WEARABLE SPEECH COMMAND BLIND ASSISTANT SYSTEM

A MINI PROJECT REPORT

Submitted by

ROSZHAN RAJ M S 201901108

Department of Computer Science and Engineering

RAJALAKSHMI INSTITUTE OF TECHNOLOGY, CHENNAI

ANNA UNIVERSITY: CHENNAI 600025

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ABSTRACT

Blind people are facing a lot of difficulties even to lead a normal life. They always need someone to help them. Their life becomes a dependable one. Our new proposed wearable Speech Command blind assistant system which will assist the blind person in all its way. It will navigate them, guide them and help them to recognize text, images, videos, obstacles. It will act as an assistant for blind people. It would be affordable, accessible and help a lot of blind people. This Blind assistant system would make the life of the blind people to be independent and to have a life without blind stick

LIST OF ABBREVIATIONS

ABBREVIATION	EXPANSION
GPS	Global Positioning System
IDE	Integrated Development Programme
LED	Light Emitting Diode
EEPROM	Electronically Erasable Programmable Read-Only Memory
TX	Transmitting pin
RX	Receiving Pin
PWM	Pulse Width Modulation
USB	Universal Serial Bus

CHAPTER 1 INTRODUCTION

1.1 OVERVIEW

India is a country with one of the largest visually impaired people. About 40 million which accounts 20% world's blind population They are facing a lot of difficulties even in normal day to day life basis such as crossing roads, finding obstacles etc. They always need a person to help them. Their life becomes unavoidably dependent one. Medically, lot of projects are going but the probability of outcome is very low. So, to overcome this this assistant system will help them a lot. Given the growth in the numbers of visually impaired (VI) people in low-income countries, the development of affordable electronic travel aid (ETA) systems employing devices, sensors, and apps embedded in ordinary smartphones becomes a potentially cost-effective and reasonable all-in-one solution .This system consists of a section for Obstacle detection and another one for to find Location. We made use of Ultrasonic sensor and GPS module to achieve the Obstacle detection and location finding respectively. The software section is done with Arduino IDE. Finally, the output will be intimated to the user through speech commands. So with all this we can assist the blind people.

1.2 NEED FOR THE PROJECT

To make the life of the blind people easier. To lower their challenging issues in the society. To find the location of the user and help them to find obstacles with distance. This project will help the blind people to lead a normal life. The Assistor may serve as a potential aid for people with visual disabilities and hence improves their quality of life.

1.3 OBJECTIVE:

- To develop an obstacle identifier and locate how far the object is presented.
- To find the person location
- To convey the gathered information to the user using speech commands.

1.4 PROBLEM STATEMENT

Blind people are facing a lot of issues to lead a normal life. To overcome this, an assistant system was developed. This will help them in all its way to lead a normal life.

1.5 ORGANIZATION OF THE REPORT

CHAPTER 1: Discusses the Overview of Wearable speech command Blind assistant system, states the need and overview of the project.

CHAPTER 2: Discusses some of the papers referred for the project works were summarized.

CHAPTER 3: Discusses about the block diagram, pin description and the components used in the project.

CHAPTER 4: Discusses the conclusion of the proposed system model and ideas that can be extended in the future.

CHAPTER 2 LITERATURE SURVEY

INTRODUCTION

In this literature survey we have discussed different types of research works in the form of journals, articles, books, literature papers to get a better understanding of the project topic. This chapter gives an overview of the researches carried out related to the project works on "WEARABLE SPEECH COMMAND BLIND ASSISTANT SYSTEM". Some of the major papers referred for the project work were summarizes below.

LITERATURE SURVEY

Mohammad Marufur et. al. The system is able to detect the obstacles in front of the user, humps on the ground, moving objects. In addition, the system detects the sudden fall and informs the user's guardian. The smartphone application generates audible instructions to navigate the user properly. The application also updates the current location of the user to keep track and notifies the guardians when the user falls down or in distress.

Niraj Kulkarni et.al in this the disciplines of Internet of Things and Deep Learning and provides features like face recognition, image captioning, text detection and recognition, and online newspaper reading. The hardware architecture consists of a Raspberry Pi, a USB webcam, a USB microphone, earphones, power source, and extension cables. The user can interact with the Smart Cap by giving specific commands, which trigger the corresponding feature module that returns an audio output. The face recognition module is based on the dlib's face recognition project. Google's Vision API service is used for text detection and recognition.

Nirmal A kumar et.al it uses an ultrasound sensor to measure the distance of an object to the user. This image is processed and the output is given in the form of an audio signal. This system also makes use of a NEO-6M GPS module to provide real time position status of the user. The system also uses an inbuilt GSM module in the Raspberry Pi to allow the user to send a distress signal to the authorities concerned. The signal transmitted consists of an alert message with the current location of the user.

Akhilesh Krishnan et.al the Assistor works based on the technology of echolocation, image processing and a navigation system.The Assistor uses ultrasonic sensors to echo sound waves and detect objects. An image sensor is used to identify the objects in front of the user and for navigation by capturing runtime images and a Smartphone app is used to navigate the user to the destination using GPS (Global Positioning System) and maps.

Roy ABI ZEID DAOU et. al the design, the implementation and the validation of smart shoes that would serve as an effective solution for more secured movements for blind and visually impaired people will be proposed. This system is developed to detect obstacles, wet floor and patient's falls. The user will be notified acoustically using some voice alarms. Moreover, a compatible phone application is designed to notify the patient's parents in case of any issue and share his location.

Jeffrey CHEHADE et.al The proposed assistive system comprises wearable smart glasses, an intelligent walking stick, a mobile device app, and a cloudbased information management platform. Visually impaired people can wear the proposed wearable smart glasses and hold the proposed intelligent walking stick to detect aerial obstacles and fall events on roads. Moreover, the proposed intelligent walking stick can vibrate to guide visually impaired people to avoid aerial obstacle collision accidents. Furthermore, when visually impaired people experience a fall event, an urgent notification is immediately sent to their family members or caregivers

Georgio ABOU HAYDAR et. al it offers an overview of recent ETA research prototypes that employ smartphones for assisted orientation and navigation in indoor and outdoor spaces by providing additional information about the surrounding objects.. Comparative meta-analysis showed how various smartphone-based ETA prototypes could assist with better orientation, navigation, and way finding in indoor and outdoor environments.

SUMMARY

Various concepts, sensors and devices for the Wearable speech command blind assistant system are explained in the literature survey for different types of applications.

CHAPTER 3 SYSTEM DESIGN AND DESCRIPTION

3.1 INTRODUCTION

This chapter describes the system design and its working. Here we discuss about the proposed system model with its architecture and pin diagram. We discuss about the detailed description of components we used in our circuit connection. The block diagram for the circuit connection will be discussed here.

3.2 BLOCK DIAGRAM

Figure 3.2(a) shows the component that is needed for the object detection .Here, the ultrasonic sensor sends the ultrasonic waves and receives it. The ultrasonic sensor works by sending out a sound wave at frequency above the range of human hearing. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse. This ultrasonic sensor is connected to ARDUINO (UNO) which is an open source microcontroller board.TO get audio output; a speaker is connected to ARDUINO (UNO).

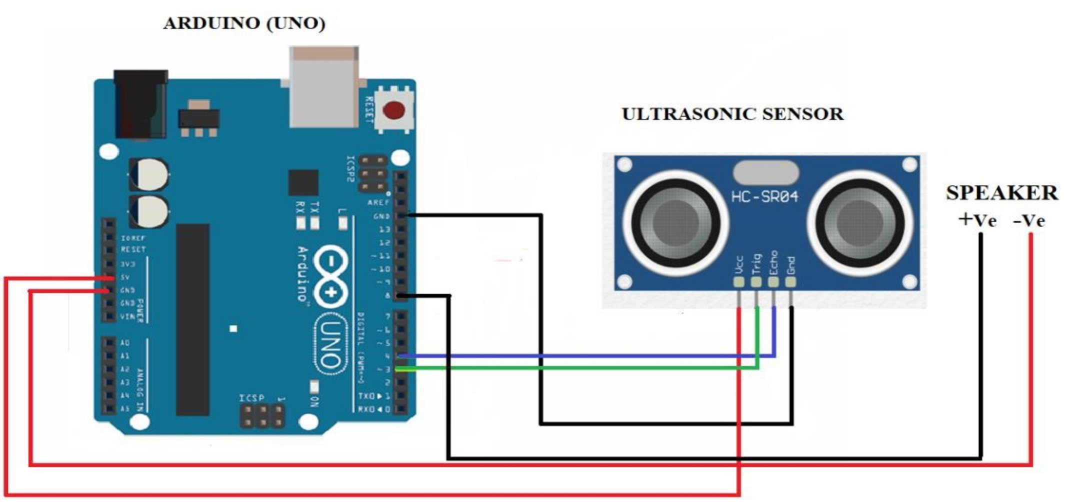

Figure 3.2(a) Block diagram of object detection

By the information from the received ultrasonic pulses, the system measures the distance between the user and the obstacle. If the obstacle is there less than 30 cm, then it will give the alert as “DANGER” via the speaker.

Figure 3.2(b) is the block diagram for location detection using GPS tracking. GPS means Global positioning system which will locate the person location.

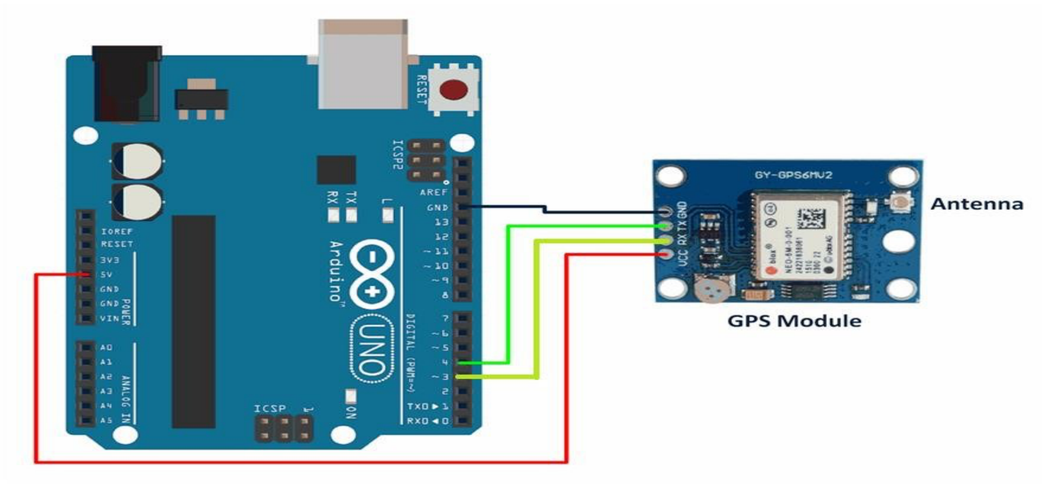

Figure 3.2(b) Block diagram of location detection

This will emit radio waves which will be decoded by GPS devices. The radio wave sent by GPS consists of three most information.

1) Pseudorandom code - This will consists of the ID of satellite which is sending the information.

2) Ephemeris data - This will consists of Position and health of the satellite.

3) Almanac data - It will tell where each GPS satellite should be at any time throughout the day and shows the orbital information for the satellite.

Normally, by decoding all these information we are tracking the locations. Here we are using UBLOX NEO 6M Module it is a chip with bandwidth of 9600. It consists of LED indicator if it doesn't blink means it is searching for the satellites and if it is blinking means position of the satellite is found. It consists of regulator because it can withstand only low voltages. It also consists of battery and EEPROM which will act as a backup and memory storage respectively. It has four pins TX, RX, Vcc and Gnd. RX pin is the input used to receive commands to set parameters as well as TX pin is the output. This both will do a serial Communication. Here we will use an antenna to capture the signals even in a closed place. [NO.4]

3.3. 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 analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards.

Figure 3.3 ARDUINO UNO

The ATmega328on the board comes pre-programmed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use the FTDI USB-toserial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

3.3.1 PIN DESCRIPTION

Figure 3.3.1 shows the list of pins available in the ARDUINO UNO. The14 digital input/output pins can be used as input or output pins by using pin Mode (), digital Read () and digital Write () functions in arduino programming.

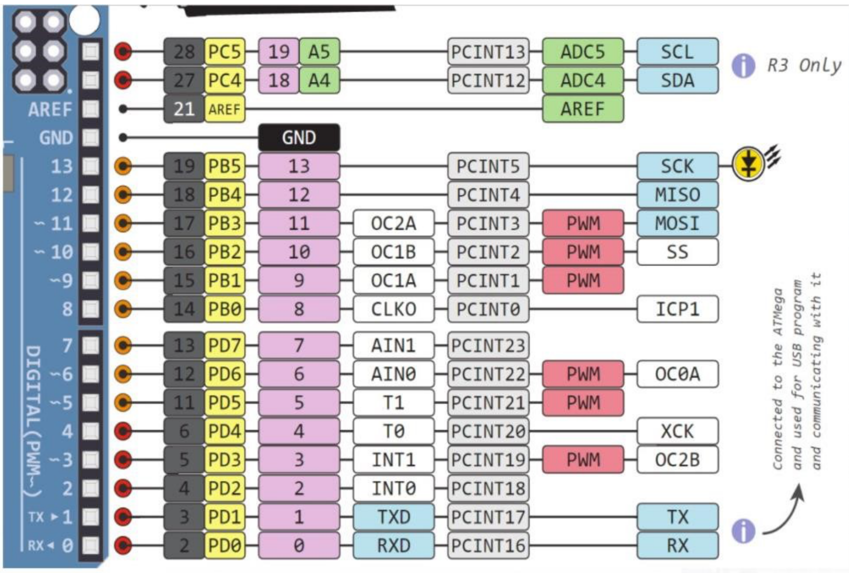

Figure 3.3.1 pin diagram of ARDUINO UNO

Each pin operate at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50Kilo Ohms which are disconnected by default. In Serial Pins 0 (Rx) and 1 (Tx), Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip. External Interrupt Pins 2 and 3 can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. PWM Pins 3, 5, 6, 9 and 11 provide an 8-bit PWM output by using analog Write () function. SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13(SCK) are used for SPI communication. In-built LED Pin 13 is connected with an built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off. Along with 14 Digital pins, there are 6 analog input pins, each of which provide 10 bits of resolution, i.e. 1024 different values. They measure from 0 to 5 volts but this limit can be increased by using AREF pin with analog Reference () function. Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using Wire library. AREF Used to provide reference voltage for analog inputs with analog Reference () function. By making this reset pin LOW, we resets the microcontroller.

3.4 ULTRASONIC SENSOR

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).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 = ½ T x C (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second).

Figure 3.4 Ultrasonic sensor

It has 4 pins-VCC, Trigger, Echo and ground. A pulse sent to the trigger pin (min. 10 millisecond pulse width) to trigger the sensor into sending 8 consecutive ultrasonic waves which is then received back upon contact with an obstacle. Ultrasonic ranging module HC - SR04 provides 2cm - 400cm noncontact measurement function, the ranging accuracy can reach to 3mm.

3.5 GPS MODULE UBLOX

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, we can monitor the status of the module

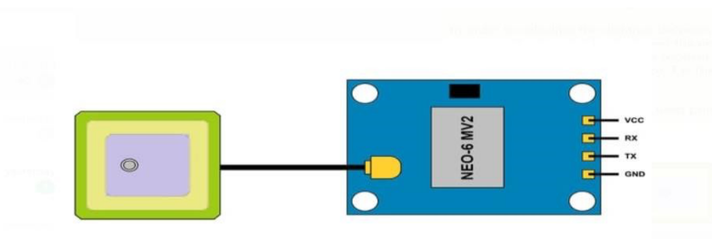

Figure 3.5 GPS Module UBLOX.

Hardware Overview of NEO-6M GPS Module

3.5.1 NEO-6M GPS Chip

At the heart of the module is a NEO-6M GPS chip from u-blox. The chip measures less than the size of a postage stamp but packs a surprising amount of features into its little frame. It can track up to 22 satellites on 50 channels and achieves the industry's highest level of sensitivity i.e. -161 dB tracking, while consuming only 45mA supply current. Unlike other GPS modules, it can do up to 5 location updates a second with 2.5m Horizontal position accuracy.

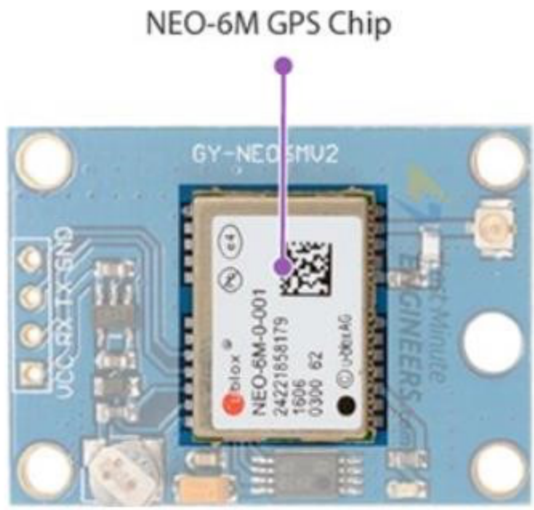

Figure 3.5.1 NEO-6M GPS CHIP

The u-blox 6 positioning engine also boasts a Time-To-First-Fix (TTFF) of less than 1 second. One of the best features the chip provides is Power Save Mode (PSM). It allows a reduction in system power consumption by selectively switching parts of the receiver ON and OFF. This dramatically reduces power consumption of the module to just 11mA making it suitable for power sensitive applications like GPS wristwatch. The necessary data pins of NEO-6M GPS chip are broken out to a 0.1″ pitch headers. This includes pins required for communication with a microcontroller over UART. The module supports baud rate from 4800bps to 230400bps with default baud of 9600.

3.5.2 POSITION FIX LED INDICATOR

There is an LED on the NEO-6M GPS Module which indicates the status of Position Fix. It'll blink at various rates depending on what state it's in:

- **No Blinking** – It's searching for satellites.
- **Blink every 1s** – Position Fix is found (The module can see enough satellites)

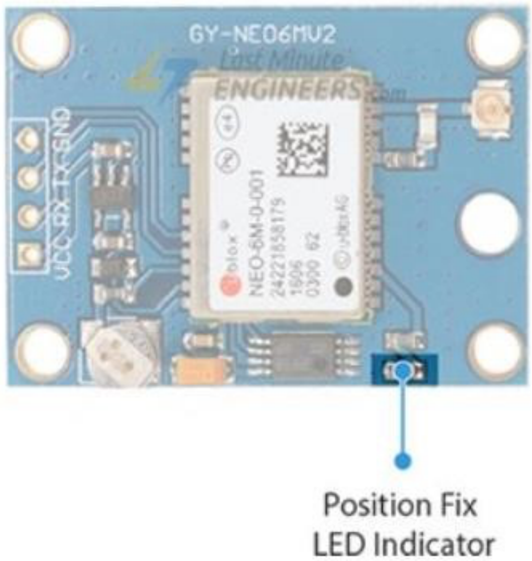

Figure 3.5.2 Position Fix LED Indicator

3.5.3 (3.3V) LDO REGULATOR

The operating voltage of the NEO-6M chip is from 2.7 to 3.6V. But the good news is that, the module comes with MIC5205 ultra-low dropout 3V3 regulator. The logic pins are also 5-volt tolerant, so we can easily connect it to an Arduino or any 5V logic microcontroller without using any logic level converter.

Figure 3.5.3 (3.3V)LDO Regulator

3.5.4 BATTERY AND EEPROM

The module is equipped with an HK24C32 two wire serial EEPROM. It is 4KB in size and connected to the NEO-6M chip via I2C.The module also contains a rechargeable button battery which acts as a super-capacitor. An EEPROM together with battery helps retain the battery backed RAM (BBR).

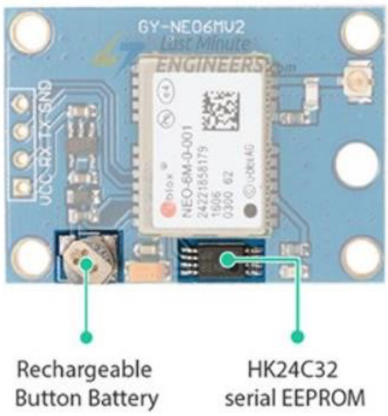

Figure 3.5.4 Battery and EEPROM

The BBR contains clock data, latest position data (GNSS orbit data) and module configuration. But it’s not meant for permanent data storage. As the battery retains clock and last position, time to first fix (TTFF) significantly reduces to 1s. This allows much faster position locks. Without the battery the GPS always cold-start so the initial GPS lock takes more time. The battery is automatically charged when power is applied and maintains data for up to two weeks without power.

3.5.5 ANTENNA

An antenna is required to use the module for any kind of communication. So, the module comes with a patch antenna having -161 dBm sensitivity. You can snap-fit this antenna to small U.FL connector located on the module. Patch antenna is great for most projects. But if we want to achieve more sensitivity or put your module inside a metal case, you can also snap on any 3V active GPS antenna via the U.FL connector.

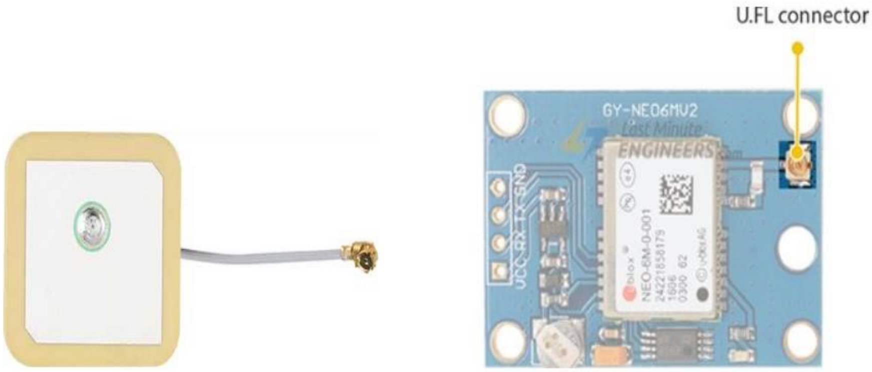

Figure 3.5.5Antenna and U.FL connector

3.5.6 NEO-6M GPS MODULE PINOUT

- **GND** is the Ground Pin and needs to be connected to GND pin on the Arduino.
- **TxD(**Transmitter) pin is used for serial communication.
- **RxD** (Receiver) pin is used for serial communication.
- **VCC** supplies power for the module. You can directly connect it to the 5V pin on the Arduino.

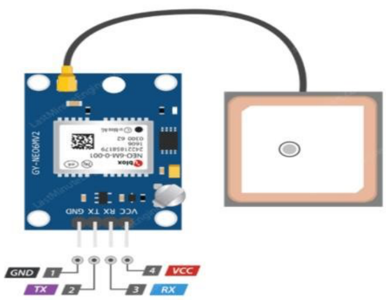

Figure 3.5.6 NEO-6M GPS Module Pin out

3.6 SPEAKER

Speakers are one of the most common output devices used with computer systems. Speakers are **transducers that convert electromagnetic waves into sound waves**. The speakers receive audio input from a device such as a computer or an audio receiver. This input may be either in analog or digital form.

3.7 SOFTWARE

3.7.1 ARDUINO IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

3.8 SUMMARY

In this section we discussed about the components used with their architect and Pin description. The Ultrasonic sensor used echolation technology to find obstacles and GPS module received the radio waves sent by satellites and decoded the location.

CHAPTER 4 CONCLUSION AND FUTURE SCOPE

This paper proposes a wearable navigation system that helps the visually challenged to move freely in both indoor and outdoor settings. The proposed model has an accuracy of 90 %. The overall aim was to provide a simple wearable and economic device for the visually impaired. It can be used by people of all ages and is convenient to operate. Obstacle is sensed and distance is measured using ultrasonic sensor. Audio assistance is given in the form of speech signals using speaker which is inbuilt in arduino ide. Thus, the final audio output containing the alert sound is given through speaker to the user. This project can be used as a wearable device or it can be implemented in the cane for the comfort of the blind.

As future work, we are trying to develop and implement a more accurate navigation model which helps blind people in identifying and distancing any surrounding objects, as the present model cannot give the distance of moving objects accurately. This will be achieved using high speed microprocessor technology. This technology can also be essentially implemented in the form of a walking stick for the blind which uses similar technology to this project but is more versatile and user friendly.

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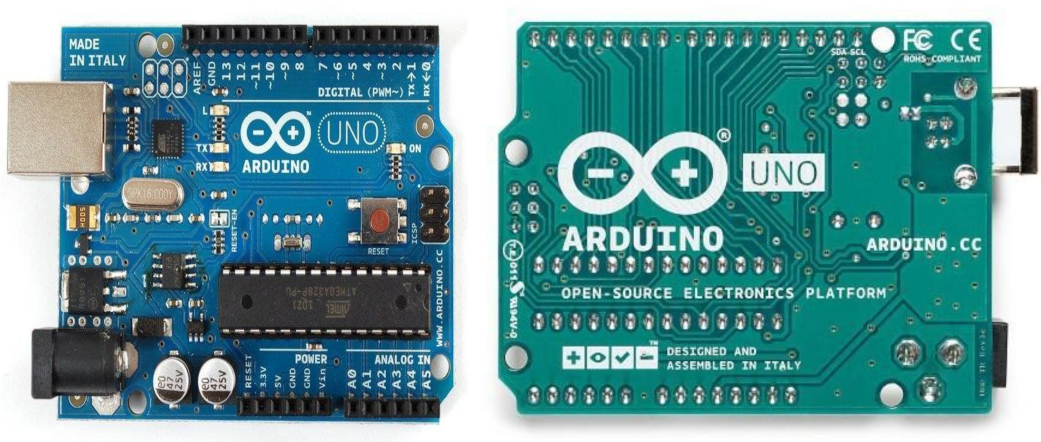
APPENDICES

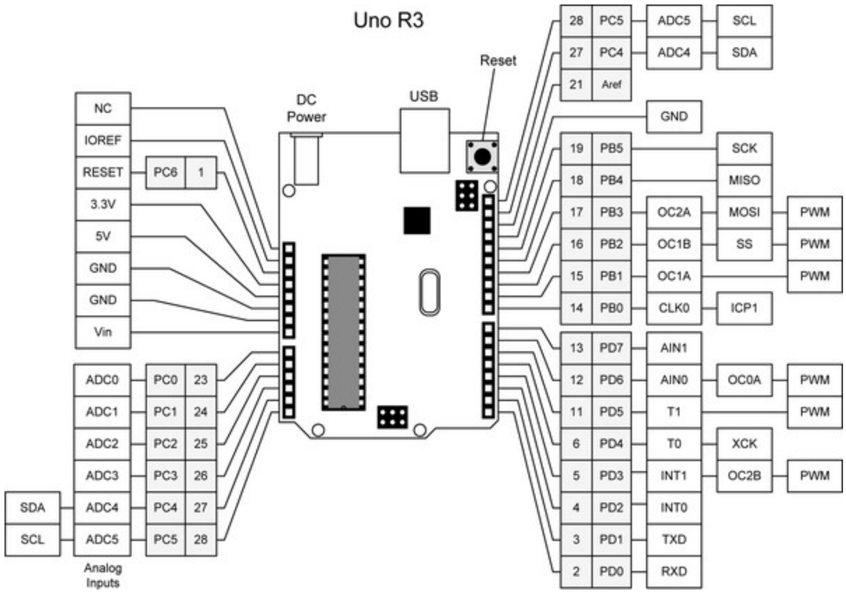
<u>DATASHEET FOR ARDUINO UNO:</u>



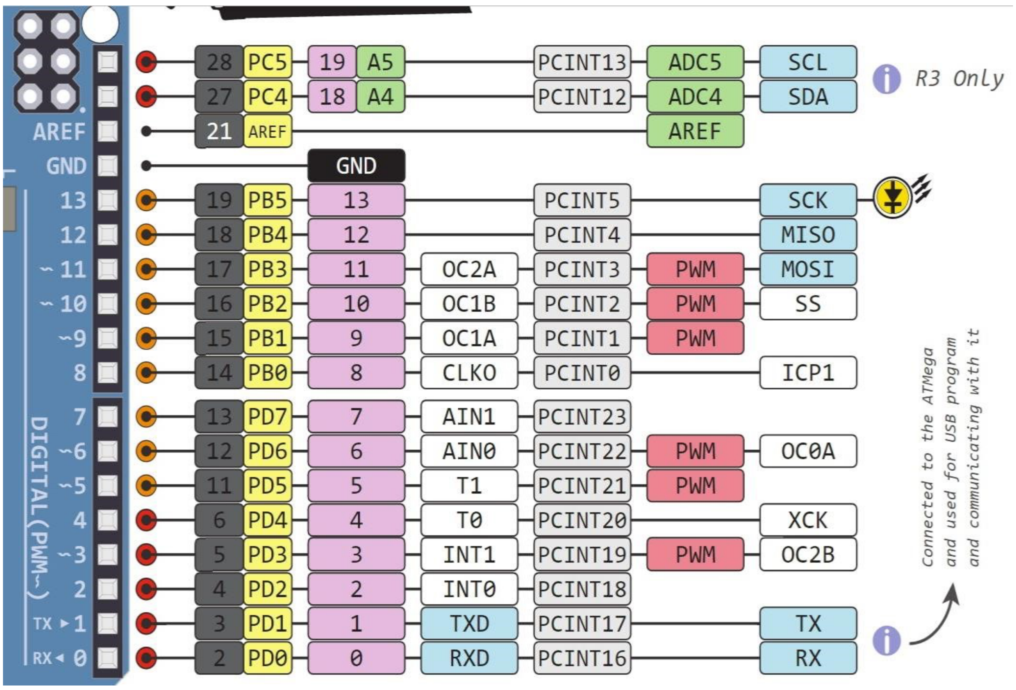
TECHNICAL SPECIFICATION:

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

BLOCK DIAGRAM



PIN DIAGRAM:

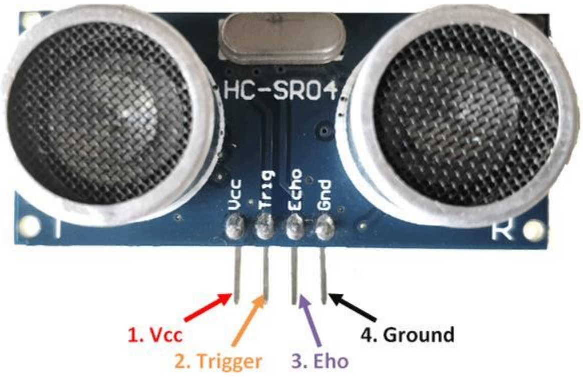


PIN DESCRIPTION:

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0-A5	Used to provide analog input in the range of 05V
Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.

Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2,3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

ULTRASONIC SENSOR



Sensor Features

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm

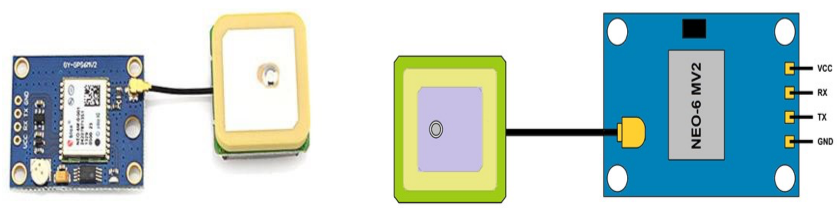
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz **Sensor pin configuration:**

Pin Number	**Pin Name**	**Description**
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo pin	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	GND	This pin is connected to the Ground of the system.

Electric parameter

Working Voltage	DC 5 V
Working Current	15mA
Working Frequency	40Hz
Max Rang	4m
Min Rang	2cm
MeasuringAngle	15degree
Trigger Input Signal	10uS TTL pulse
Echo Output Signal	Input TTL lever signal and the r ange in proportion
Dimension	45*20*15mm

GPS module ublox:



Features and Electrical Characteristics

Standalone GPS receiver

Anti-jamming technology

UART Interface at the output pins (Can use SPI ,I2C and USB by soldering pins to the chip core)

Under 1 second time-to-first-fix for hot and aided starts

Receiver type: 50 Channels - GPS L1 frequency - SBAS (WAAS, EGNOS, MSAS, GAGAN)

Time-To-First-fix: For Cold Start 32s, For Warm Start 23s, For Hot Start <1s

Maximum navigation update rate: 5Hz

Default baud rate: 9600bps

EEPROM with battery backup

Sensitivity: -160dBm

Supply voltage: 3.6V

Maximum DC current at any output: 10mA

Operation limits: Gravity-4g, Altitude-50000m, Velocity-500m/s

Operating temperature range: -40ºC TO 85°C **Pin description:**

Pin Name	**Description**
Vcc	Positive power pin
RX	UART receive pin
TX	UART transmit pin
GND	Ground

CODING FOR OBJECT DETECTION AND NOTIFICATION:

```
#include < Arduino.h >

#include "Talkie.h"

#include "Vocab_US_Large.h"

#include "Vocab_Special.h"

Talkie voice; int trigPin=9;

int echoPin=10; int led=7;

void setup() {

Serial.begin(9600);

  pinMode(led,OUTPUT);

pinMode(trigPin,OUTPUT);

pinMode(echoPin,INPUT);

    }
```

```
void loop()
{   long duration,distance;
digitalWrite(trigPin,HIGH);
delayMicroseconds(1000);
digitalWrite(trigPin,LOW);
duration =pulseIn(echoPin,HIGH);
distance =(duration/2)/29.1;
Serial.print(distance);
Serial.println("CM");   delay(10);
if((distance<=30))
  {
    digitalWrite(led,HIGH);
voice.say(spPAUSE2);
voice.say(sp2_DANGER);
voice.say(sp2_DANGER);
     }
else
     {
      digitalWrite(led,LOW);
        }
}
```