

DEVELOPMENT OF NAVIGATION SYSTEM FOR VISUALLY IMPAIRED PERSON



A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of
Bachelor of Science in Electrical and Electronics and Engineering

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
BRAC UNIVERSITY
BANGLADESH**

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APPROVAL

The Thesis Report “**DEVELOPMENT OF NAVIGATION SYSTEM FOR VISUALLY IMPAIRED PERSON**” submitted by Rajesh Kumar Saha, Niaz Mahmud, Sraboni Rahman, Ridwan Bin Zafar to the Department of Electrical and Electronics Engineering, BRAC University Bangladesh, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science (Hons) in Electrical and Electronics Engineering and approved as to its style and contents.

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DECLARATION

We, hereby, declare that the work presented in this Thesis Project is the outcome of the investigation performed by us under the supervision of **Dr. Mohammed Belal Hossain Bhuian** as Supervisor and **Syed Shakib Sarwar** as Co-advisor, Department of Electrical and Electronics Engineering, Brac University Bangladesh. We also declare that no part of this Thesis and thereof has been or is being submitted elsewhere for the award of any degree or Diploma.

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Last of all we are very grateful to our family and friends for their unconditional love and selfless support.

ABSTRACT

Blindness is one of the most severe types of disability that a person has to endure. Traditionally blind people use white canes which are very limited in its ability to provide navigation properties to the user and cannot easily detect obstacles. Mobility of visually impaired people is limited by their inability to perceive their surroundings. This renders their life to depend on some kind of aid to move around. In this project we propose to build a navigation system that will be able to guide a visually impaired person safely and with ease in an indoor and outdoor environment. This goal has been realized through the use of an ultrasonic device as transmitter and detector to determine the range of obstacles and also microcontroller. The system includes a warning system through voice alert and through generation of vibration.

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CHAPTER-1

Introduction:

With the recent fast growing technology and so many resources available, researches have been conducted on building a navigation system for the visually impaired people in order to aid them in a more independent way. Many students around the world have been putting their ideas forth in order to develop a system for both the outdoor and the indoor environment.

In recent years many papers have been researched on:-

- **Pathfinder A handheld device for detecting obstructions in the path of the blind and visually impaired**[Project by Kyle Boyace]
- **VI-Navi: a novel indoor navigation system for visually impaired people**[Project by- Parth Mehta]
- **An Ultrasonic Navigation System for Blind People** [Project by -Bousbia Saleh]
- **Blind Audio Guidance System**[Project by -Brey Danels, Oluakode Ogunmakin, George Agollah, Eric Worley]
- **Drishti: An Integrated Indoor/Outdoor Blind Navigation System and Service**[Project by- Lisa Ran, Sumi Helal and Steve Moore]
- **Navigation System for the Blind:Auditory Display Modes and Guidance**[Project by - Jack M. Loomis, Reginald G. Golledge, Roberta L. Klatzky]
- **INDOOR NAVIGATION SYSTEM FOR VISUALLY IMPAIRED PERSON USING GPS**[Project by -Dr. Boyina.S.Rao, Ms. K.Deepa, Hari Prasanth.L, Vivek.S, Nanda Kumar.S,Rajendhiran.A, Saravana.J]

Our thesis will be based on developing a system having microcontroller with speech output. This navigation system has two distinct components: detecting obstacles and alerting the person by means of vibration and voice command. So our goal is to construct a portable simple less costly device that will help visually impaired people to move in familiar and unfamiliar environments.

Throughout the thesis our mission is to carry out the following functions.

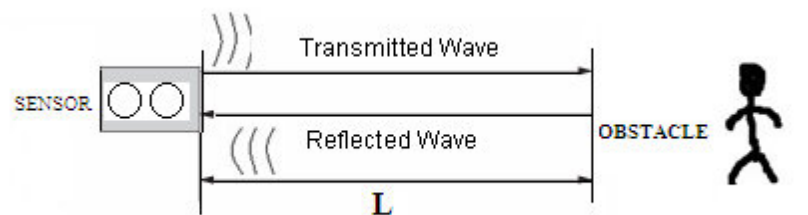
- Implement the use of Microcontroller.
- Detection of obstacles using ultrasonic sensors
- Implement ISD2560 ChipCorder and introduce voice alert to the system.
- Implement required electronic components such as transistors, voltage regulators.

Short briefing of our project can be describe as

- **Chapter 1-** This chapter reviews the basic and fundamental concept of Ultrasonic Sensor
- **Chapter 2-** This chapter reviews Our Project Objective
- **Chapter 3-** This chapter reviews some of the work related to the study of the ultrasonic. The main reviews are ultrasonic sensor, PIC microcontroller, ISD2560, Motor (Cell phone Vibrator) and Power Supply regulator.
- **Chapter 4-** This chapter reviews the Practical Implementation of our Project.
- **Chapter 5-** This chapter reviews the Scope for Improvement of this Project and Our Future plan

CHAPTER-2

ULTRASONIC SENSOR



2.1- FIG: Ultrasonic sonar Transmitter and Receiver

The diagram shows the schematics of how the sonar works. The Ultrasonic Transmitter which will send a signal out into its surrounding area. The Ultrasonic Receiver will detect this signal once it bounces off from an object.

2.1 Ultrasonic Transmitter:

Before transmit the ultrasonic wave, there is a part which is ultrasonic wave generator that function to generate ultrasonic wave. In that part, generating an instruction signal for intermittently providing ultrasonic waves. After ultrasonic wave was produced, ultrasonic transmitter transmits the ultrasonic waves toward a road surface to find out the obstacle. The range that obstacle detected is depends on the range of ultrasonic sensors that used.

2.2 Ultrasonic Receiver:

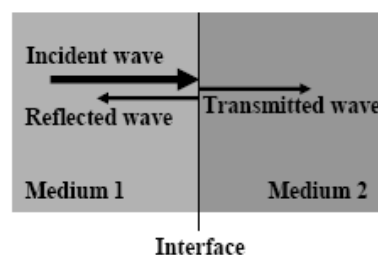
If the ultrasonic wave detect the obstacle, its will produce a reflected wave. An ultrasonic receiver is used for receiving the ultrasonic waves reflected from the road surface to generate a reception signal. The signal is compared with reference signal to detect Components in the amplified signal due to obstacles on the road surface. The magnitude of the reference signal or the amplification factor of the amplifier is controlled to maintain a constant ratio between the average of the reference signal and the average of the amplified signal.

2.3 Basic Principle of Ultrasonic Sound:

Ultrasonic sensing techniques have become mature and are widely used in the various fields of engineering and basic science. One of advantages of ultrasonic sensing is its outstanding capability to probe inside objects nondestructively because ultrasound can propagate through any kinds of media including solids, liquids and gases except vacuum. In typical ultrasonic sensing the ultrasonic waves are travelling in a medium and often focused on evaluating objects so that useful information on the interaction of ultrasonic energy with the objects are acquired as ultrasonic signals that are in wave forms variations with transit time. Ultrasound waves are generated by piezoelectric crystals. Piezoelectric means "pressure electric" effect. When an electric current is applied to a quartz crystal, its shape changes with polarity. This causes expansion and contraction that in turn causes compression and rarefaction of sound waves. Many animals have the ability to hear sounds in the human ultrasonic frequency range.

2.4 The Fundamental of Ultrasonic Sensor:

Ultrasonic ranging and detecting devices use high-frequency sound waves to detect the presence of an object and its range. The systems either measure the echo reflection of the sound from objects or detect the interruption of the sound beam as the objects pass between the transmitter and receiver. A simple illustration of the ultrasonic waves produced in a solid where distortion caused depending on whether a force is applied normal or parallel to the surface at one end of the solid can result in producing compression or shear vibrations respectively, so that two types of ultrasonic waves, longitudinal waves or transverse waves propagate through the solid. The energy of the wave is also carried with it. In a continuous medium, the behaviour of ultrasonic waves is closely related to a balance between the forces of inertia and of elastic deformation. An ultrasonic wave moves at a velocity (the wave velocity) that is determined by the material properties and shape of the medium, and occasionally the frequency. The ultrasonic wave imparts motion to the material when it propagates. It is noted in ultrasonic measurements that the particle velocity is much smaller than wave velocity. Also, one can understand that no ultrasonic wave propagates in vacua because there are no vibrating particles present there.



2.2-FIG: Sonic Behavior

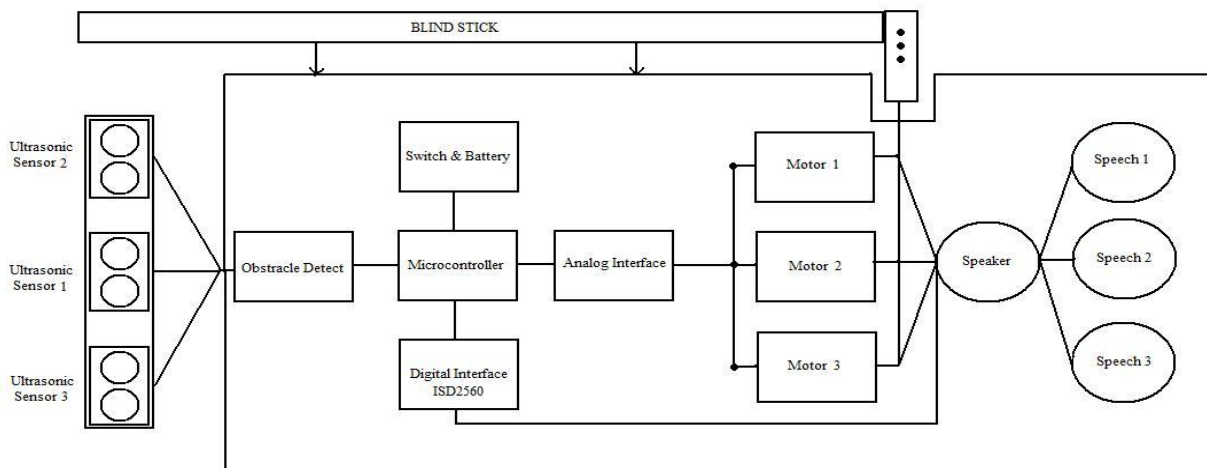
CHAPTER-3

PROJECT OBJECTIVE

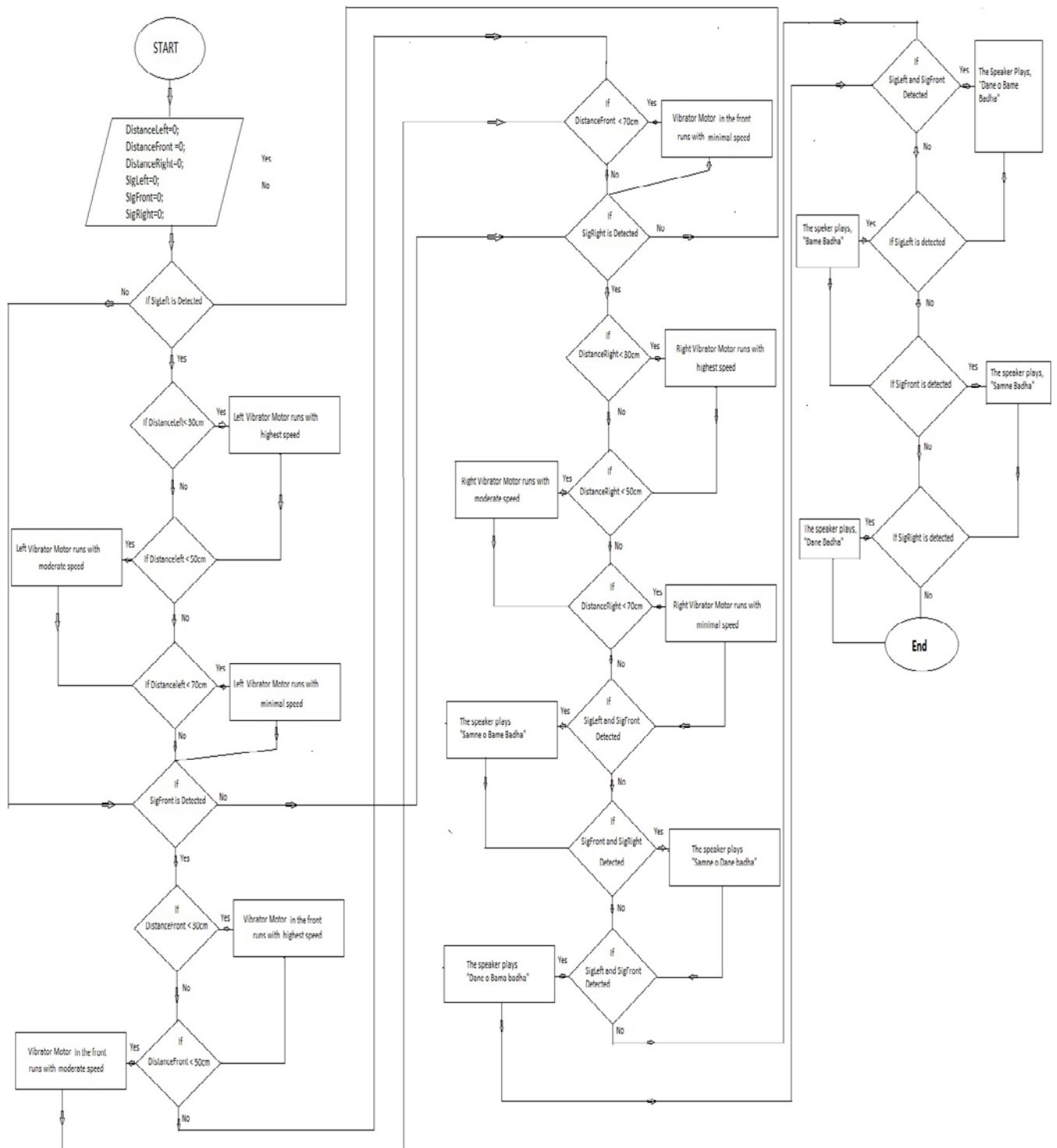
We are contemplating in creating a system that will guide a visually impaired person to move around efficiently and independently. We have used the **ultrasonic sensor TS601**, which will detect the barriers in the path. **PIC 16F877A microcontroller** that works on code language has been used to measure the distance between the person and the obstacle, connects with the motor circuit to act as an alert system and also interface with **ISD 2560** to produce a speech output so that the person can know the direction of the obstacle.

We have used three sensors and three vibrators (motor) in the circuit. Whenever any of the three sensors separately or together detect obstacles, the signal passes onto the microcontroller. The **code** that is set in the **microcontroller** works under condition which when fulfilled interfaces with the **motor circuit** (motor of a cell phone) and the **ISD IC** to produce vibrations (motor circuit) and speech output (ISD).

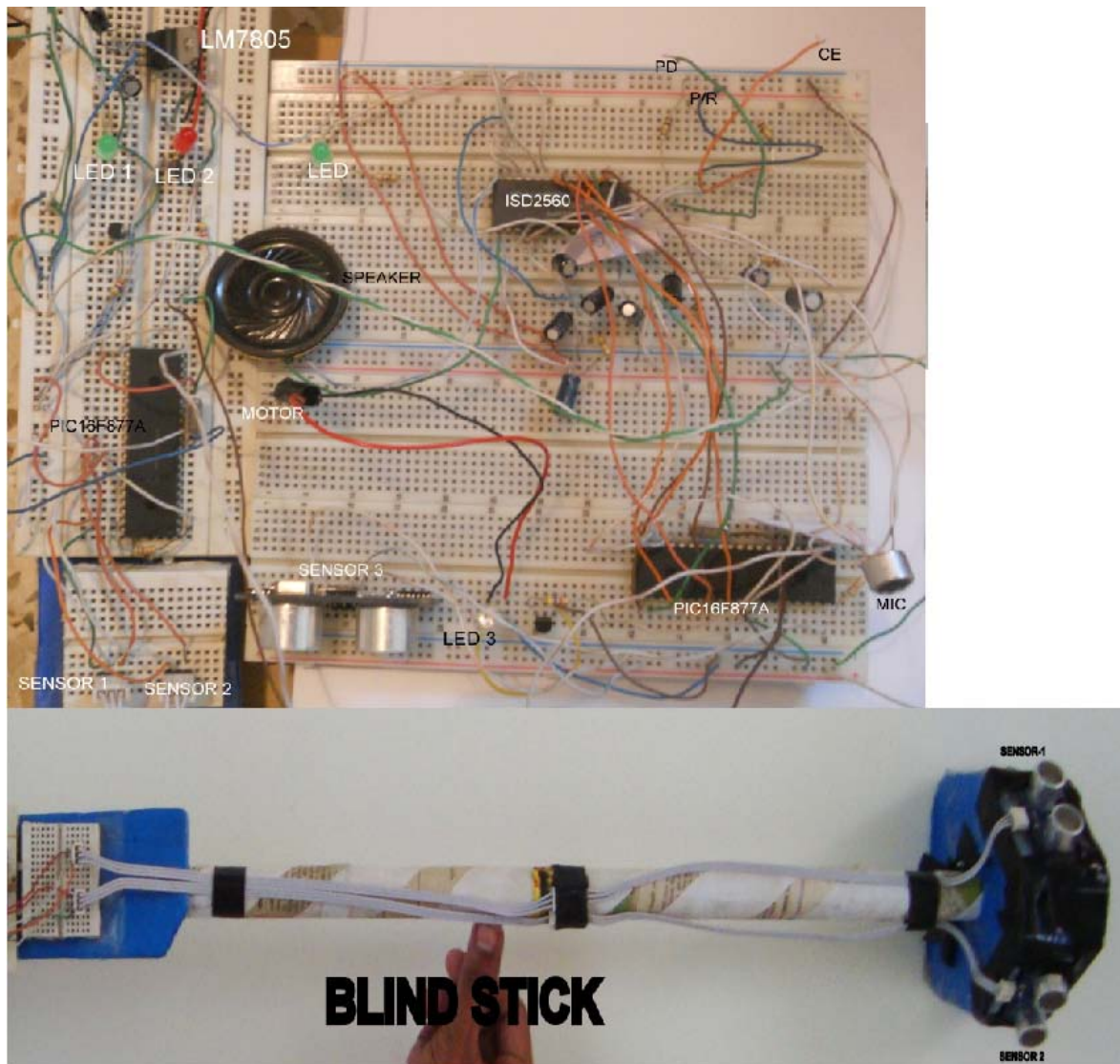
The source battery is of 9V. Our system required 5V input. In order to bring down the voltage we implemented a voltage regulator circuit using **LM7805**. We have put in a switch in the system. After turning on the switch, the regulated power is transmitted to the circuit board for functioning of all the components. The motor requires 1.3V. The 5V input supplied is reduced to this level by means of a resistor and transistor.



3.1-FIG: Block Diagram of the System



3.2-FIG: Flowchart of the System of the Project



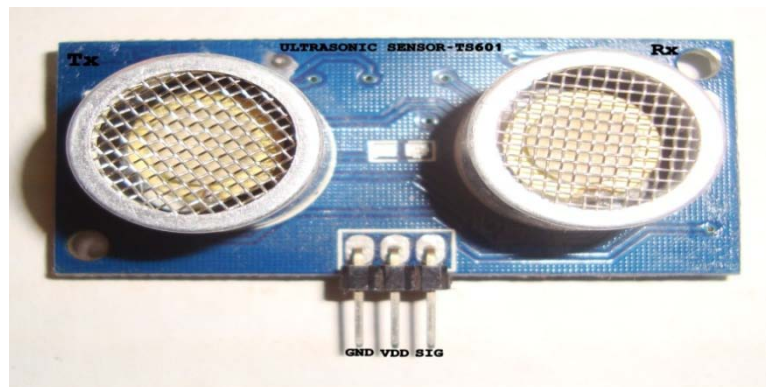
Development of Navigation System for Visually Impaired Person

3.3-FIG: Practical Implementation of the Navigation System

CHAPTER-4

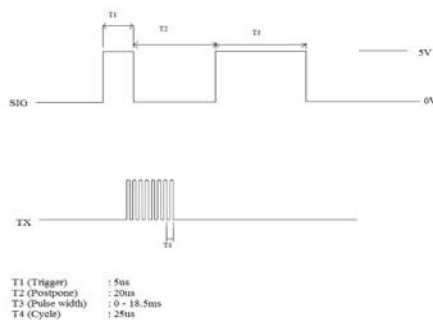
THEORITICAL VIEW

4.1 ULTRASONIC SENSOR-TS601:

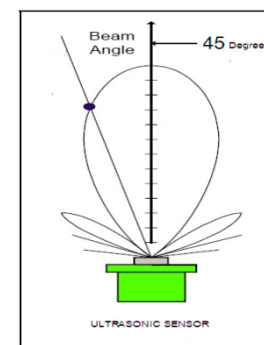


4.1-FIG: Ultrasonic Sensor

Ultrasonic Electronic Eye Telemeter Module, TS601 is the ultrasonic sensor that will carry out the detection of the obstacles. Through the technology of non contacted ultrasonic measurement this particular sensor detects the distance effectively. The sensor is able to transform the data into an impulse of different width by means of microcontroller.



4.2- FIG: Length and Amplitude



4.3- FIG: Sonar Angle

A square pulse is triggered and the **ultrasonic transmitter** sends out a signal at an angle of **45 degree**. Obstacles within this range are detected and the signal is sent back to the **ultrasonic receiver**. The square impulse is given to the SIG pin of the ultrasonic sensor. The electrical level of the SIG line rises as shown by T1. This triggers a range of 40 kHz signals. The receiving pulse will come back to the output pin after 200us. When there is an object the sensor will send back the signal that is indicated by T3. As there is no object the signal descends to low value.

The minimum distance at which the sensor detects the obstacle is 10cm and the maximum distance is 290cm.

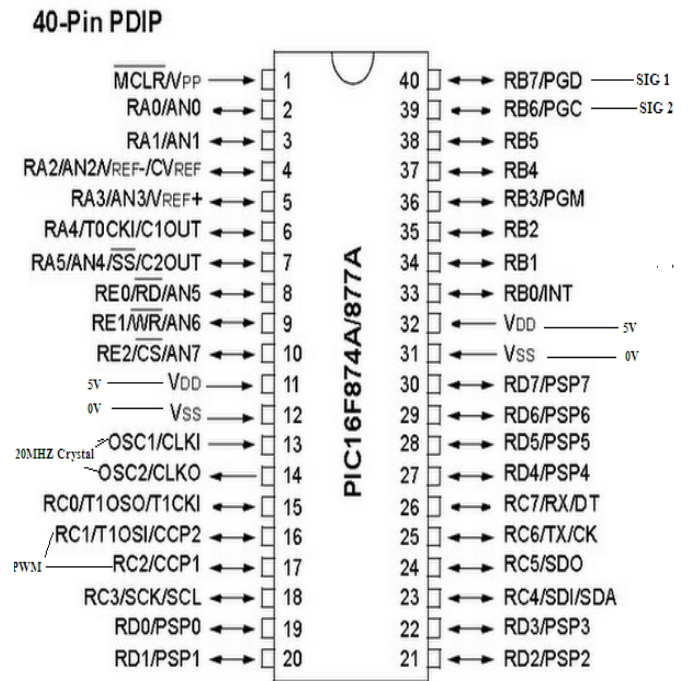
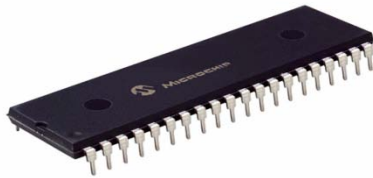


4.4- FIG: Sonar Transmitter and Receiver

FEATURES:

- Application: Distance measurement
- Range of measurement (from datasheet): 0.03M ~ 3M
- Output: impulse width
- Rated working voltage: 5V
- Working current : < 15mA
- Frequency of Sensor: 40 kHz
- Response Time: 5ms
- Angle for detection : 45 Degree

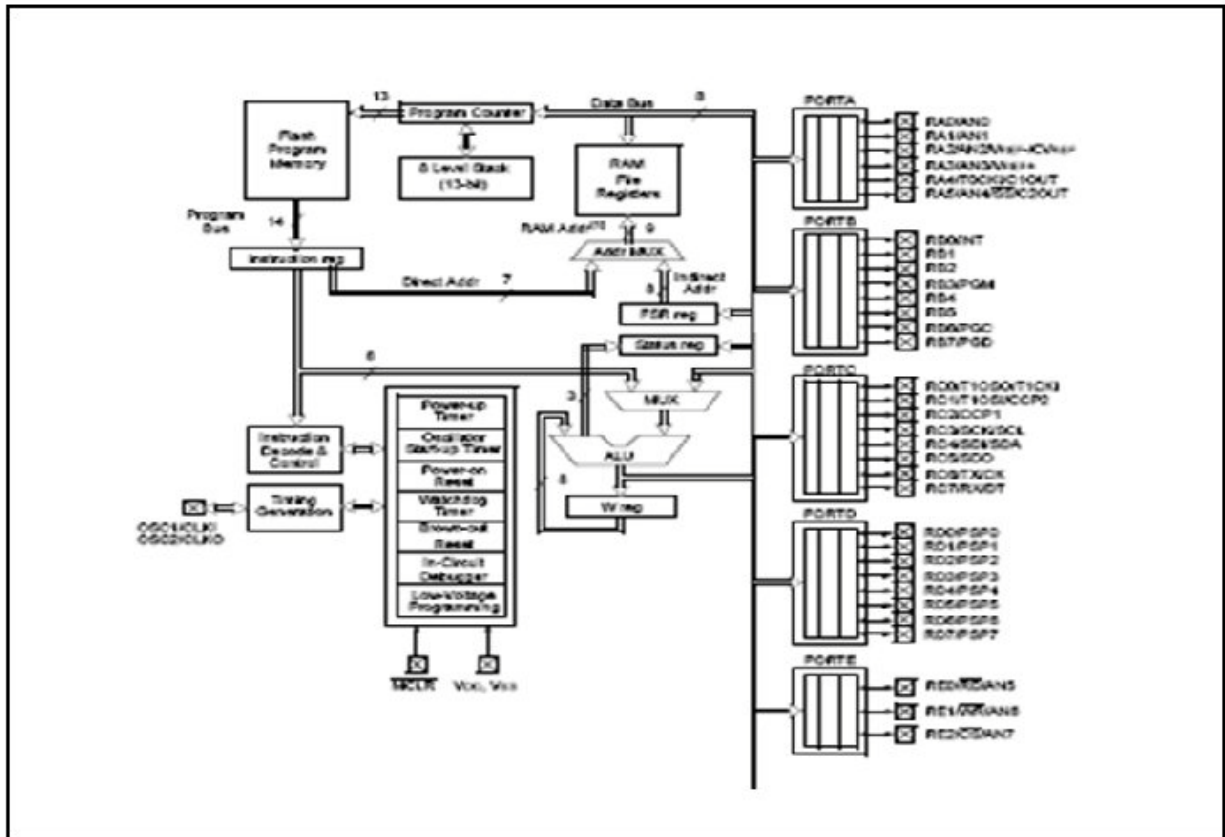
4.2 PIC16F877A MICROCONTROLLER:



4.5-FIG: Microcontroller (PIC16F877A) PIN Diagram

A microcontroller is a computer-on-chip used to control electronic device. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness. A typical microcontroller contains all the memory and interface needed for a simple application. A microcontroller is single integrated circuit.

PIC16F877A



Microcontroller Features:

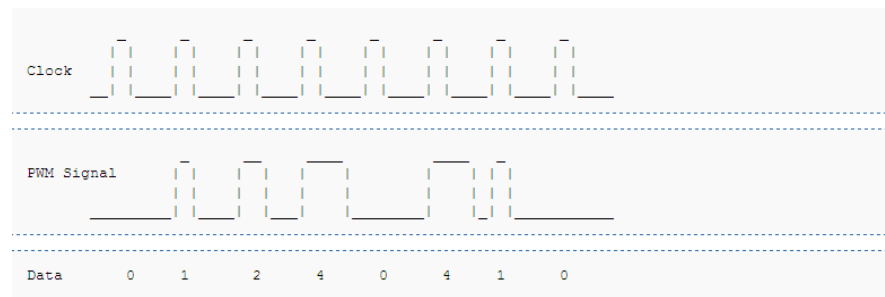
- 100,000 erase/write cycle Enhanced Flash program memory typical
- 1,000,000 erase/write cycle Data EEPROM memory typical
- Data EEPROM Retention > 40 years
- Self-reprogrammable under software control
- In-Circuit Serial Programming™ (ICSP™) via two pins
- Single-supply 5V In-Circuit Serial Programming
- Programmable code protection
- Power saving Sleep mode
- Selectable oscillator options

Peripheral Features:

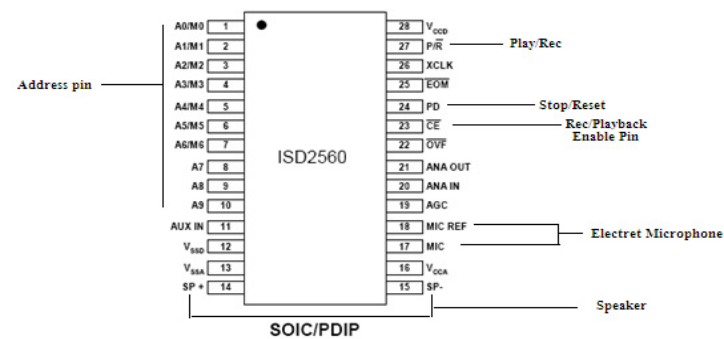
- Timer 0: 8-bit timer/counter with 8-bit prescaler
 - Timer 1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock
 - Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
 - Two Capture, Compare, PWM modules
 - Capture is 16-bit, max. Resolution is 12.5 ns
 - Compare is 16-bit, max. Resolution is 200 ns
 - PWM max. Resolution is 10-bit

4.3 PWM (Pulse-width modulation):

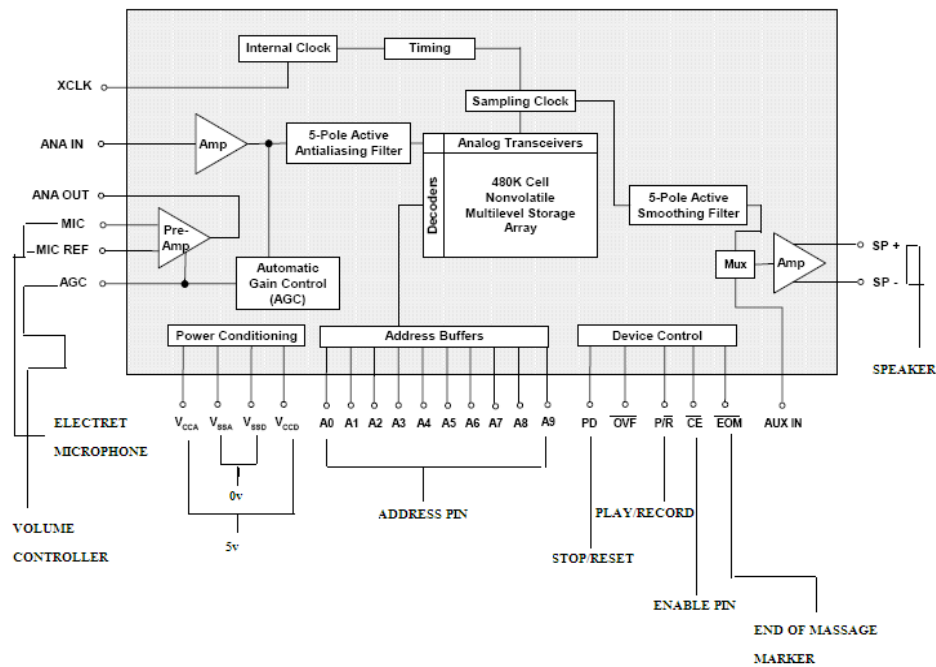
Pulse-width modulation (PWM) is a commonly used technique for controlling power to electrical devices, made practical by modern electronic power switches. The average value of voltage and current fed to the load is controlled by turning the switch between supply and load on and off at a fast pace. The longer the switch is on compared to the off periods, the higher the power supplied to the load is.

**4.6-FIG: PWM Signal**

4.4 ISD2560 SINGLE CHIP, MULTIPLE MESSAGE VOICE RECORD AND PLAYBACK DEVICE



4.7-FIG: ISD2560 PIN CONFIGURE



4.8- FIG: BLOCK DIAGRAM OF ISD2560

1.1-TABLE: PASSIVE COMPONENT USES APPLICATION IN SPEECH CIRCUIT

| Part | Function | Comments |
|------------|---|--|
| R1 | Microphone power supply decoupling | Reduces power supply noise |
| R2 | Release time constant | Sets release time for AGC |
| R3, R5 | Microphone biasing resistors | Provides biasing for microphone operation |
| R4 | Series limiting resistor | Reduces level to prevent distortion at higher supply voltages |
| R6 | Series limiting resistor | Reduces level to high supply voltages |
| C1, C5 | Microphone DC-blocking capacitor Low-frequency cutoff | Decouples microphone bias from chip. Provides single-pole low-frequency cutoff and command mode noise rejection. |
| C2 | Attack/Release time constant | Sets attack/release time for AGC |
| C3 | Low-frequency cutoff capacitor | Provides additional pole for low-frequency cutoff |
| C4 | Microphone power supply decoupling | Reduces power supply noise |
| C6, C7, C8 | Power supply capacitors | Filter and bypass of power supply |

Microcontroller Interface:

The use of ISD2560 is very simple and it contains all the necessary interfaces for microcontroller driven applications. The address and control pins can be connected to a microcontroller, manipulating different tasks such as message assembly, message concatenation, predefined fixed message segmentation and message management.

Programming:

The ISD2560 is ideal for playback-only applications. Single or multiple messages are referenced manually or through a microcontroller. Once the desired message configuration is created, the duplicate messages can be easily created through programming.

There are two Modes we can operate the ISD2560 device one is operational mode and another is Push-Button Mode.

Operational Mode:

The ISD2560 is designed with several built-in Operational Modes which can provide maximum functionalities with usage of minimum external components. These modes are described in details as below. The Operational Modes are accessed via the address pins. When the two most significant bits (MSB) A8 and A9 are HIGH, the remaining address signals are interpreted as mode bits and not as address bits. Secondly, Operational Modes are executed when CE pin goes LOW. This Operational Mode remains in effect until the next LOW-going CE signal, at which point the current modes are sampled and executed.

M0 – Message Cueing

Message Cueing allows the user to skip messages without knowing the actual physical addresses of each message. Each CE-LOW pulse causes the internal address pointer to skip to the next message. This mode is only used for playback.

M1 – Delete EOM Markers

The M1 Operational Mode allows sequentially recorded message to be combined into a single_message. When the Operational Mode is configured, messages recorded sequentially are played back as one continuous message.

M2 – Unused

When Operational Modes are selected, the M2 pin should be LOW

M3 – Message Looping

The M3 operational Modes allows the automatic and continuous repeatedly playback of the message located at the beginning of the address space..

M4 – Consecutive Addressing

During normal operation, the address pointer will reset when a message is played through an EOM marker. The M4 Operational Mode inhibits the address pointer on EOM and allows the message to be played back consecutively.

M5 – CE-Level Activated

In this mode, CE LOW begins a playback cycle, at the beginning of the device memory. The playback cycle continues as long as CE is held LOW. When CE goes HIGH, playback will immediately end. A new CE LOW will restart the message from the beginning unless M4 is also HIGH.

M6 – Push-Button Mode

The ISD2560 device contains a Push-Button Operation Mode. The most significant address bits must be HIGH and the M6 mode pin must also be HIGH. A device in this mode always powers down at the end of each playback or record cycle after CE goes HIGH.

1.2-TABLE: OPERATIONAL MODE APPLICATION

| Mode ^[1] | Function | Typical Use | Jointly Compatible ^[2] |
|---------------------|--|--|-----------------------------------|
| M0 | Message cueing | Fast-forward through messages | M4, M5, M6 |
| M1 | Delete $\overline{\text{EOM}}$ markers | Position $\overline{\text{EOM}}$ marker at the end of the last message | M3, M4, M5, M6 |
| M2 | Not applicable | Reserved | N/A |
| M3 | Looping | Continuous playback from Address 0 | M1, M5, M6 |
| M4 | Consecutive addressing | Record/playback multiple consecutive messages | M0, M1, M5 |
| M5 | $\overline{\text{CE}}$ level-activated | Allows message pausing | M0, M1, M3, M4 |
| M6 | Push-button control | Simplified device interface | M0, M1, M3 |

1.3-TABLE: PUSH-BUTTON MODE

| Control Step | Function | Action |
|--------------|---|--|
| 1 | Set message address for record/playback | Set addresses A0-A9 |
| 2 | Begin playback | P/\bar{R} = HIGH, \overline{CE} = Pulse LOW |
| 3 | Begin record | P/\bar{R} = LOW, \overline{CE} = Pulse LOW |
| 4 | Pause record or playback | \overline{CE} = Pulsed LOW |
| 5 | End playback | Automatic at \overline{EOM} marker or PD = Pulsed HIGH |
| 6 | End record | PD = Pulsed HIGH |

- CE - Start Record (LOW pulse-activated)
- CE - Playback (LOW pulse-activated)
- P/R- Recording (HIGH pulse-activated)
- P/R- Start Play (HIGH pulse-activated)
- PD - Stop/Reset (HIGH pulse-activated)
- EOM – Active (HIGH Run Indicator)

- **CE (Record/Playback):**

In Push-Button Mode, CE acts as a LOW-going pulse-activated RECORD/PLAYBACK signal. If no operation is currently in progress, a LOW-going pulse on this signal will initiate a playback or record cycle according to the level on the P/ R pin.

- **P/R (Play/Record):**

In Push-Button Mode, P/R acts as a HIGH and LOW-going pulse-activated PLAY/REC signal. , CE acts as a LOW-going pulse-activated while RECORD and PD acts as a HIGH-going pulse STOP Recording as well as stop the playback

- **PD (STOP/RESET):**

In Push-Button Mode, PD acts as a HIGH-going pulse-activated STOP/RESET signal. When a playback or record cycle is in progress and a HIGH-going pulse is observed on PD, the current cycle is terminated and the address pointer is reset to address 0, the beginning of the message space.

- **EOM (RUN):**

In Push-Button Mode, EOM becomes an active-HIGH RUN signal which can be used to drive an LED or other external device. It is HIGH whenever a record or playback operation is in progress.

- **Recording in Push-Button Mode:**

1. The PD pin should be LOW, usually using a pull-down resistor.
2. The P/ R pin is taken LOW.
3. The CE pin is pulsed LOW. Recording starts, EOM goes HIGH to indicate an operation in progress.
4. When the CE pin is pulsed LOW. Recording pauses, EOM goes back LOW. The internal address pointers are not cleared, but the EOM marker is stored in memory to indicate as the message end. The P/R pin may be taken HIGH at this time.

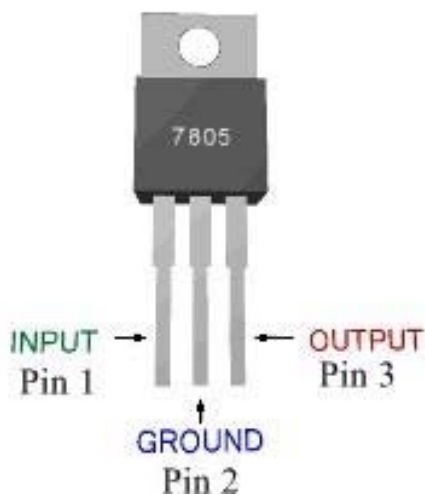
- **Playback in Push-Button Mode:**

1. The PD pin should be LOW.
2. The P/ R pin is taken HIGH.
3. The CE pin is pulsed LOW. Playback starts, EOM goes HIGH to indicate an operation in progress.
4. If the CE pin is pulsed LOW or an EOM marker is encountered during an operation, the part will pause. The P/ R pin may be changed at this time. A subsequent record operation would not reset the address pointers and the recording would begin where playback ended.
5. CE is again pulsed LOW. Playback starts where it left off, with EOM going HIGH to indicate an operation in progress.
6. Pulling CE LOW will reset the address pointer and start playback from the beginning. After a PD pulse, the part is reset to address 0.

4.5 POWER SUPPLY REGULATOR LM2805

Depending on the voltage regulator in use, we can get a regulated positive or negative voltage, at whichever voltage we require. The LM7805 voltage regulators are a popular kind for regulating. In this project, we use a positive voltage regulator, which outputs 5V, the LM7805 regulator.

Before we can hook up the circuit, there is the layout of the pin out diagram of the voltage regulator, which is vital for the connections in the circuit. A voltage regulator is a three-terminal device.



4.8-FIG: Voltage Regulator Pin out

Pin 1 is the Input Pin. The output voltage of whatever voltage source you want to regulate down (whether it's a transformer, battery, etc.) is fed into this pin. So for instance, if you have 9volts coming from a Battery that you want regulated down to 5 volts, the output of the Battery (the 9 volts) is fed into the regulator input (pin 1) so that the regulator can regulate it down to your wanted voltage (5 volts). Remember, the input voltage has to be larger than the voltage that the regulator regulates out. In this case, we are using a LM7805, which outputs 5 volts.

Pin 2 is Ground. Without ground, the circuit couldn't be complete because the voltage wouldn't have electric potential and the circuit wouldn't have a return path. Ground is essential. Pin 3 is the Output Pin. This is the pin that gives out the regulated voltage, which is 5 volts.

Build-up of the circuit:

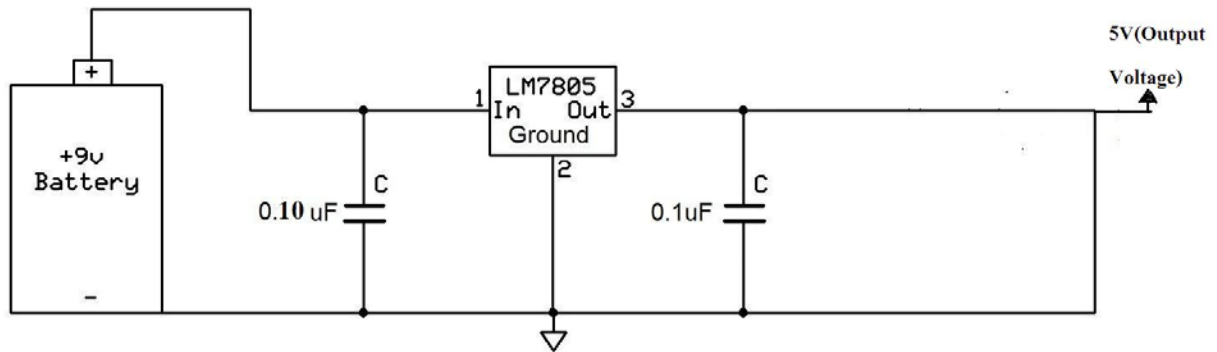
These are the Parts Required to Do So:

-LM7805 Voltage Regulator Chip

-9-volt Battery

-0.10uF Capacitor

-0.1uF Capacitor



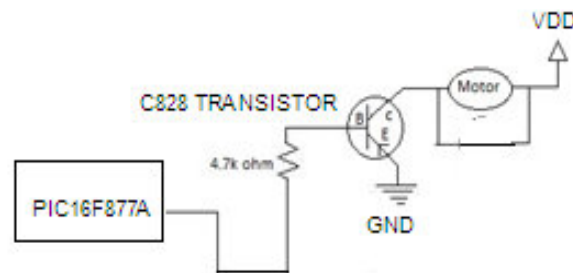
4.10-FIG: VOLTAGE REGULATOR CIRCUIT

4.6 MOTOR (CELL PHONE VIBRATOR):

In our project we use 3 Motor as a alarm system for the system. We used a cell phone vibrator as Motor. When input of the sonar sig goes into the microcontroller (**PIC16F877A**) PWM port CCP1 and CCP2 the motor will vibrate decrease and increase order. We set a condition to the microcontroller (PIC16F877A) that if the obstacle is between 0-30cm the motor will vibrate at a slow speed, at 50cm the motor will vibrate a little faster and at 70cm the motor will vibrate more rapidly.

On the other hand Motor itself can not run, its needs to construct for run for this reason we used a transistor(C828), a resistor(4.7 k ohm) and power source 5V and GND.Motor input voltage is 1.3 that's why we used a resistor to voltage bring it down from 5V to 1.3 volt

We construct the Motor Circuit which shown in below-



4.11-FIG: Motor Circuit

CHAPTER-5

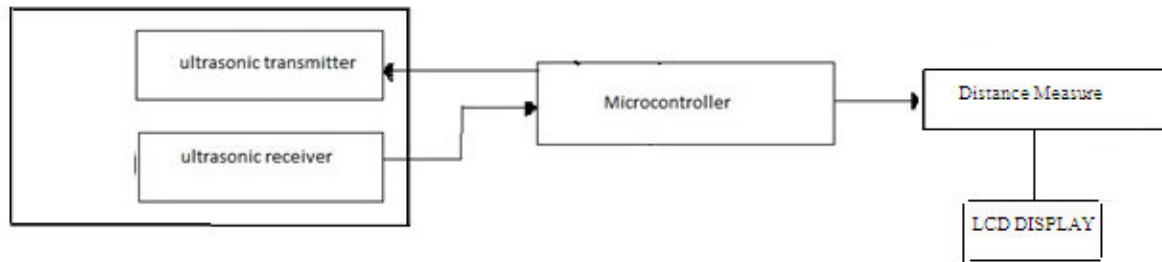
PRACTICAL IMPLEMENTATION



5.1 Distance Measurement:

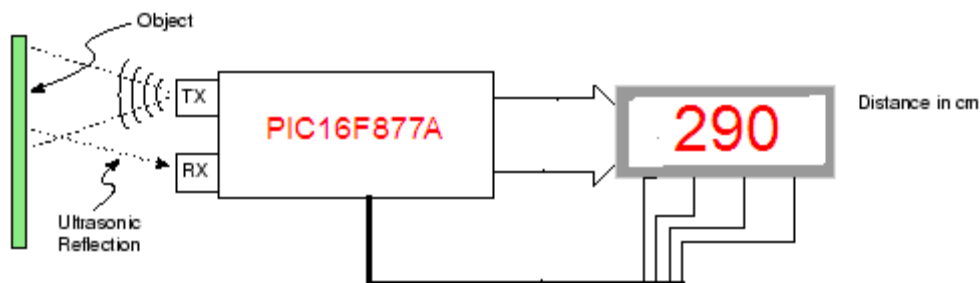
Our work begins with first understanding the function of the ultrasonic transmitter. In order to understand its range and the detection of obstacles the following experiment is carried out. Initially a circuit is set up using an ultrasonic sensor, a microcontroller PIC 16F877A and an LCD display. According to the datasheet acquired from the internet the circuit is set up by connecting the appropriate wires to the corresponding pins of the microcontroller. A code is set in the microcontroller.

As per instructed in the micro controller code a square impulse is given to the SIG pin of the ultrasonic sensor. The electrical level of the SIG line rises when the pulse is given. This triggers a range of 40 kHz signals. According to the code of the micro controller the receiving pulse will come back to the output pin after 200us. When there is an object the sensor will send back the signal to the receiver. As there is no object the signal descends to low value. The pulses have been observed by means of digital oscilloscope.



5.1-FIG: Distance Measurement

The distance is shown in the LCD display. However upon measuring the distance between the object and the sensor by means of a scale the distance was found to be different. Therefore by calculations a formula has been derived and put forth in the microcontroller code from where the correct distance between the sensor and the obstacle can be determined and viewed in the LCD display. The experimental range is found to be 10cm ~290cm and the signal covers an angle of 45 degree as measured.



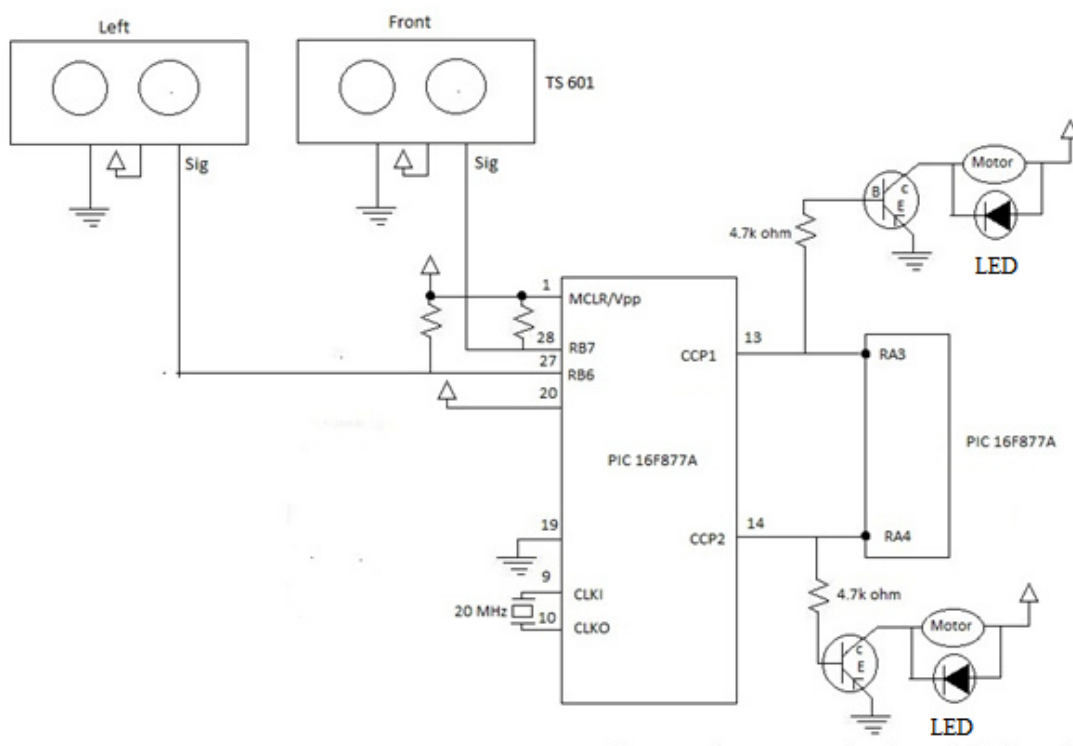
5.2-FIG: Distance Measurement

5.2 Interfacing with Microcontroller and Motor:

After deducting the range of the ultrasonic sensor, the LCD display has been removed. A motor circuit is introduced. A PWM (PULSE WIDTH MODULATION) signal is simply a pulse of varying length. It is applied in this circuit in order to aid in the motor control. By varying the operating time of the PWM signal the speed of the motor can increase or decrease depending on how long the pulse is sent to the motor. In this manner the effective power of the signal varies. The signal generated by the PIC cannot be

directly attached to the motor and thus the PIC cannot be the source of power required to generate the motor. Therefore a transistor is introduced in order to generate the flow of current required for the motor to run. The transistor is a semiconductor device that converts the electric signal from the PIC to voltage required to start the motor. A logic high that is 5V allows the flow of current through the circuit and a logic low i.e. 0V restricts it.

According to the diagram below the output of the PIC i.e. the PWM module is wired to the collector. The negative terminal of the motor is wired to the base and the collector is wired to the base and the emitter is grounded. The PWM signal is sent from the PIC which will up and down the transistor thus causing to control the speed of the motor with the PWM signal.

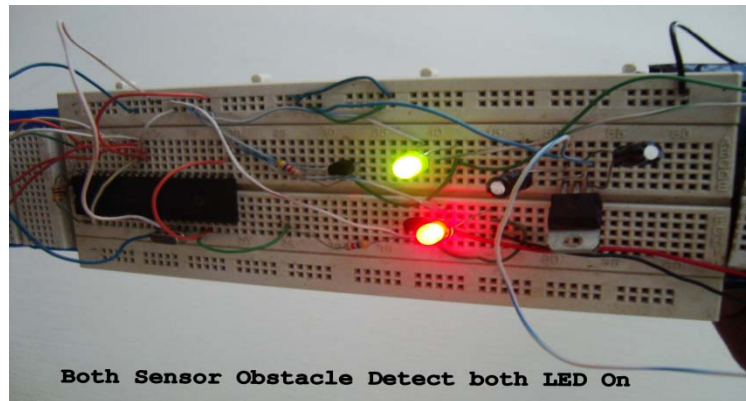


5.3-FIG: Two sensors interfaced with PIC16F877A and Alarm System (Motor)

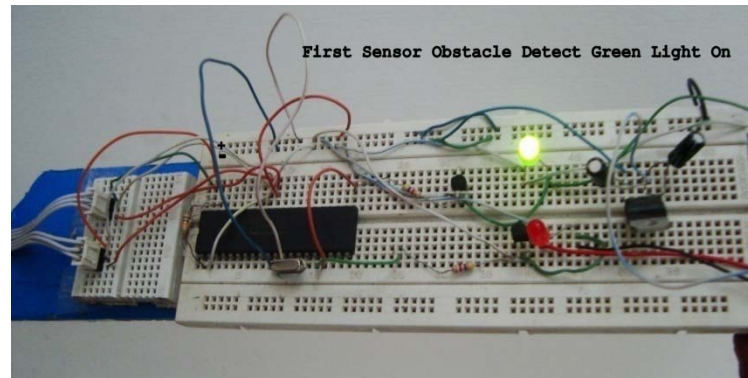
The code in the microcontroller is further modified to bring it new conditions. We have already deduced the range of the sensor signal and the motor circuit is proven to vibrate upon detection of obstacles. The codes now contain ranges that will cause the motor to vibrate at a certain speed giving the blind person a fair approximate of how close or far away the obstacle is. For instance, at range of 0-30cm the motor will vibrate at a slow speed, at 50cm the motor will vibrate a little faster and at 70cm the motor will vibrate more rapidly.

The system is powered by a 9V battery. In order to bring the voltage down to 5V, the voltage regulator circuit maintains the output voltage at a constant value. The LM7805 voltage regulator IC provides +5v regulated power supply.

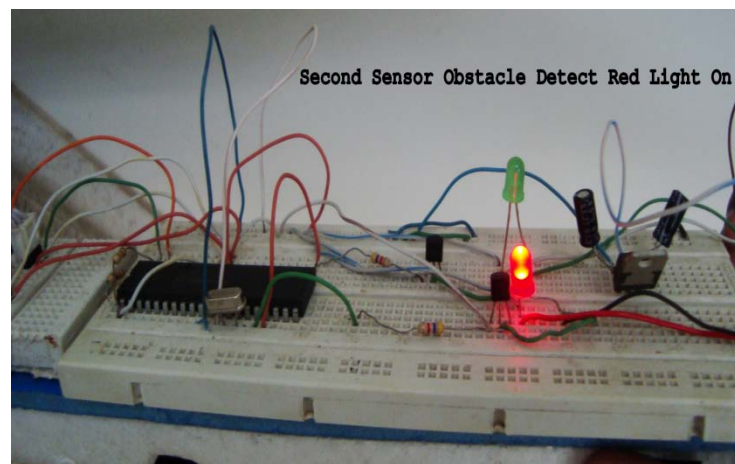
5.3 Result and Alarm Indicator



5.4-FIG: Sensor Detects Obstacle both light glow



5.5-FIG: First Sensor Detects Obstacle Green Light Glow

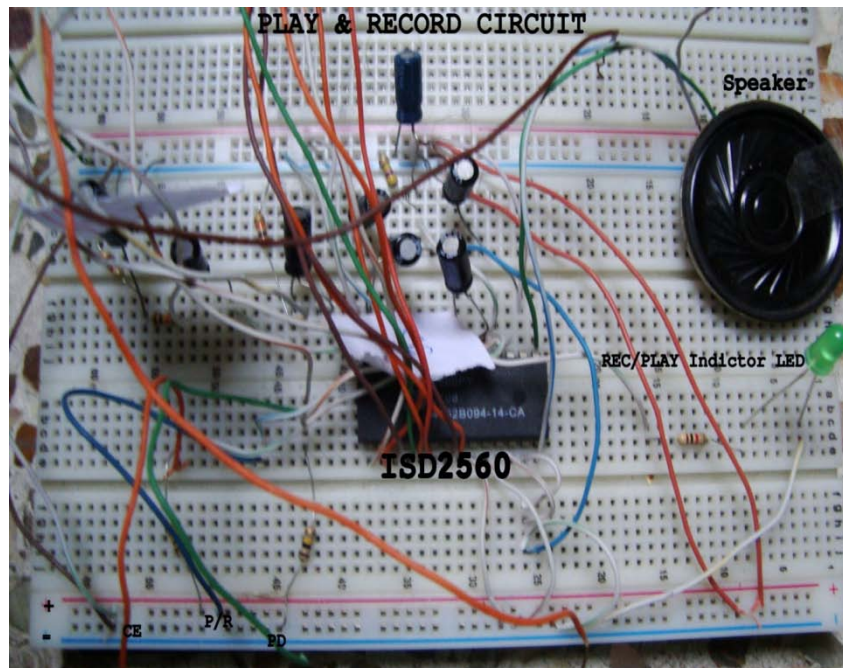


5.6-FIG: Second Sensor detect obstacle Red light will glow

5.4 Speech Programming:

ISD 2560:

ISD2560 IC allows us to record 60 seconds voice and playback it with very high quality. It is a single chip that allows multiple messages.



5.7-FIG: Speech Circuit(ISD2560)

The above circuit is constructed using the ISD2560 to check the playback/record of the speech. The LED indicates when the recording/playback starts and ends. On connecting the pins accordingly the circuit successfully produces output as speech. The recorded speech is stored in the memory of the pins A0 to A7.

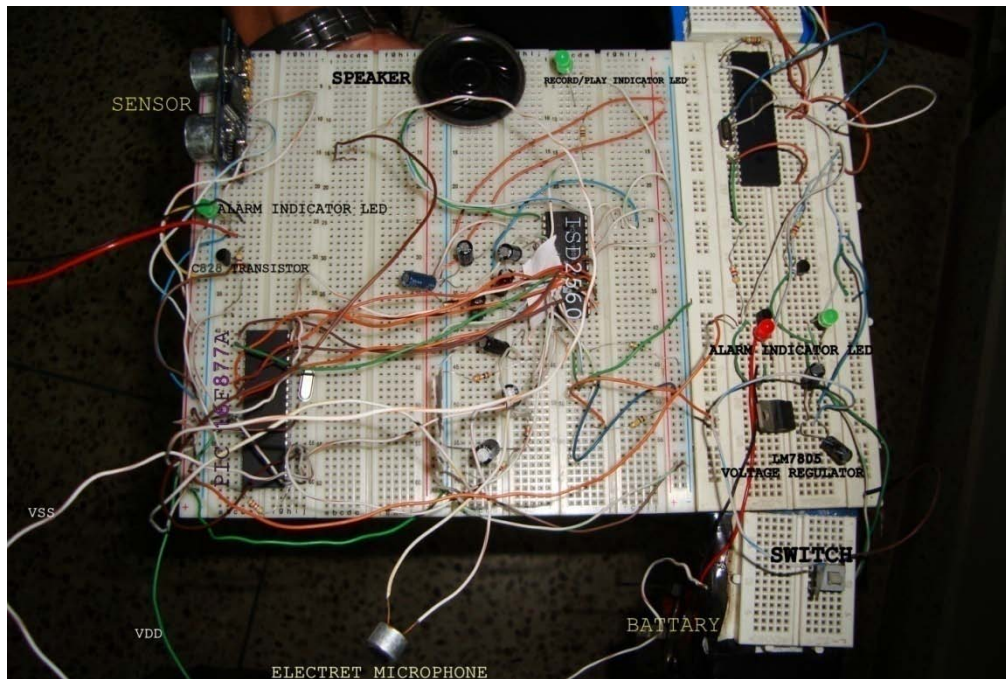
1.4-TABLE: PINS USED TO GENERATE SPEECH

| | |
|-----------------------|--|
| Address Mode (A0-A9) | The address inputs have two functions depending on the level of the two most significant bits (MSB) of the address pins, A8 and A9. When either or both the address pins are LOW the inputs are all considered as address bits and are used as start address for the current record. |
| Vssa, Vssd(A12, A13) | These pins should be connected separately to the ground through a low impedance path (capacitor) |
| SP+/SP-(A14, A15) | An 8ohm speaker is connected to the address pins for speech output |
| Vcca, Vccd (A16, A28) | These pins are for the supply voltage |
| MIC(A17) | The pin transfers the input signal and stores it in its memory. |
| MIC REF (A18) | This provides a noise cancelling reduction or common-mode rejection input to the device. |
| AGC(A19) | This is Automatic Gain Control. This s used for gain controlling to compensate for the wide range of mirophone levels.it allows sound to be recorded with minimal distortion. |
| ANA IN (A20) | The analog input transfers analog signal to the chip for recording. |
| ANA OUT (A21) | The analog output transfers the output to the speaker |
| CE(A23) | This chip enable input is given LOW to enable record and playback operations. |
| PD(A24) | This pin is pulled to HIGH when neither record or playback is operating. This pin is brought to HIGH to reset the address pointer back to the beginning of the memory array. |
| EOM(A25) | This End of Message pin provides an active HIGH signal indicating recording. This signal drives an LED for visual indicator of the recording operation inprocess. |
| XCLK(A26) | This pin is grounded. |
| P/R(A27) | This playback/record starts when CE pin is low. A HIGH |

| | |
|--|--|
| | signal refers to playback while a LOW signal refers to record. |
|--|--|

5.5 IMPLEMENTATION OF SPEECH:

The ultrasonic sensors are set up to detect the obstacles in the left, right, front, left-right, right-front and left-front directions. The code is set in the microcontroller (PIC 16F876A) for the detection of the obstacles. Three sensors are set to detect the directions. The connections are done in such a way that we have fixed the sonar that will detect the obstacle in the left direction, the sonar that will detect the obstacle in the right direction and the sonar that will detect the obstacle in the front direction. Upon detection the signal from the triggered sensor or sensors is matched with that of the code written in the microcontroller. The port RD is set with addresses in the microcontroller. The recorded messages are stored in the addressing memory of the ISD. The port RD is connected with the address pins of the ISD. The address pins of the ISD are set. The chip enable input (CE) is LOW enabling playback.



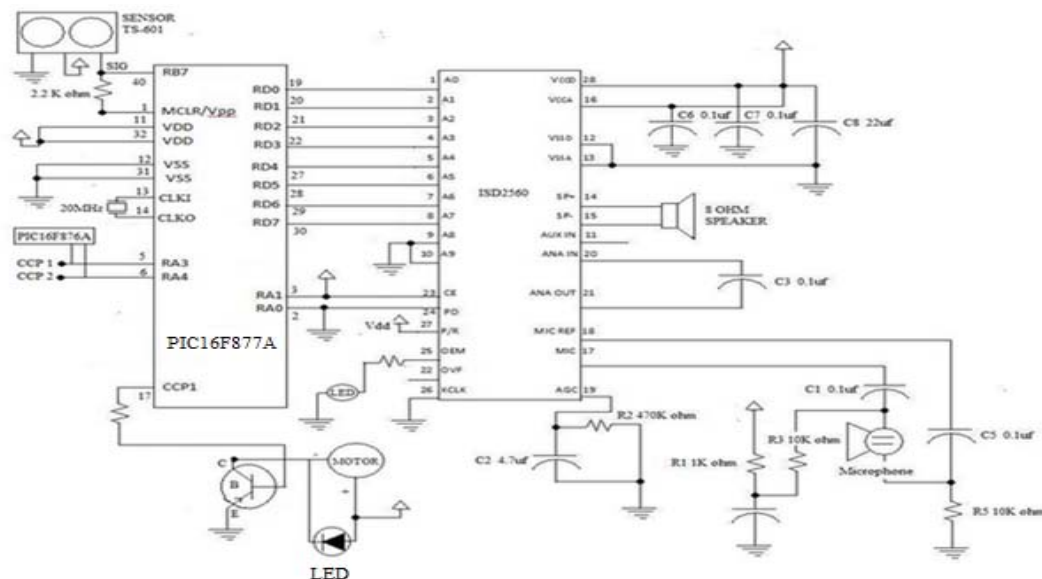
5.8-FIG: interface the speech circuit with microcontroller and other circuit shown above

Record:

According to the code set in the micro controller, on setting the CE pin to LOW, the PR pin to low the recording cycle begins. For this the address pins provide the address cycle and the recording continues until the PD pin is HIGH. On ending the record, the EOM is set to low. For visual interpretation this signal drives an LED. When the LED lights up this means the recording is in progress and the when it turns off this means the recording has ended. In such a manner three messages are recorded in the ISD, “BAME BADHA”, “SHAMNE BADHA” and “DANE BADHA”.

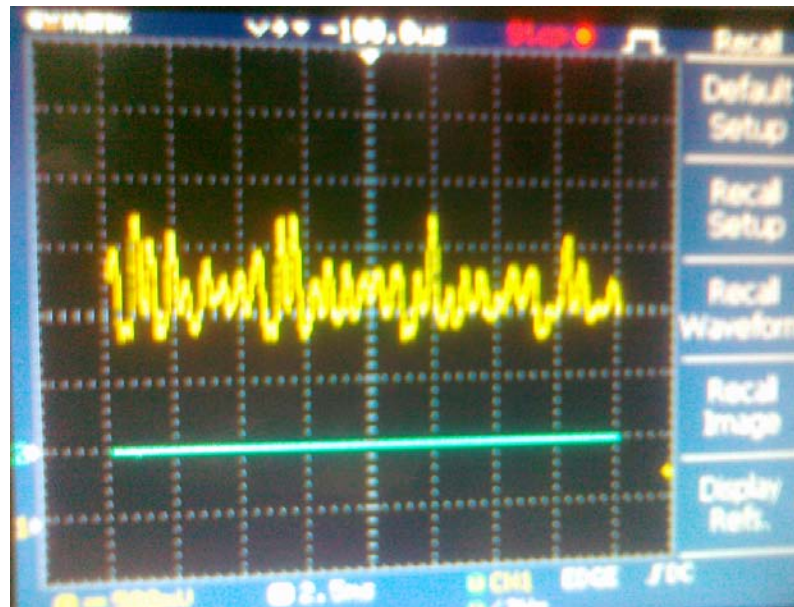
Playback:

When obstacles are detected, the voice alert is triggered. The signal enters the conditional loop of the microcontroller code. On matching with the certain code such as “BAME BADHA”, the CE pin is set to low, the PR pin sets to high thus starting playback. During playback the LED will light up which is visual indicator of EOM. The playback will continue until PD pin is high.

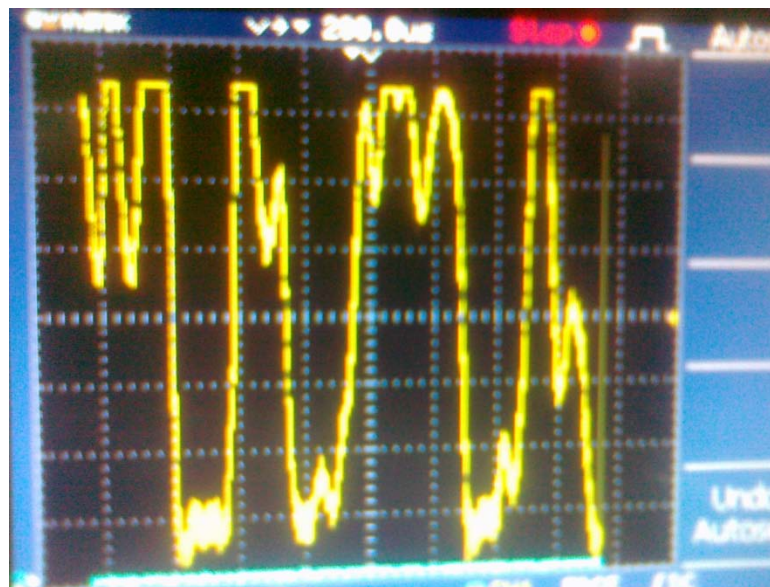


5.9-FIG: Overall Circuit Diagram between Sensor, Speech, Microcontroller, and Motor

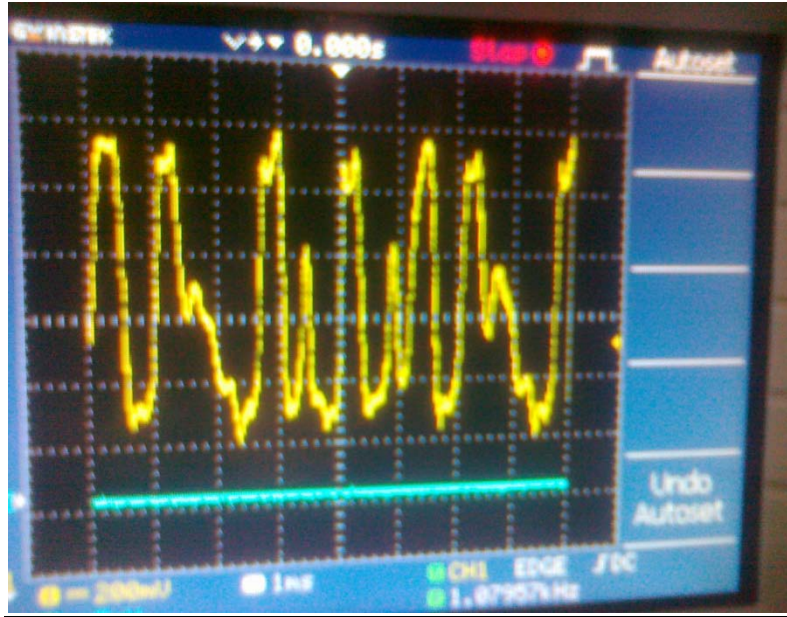
5.6 Result and Output Wave Shape of the Speech



5.10- FIG: Wave Shape When Detects in Obstacle Left (Say' BAME BADHA')



5.11- FIG: Wave Shape When Detects Obstacle in Right (Say'DANE BADHA')



5.12 -FIG: Wave Shape When Detects obstacle in Forward (Say'SAMNE BADHA')

CHAPTER-6

6.1 SCOPE FOR IMPROVEMENT:

However while doing the experiment there are some things that can be improved further.

There is scope of improvement to our navigation system.

- During a windy day the sensors have difficulty in detecting obstacles. More powerful sensors can be incorporated in the project to provide the detection of obstacles in a wider range. A motion sound sensor can be further installed to maneuver around holes and bumps in the road.
- The position of the person can be known by GPS (Global Position System) which can also be installed in the project. This will help the person to locate his position. T
- There is improvement of battery life-time; we used 9V battery as power source which can give only 2 days backup. We can replace it by Lithium Battery to more efficient

6.2 AN OUTLINE OF FUTURE WORK

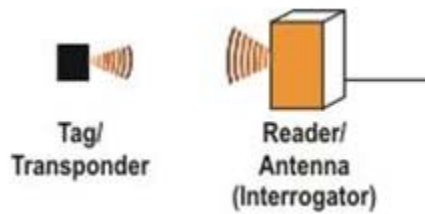
Radio frequency identification (**RFID**):

Radio frequency identification (RFID) is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. RFID technology does not require contact or line of sight for communication. RFID data can be read through the human body, clothing and non-metallic materials.

Components

A basic RFID system consists of three components:

- An antenna or coil
- A transceiver (with decoder)
- A transponder (RF tag) electronically programmed with unique information



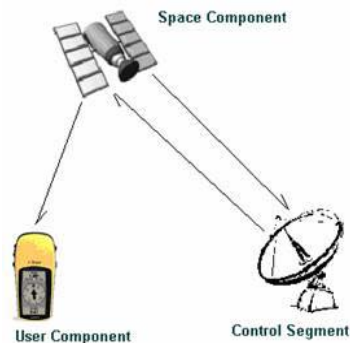
6.1-FIG: RFID SYSTEM

- The antenna emits radio signals to activate the tag and to read and write data to it.
- The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal.
- The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.

The purpose of an RFID system is to enable data to be transmitted by a portable device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application. The data transmitted by the tag may provide identification or location information, or specifics about the product tagged, such as price, color, date of purchase, etc.

The Global Positioning System (**GPS**):

For future development, and as it is difficult to know where the blind is globally, it is then desirable to use the global positioning system (GPS) in order to get the user position information.



6.2-FIG: Global Position System

CONCLUSION

We presented a navigation aid which helps blind people to navigate safely. This aid allows the blind person to avoid obstacles by warning system through vibrations and voice. Our main goal is to make a system that will be cost effective and easier for the physically challenged person to handle. In order to make it easier for the person to use, we have fixed the sonar's for detecting obstacles in particular direction. Therefore the person does not require to move the cane around to detect barriers like they do with the normal cane. They can easily walk with the cane and the sonar's will simply detect the problems and help the person to maneuver around it. We hope that this aid will be an effective, low-cost solution for reducing navigation problems for blind users.

Appendix-A.**Code for Obstacle Detection, Alarm System and Speech Output**

```

// LCD module connections
sbit LCD_RS at RB4_bit;
sbit LCD_EN at RB5_bit;
sbit LCD_D4 at RB0_bit;
sbit LCD_D5 at RB1_bit;
sbit LCD_D6 at RB2_bit;
sbit LCD_D7 at RB3_bit;

sbit LCD_RS_Direction at TRISB4_bit;
sbit LCD_EN_Direction at TRISB5_bit;
sbit LCD_D4_Direction at TRISB0_bit;
sbit LCD_D5_Direction at TRISB1_bit;
sbit LCD_D6_Direction at TRISB2_bit;
sbit LCD_D7_Direction at TRISB3_bit;
// End LCD module connections

#define SIG_PIN RB7_bit
#define SIG_TRIS TRISB7_bit

#define LED_PIN RA0_bit
#define LED_TRIS TRISA0_bit

#define CE_PIN RA1_bit
#define CE_TRIS TRISA1_bit

#define SAMNE_BADHA RA3_bit
#define SAMNE_TRIS TRISA3_bit

#define BAME_BADHA RA4_bit
#define BAME_TRIS TRISA4_bit

void main()
{
    unsigned int EchoTime = 0, i;
    float Distance, Distance2 = 0;
    char txt[20];
    char DANE_BADHA=0 ;

    PWM1_Init(40000);

    PWM1_set_duty(0);
    PWM1_Start();

    ADCON1 = 6;

```

```

Lcd_Init();
Lcd_Cmd(_LCD_CLEAR);      // Clear display
Lcd_Cmd(_LCD_CURSOR_OFF); // Cursor off

Delay_us(5);

LED_PIN = 0;
LED_TRIS = 0;
CE_TRIS = 1;
CE_PIN = 1;

LCD_Out(1, 1, "Dist: ");
LCD_Out(3, 1, "Dist: ");
Delay_ms(500);

while(1)
{
    /*
    * SONAR 1
    */
    // make IO as output
    SIG_PIN = 0;
    SIG_TRIS = 0;
    Delay_us(5);

    // give the start signal
    SIG_PIN = 1;
    Delay_us(5);
    SIG_PIN = 0;

    // wait..
    Delay_us(200);

    // make IO as input
    SIG_TRIS = 1;

    EchoTime = 0;
    while(SIG_PIN == 1)
    {
        EchoTime++;
        Delay_us(10);
    }

    Distance = EchoTime / 5;

```



```

if(Distance > 300)
{
    LCD_Out(1, 7, "  MAX  ");
}
else if(Distance <= 10)
{
    LCD_Out(1, 7, "  MIN  ");
}
else
{

    if(Distance < 30)
    {
        PWM1_Set_Duty(255);

        DANE_BADHA=1;

    }

    else if(Distance < 50)
    {
        PWM1_Set_Duty(127);

        DANE_BADHA=1;

    }
    else if(Distance < 70)
    {
        PWM1_Set_Duty(70);

        DANE_BADHA=1;

    }

    else
    {

        LED_PIN = 0;
        PWM1_Set_Duty(0);

        DANE_BADHA= 0;

        BAME_TRIS = 1 ;
        SAMNE_TRIS =1 ;
        delay_us(5);

        if (BAME_BADHA==1 && SAMNE_BADHA==1 )
        {

```

```

        LED_PIN = 1;
        Delay_us(5);
        LED_PIN = 0;

        TRISD = 0;
        PORTD = 150;

        Delay_us(200);
        CE_PIN= 0;
        CE_TRIS = 0 ;
        Delay_us(200);
        CE_TRIS = 1 ;
    }

else if (DANE_BADHA ==1 && BAME_BADHA==1)
{
    LED_PIN = 1;
    Delay_us(5);
    LED_PIN = 0;

    TRISD = 0;
    PORTD = 250;

    Delay_us(200);
    CE_PIN= 0;
    CE_TRIS = 0 ;
    Delay_us(200);
    CE_TRIS = 1 ;
}

else if (DANE_BADHA == 1 && SAMNE_BADHA==1)
{
    LED_PIN = 1;
    Delay_us(5);
    LED_PIN = 0;

    TRISD = 0;
    PORTD = 200;

    Delay_us(200);
    CE_PIN= 0 ;
    CE_TRIS = 0 ;
    Delay_us(200);
    CE_TRIS = 1 ;
}

else if (DANE_BADHA== 1)
{
    LED_PIN = 1;
    Delay_us(5);
    LED_PIN = 0;

    TRISD = 0;

```

```

        PORTD = 100;

        Delay_us(200);
        CE_PIN= 0 ;
        CE_TRIS = 0 ;
        Delay_us(200);
        CE_TRIS = 1 ;
    }
    else if(SAMNE_BADHA==1)
    {
        LED_PIN = 1;
        Delay_us(5);
        LED_PIN = 0;

        TRISD = 0;
        PORTD = 0;

        Delay_us(200);
        CE_PIN= 0 ;
        CE_TRIS = 0 ;
        Delay_us(200);
        CE_TRIS = 1 ;
    }
    else if(BAME_BADHA==1)
    {
        LED_PIN = 1;
        Delay_us(5);
        LED_PIN = 0;

        TRISD = 0;
        PORTD = 51 ;

        Delay_us(200);
        CE_PIN= 0 ;
        CE_TRIS = 0 ;
        Delay_us(200);
        CE_TRIS = 1 ;
    }
    else
    {
        PORTB = 0;
    }
}

```

```

WordToStr(Distance, txt);
LCD_Out(1, 7, txt);
LCD_Out_Cp("cm");

```

```
}
```

```
    Delay_ms(1);
```

```
}
```

```
}
```

Appendix-B

List of Components Used in the Project

#Resistor:

- 100 Ω
- 4.7 k Ω
- 2.72k Ω
- 10 k Ω
- 100 k Ω
- 1 k Ω
- 100 k Ω potentiometer

#Capacitors:

- 0.1 μ F
- 100 μ F
- 220 μ F
- 22 μ F
- 10 μ F

#Switches:

- Mini push-button

#Sensors:

- Ultrasonic sensor TS-601

#Discrete Semiconductor

- C828 PNP transistor

#Integrated Circuit:

- PIC16F877A Microcontroller
- ISD2560 Single Chip Record and Playback
- LM7805 Voltage Regulator
- Motor(Cell Phone Vibrator)

#Miscellaneous:

- 20MHz Crystal
- LCD Display
- Speaker (8 ohm)
- Electret Microphone
- Breadboard
- Connection Cord
- Mini Trainer Board
- 9 volt battery

Reference

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- [MELabs PICBASIC Forums: http://www.picbasic.org/forum/](http://www.picbasic.org/forum/)
- [Basic Micro Forums: http://forums.basicmicro.net/Default.aspx](http://forums.basicmicro.net/Default.aspx)
- [Proton PIC http://www.mikroe.com/forum/search.php?mode=results](http://www.mikroe.com/forum/search.php?mode=results)
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THE END