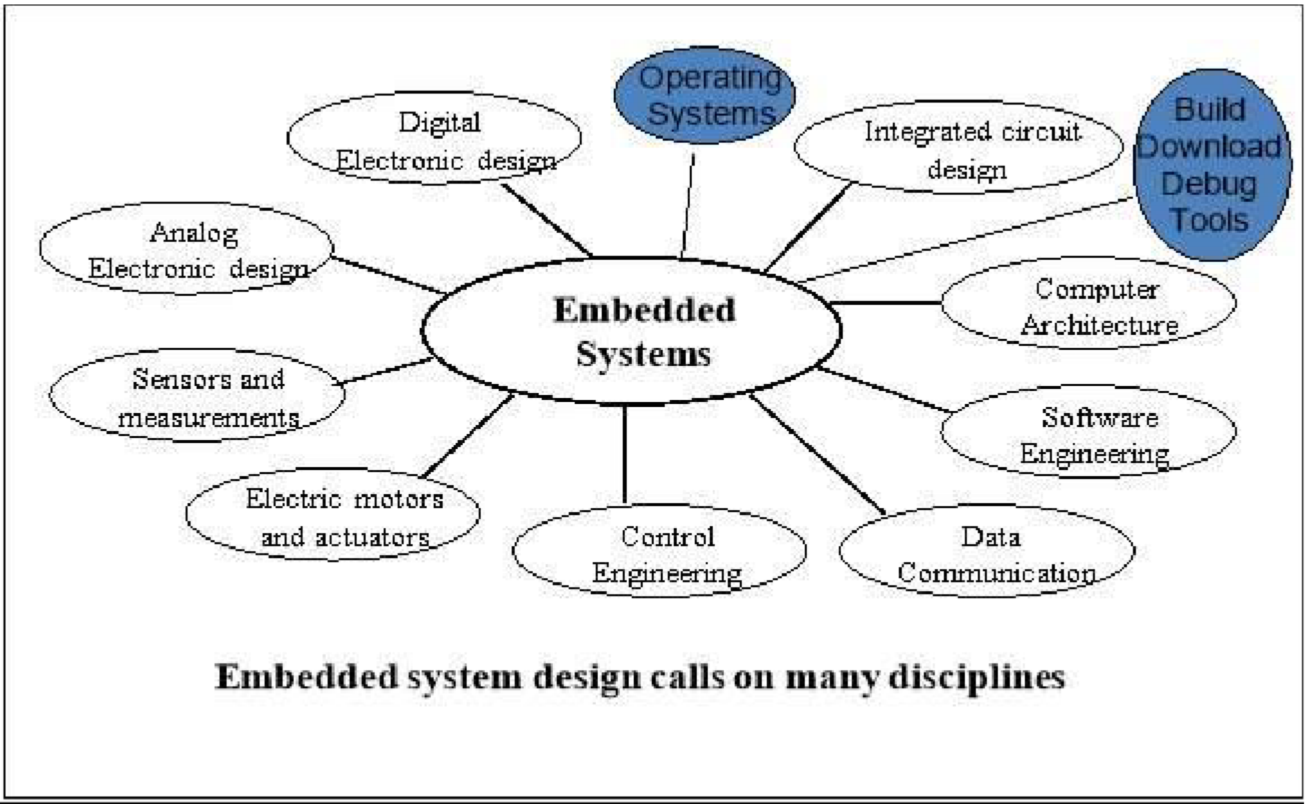


Figure 2: Embedded System design Calls

1.3.3 CHARACTERISTICS OF EMBEDDED SYSTEM

1. An embedded system is any computer system hidden inside a product other than a computer.

2. They will encounter several difficulties when writing embedded system software in addition to those we encounter when we write applications.

i. Throughput — Our system may need to handle a lot of data in a short period of time.

ii. Response—Our system may need to react to events quickly

iii. Testability—Setting up equipment to test embedded software can be difficult.

iv. Debuggability—Without a screen or a keyboard, finding out what the software is doing wrong (other than not working) is a troublesome problem.

v. Reliability — embedded systems must be able to handle any situation without human intervention.

vi. Memory space — Memory is limited on embedded systems, and you must make the software and the data fit into whatever memory exists.

vii. Program installation — you will need special tools to get your software into embedded systems.

viii. Power consumption — Portable systems must run on battery power, and the software in these systems must conserve power.

ix. Processor hogs — computing that requires large amounts of CPU time can complicate the response problem.

x. Cost — Reducing the cost of the hardware is a concern in many embedded system projects; software often operates on hardware that is barely adequate for the job.

Embedded systems have a microprocessor/ microcontroller and a memory. Some have a serial port or a network connection. They usually do not have keyboards, screens or disk drives.

1.3.4 APPLICATIONS

1) Military and aerospace embedded software applications

2) Communication Applications

3) Industrial automation and process control software

4) Mastering the complexity of applications.

5) Reduction of product design time.

6) Real time processing of ever-increasing amounts of data.

7) Intelligent, autonomous sensors

1.3.5 CLASSIFICATION

• Real Time Systems.

• RTS is one which must respond to events within a specified deadline.

• A right answer after the dead line is a wrong answer.

➢ RTS CLASSIFICATION

• Hard Real Time Systems

• Soft Real Time System

➢ HARD REAL TIME SYSTEM

• "Hard" real-time systems have very narrow response time

• Example: Nuclear power system, Cardiac pacemaker.

➢ SOFT REAL TIME SYSTEM

• "Soft" real-time systems have reduced constrains on "lateness" but still must operate very quickly and repeatable.

• Example: Railway reservation system — takes a few extra seconds the data remains valid.

CHAPTER 2: HARDWARE DESCRIPTION

In this chapter we will discuss in brief about the hardware components used in the project. All the components are described in a concise manner so that a brief idea can be built about the hardware used in the project.

2.1 Capacitive Touch Sensor –

Figure 3: Capacitive Touch Sensor

Capacitive Touch Switch allows you to remove the worry of conventional push-type keys. Normally, it outputs low and keeps at low power state. When a touch is sensed on the circular marked region, it outputs high and switches to the quick response state. When not being touched, it switches to low power state again. Capacitive sensing technology works by measuring the change in capacitance (the ability of a system to store an electric charge) within its projected field due to the presence of a conductive object. That object is typically a human finger, but it could be any conductive object that has a dielectric different than air. Capacitive sensing is based on this property. This means that when a pointer (finger or stylus) approaches two metal plates, the mutual capacitance between the plates decreases, as the finger "steals" some electric field lines. On the other hand, the self-capacitance of both conductors increases, since in this case the pointer acts as an additional conductor of the system. These changes in capacitance may define a touch event, depending on the operation principle of the sensor, that is, mutual- or self-capacitive.

Capacitive sensors are driven by ICs (Integrated Circuits), so they must be connected to them through conductive paths, called "traces", "tracking" or "routing". Traces are relatively thin lines with a certain width and are usually placed close to each other due to space limitations. Consequently, there is a considerable coupling between two adjacent traces, causing an additional mutual capacitance that must be considered together with the one that exists between the electrodes. This mutual capacitance becomes higher for longer traces and when they are coming closer to each other; this effect can be explained by considering once more the case of parallel plates.

2.2 Bluetooth Module HC-05 –

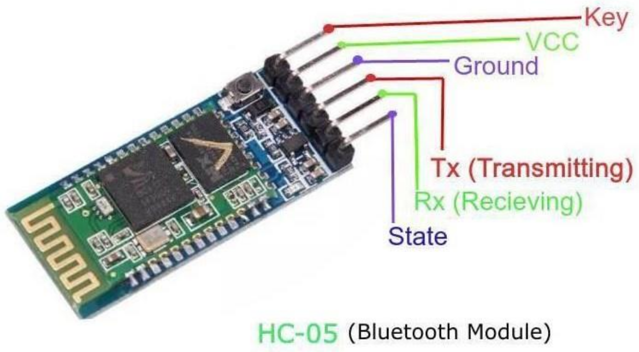


Figure 4: Bluetooth HC05 Module

Wireless communication is swiftly replacing the wired connection when it comes to electronics and communication. Designed to replace cable connections HC-05 uses serial communication to communicate with the electronics. Usually, it is used to connect small devices like mobile phones using a short-range wireless connection to exchange files. It uses the 2.45GHz frequency band. The transfer rate of the data can vary up to 1Mbps and is in range of 10 meters. The HC-05 module can be operated within 4-6V of power supply. It supports baud rate of 9600, 19200, 38400, 57600, etc. Most importantly it can be operated in Master-Slave mode which means it will neither send or receive data from external source.

Modes of Operation

The HC-05 Bluetooth Module can be used in two modes of operation: Command Mode and Data Mode.

2.2.1 Command Mode

In Command Mode, you can communicate with the Bluetooth module through AT Commands for configuring various settings and parameters of the Module like get the firmware information, changing Baud Rate, changing module name, it can be used to set it as master or slave.

A point about HC-05 Module is that it can be configured as Master or Slave in a communication pair. In order to select either of the modes, you need to activate the Command Mode and sent appropriate AT Commands.

2.2.2 Data Mode

Coming to the Data Mode, in this mode, the module is used for communicating with other Bluetooth device i.e. data transfer happens in this mode.

2.3 Ultrasonic Sensor –

Figure 5: Ultrasonic Sensor

Ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. An optical sensor has a transmitter and receiver, whereas an ultrasonic sensor uses a single ultrasonic element for both emission and reception. In a reflective model ultrasonic sensor, a single oscillator emits and receives ultrasonic waves alternately. This enables miniaturization of the sensor head. Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Ultrasonic sensors transmit sound waves toward a target and will determine its distance by measuring the time it took for the reflected waves to return to the receiver.

This sensor is an electronic device that will measure the distance of a target by transmitting ultrasonic sound waves, and then will convert the reflected sound into an electrical signal. In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is $D = \frac{1}{2} T \times C$ (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second).

$$D = 0.5 \times 0.025 \times 343$$

2.4 ESP32 Module-

Figure 6: ESP32 Module

ESP32 is a low-cost System on Chip (SoC) Microcontroller from Espressif Systems, the developers of the famous ESP8266 SoC. It is a successor to ESP8266 SoC and comes in both single-core and dual-core variations of the Tensilica's 32-bit Xtensa LX6 Microprocessor with integrated Wi-Fi and Bluetooth. The good thing about ESP32, like ESP8266 is its integrated RF

components like Power Amplifier, Low-Noise Receive Amplifier, Antenna Switch, Filters and RF Balun. It is used for transmitting data serially. Engineered for mobile devices, wearable electronics and IoT applications, ESP32 achieves ultra-low power consumption with a combination of several types of proprietary software. ESP32 also includes state-of-the-art features, such as fine-grained clock gating, various power modes and dynamic power scaling. ESP32 can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor. ESP32 can interface with other systems to provide Wi-Fi and Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces. ESP32 is highly-integrated with in-built antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules. ESP32 adds priceless functionality and versatility to your applications with minimal Printed Circuit Board (PCB) requirements. All ESP32 Series of modules have a wide operating temperature range of -40°C to 105°C, and are suitable for commercial application development with a robust 4-layer design.

2.5. <u>Force Sensor-</u>

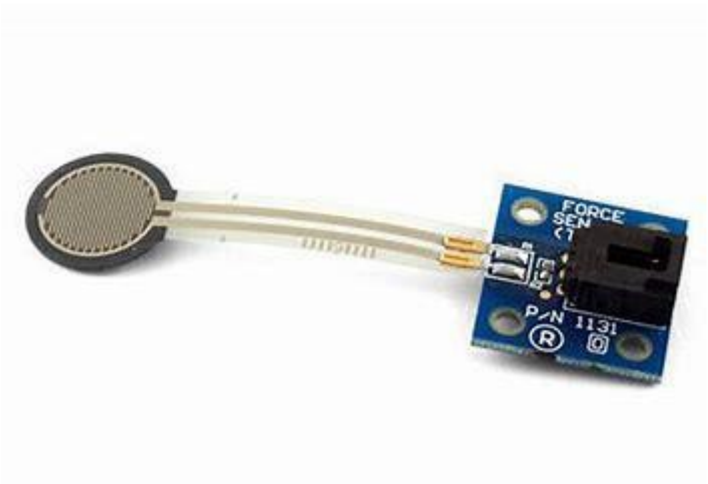


Figure 7: Force Sensor

A Force Sensor is a sensor that helps in measuring the amount of force applied to an object. By observing the amount of change in the resistance values of force- sensing resistors, the applied force can be calculated. The general working principle of Force Sensors is that they respond to the applied force and convert the value into a measurable quantity. There are various types of Force Sensors available in the market based on various sensing elements. Most of the Force Sensors are designed using Force-Sensing Resistors. These sensors consist of a sensing film and electrodes. By definition, force sensor is a type of transducer, specifically a force transducer. It converts an input mechanical force such as load, weight, tension, compression or pressure into another physical variable, in this case, into an electrical output signal that can be measured, converted and standardized. As the force applied to the force sensor increases, the electrical signal changes proportionally. Force Transducers became an essential element in many industries from Automotive, High precision manufacturing, Aerospace & Defense, Industrial Automation, Medical & Pharmaceuticals and Robotics where reliable and high precision measurement is paramount. Most recently, with the advancements in Collaborative Robots (Cobots) and Surgical Robotics, many novel force measurement applications are emerging. Structurally, a force sensor load cell is made of a metal body (also called flexure) to which foil strain gauges are bonded. The sensor body is usually made of aluminum or stainless steel, which gives the sensor two important characteristics: (1) provides the sturdiness to withstand high loads and (2) has the elasticity to minimally deform and return to its original shape when the force is removed.

2.6. GSM Module SIM800-

Figure 8: GSM Module

A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system. These modules consist of a GSM module or GPRS modem powered by a power supply circuit and communication interfaces (like RS-232, USB 2.0, and others) for computer. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection. SIM800 is a quad-band GSM/GPRS module. SIM800 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications. **SIM800L** is a miniature cellular **module** which allows for GPRS transmission, sending and receiving SMS and making and receiving voice call. This module have two antennas included. First is made of wire (which solders directly to NET pin on PCB) - very useful in narrow places. Second - PCB antenna - with double sided tape and attached pigtail cable with IPX connector. This one has better performance and allows to put your module inside a metal case - as long the antenna is outside. SIM800L GSM/GPRS module is a miniature GSM modem, which can be integrated into a great number of IoT projects. We can use this module to accomplish almost anything a normal cell phone can; SMS text messages, Make or receive phone calls, connecting to internet through GPRS, TCP/IP, and more! To top it off, the module supports quad-band GSM/GPRS network, meaning it works pretty much anywhere in the world.

2.7 GPS Module

Figure 9: GPS Module

GPS stands for Global Positioning System by which anyone can obtain the current position information by living anywhere in the world accordingly. GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. The GPS module for Arduino is a small electronic circuit that allows to connect to your Arduino board to get position and altitude, as well as speed, date and time on UTC (Universal Time Coordinated). It uses the standard NMEA protocol to transmit the position data via serial port. The Global Positioning System (GPS) is a satellite-based navigation system that provides location and time information. The system is freely accessible to anyone with a GPS receiver and unobstructed line of sight to at least four of GPS satellites. A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites. GPS is nowadays widely used and also has become an integral part of smart phones. The GTPA010 module is easy to use, having RS232 as well as USB interface. It operates over 3.2 to 5V supply range thus enabling interfacing with microcontrollers with 3.3V as well as 5V.

2.8 DC Geared Motor –

Figure 10: DC Geared Motor

DC Gear Motor (also known as DC Geared Motor or Speed Reduction Motor) is the combination of DC motor and gearbox. It adopts direct current power. In most cases, the addition of a gearbox is intended to limit the speed of the motor's shaft, and increase the motor's ability to output torque. Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified here. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM.The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction.

2.9 Arduino Uno R3

Figure 11: Arduino Uno R3

Arduino is a physical computing platform with open code, based on a board with a simple microcontroller and a development environment to create software (programs) for the board. You can use Arduino to create interactive objects, reading data from a great variety of switches and sensors, and control different kind of lights, motors and other types of physical actuators. Arduino projects can be autonomous, or they can communicate with other software running on a computer. The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features an ATmega16U2 programmed as a USB-to-serial converter. This auxiliary microcontroller has its own USB bootloader, which allows advanced users to reprogram it.

2.10 L293D Motor Driver Module

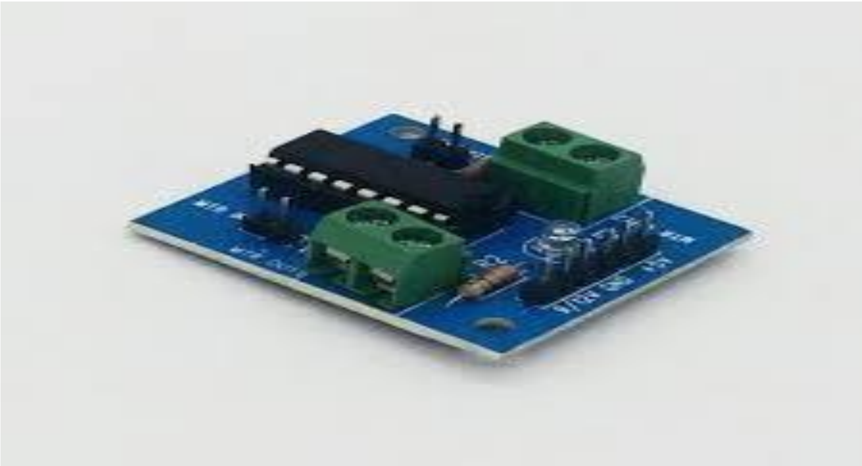


Figure 12: L293D Driver Motor

The Motor Driver is a module for motors that allows you to control the working speed and direction of two motors simultaneously. This Motor Driver is designed and developed based on L293D IC. L293D is a 16 Pin Motor Driver IC. This is designed to provide bidirectional drive currents at voltages from 5 V to 36 V. Using this L293D motor driver IC is very simple. The IC works on the principle of Half H-Bridge, let us not go too deep into what H-Bridge means, but for now just know that H bridge is a set-up which is used to run motors both in clock wise and anti-clockwise direction. he L293D is a 16 pin IC, with eight pins, on each side, dedicated to the controlling of a motor. There are 2 INPUT pins, 2 OUTPUT pins and 1 ENABLE pin for each motor. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor.

CHAPTER 3: MICROCONTROLLER

3.1 INTRODUCTION

A microcontroller or MCU (microcontroller unit) is a small computer on a single integrated circuit. In modern terminology, it is a system on a chip or SoC. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general-purpose applications consisting of various discrete chips.

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems.

Some microcontrollers may use four-bit words and operate at frequencies as low as 4 kHz, for low power consumption (single-digit Mill watts or microwatts). They generally can retain functionality while waiting for an event such as a button press.

other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just Nanowatts, making many of them well suited for long lasting battery applications. Other microcontrollers may serve performance-critical roles, where they may need to act more like a digital signal processor (DSP), with higher clock speeds and power consumption.

3.1.1 The Elements of a Microcontroller

A microcontroller consists of a central processing unit (CPU), nonvolatile memory, volatile memory, peripherals, and support circuitry.

3.1.1.1 The Central Processing Unit

The CPU performs arithmetic operations, manages data flow, and generates control signals in accordance with the sequence of instructions created by the programmer. The extremely complex circuitry required for CPU functionality is not visible to the designer. In fact, thanks to integrated development environments and high-level languages such as C, writing code for microcontrollers is often a straightforward task.

3.1.1.2 Memory

Nonvolatile memory is used to store the microcontroller's program—i.e., the (oftenvery long) list of machine-language instructions that tell the CPU exactly what to do. You will typically see the word "Flash" (which refers to a specific form of nonvolatile data storage) instead of "nonvolatile memory.

Volatile memory (i.e., RAM) is used for temporary data storage. This data is lost when the microcontroller loses power. Internal registers also provide temporary data storage, but we don’t think of these as a separate functional block because they are integrated into the CPU.

3.1.1.3 Support Circuitry

Microcontrollers incorporate a variety of functional blocks that cannot be classified as peripherals because their primary purpose is not to control, monitor, or communicate with external components. They are, nonetheless, very important—they support the internal operation of the device, simplify implementation, and improve the development process.

3.1.1.4 Peripherals

We use the word “peripheral” to describe the hardware modules that help a microcontroller to interact with the external system.

3.2 ARDUINO UNO R3 MICROCONTROLLER

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable and give the supply using AC-DC adapter or a battery to get started. The term Uno means “one” in the language of “Italian” and was selected for marking the release of Arduino’s IDE 1.0 software. The R3 Arduino Uno is the 3rd as well as most recent modification of the Arduino Uno. Arduino board and IDE software are the reference versions of Arduino and currently progressed to new releases. The Uno-board is the primary in a sequence of USB-Arduino boards, & the reference model designed for the Arduino platform. It is a physical computing platform with open code, based on a board with a simple microcontroller and a development environment to create software (programs) for the board. You can use Arduino to create interactive objects, reading data from a great variety of switches and sensors, and control different kind of lights, motors and other types of physical actuators.

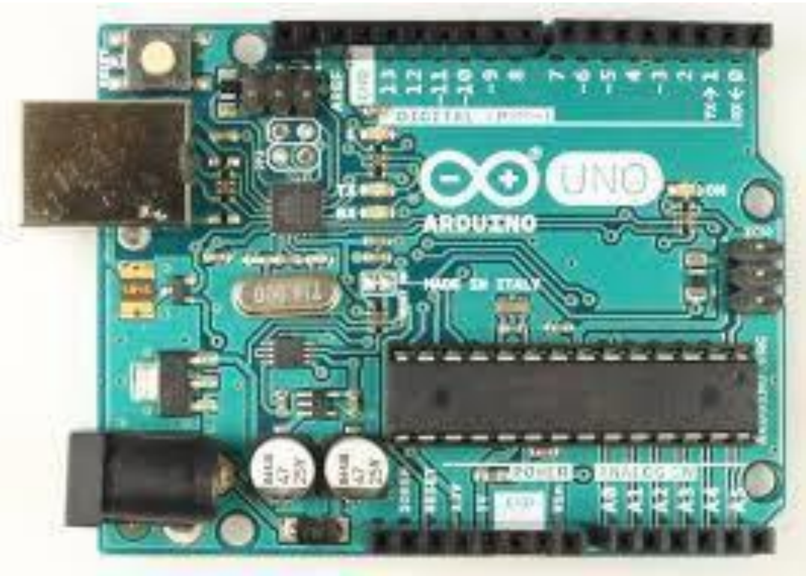


Figure 13: Arduino Microcontroller

3.2.1 Arduino Uno R3 Specifications

The Arduino Uno R3 board includes the following specifications-

- It is an ATmega328P based Microcontroller
- The Operating Voltage of the Arduino is 5V
- The recommended input voltage ranges from 7V to 12V

- The i/p voltage (limit) is 6V to 20V
- Digital input and output pins-14
- Digital input & output pins (PWM)-6
- Analog i/p pins are 6
- DC Current for each I/O Pin is 20 mA
- DC Current used for 3.3V Pin is 50 mA
- Flash Memory -32 KB, and 0.5 KB memory is used by the boot loader
- SRAM is 2 KB
- EEPROM is 1 KB
- The speed of the CLK is 16 MHz
- In Built LED
- Length and width of the Arduino are 68.6 mm X 53.4 mm
- The weight of the Arduino board is 25 g

3.2.2 Arduino Uno R3 Block Diagram

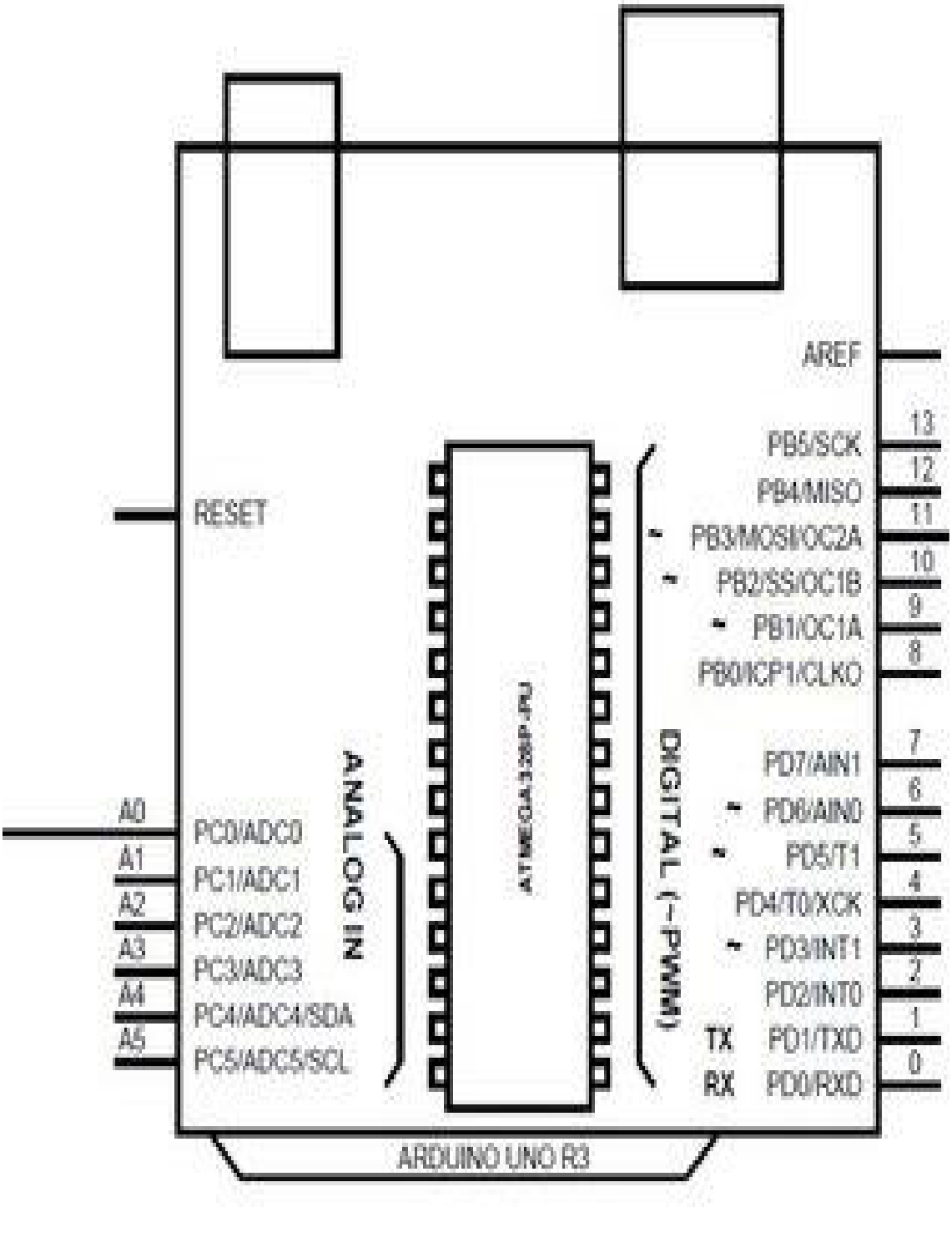


Figure 14: Arduino Uno R3 Block Diagram

3.3 ARDUINO UNO R3 PIN SPECIFICATIONS

The Arduino Uno R3 pin diagram is shown below. It comprises 14-digit I/O pins. From these pins, 6-pins can be utilized like PWM outputs. This board includes 14 digital input/output pins, Analog inputs-6, a USB connection, quartz crystal-16 MHz, a power jack, a USB connection, resonator-16Mhz, a power jack, an ICSP header an RST button.

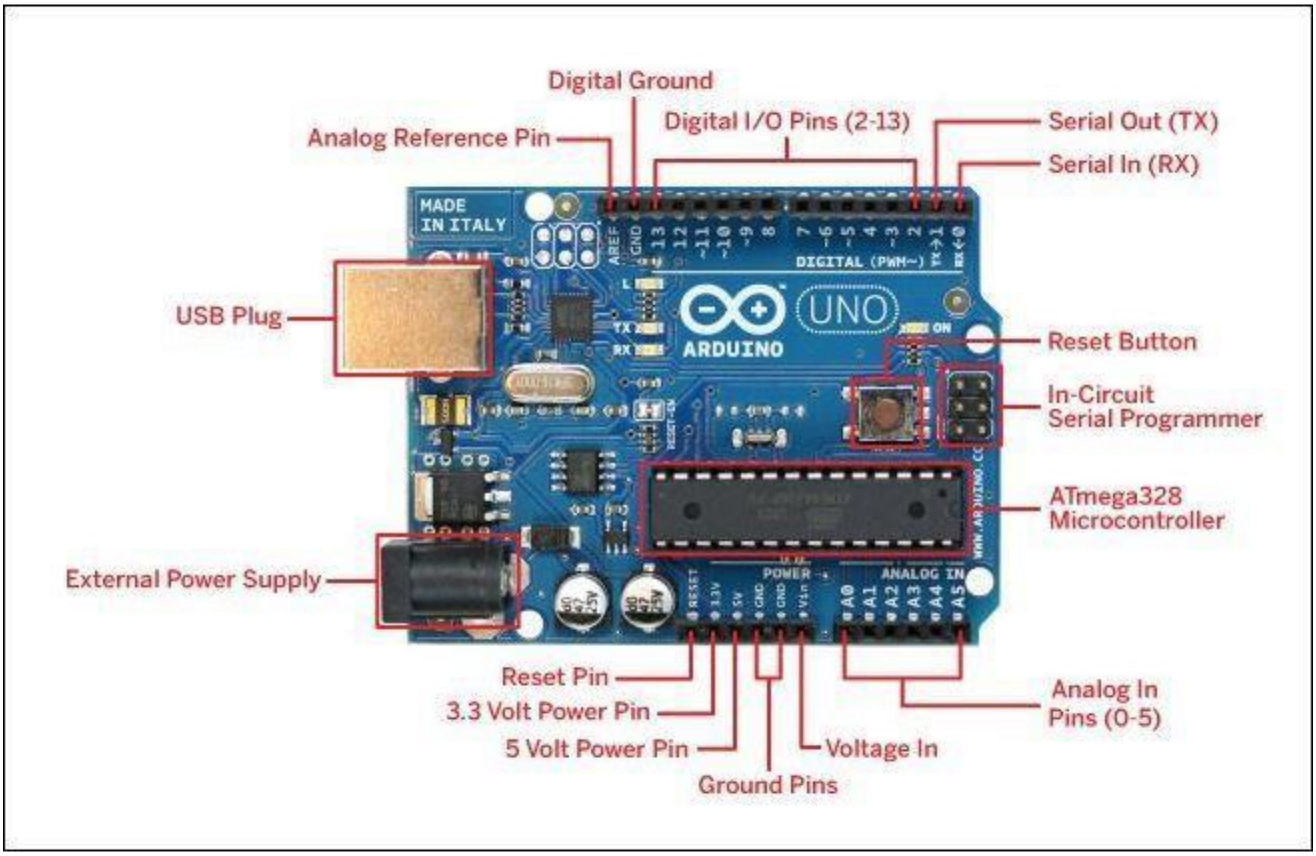


Figure 15: Arduino Uno R3 Pin Specifications

3.3.1 Power Supply

The power supply of the Arduino can be done with the help of an exterior power supply otherwise, USB connection. The exterior power supply (6 to 20 volts) mainly includes a battery or an AC to DC adapter. The connection of an adapter can be done by plugging a center-positive plug (2.1mm) into the power jack on the board. The battery terminals can be placed in the pins of Vin as well as GND. The power pins of an Arduino board include the following.

1. Vin: The input voltage or Vin to the Arduino while it is using an exterior power supply opposite to volts from the connection of USB or else RPS (regulated power supply). By using this pin, one can supply the voltage.

2. 5Volts: The RPS can be used to give the power supply to the microcontroller as well as components which are used on the Arduino board. This can approach from the input voltage through a regulator.

3. 3V3: A 3.3 supply voltage can be generated with the onboard regulator, and the highest draw current will be 50 mA.

4. GND: GND (ground) pins.

3.3.2 Memory

1. The memory of an ATmega328 microcontroller includes 32 KB and 0.5 KB memory is utilized for the Boot loader), and also it includes SRAM-2 KB as well as EEPROM-1KB.

3.3.3 Input and Output

We know that an arguing Uno R3 includes 14-digital pins which can be used as an input otherwise output by using the functions like pin Mode (), digital Read(), and digital Write(). These pins can operate with 5V, and every digital pin can give or receive 20mA, & includes a 20k to 50k ohm pull up resistor. The maximum current on any pin is 40mA which cannot surpass for avoiding the microcontroller from the damage. Additionally, some of the pins of an Arduino include specific functions.

3.3.3.1 Serial Pins-

The serial pins of an Arduino board are TX (1) and RX (0) pins and these pins can be used to transfer the TTL serial data. The connection of these pins can be done with the equivalent pins of the ATmega8 U2 USB to TTL chip.

3.3.3.2 **External Interrupt Pins:**

The external interrupt pins of the board are 2 & 3, and these pins can be arranged to activate an interrupt on a rising otherwise falling edge, a low-value otherwise modify in value.

3.3.3.1 PWM Pins

The PWM pins of an Arduino are 3, 5, 6, 9, 10, & 11, and gives an output of an 8-bit PWM with the function analog Write ().

3.3.3.2 SPI (Serial Peripheral Interface) Pins

The SPI pins are 10, 11, 12, 13 namely SS, MOSI, MISO, SCK, and these will maintain the SPI communication with the help of the SPI library.

3.3.3.3 LED Pin

An arguing board is inbuilt with a LED using digital pin-13. Whenever the digital pin is high, the LED will glow otherwise it will not glow.

3.3.3.4 TWI (2-Wire Interface) Pins

The TWI pins are SDA or A4, & SCL or A5, which can support the communication of TWI with the help of Wire library.

3.3.3.5 AREF (Analog Reference) Pin

An analog reference pin is the reference voltage to the inputs of an analog i/ps using the function like analog Reference().

3.3.3.6 Reset (RST) Pin

This pin brings a low line for resetting the microcontroller, and it is very useful for using an RST button toward shields which can block the one over the Arduino R3 board.

3.3.1 Communication

The communication protocols of an Arduino Uno include SPI, I2C, and UART serial communication.

3.3.4.1 UART

An Arduino Uno uses the two functions like the transmitter digital pin1 and the receiver digital pin0. These pins are mainly used in UART TTL serial communication.

3.3.4.2 I2C

An Arduino UNO board employs SDA pin otherwise A4 pin & A5 pin otherwise SCL pin is used for I2C communication with wire library. In this, both the SCL and SDA are CLK signal and data signal.

3.3.4.3 SPI Pins

The SPI communication includes MOSI, MISO, and SCK.

3.3.4.3.1 MOSI (Pin11)-

This is the master out slave in the pin, used to transmit the data to the devices.

3.3.4.3.2 MISO (Pin12)-

This pin is a serial CLK, and the CLK pulse will synchronize the transmission of which is produced by the master.

3.3.4.3.3 SCK (Pin13)-

The CLK pulse synchronizes data transmission that is generated by the master. Equivalent pins with the SPI library are employed for the communication of SPI.

CHAPTER 4: GSM & GPS COMMUNICATION

4.1. GSM INTRODUCTION

GSM stands for Global System for Mobile communication. It is a standard developed by European Telecommunication Standards Institute (ETSI) to describe protocols for second generation (2G) digital cellular networks. It was a replacement for the first generation (1G) cellular networks. The idea of developing GSM originated from a cell-based mobile radio system at the Bell Laboratories in the early 1970s. GSM is an open, digital cellular radio network operating in over 200 countries worldwide. It uses narrowband time division multiple access (TDMA) technology. It covers almost complete Western Europe and growing in America and Asia. It is not only used for voice calls, it can also be used for data computing and sending text messages. A user can connect his GSM-enabled phone with his laptop to send or receive e-mails, faxes, browse internet, check security etc. GSM is an open and digital cellular technology used for mobile communication. It uses 4 different frequency bands of 850 MHz, 900 MHz, 1800 MHz and 1900 MHz . It uses the combination of FDMA and TDMA. This article includes all the concepts of GSM architecture and how it works.

GSM is having 4 different sizes of cells are used in GSM :

4.1.1. Macro: In this size of cell, Base Station antenna is installed.

4.1.2. Micro: In this size of cell, antenna height is less than the average roof level.

4.1.3. Pico: Small cells’ diameter of few meters.

4.1.4. Umbrella: It covers the shadowed (Fill the gaps between cells) regions.

4.2. Important facts about the GSM are given below –

- The concept of GSM emerged from a cell-based mobile radio system at Bell Laboratories in the early 1970s.
- GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard.
- GSM is the most widely accepted standard in telecommunications, and it is implemented globally.
- GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz timeslots. GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world. In the US, GSM operates in the bands 850 MHz and 1900 MHz
- GSM owns a market share of more than 70 percent of the world's digital cellular subscribers.

- GSM makes use of narrowband Time Division Multiple Access (TDMA) technique for transmitting signals.
- GSM was developed using digital technology. It has an ability to carry 64 kbps to 120 Mbps of data rates.
- Presently GSM supports more than one billion mobile subscribers in more than 210 countries throughout the world.
- GSM provides basic to advanced voice and data services including roaming service. Roaming is the ability to use your GSM phone number in another GSM network.
- GSM digitizes and compresses data, then sends it down through a channel with two other streams of user data, each in its own timeslot.

4.3. Features of GSM are -

4.3.1. Supports international roaming

4.3.2. Clear voice clarity

4.3.3. Ability to support multiple handheld devices.

4.3.4. Spectral / frequency efficiency

4.3.5. Low powered handheld devices.

4.3.6. Case of accessing network

4.3.7. International ISDN compatibility.

4.4. GSM ARCHITECTURE

The GSM architecture consists of three major interconnected subsystems that interact with themselves and with users through certain network interface. The subsystems are Base Station Subsystem (BSS), Network Switching Subsystem (NSS) and Operational Support Subsystem (OSS). Mobile Station (MS) is also a subsystem but it is considered as a part of BSS.

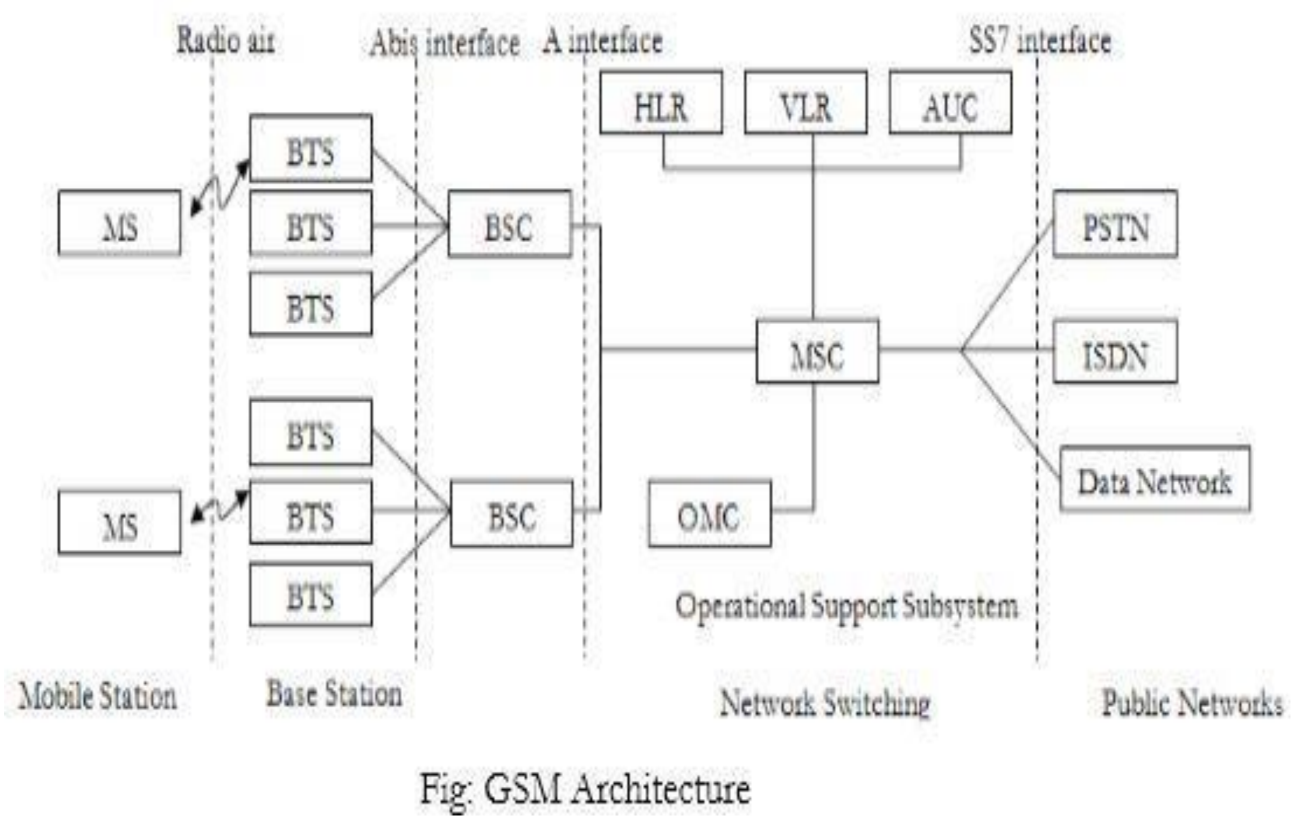


Figure 16: GSM Architecture

4.4.1. Mobile Station (MS): Mobile Station is made up of two entities.

4.4.1.1. Mobile equipment (ME):

- ❖ It is a portable, vehicle mounted, handheld device.
- ❖ It is uniquely identified by an IMEI number.
- ❖ It is used for voice and data transmission. It also monitors power and signal quality of surrounding cells foe optimum handover. 160 characters long SMS can also be sent using Mobile Equipment.

4.4.1.2. Subscriber Identity module (SIM):

- ❖ It is a smart card that contains the International Mobile Subscriber Identity (IMSI) number.
- ❖ It allows users to send and receive calls and receive other subscriber services. - It is protected by password or PIN.
- ❖ It contains encoded network identification details. it has key information to activate the phone.
- ❖ It can be moved from one mobile to another.

4.4.2. Base Station Subsystem (BSS): It is also known as radio subsystem, provides and manages radio transmission paths between the mobile station and the Mobile Switching Centre (MSC). BSS also manages interface between the mobile station and all other subsystems of GSM. It consists of two parts.

4.4.2.1. Base Transceiver Station (BTS):

- ❖ It encodes, encrypts, multiplexes, modulates and feeds the RF signal to the antenna.
- ❖ It consists of transceiver units.
- ❖ It communicates with mobile stations via radio air interface and communicates with BSC via Abis interface.

4.4.2.2. Base Station Controller (BSC):

- ❖ It manages radio resources for BTS. It assigns frequency and time slots for all mobile stations in its area.
- ❖ It handles call set up, transcoding and adaptation functionality handover for each MS radio power control.
- ❖ It communicates with MSC via A interface and also with BTS.

4.4.3. Network Switching Subsystem (NSS): it manages the switching functions of the system and allows MSCs to communicate with other networks such as PSTN and ISDN. It consist of-

4.4.3.1. Mobile switching Centre:

- ❖ It is a heart of the network. It manages communication between GSM and other networks.
- ❖ It manages call set up function, routing and basic switching.
- ❖ It performs mobility management including registration, location updating and inter BSS and inter MSC call handoff.

- ❖ It provides billing information.
- ❖ MSC does gateway function while its customers roam to other network by using HLR/VLR.

4.4.3.2. Home Location Registers (HLR):

- ❖ It is a permanent database about mobile subscriber in a large service area.
- ❖ Its database contains IMSI, IMSISDN, prepaid/post-paid, roaming restrictions, supplementary services.

4.4.3.3. Visitor Location Registers (VLR):

- ❖ It is a temporary database which updates whenever new MS enters its area by HLR database.
- ❖ It controls mobiles roaming in its area. It reduces number of queries to HLR.
- ❖ Its database contains IMSI, TMSI, IMSISDN, MSRN, location, area authentication key.

4.4.3.4. Authentication Centre:

- ❖ It provides protection against intruders in air interface.
- ❖ It maintains authentication keys and algorithms and provides security triplets (RAND, SRES, Ki).

4.4.3.5. Equipment Identity Registry (EIR):

- ❖ It is a database that is used to track handset using the IMEI number.
- ❖ It is made up of three sub classes- the white list, the black list and the gray list.

4.4.4. Operational Support Subsystem (OSS): It supports the operation and maintenance of GSM and allows system engineers to monitor, diagnose and troubleshoot all aspects of GSM system. It supports one or more Operation Maintenance Centers (OMC) which are used to monitor the performance of each MS, Bs, BSC and MSC within a GSM system. It has three main functions:

4.4.4.1 To maintain all telecommunication hardware and network operations with a particular market.

4.4.4.2 To manage all charging and billing procedures

4.4.4.3 To manage all mobile equipment in the system.

Interfaces used for GSM network :

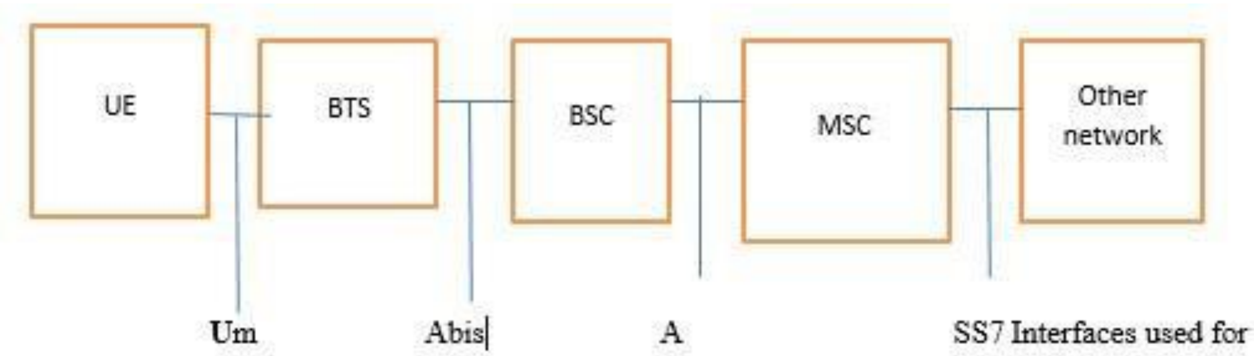


Fig 2 GSM network Interfaces

Figure 17: GSM Network Interfaces

1)UM Interface –Used to communicate between BTS with MS

2)Abis Interface— Used to communicate BSC TO BTS

3) A Interface-- Used to communicate BSC and MSC

4) Singling protocol (SS 7)- Used to communicate MSC with other networks.

4.5. Why GSM?

Listed below are the features of GSM that account for its popularity and wide acceptance.

4.5.1. Improved spectrum efficiency

4.5.2. International roaming.

4.5.3. Low-cost mobile sets and base stations (BSs)

4.5.4. High-quality speech

4.5.5. Compatibility with Integrated Services Digital Network (ISDN) and other telephone company services

4.5.6. Support for new services

4.6. Advantages of GSM

4.6.1. Since GSM service is obtained over 200 countries, so it provides worldwide roaming for its clients to roam throughout the world.

4.6.2. GSM is extremely secured because its devices and facilities cannot be easily duplicated.

4.6.3. It has an extensive coverage in all over the world.

4.6.4. Clear voice calls and efficient use of spectrum.

4.6.5. Compatible with wide range of handsets and accessories.

4.6.6. Advanced features such as short messages, caller ID, Call hold, Call forwarding etc.

4.6.7. Compatible with Integrated Services Digital Network (ISDN) and other telephone company services.

4.7. Disadvantages of GSM

4.7.1. The biggest disadvantage of GSM is that multiple users share the same bandwidth. This may cause interference and due to interference bandwidth limitation occurs.

4.7.2. The other disadvantage of GSM is that it may cause electronic interference. That is the reason why sensitive locations like hospitals and airplanes require cell phone to be turned off otherwise it can create interference with the equipment of hospitals and airplanes.

4.8. GSM Modems-

Figure 18: GSM Modem

When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile Internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

A GSM modem can be a dedicated modem device with a serial, USE or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

For this document, the term GSM modem is used as a generic term to refer to any modem that supports one or more of the protocols in the GSM evolutionary family, including the 2.5G technologies GPRS and EDGE, as well as the 3G technologies WCDMA, UMTS, HSDPA and HSUPA.

A GSM modem exposes an interface that allows applications such as SMS to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an "extended AT command set" for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005 specifications.

GSM modems can be a quick and efficient way to get started with SMS, because a special subscription to an SMS service provider is not required. In most parts of the world, GSM modems are a cost-effective solution for receiving SMS messages, because the sender is paying for the message delivery.

A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, such as the Falcom Samba 75. (Other manufacturers of dedicated GSM modem devices include Wavecom, Multitech and iTegno. We've also reviewed a number of modems on our technical support blog). To begin, insert a GSM SIM card into the modem and connect it to an available USB port on your computer.

A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer. Any phone that supports the "extended AT command set" for sending/receiving SMS messages, as defined in ETSI GSM 07.05 and/or 3GPP TS 27.005, can be supported by the Now SMS

& MMS Gateway. Note that not all mobile phones support this modem interface.

Due to some compatibility issues that can exist with mobile phones, using a dedicated GSM modem is usually preferable to a GSM mobile phone. This is more of an issue with MMS messaging, where if you wish to be able to receive inbound MMS messages with the gateway, the modem interface on most GSM phones will only allow you to send MMS messages. This is because the mobile phone automatically processes received MMS message notifications without forwarding them via the modem interface.

It should also be noted that not all phones support the modem interface for sending and receiving SMS messages. Most smart phones, including Blackberries, iPhone, and Windows Mobile devices, do not support this GSM modem interface for sending and receiving SMS messages at all at all. Additionally, Nokia phones that use the S60 (Series 60) interface, which is Symbian based, only support sending SMS messages via the modem interface, and do not support receiving SMS via the modem interface.

4.9. GPS INTRODUCTION

The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 30+ satellites and their ground stations. GPS uses these “man-made stars” as reference points to calculate positions accurate to a matter of meters. In fact, with advanced forms of GPS you can make measurements to better than a centimeter! In a sense it’s like giving every squaremeter on the planet a unique address.

GPS receivers have been miniaturized to just a few integrated circuits and so are becoming very economical. And that makes the technology accessible to virtually everyone. These days GPS is finding its way into cars, boats, planes, construction equipment, movie making gear, farm machinery, even laptop computers. Soon GPS will become almost as basic as the telephone. The Global Positioning System (GPS) is the most widely used satellite navigation system around the world. It is one of the Global Navigation Satellite Systems (GNSS) that provides geolocation, time, and velocity information.

GPS is operational since 1978 and globally available since 1994. The latest GPS receivers provide geolocation with an accuracy of 30 centimeters. The GPS system is owned by the United States government and is maintained by the United States Space Force. GPS is a network of 30+ Medium Earth Orbit (MEO) satellites. These satellites continuously send signals over dedicated RF frequencies that a GPS receiver can listen to. By calculating its distance from four or more satellites, a GPS receiver can find out its position in latitude and longitude anywhere on earth. There are many kinds of GPS receivers with different capabilities. All GPS receivers essentially can provide their geolocation, UTC time, and velocity information. The latest GPS receivers are ultra-compact and accurate than ever. These tiny devices provide geolocation, time, and velocity data for no cost and are now found in most of the smartphones. GPS receivers arealso used in automobiles, for tracking commerce and in several tracking applications like in drones and UAVs.

4.10. Building blocks of GPS

GPS consists of three segments:

4.10.1. Space segment – This segment consists of GPS navigation satellites. There are 30+ GPS satellites deployed on six orbits around the earth at an altitude of approximately 20,000 Km. These satellites revolve around the earth at an interval of 12 hours, such that they provide coverage all around the world all the time.

4.10.2. Control segment – This segment consists of Ground Control Stations. These stations are responsible for monitoring, controlling, and maintaining orbits of GPS satellites. The ground control stations ensure that deviation of satellites from their orbit and their timing are within tolerance level.

4.10.3. User segment – This segment consists of GPS receivers. A GPS receiver listens to RF signals from GPS satellites and calculates its distance with at least four satellites to get its position and time. At any time, at most, 12 GPS satellites are visible in the sky to a GPS receiver. The satellites transmit information over a band of radio frequency which ranges from 1.1 to 1.5 GHz.

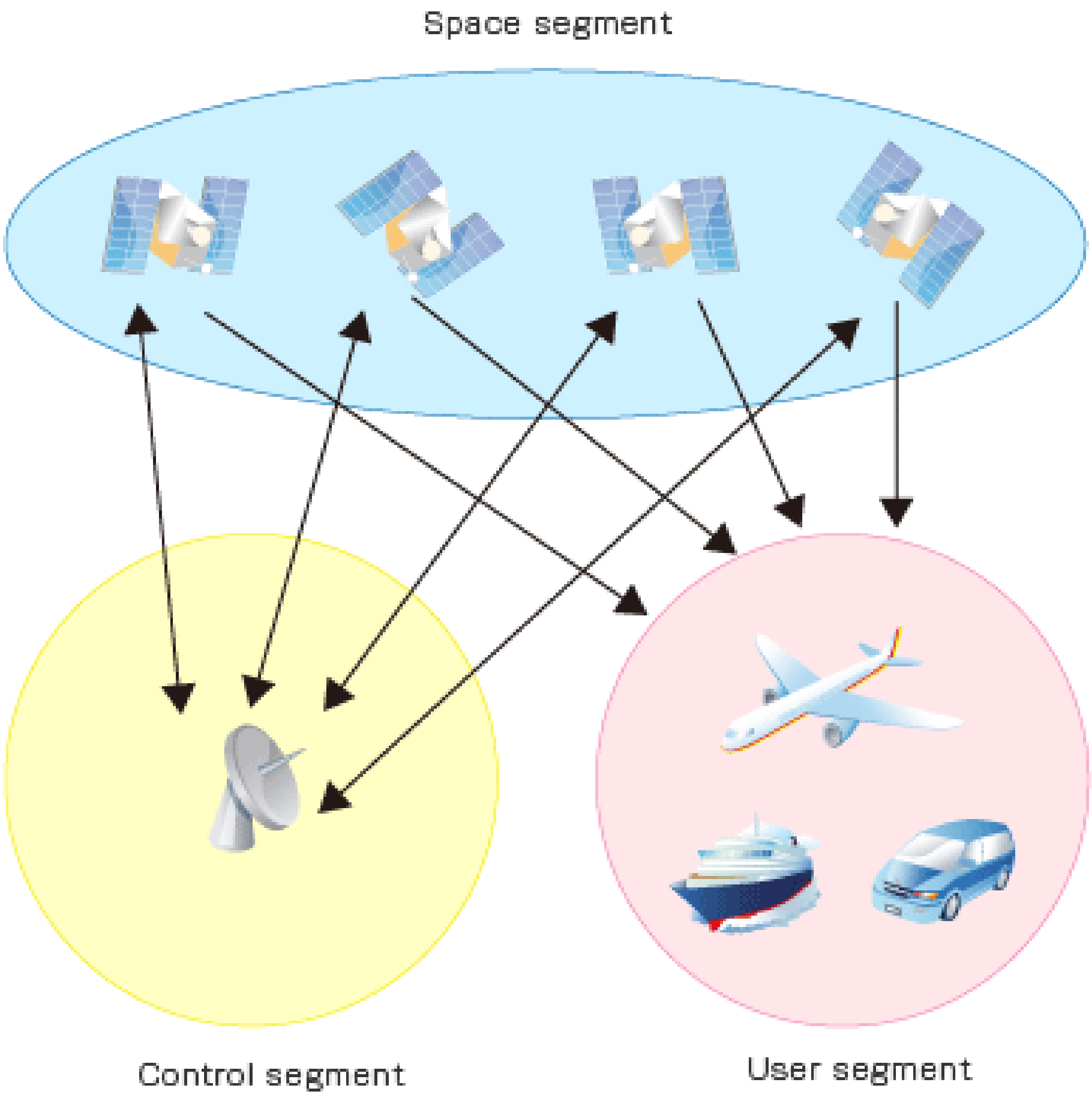


Fig. 1-2 Three elements of GPS

Figure 19: GPS Work Flow Diagram

4.11. GPS positioning

Firstly, the signal of time is sent from a GPS satellite at a given point. Subsequently, the time difference between GPS time and the point of time clock which GPS receiver receives the time signal will be calculated to generate the distance from the receiver to the satellite. The same process will be done with three other available satellites. It is possible to calculate the position of the GPS receiver from distance from the GPS receiver to three satellites. However, the position generated by means of this method is not accurate, for there is an error in calculated distance between satellites and a GPS receiver, which arises from a time error on the clock incorporated into a GPS receiver. For a satellite, an atomic clock is incorporated to generate on-the-spot time information, but the time generated by clocks incorporated into GPS receivers is not as precise as the time generated by atomic clocks on satellites. Here, the fourth satellite comes to play its role: the distance from the fourth satellite to the receiver can be used to compute the position in relations to the position data generated by distance between three satellites and the receiver, hence reducing the margin of error in position accuracy.

The Figure below illustrates an example of positioning by two dimensions (position acquisition by using two given points). We can compute where we are at by calculating distance from two given points, and at the same time calibrate with accurate time signal from satellites. The GPS is the system that can be illustrated by multiplying given points and replacing them with GPS satellites on this figure.

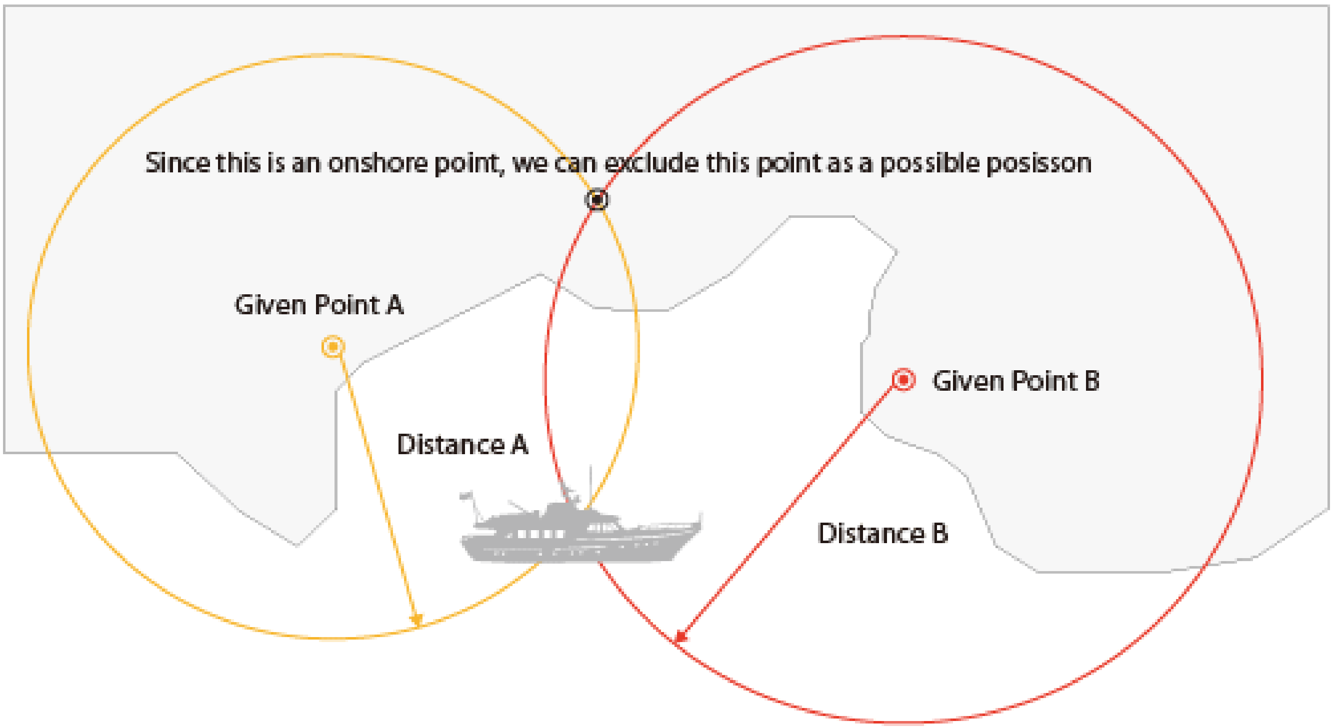


Figure 20: GPS Positioning

4.12. <u>How GPS Work</u>

The GPS receiver gets a signal from each GPS satellite. The satellites transmit the exact time the signals are sent. By subtracting the time the signal was transmitted from the time it was received, the GPS can tell how far it is from each satellite. The GPS receiver also knows the exact position in the sky of the satellites, at the moment they sent their signals. So given the travel time of the GPS signals from three satellites and their exact position in the sky, the GPS receiver can determine your position in three dimensions – east, north and altitude.

Imagine you are standing somewhere on Earth with three satellites in the sky above you. If you know how far away you are from satellite A, then you know you must be located somewhere on the red circle. If you do the same for satellites B and C, you can work out your location by seeing where the three circles intersect. This is just what your GPS receiver does, although it uses overlapping spheres rather than circles.

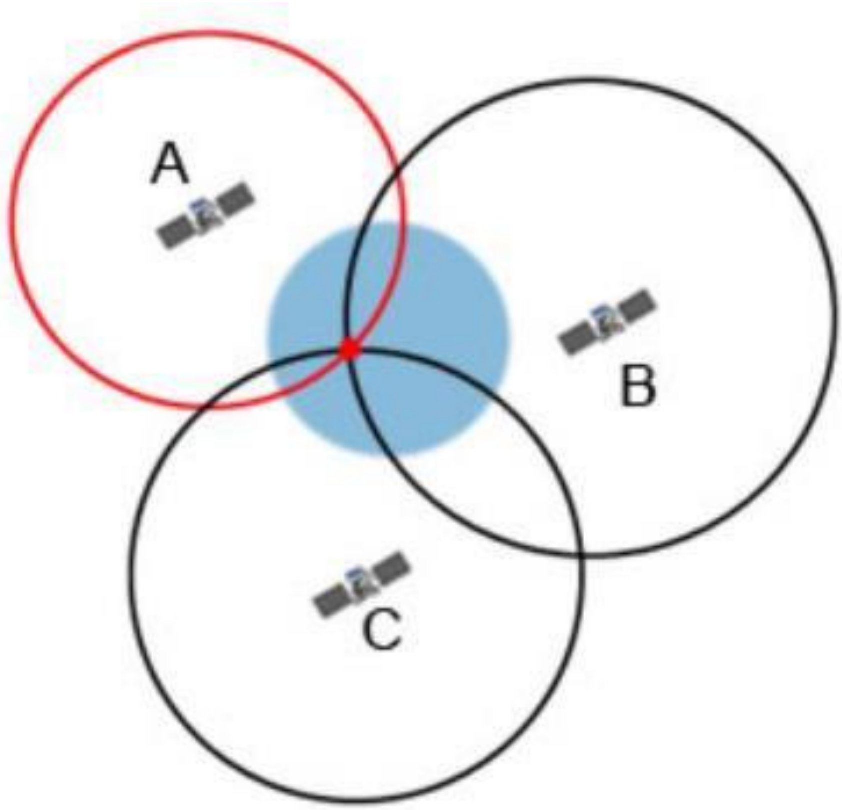


Figure 21: GPS View Diagram

There is a complication. To calculate the time the GPS signals took to arrive, the GPS receiver needs to know the time very accurately. The GPS satellites have atomic clocks that keep very precise time, but it's not feasible to equip a GPS receiver with an atomic clock. However, if the GPS receiver uses the signal from a fourth satellite it can solve an equation that lets it determine the exact time, without needing an atomic clock

If the GPS receiver is only able to get signals from 3 satellites, you can still get your position, but it will be less accurate. As we noted above, the GPS receiver needs 4 satellites to work out your position in 3-dimensions. If only 3 satellites are available, the GPS receiver can get an approximate position by making the assumption that you are at mean sea level. If you really are at mean sea level, the position will be reasonably accurate. However if you are in the mountains, the 2-D fix could be hundreds of meters off. A modern GPS receiver will typically track all of the available satellites simultaneously, but only a selection of them will be used to calculate your position. To determine the location of the GPS satellites two types of data are required by the GPS receiver: the almanac and the ephemeris. This data is continuously transmitted by the GPS satellites and your GPS receiver collects and stores this data.

4.13. Advantages of Global Positioning System

4.13.1. GPS is extremely easy to navigate because it tells you to direction for every turn, you’re taking otherwise you need to fancy reach to your destination.

4.13.2. GPS works altogether weather so you would like to not worry of climate as In other navigating devices.

4.13.3. GPS costs you very low as compared other navigation systems.

4.13.4. Most attraction of this technique is its100% coverage on earth.

4.13.5. It also helps you to look nearby restaurants, hotels and gas stations and is extremely useful for a replacement place.

4.13.6. Due to its low cost, it’s very easy to integrate into other technologies like telephone.

4.13.7. System is updated regularly by United States government and hence is extremely advance.

4.13.8. This is the simplest navigating system in water as in larger water bodies we are often misled thanks to lack of proper directions.

4.13.9. GPS signal is out there worldwide. Therefore, users won’t be bereft of it anywhere.

4.13.10. GPS are often used anywhere within world, it’s powered by world satellites, so it are often accessed anywhere, a solid tracking system and a GPS receiver are all you would like.

4.14. Disadvantages of worldwide Positioning System :

4.14.1. Sometimes GPS may fail thanks to certain reasons and therein case you would like to hold a backup map and directions.

4.14.2. If you’re using GPS on A battery operated device, there could also be A battery failure and you’ll need a external power supply which isn’t always possible.

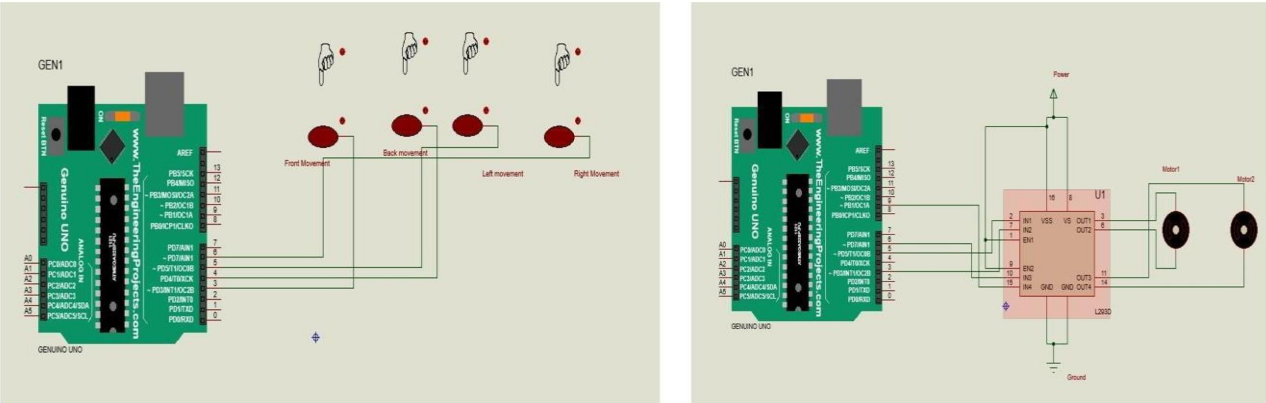
4.14.3. Sometimes GPS signals aren't accurate thanks to some obstacles to signals like buildings, trees and sometimes by extreme atmospheric conditions like geomagnetic storms.

4.14.4. GPS chip is hungry for power which drains battery in 8 to 12 hours. this needs replacement or recharge of battery quite frequently.

4.14.5. GPS doesn't penetrate solid walls or structures. it's also suffering from large constructions or structures.

CHAPTER 5: WORKING

5.1. Circuit Diagram



Touch sensor circuit

Wheelchair Motor circuit

Figure 22: Project Circuit Diagram

Our wheelchair will be controlled by the people who have less movements in their fingers as it will be controlled by touch sensors embedded on gloves with the help of wireless communication to control the chair means wheelchair movements will be control by touching the touch sensors on which different moments has been defined like forward, stop, backward, left and right. It has quick response during the accident with obstacle detection system and also have special features of GPS and GSM enabled with the force sensor to sense the force in case of any accident and help the person's caretaker to inform about the live location tracking and also helps in keeping the track of the health of the person sitting on wheelchair in case of any emergency.

5.2. Block Diagram

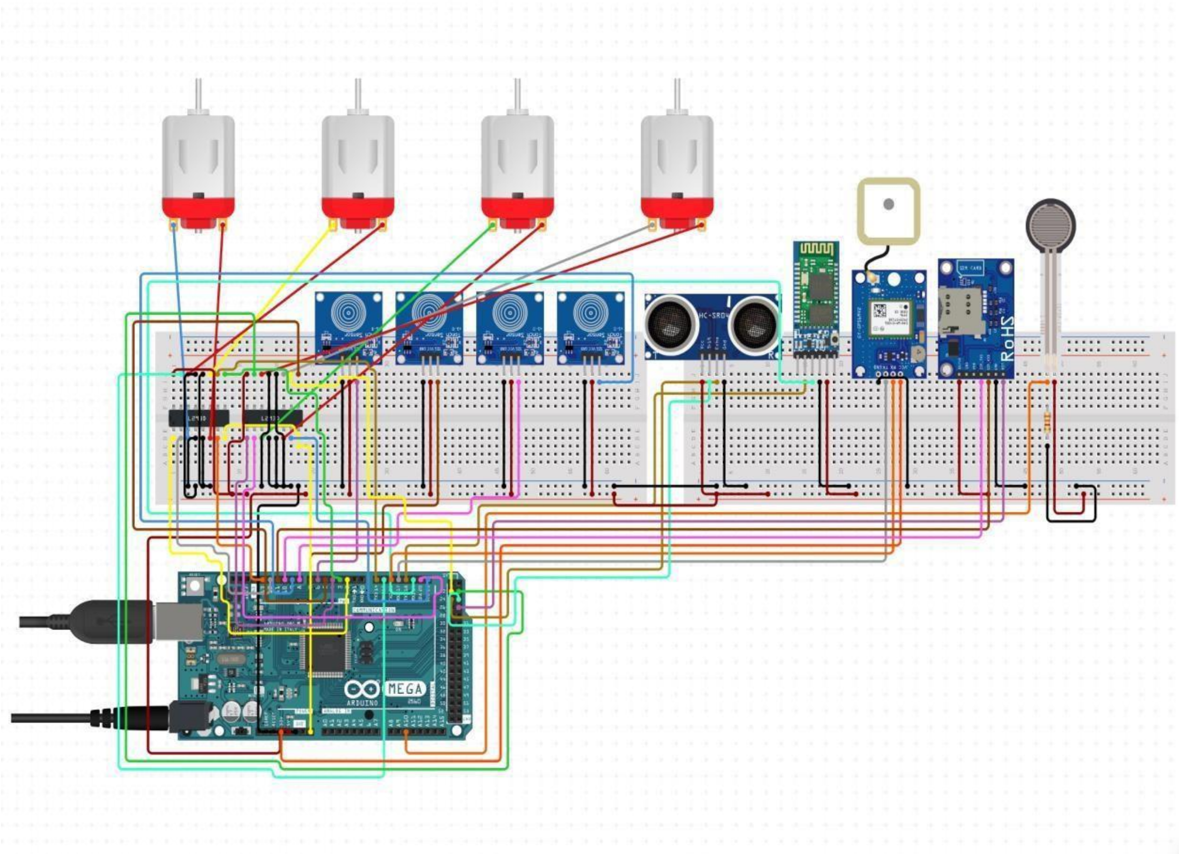


Figure 23: Complete Circuitory of Project

5.3 Advantages

- Design for handicapped people who have some movement in their fingers to control the wheelchair with the help of wirelessly designed gloves.
- Quick Response during an accident.
- Fast detection of obstacles.
- GSM and GPS based Tracking System.
- Cost is minimum.

5.4 Conclusion

At last, a unique wheel chair approach is being discussed here which entailed the designing of an embedded system that is real-time and owing to the sensor that would be employed. Sensors such as the Bluetooth HC 05 module, Ultrasonic sensor, GSM module, and GPS module are used in most modern technologies to take interactive input. So, we wanted to develop a novel, fast and real time project that can help handicapped and old people. These conditions made Smart Wheelchair a suitable project for us.

5.5 Future Scope

- Artificial Intelligence can be added to this wheelchair to make it more advanced.
- The range of wireless communication in our project can be increased by using Lora module.
- Accident avoiding capability can be improved.

5.6 Programs

GPS GSM CODE

```
#include <TinyGPS.h>

#include <SoftwareSerial.h>

SoftwareSerial Gsm(7, 8);

char phone_no[] = "6387850312"; //replace with phone no. to get sms


TinyGPS gps;  // Creates a new instance of the TinyGPS object

void setup()


{

 Serial.begin(9600);

 Gsm.begin(9600);


}


void loop()

{

 bool newData = false;

 unsigned long chars;

 unsigned short sentences, failed;


 // For one second we parse GPS data and report some key values

 for (unsigned long start = millis(); millis() - start < 1000;)

 {

  while (Serial.available())

  {
```

```
    char c = Serial.read();
    Serial.print(c);
    if (gps.encode(c))
      newData = true;
  }
}

if (newData)      //If newData is true
{
  float flat, flon;
  unsigned long age;
  gps.f_get_position(&flat, &flon, &age);
  Gsm.print("AT+CMGF=1\r");
  delay(400);
  Gsm.print("AT+CMGS=\"");
  Gsm.print(phone_no);
  Gsm.println("\"");


  delay(300);
  Gsm.print("http://maps.google.com/maps?q=loc:");


 // Gsm.print("Latitude = ");
  Gsm.print(flat == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flat, 6);
  //Gsm.print(" Longitude = ");
  Serial.print(",");
  Gsm.print(flon == TinyGPS::GPS_INVALID_F_ANGLE ? 0.0 : flon, 6);
  delay(200);
  Gsm.println((char)26); // End AT command with a ^Z, ASCII code 26
  delay(200);
```

```
   Gsm.println();

 }

 Serial.println(failed);
// if (chars == 0)
  // Serial.println("** No characters received from GPS: check wiring *)
```

MASTER CONTROL CODE

```
//master control code
#define ctsPin1 7
#define ctsPin2 8
#define ctsPin3 4
#define ctsPin4 5
#include <SoftwareSerial.h>
SoftwareSerial BTSerial(2,3);

int state = 0;

int ctsValue1=0;
int ctsValue2=0;
int ctsValue3=0;
int ctsValue4=0;

void setup()
{
  BTSerial.begin(38400);
  Serial.begin(38400);
  pinMode(ctsPin1,INPUT);
  pinMode(ctsPin2,INPUT);
  pinMode(ctsPin3,INPUT);
```

```
 pinMode(ctsPin4,INPUT);
}

void loop()
{
 if(BTSerial.available() > 0)
 {
   // Checks whether data is comming from the serial port
   state = BTSerial.read(); // Reads the data from the serial port
 }
int ctsValue1 = digitalRead(ctsPin1);
int ctsValue2 = digitalRead(ctsPin2);
int ctsValue3 = digitalRead(ctsPin3);
int ctsValue4 = digitalRead(ctsPin4);
Serial.println(ctsValue1);
Serial.println(ctsValue2);
Serial.println(ctsValue3);
Serial.println(ctsValue4);
 if (ctsValue1 == 1)
 {
  BTSerial.write('1');
 }
 else if (ctsValue2 == 1)
 {
  BTSerial.write('2');
 }
 else if (ctsValue3 == 1)
 {
  BTSerial.write('3');
 }
 else if (ctsValue4 == 1)
 {
```

```
 BTSerial.write('4');
}
else if(ctsValue1 == 0&&ctsValue2 == 0&&ctsValue3 == 0&&ctsValue4 == 0)
{
 BTSerial.write('0')    }}
```

SLAVE CONTROL PROGRAM

```
//slave control program

#include  <SoftwareSerial.h>
SoftwareSerial BTSerial(2,3);
#define trigPin 7
#define echoPin 12
  // Motor A

 const int inputPIN1 = 10;
 const int inputPIN2 = 11;
 // Motor B
 const int inputPIN3 = 8;
 const int inputPIN4 = 9;

int state = 0;
long duration, distance;
void setup()
{
  BTSerial.begin(38400);
  Serial.begin(38400);
  pinMode(inputPIN1, OUTPUT);
  pinMode(inputPIN2, OUTPUT);
  pinMode(inputPIN3, OUTPUT);
  pinMode(inputPIN4, OUTPUT);
```

```
 pinMode(inputPIN5, OUTPUT);
 pinMode(inputPIN6, OUTPUT);
 pinMode(inputPIN7, OUTPUT);
 pinMode(inputPIN8, OUTPUT);
 pinMode(trigPin, OUTPUT);
 pinMode(echoPin, INPUT);

}
void loop()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = (duration/2) / 29.1;
if(BTSerial.available() > 0)
 {
   // Checks whether data is comming from the serial port
   state = BTSerial.read(); // Reads the data from the serial port
 }
 Serial.println(state);
 if ( state=='1')
 {
   if (distance < 20)
    {
    brake();
    }
   else
    {
```

```
    forward();
    } state=0;
  }
  else  if (state == '2')

  {
    right();state=0;
  }
  else if (state =='3')
  {
    left();state=0;
  }
  else if (state == '4')
  {
    back();state=0;
    }
  else if(state=='0')
  {
    brake();
  }
}

//  TO ROTATE  MOTOR forward
 void forward()
 {
  digitalWrite(inputPIN1, HIGH);
  digitalWrite(inputPIN2,  LOW);
  digitalWrite(inputPIN3, HIGH);
  digitalWrite(inputPIN4, LOW);
  }
  void right()
 {
```

```
digitalWrite(inputPIN1, HIGH);
digitalWrite(inputPIN2,  LOW);
digitalWrite(inputPIN3, HIGH);
digitalWrite(inputPIN4, LOW);
}
 void left()
{
digitalWrite(inputPIN1,  LOW);
digitalWrite(inputPIN2, HIGH);
digitalWrite(inputPIN3,  LOW);
digitalWrite(inputPIN4, HIGH);
}
 void back()
{
digitalWrite(inputPIN1,  LOW);
digitalWrite(inputPIN2, HIGH);
digitalWrite(inputPIN3,  LOW);
digitalWrite(inputPIN4, HIGH);
}

// MOTOR BRAKE
 void brake()
 {
digitalWrite(inputPIN1, LOW);
digitalWrite(inputPIN2, LOW);
digitalWrite(inputPIN3, LOW);
digitalWrite(inputPIN4, LOW);

}
```

6. Outcome of the Project(Patent Published)

12/10/21, 6:56 PM Intellectual Property India

Office of the Controller General of Patents, Designs & Trade Marks
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APPLICANT NAME	1 . Shubham Shukla 2 . Parvin Kumar 3 . Sanjay Kumar Sharma 4 . Vibhav Kumar Sachan 5 . Parul Grover 6 . Sachin Tyagi 7 . Mohit Tyagi 8 . Kamal Kishor Upadhyay 9 . Amit Kumar Arora 10 . Abhishek Sharma 11 . Ragini Sharma 12 . Ayush Bhardwaj 13 . Dhanesh Shukla 14 . N. K. Shukla
TITLE OF INVENTION	IOT BASED TOUCH SENSORS EMBEDDED SMART GLOVES WHEELCHAIR
FIELD OF INVENTION	BIO-MEDICAL ENGINEERING
E-MAIL (As Per Record)	pooja@innoveintellects.com
ADDITIONAL-EMAIL (As Per Record)	pujakr@gmail.com
E-MAIL (UPDATED Online)	
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