IOT BASED SMART BLIND STICK

FINAL YEAR B.TECH.PROJECT REPORT

Submitted to

Government College of Engineering, Jalgaon 425002

(*An Autonomous Institute of Government of Maharashtra and NAAC accredited and affiliated to Kavayatri Bahinabai Chaudhari North Maharashtra University, Jalgaon*)

In Partial Fulfilment of the Requirements for the Degree of **BACHELOR OF TECHNOLOGY** in

Electronics and Telecommunication Engineering

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GOVERNMENT COLLEGE OF ENGINEERING, JALGAON (425002)

MAY 2023

GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

(*An Autonomous Institute of Government of Maharashtra and NAAC accredited and affiliated to Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon*)

Department of Electronics and Telecommunication Engineering

CERTIFICATE

This is to certify that the the project entitled, **"IoT Based Smart Blind Stick"** , which is being here with for the award of f **Final Year B.Tech.** is the result of the work completed by **DHARNE SAHIL AJAY, SANTOSH ADITYA KAPSE, DHAGE BHASKAR POOJA, PRAHLAD SACHIN KAMBLE,** under my supervision and guidance within the four walls of the institute and the same has not been submitted elsewhere for the award of any degree.

Smt. M. R. Dhotre
Assistant Professor
E&Tc Department

Dr. S. P. Mohani
Head of Department

(Dr. G. M. Malwatar)
Principal

Examiner

DECELARATION

We hereby declare the project entitled**,** "**IoT Based Smart Blind Stick**" was carried out and written by us under the guidance of **Smt. M. R. Dhotre**, Assistant Professor of Department of Electronics and Telecommunication Engineering, Government College of Engineering, Jalgaon. This work has not been previously formed the basis for the award of any degree or diploma or certificate nor been submitted elsewhere for the award of any degree or diploma or certification.

Place: - Jalgaon

Date: -

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ACKNOWLEDGEMENT

We would have never succeeded in completing my task without the cooperation, encouragement and help provided to us by various people. Words are often too less to reveals one's deep regards. We take this opportunity to express our profound sense of gratitude and respect to all those who helped us through the duration of this report.

We acknowledge with gratitude and humanity our indebtedness to the supervisor **Smt. M. R. Dhotre,** Assistant Professor of Electronics and Telecommunication department for valuable guidance throughout presentation.

We also very much indebted to **Dr. S. P. Mohani** HoD of electronics and telecommunication for his valuable motivation and effective support and also thankful to Principal **Dr. G. M. Malwatkar** sir who made available to us library, labs and facilities without hesitation.

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ABSTRACT

A smart stick concept is devised to provide a smart electronic aid for blind people . Blind and visually impaired find difficulties in detecting obstacles during walking in the street. The system is intended to provide artificial vision and object detection, real time assistance via making use of IOT.

The main objective of our project is to provide a IOT based assistance to blind people. The existing devices for the visually impaired only focus on travelling from one location to another.

The device is aimed to help visually impaired with the same manoeuvre as that of sighted people.

A brief study had been carried out to understand various issues related to the project which involves providing a smart electronic aid for blind people to provide artificial vision and object detection, real assistance via GPS module by using IOT. Our project mainly focuses on the visually impaired people who cannot walk independently environment.

The system consists of ultrasonic sensors, and the feedback is received through audio. The aim of the overall system is to provide a low cost and efficient navigation and obstacle detection aid for blind which gives which gives a sense of artificial by providing information about the environmental scenario of static and dynamic object round them, so that they can walk independently.

CONTENT

LIST OF FIGURES

CHAPTER 1

1.1 INTRODUCTION

A survey by WHO (World Health Organization) carried out in 2011 estimates that in the world, about 1% of the human population is visually impaired (about 70 million people) and amongst them, about 10% are fully blind (about 7 million people) and 90% (about 63 million people) with low vision. The main problem with blind people is how to navigate their way to wherever they want to go. Such people need assistance from others with good eyesight. As described by WHO, 10% of the visually impaired have no functional eyesight at all to help them move around without assistance and safely. This study proposes a new technique for designing a smart stick to help visually impaired people that will provide them navigation. The conventional and archaic navigation aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs which are characterized by a many imperfections . The most critical shortcomings of these aids include essential skills and training phase, range of motion, and very insignificant information communicated been communicated.

Our approach modified this cane with some electronics components and sensors, the electronic aiding devices are designed to solve such issues. The ultrasonic sensor, buzzer, GPS, and NODE MCU are used to record information about the presence of obstacles on the road. Ultrasonic sensors have the capacity to detect any obstacle within the distance range of 2 cm-450 cm. Therefore, whenever there is an obstacle in this range it will alert the user. is used to detect if there is water in path of the user. Most blind guidance systems us ultrasound because of its immunity to the environmental noise. With the rapid advances of modern technology both in hardware and software it has become easier to provide intelligent navigation system to the visually impaired. Also, high-end technological solutions have been introduced recently to help blind persons navigate independently. Whenever the user wants to locate it, such a person will press a button on remote control and buzzer will ring, then the person can get the idea of where the stick is placed. Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight.

The 2011 statistics by the World Health Organization (WHO) estimates that there are 70 million people in the world living with visual impairment, 7 million of which are blind and 63 million with low vision. The conventional and oldest mobility aids for persons with visual impairments are characterized with many limitations. Some inventions also require a separate power supply or navigator which makes the user carry it in a bag every time they travel outdoor. These bulky designs will make the user to be exhausted. so, let's see, how we can design smart blind stick using Arduino in this blog.

Smart Blind Stick is an interactive device which mainly aims at helping the blind to navigate easily and in a safer manner. In a normal day to day situation a blind person waves the blind stick ahead of them to check for any objects or obstacles. The smart stick helps them in this by detecting if any obstacle is blocking the path being taken by the subject. The device detects the obstacle with the help of a camera attached to the front of the stick. On detection of the obstacle, it is identified, and appropriate instructions are provided to the user. Ultrasonic sensors are used for proximity detection of the obstacle. The stick vibrates on approaching an obstacle. This adds to the safety of the blind person. The appropriate instruction to the blind person is given over Bluetooth earphones. Thus, using the various technology, the stick provides a safer and a better navigation experience for the visually challenged.

1.2 OBJECTIVE

A blind stick is a tool that helps the blind people to navigate and move around in public areas. The blind person is expected to move the stick in front of him to ensure no obstacle is in his way. When the stick meets an obstacle, it is an indication for the blind person that he needs to change the path he was moving in. The smart blind stick aims at giving the blind person a better understanding of the path he is moving in. We achieve this by using a camera and a few ultrasonic sensors. The stick, with the help of a camera, detects the obstacle the blind person is approaching.

The smart blind stick aims at giving the blind person a better understanding of the path he is moving in. We achieve this by using a camera and a few ultrasonic sensors. The stick, with the help of a camera, detects the obstacle the blind person is approaching. This obstacle is detected and analysed, and this data is retrieved on an android device. The data received, which is the obstacle detected, is converted to speech and appropriate instructions are given over Bluetooth earphones to the blind person. The ultrasonic sensors placed at either side of the stick are used to detect the obstacles present in the sides. This helps us in

giving a more efficient instruction to the blind person as to how he can evade the obstacles in front of him in a safe manner. The data of the ultrasonic sensors are manipulated using an Arduino UNO.

With the help of the data processed using these technologies, we aim at providing a better and more convenient method of navigation for the blind person. This stick helps them achieve a higher rate of self-dependency. The system gives a priority to safety and comfort and is also cost effective.

Visually impaired people are the people who find it difficult to recognize the smallest detail with healthy eyes. The objectives of this research work include as follows:

1. To design an assistive technology for visually impaired people that can detect obstacles and provide alternative routes for the blind.
2. To alarm the user through vibration to determine the obstacles direction sources.
3. To help the user find his stick when he mistakenly loses it somewhere. Through this smart blind stick, visually impaired people will have so much of assistance.
4. In case of any problem, with the function of Global Positioning System (GPS), we can track their whereabouts.

CHAPTER 2
LITERATUTE SURVEY

1. A literature survey is a proof essay of sorts. It is a study of relevant literature materials in relation to a topic we have been given. For thorough development of the device Smart Stick for Blind using IOT, we need to go through each and every technical aspect related to it. This chapter provides an introduction to the area of research.

2. A brief Study and Survey has been carried out to understand various issues related to the project which involves providing a smart electronic aid for blind people to provide artificial vision and object detection, real time assistance via using IOT.

3. Our project mainly focuses on the visually impaired people who cannot walk independently in unfamiliar environment. The main aim of our project is to develop a system that helps blind people to move independently.

4. Smart Stick for the blind stick usually consists of three parts to help people travel with a greater degree of psychological comfort and independence: sensing the immediate environment for obstacles and hazards, providing information to move left and right and orientation during travel.

5. Smart Stick for the Blind a complete solution to reach the destination. This system uses IR sensor, Ultrasound sensor and water sensor to detect the obstacle. However, this system just gives an alert if any one of the sensor is triggered, it uses a buzzer to alert the blind person. This system does not use any location identifier or location indicator.

6. Pothole detection for visually impaired which uses a camera that captures image 15 frame per second and based on the concept of image processing the pothole is detected. Problem with this system is use of camera makes it expensive, and also a lot of images captured per second increases overhead and storage requirement.

7. Smart Walking Stick for Blind describes about a Stick which use Raspberry Pi [10] and an ultrasonic sensor to detect objects and intruder, the system also has a camera embedded

with it, and based on the images captured the objects are detected. The objects are analysed based on the set of image datasets that are already stored. This system however, becomes costly due to the use of high-end camera and also because of storage constraints as large volume of datasets are needed to be stored. This system, sometimes might also be inaccurate because the obstacles are detected based on dataset (large set of images) as different objects vary in their shape and size.

8. Smart Belt for Blind uses a belt embedded with ultrasound sensor which detects the obstacle. The belt also has a buzzer which vibrates when obstacle is detected. The entire system is developed in such a way that the distance calculated is sent as an audio message for the blind person, where in which he hears the distance calculated using a speaker.

9. A wearable ultrasonic obstacle sensor for visually impaired. This system uses a couple of ultrasound sensor on either side over the strap of the goggles. This project can detect the intruder in front of the blind person who is wearing the goggles. This system is not robust as the sensor embedded with the goggles makes it heavier and also it cannot detect complex objects such as water, vehicle etc.

CHAPTER 3
HARDWARE DESIGIN

3.1 METHODOLOGY

1. Obstacle detection:

Object detection is the main module of the project. The module mainly aims at finding the right models for detection of the obstacle. There are multiple algorithms that can be used to detect the presence of the obstacle. These models are loaded on to the Raspberry Pi. The obstacle detection actually takes place on the Pi.

2. Obstacle Recognition:

This is the second step once the detection of the obstacle is completed. The models used for the recognition can be trained to recognize custom objects that are required by us. The training is done by feeding the network of the model with enough images of the required object, which allows the m0del to learn from it. Once the model has learnt from the training data, it makes prediction on an image, or a video fed provide by us. The model can also be used to refer obstacle in real time as well.

3. Distance sensing:

Ultrasonic sensors (HCSR04) are used for distance sensing. The Ultrasonic sensors have an echo and a trigger. The trigger Pin sends out an ultrasonic signal out on starting the sensor. The signal on encounter of an obstacle, returns the signal. This signal is captured by the echo terminal of the USs. Based on the time taken by the signal to travel from the trigger and back after hitting the obstacle, is used to calculate the distance. This distance is used to trigger the obstacle detec6 and obstacle recognize modules on the stick.

4. Text to Speech:

This is a small but a vital module of the project. This is used to convert the text messages to speech. These instructions are given over an earphone to the user. The google API GTTS (Google Text-to-Speech) is used for this purpose.

5. Obstacle avoidance:

This is the final module of the project. This mainly deals with the instructions given to the user based on the detected obstacle and the distance to the closest obstacle on either side to re-route. These are converted to speech using gtts. These instructions are given to the blind person over earphones.

3.2 LIST OF HARDWARE COMPONENTS

1. Arduino UNO
2. NODE MCU
3. GPS Module
4. Ultrasonic Sensor
5. Buzzer

3.3 DETAILS OF HARDWARE COMPONENTS

3.3.1 Arduino UNO: -

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analogy input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

Fig 3.3.1 Arduino UNO

Microcontroller	Atmega328p – 8 BIT AVR controller
Operating Voltage	5V and 3.3V
Raw Voltage input	5V to 12V
DC current per I/O pin	40mA

DC current in 3.3V pin	50mA
Flash memory	32Kbytes
EEPROM	1Kbytes
Internal RAM	2Kbytes
Clock Frequency	3.3 V---8MHz 5V----- 16MHz
Operating Techniques	-40℃ to +105℃

3.3.2 Node MCU: -

Node MCU is an open-source firmware for which open source prototyping board designs are available. The name "Node MCU" combines "node" and "MCU" (micro-controller unit). Strictly speaking, the term "Node MCU" refers to the firmware rather than the associated development kits.

Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Extensa LX106 core, widely used in IoT applications (see related projects).

Fig 3.3.2 Node MCU

3.3.3 GPS MODULE: -

GPS(Global positioning System)is a satellite navigation system used to determine the ground position of an object. GPS technology was first used by the United state military in 1960s and expanded into civilian use over the next few decades. Today, GPS receiver are included in many commercial products, such as automobiles, Smartphone, exercise watches etc. GPS system include 24 satellite deployed in space about 12000 miles (19300 kilometre) above the earth's surface. The orbit earth one every 12 hours at extremely fast pace of roughly 7000 miles per hour. The satellites are evenly spread so that satellites are accessible via direct line-of-sight anywhere on the globe. The navigation messages are broadcast at a rate of 50 bits per second. Utilizing this collocation of data, GPS receiver in order to generate position data.

Fig 3.3.3 GPS Module

3.3.4 ULTRASONIC SENSOR: -

An ultra sonic is a device that can measure the distance to an object by using sound waves .It measure distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. The ultrasonic transmitter an ultrasonic wave this wave travel in air and when it gets object by any material it gets reflected back toward the sensor this reflected wave is observed by the ultrasonic receiver module. The accuracy of ultrasonic sensor can be affected by temperature and humidity of the air it is being used. It

operated in frequency in 40 Hz. It can measure the distance 2 cm to 80 cm. This sensor is very popular because multiple purpose application.

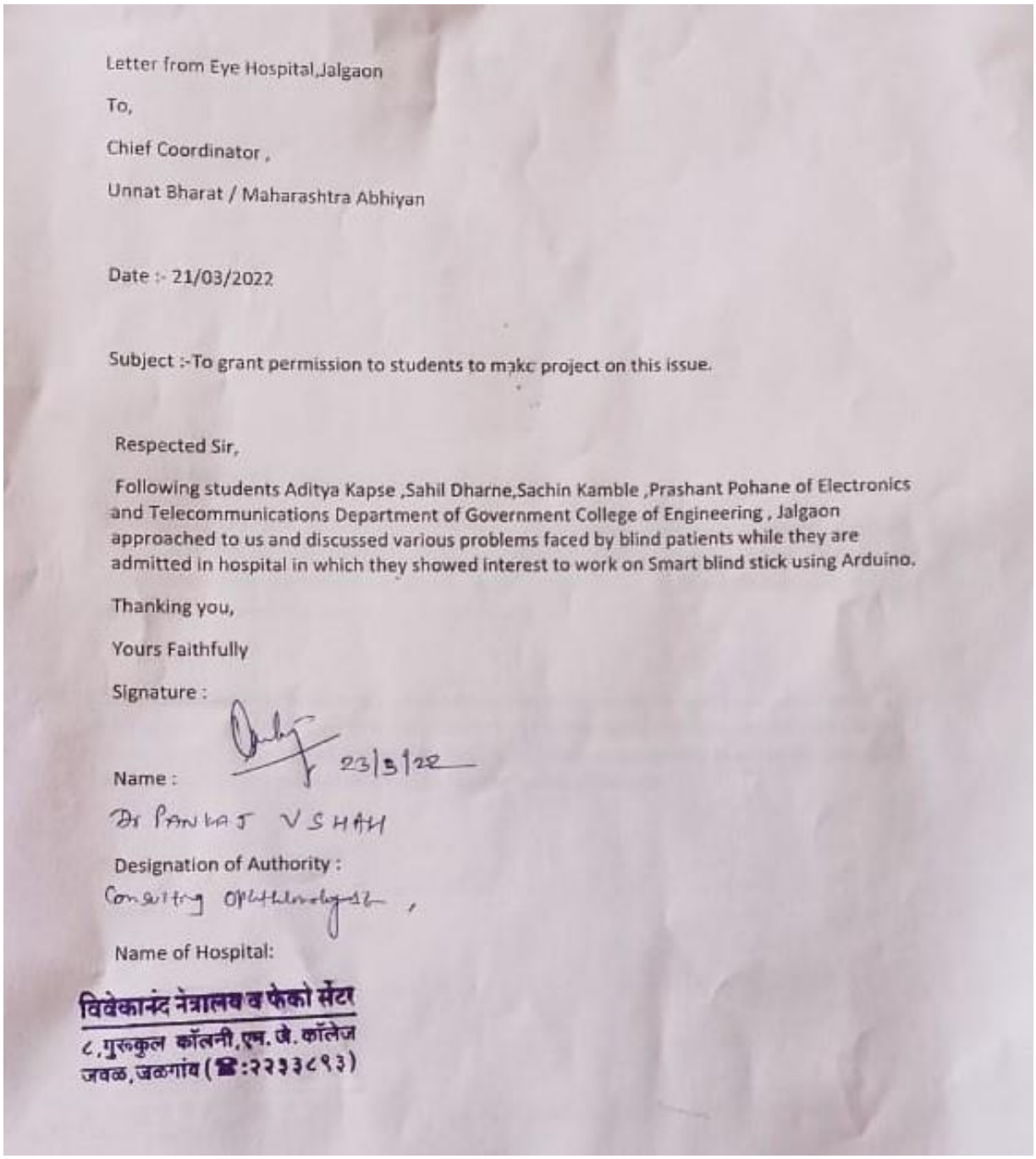
Fig 3.3.4 Ultra Sonic Sensor

3.3.5 BUZZER: -

A buzzer is a small yet efficient component to add sound features to add sound to our project system. It is very small and compact 2 pin structure. Buzzer is in the lower portion of the audible frequency range of 20 Hz to 20 KHz. This is accomplished by covering an electric, oscillating signal in the audible range, into mechanical energy.

Fig 3.3.5 Buzzer

3.4 LETTER OF AUTHORITY



Letter from Eye Hospital,Jalgaon

To,

Chief Coordinator ,

Unnat Bharat / Maharashtra Abhiyan

Date :- 21/03/2022

Subject :-To grant permission to students to make project on this issue.

Respected Sir,

Following students Aditya Kapse ,Sahil Dharne,Sachin Kamble ,Prashant Pohane of Electronics and Telecommunications Department of Government College of Engineering , Jalgaon approached to us and discussed various problems faced by blind patients while they are admitted in hospital in which they showed interest to work on Smart blind stick using Arduino.

Thanking you,

Yours Faithfully

Signature :

23/3/22

Name :

Dr PANKAJ V SHAH

Designation of Authority :

Consulting Ophthalmologist ,

Name of Hospital:

विवेकानंद नेत्रालय व फेको सेंटर
८,गुरुकुल कॉलनी,एम. जे. कॉलेज
जवळ,जळगांव (☎:२२३३८९३)

CHAPTER 4

SYSTEM PERFOMANCE AND ANALYSIS

4.1 BLOCK DIAGRAM

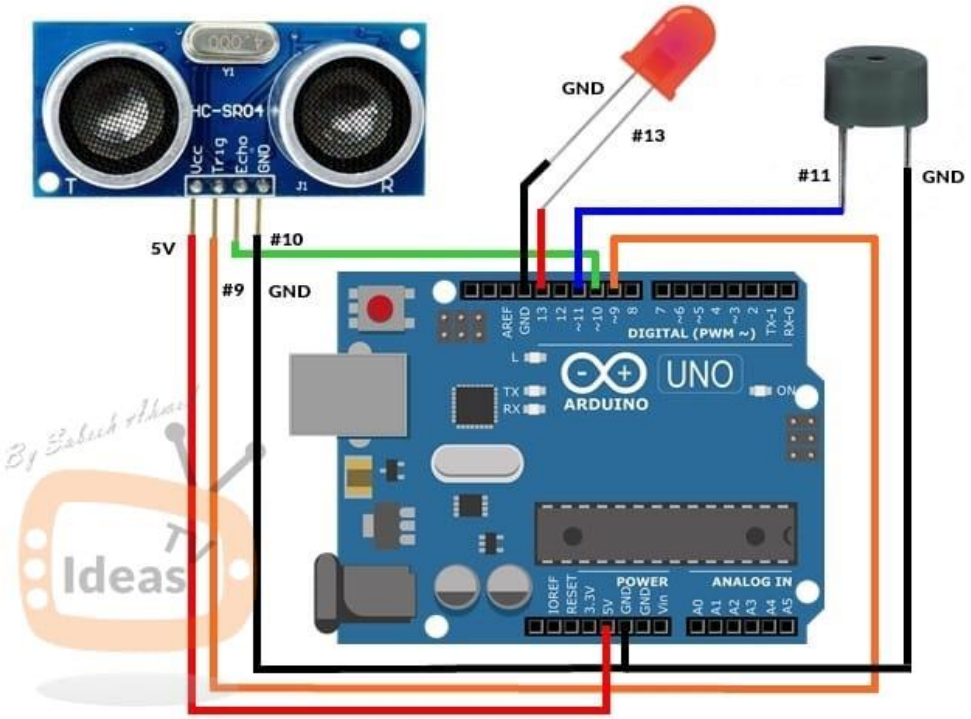


Fig 4.1.(a) Block Diagram of Obstacle Detector

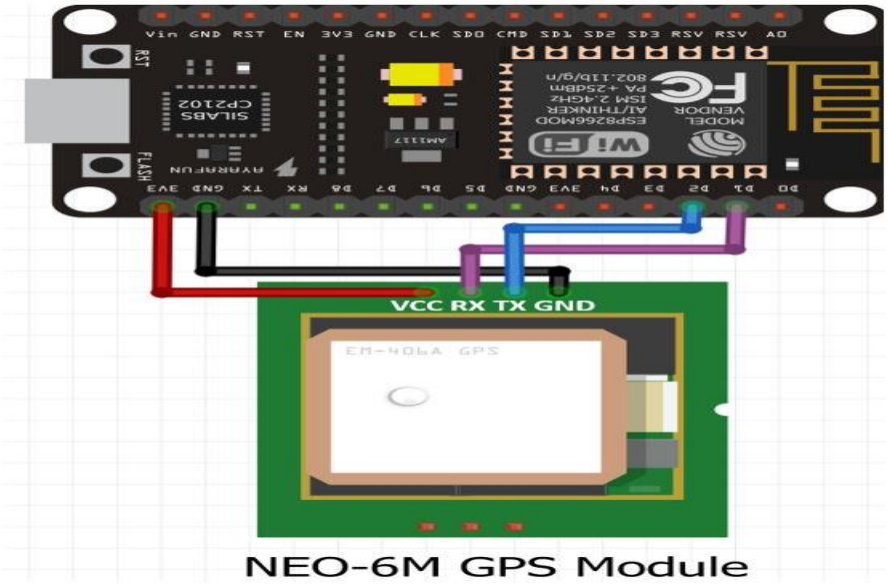
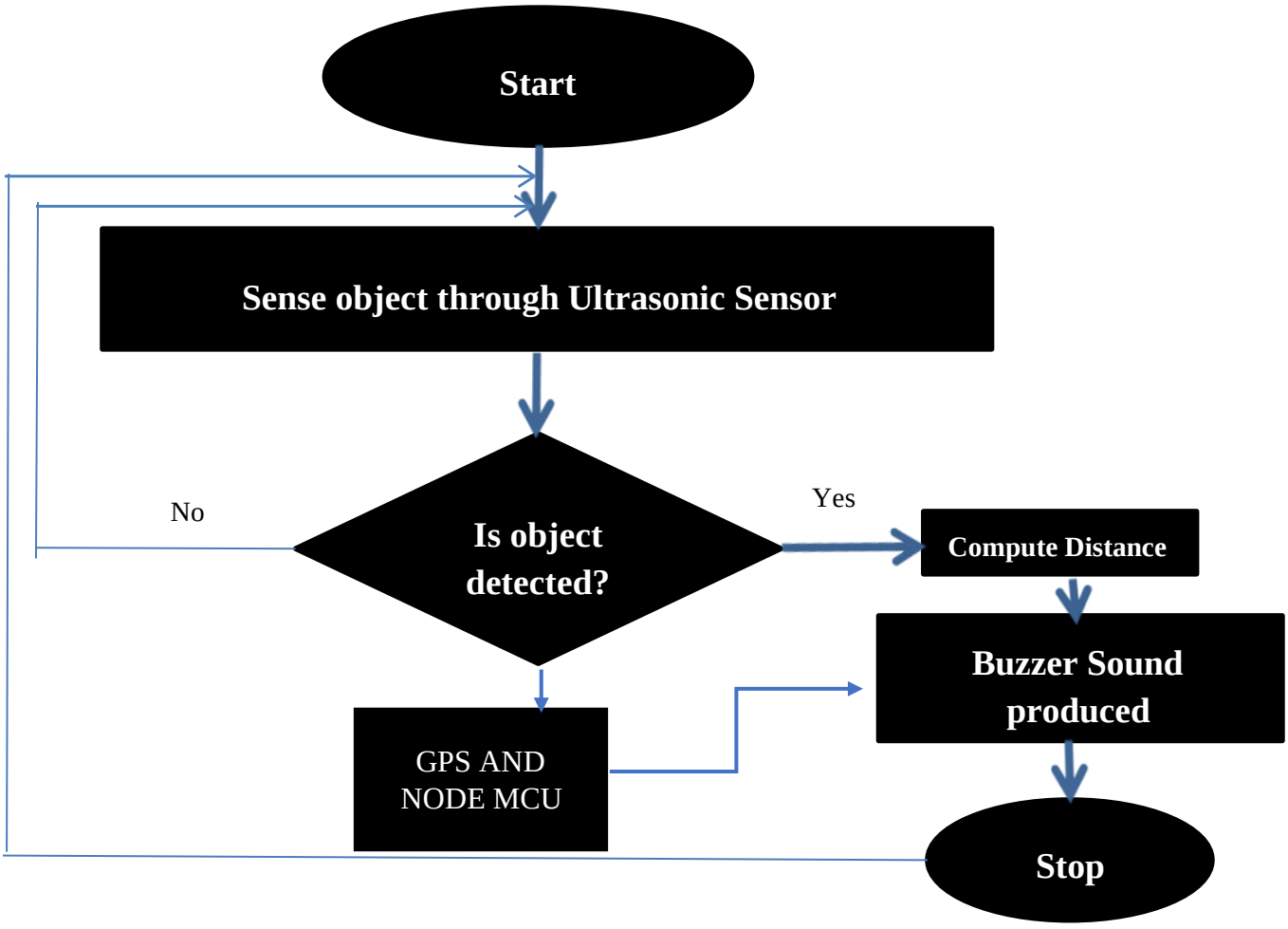


Fig 4.2(b) Block Diagram of Location Tracker

4.2 Software Design

The smart blind stick system project uses C programming in Arduino software for operating the whole hardware. This section mainly includes information about software and programming in detail. We are using Arduino software for programming our sensors and compiling the code we designed for our project.

4.3 FLOW CHART



4.4 RESULT

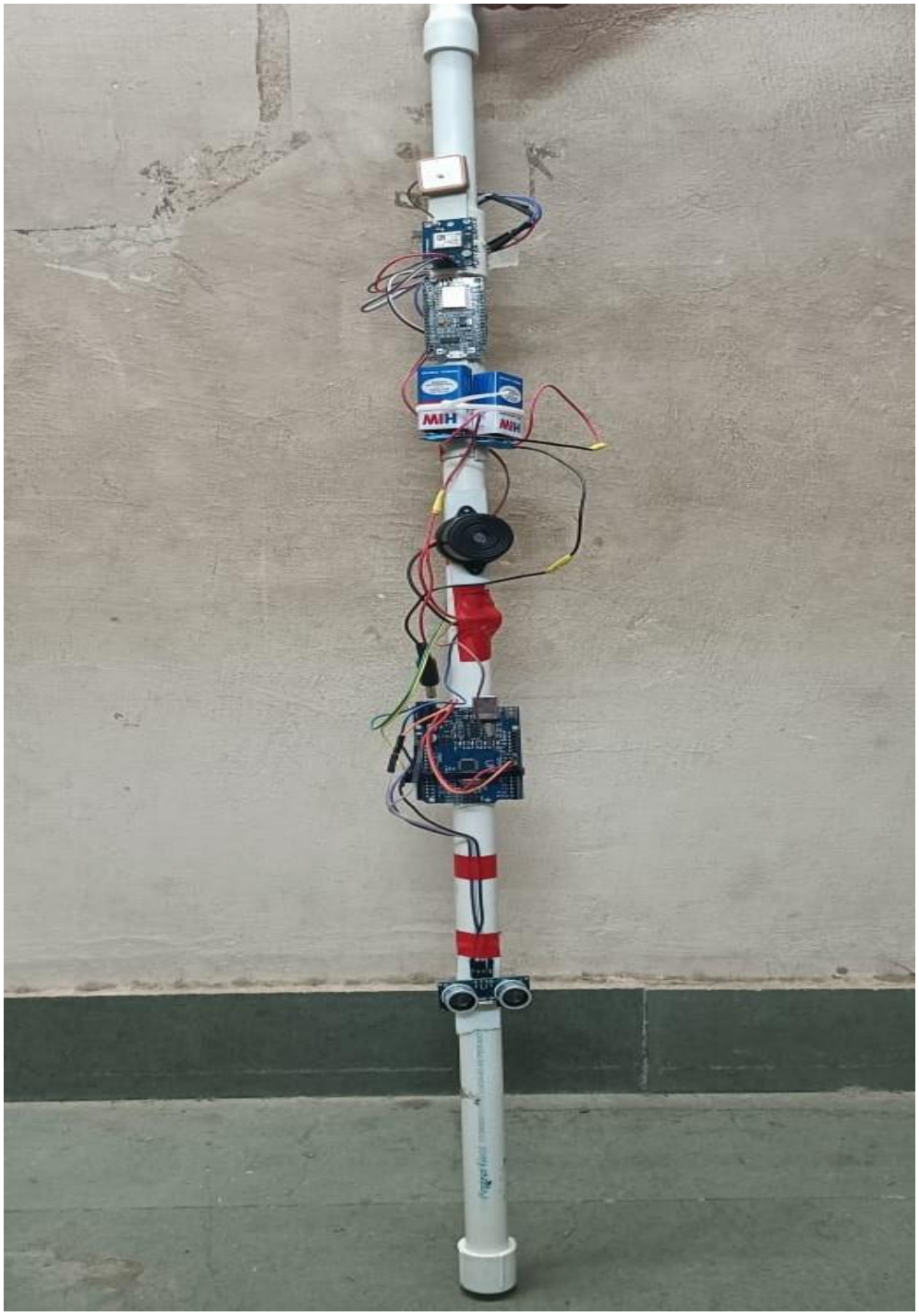


Fig 4.4 (a) SMART BLIND STICK PHOTO

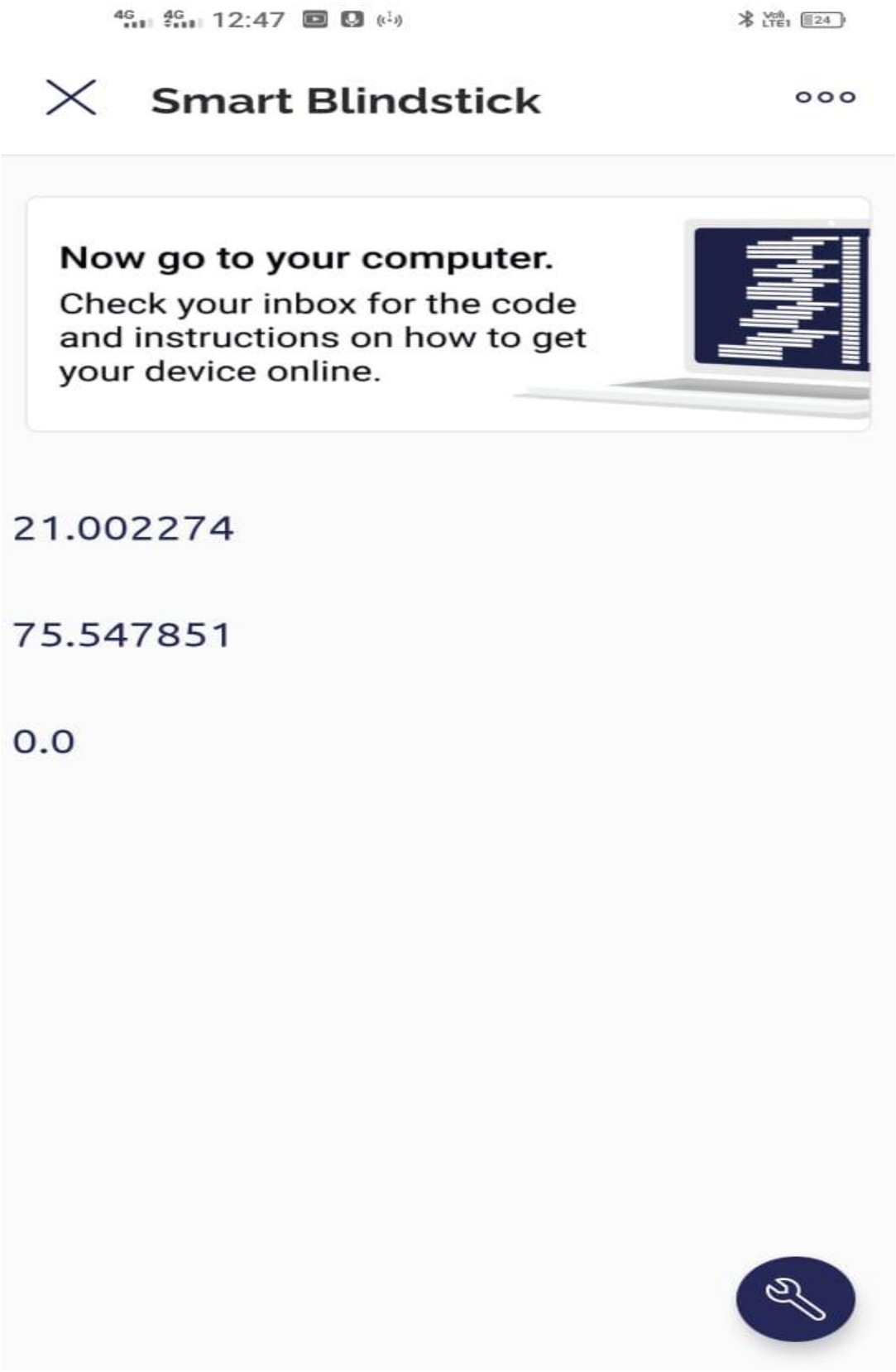


Fig 4.4 (b) Result of Location Tracker

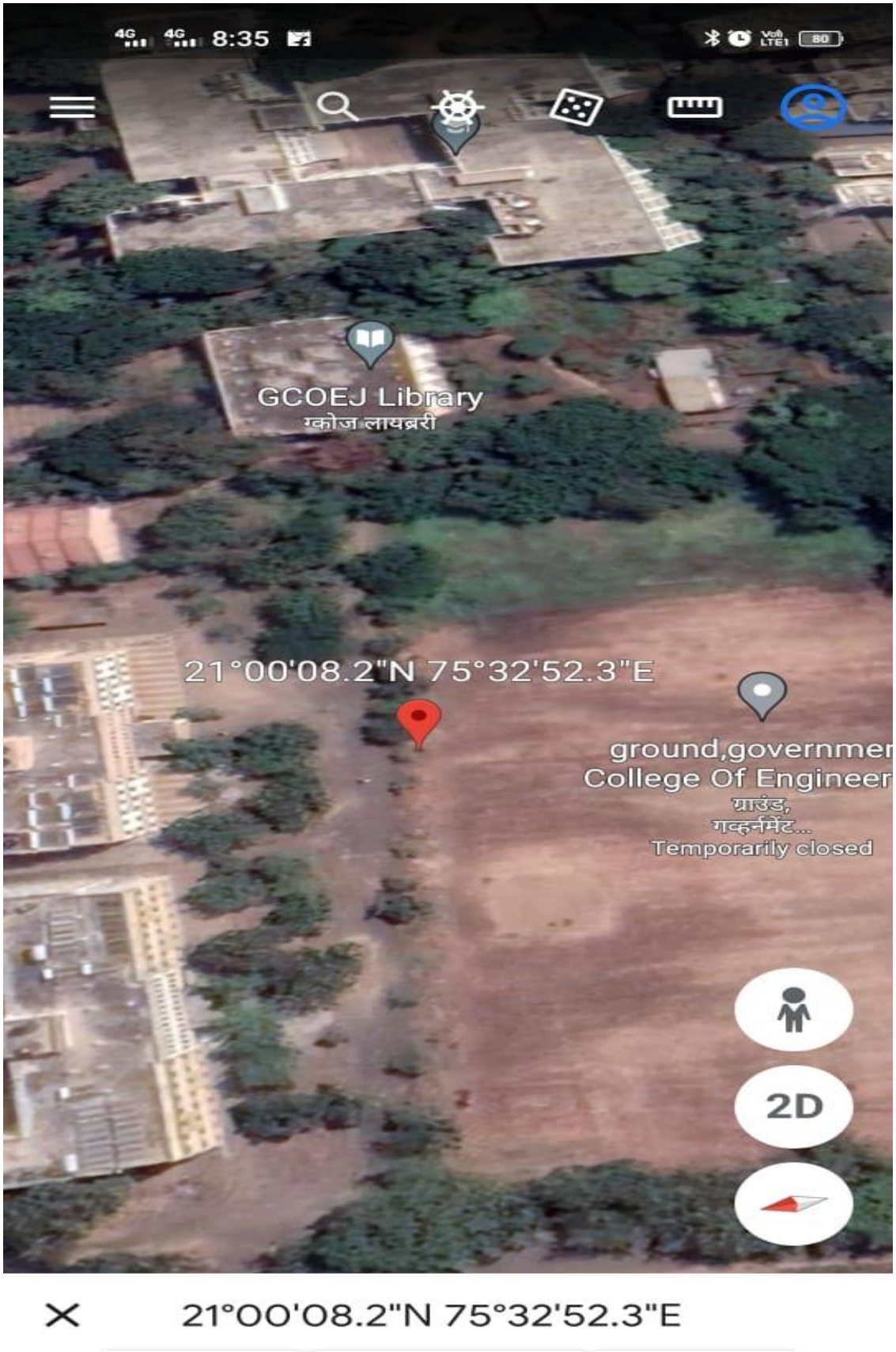


Fig 4.4(c) Map For Location Tracker

CHAPTER 5

ADVANTAGES, LIMITATIONS AND APPLICATION

4.1 ADVANTAGES: -

1. This system consists of different type of the sensor, which is used to measure the distance and alert the blind people.
2. It is simple to use and is affordable.
3. This system can navigate the location of the blind people when they find themselves in danger or some adverse situations.
4. Smart blind stick is robust, and the stick is light, portable and reliable.
5. It consumes low power which makes it feasible to use.

4.2 LIMITATIONS: -

1. Pits and bumps of the road cannot be detected using this device.
2. Smart stick is unfolded able.
3. As the sensor is sensitive, it should be handled in utmost care and prevented from contact with water.

4.3 APPLICATIONS: -

Facilitates the visually impaired people through various user-friendly features such as Navigation, Obstacle alert and communication.

CHAPTER 6
CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION: -

It is worth mentioning at this point that the aim of the of this study is design and implementation of a smart walking stick for the blind has been fully achieved. The smart stick as a basic platform for the coming generation of more adding devices to help the visually impaired to navigate safely both indoor and outdoor. It is effective and affordable. It leads the good result in detecting the obstacles on the path of the user in a range. This project offers low cost, reliable, portable, low power consumption, and robust technology for navigation with obvious short response time. In this project, different types of sensors and other component with the light weight. It also includes Global Positioning system (GPS) which is used to find the actual position of the blind person. And other function is Global system for mobile communication (NODE MCU) module which help to send the location to their member in case the blind person gets lost or if they are in the danger. In this way we can make smart blind stick using Arduino.

5.2 FUTURE SCOPE: -

The stick can be enabled with GPS which can help the blind for better navigation. The smart blind stick can be trained for a greater number of objects which in turn would help the blind person to move around in various neighbourhoods with increased level of safety. In the future, the stick can be used for face detection. This increases the safety of the blind person in knowing the identity of the person in front of him.

CHAPTER 7

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CHAPTER 8 APPENDIX A

DATASHEET OF ESP8266 MODULE

ESP8266 Specification

Parameters		Conditions	Min	Typical	Max	Unit
Operating Temperature Range		-	–40	Normal	125	°C
Maximum Soldering Temperature		IPC/JEDEC J-STD-020	-	-	260	°C
Working Voltage Value		-	2.5	3.3	3.6	V
I/O	V_{IL}	-	–0.3	-	$0.25V_{IO}$	V
	V_{IH}		$0.75V_{IO}$		3.6	
	V_{OL}	-	-	-	$0.1V_{IO}$	
	V_{OH}		$0.8V_{IO}$		-	
	I_{MAX}	-	-	-	12	mA
Electrostatic Discharge (HBM)		TAMB=25°C	-	-	2	KV
Electrostatic Discharge (CDM)		TAMB=25°C	-	-	0.5	KV

Fig A.1 Specification of ESP8266 Overview

ESP8266 is Wi-Fi enabled system on chip (SoC) module develop by ESP8266 if system. It is mostly used for the development of the Internet of Things (IoT) embedded applications. The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturing company ESP8266 if Systems. The ESP8266 is capable of either hosting an application or offloading all the Wi-Fi networking functions from another application processor.

WI-FI MODULE ESP8266

ESP8266 if systems designed the ESP8266 Wi-Fi module to support both the TCP/IP capability and the microcontroller access to any Wi-Fi network. It provides the solutions to meet the requirements of industries of IoT such as cost, power, performance, and design. It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network.

The ESP8266 Wi-Fi module is highly integrated with RF balun, power modules, RF transmitter and receiver, analog transmitter and receiver, amplifiers, filters, digital baseband, power modules, external circuitry, and other necessary components.

Fig A.2 Wi-Fi Module

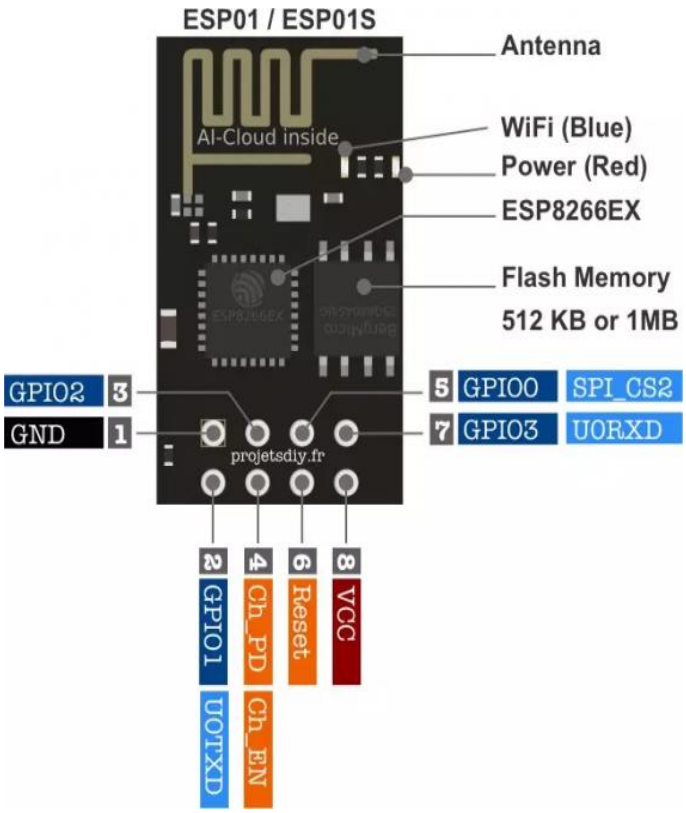

Fig A.3 Pin Description of Wi-Fi Module

Pin Description

- 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2).
- General-purpose input/output (16 GPIO).
- Inter-Integrated Circuit (I^2C) serial communication protocol.
- Analog-to-digital conversion (10-bit ADC).
- Serial Peripheral Interface (SPI) serial communication protocol.
- I^2S (Inter-IC Sound) interfaces with DMA(Direct Memory Access)
- UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2).
- Pulse-width modulation (PWM).
- ESP-01 comes with 8 pins (2 GPIO pins) with PCB (printed circuit board) trace antenna.
- ESP-02 comes with 8 pins, (3 GPIO pins) with a U-FL antenna connector.
- ESP-03 comes with 14 pins, (7 GPIO pins) with Ceramic antenna.
- ESP-04 comes with 14 pins, (7 GPIO pins) and without an antenna.
- **3V3**: – 3.3 V Power Pin.
- **GND**: – Ground Pin.
- **RST**: – Active Low Reset Pin.
- **EN**: – Active High Enable Pin.
- **TX**: – Serial Transmit Pin of UART.
- **RX**: – Serial Receive Pin of UART.

GPIO0 & GPIO2: – General Purpose I/O Pins. It also known as TX/RX pins are used for Programming the module or for serial I/O purpose