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VOICE MAPS

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Abstract - *The paper represents the architecture and implementation of a system that will help to navigate the visually impaired people. The designed system uses GPS and voice recognition along with obstacle avoidance for the purpose of guiding visually impaired. With the advancement in voice recognition, it becomes easier to issue commands regarding directions to the visually impaired. Blind People uses white canes to aid in obstacle detection & avoidance. Guide dogs can also be of limited aid for finding the way to a remote location. So our goal is to create a portable, simple and cheap system that will allow blind people to travel through familiar and unfamiliar environments without the aid of guides. Several guidance systems have been developed for vision impaired people, but these systems tend to be expensive, also make use of a client server approach. This Navigation system consists of two distinct components: sensing of the immediate environment for blind people to travel (e.g., obstacles and hazards) and navigating to remote destinations beyond the immediately perceptible environment. The paper described here focused on the development and evaluation of a Navigation system that makes use of GPS (Global Positioning System), voice and ultrasonic sensor for obstacle detection.*

Key Words: **GPS, Blind, Navigation, Impaired Vision, Braille**

1. INTRODUCTION

According to survey, India is now home to the world's largest number of blind people. Of the 37 million people across the globe who are blind, over 15 million are from India. [1] In India, blindness is the biggest problem. The leading causes of blindness are cataract, uncorrected refractive errors, glaucoma, and macular degeneration. India's current population is 1.22 billion. Due to this huge population, there is a lot of traffic in the road and in today's world no one has time even to talk with each other especially in metro cities. The blind people or vision impaired person feels alone in this environment. People who have impaired vision regularly use white canes and or guide dogs to assist in obstacle avoidance. Guide dogs can also be of limited assistance for finding the way to a remote location, known as "way finding". Our goal is to create a portable, self-contained system that will allow visually impaired issues the command and receives the direction response using audio signals. The latitude and longitude values are received continuously from the GPS receiver. The directions are given to Individuals to travel through familiar and unfamiliar environments without the assistance of guides. Several electronic devices are currently available for providing guidance to a remote location, but these tend to be expensive, or make use of a Braille interface. [2]

The paper described here develops a Navigation system that makes use of GPS (the Global Positioning System), voice and ultrasonic sensor for obstacle detection. The decreasing cost of GPS units, coupled with the recent growth in the availability of voice recognition services, presents an opportunity to create a low cost solution. A key priority of this system is meeting the user's navigational needs while ensuring low cost and portability. [3]

The system can advise the user where he/she is currently located, and provide directions to travel to a remote destination using voice. The visually impaired are at a considerable disadvantage, for they often lack the required information for bypassing obstacles and hazards and have relatively little information about landmarks. GPS systems are primarily suitable for the outdoor environments because the receivers are commonly unable to perform well in an indoor environment. Some of the current GPS systems make use of Braille keyboards for user input and/or system output. However, all vision impaired people may not be able to read Braille.

To ensure that a navigation system will be accessible to the greatest proportion of vision impaired people, usability is a key focus of the project, and speech technology was identified as a priority feature of the system. Further, by using the Braille keyboard with a speech technology, the device will be more portable and less cumbersome to use while walking. Speech technology has been under development for more than three decades.

2. METHODOLOGY

The block diagram of main board is shown in Fig-1. In this diagram PIC18F4520 is used, which is the heart of this project. GPS receiver is used to get the current location in the form of longitude and latitude. PIC devices are popular with both industrial developers and hobbyists due to their low cost, wide availability, large user base, extensive collection of application notes, and availability of low cost or free development tools, serial programming, and re-programmable Flash-memory capability. The output of GPS receiver is given to the processor using serial communication. In this system output is in the form of voice hence speaker/headphones are used.

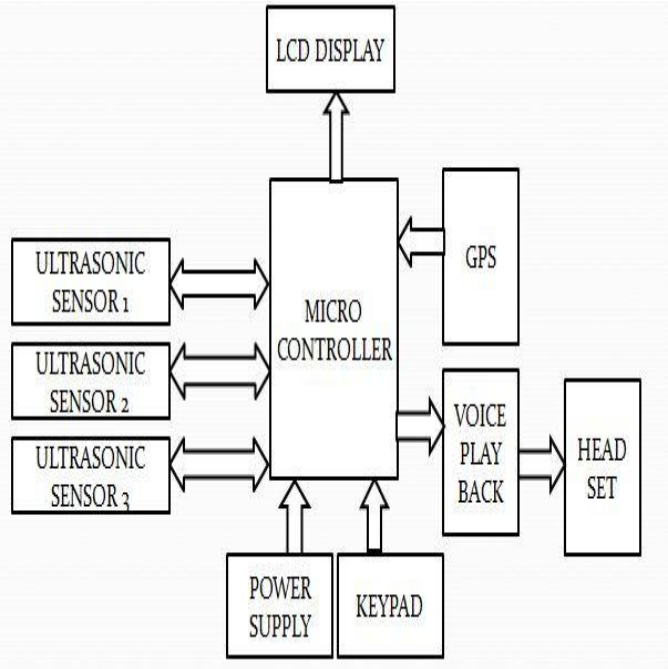

Fig -1: Block diagram

Microcontroller is the main control unit of the whole system. For the project PIC18F4520 is used.APR9600 Voice module is a low cost device. Voice module provides greater performance in sound recording/playing. APR9600 IC incorporated in the voice module board has flash analogue storage. It has 8 channels as M0 to M8. Each channel stores one voice message. So that a maximum of 8 voice messages can be recorded using onboard MIC present on the voice module board. Single voice message storage duration is 60 seconds. Ultrasonic (US) sensors are widely used to measure distances. The sensor HCSR04 is used for detecting the obstacles on the way for the blind persons in this project. This sensor transmits an ultrasonic burst and correspondingly gives an output pulse based on the time required for the burst echo to return ultrasonic sensor.

Global positioning system is a space based satellite routing system GPS has cluster of 24 satellites in earth orbit that sends accurate GPS signals and permits the GPS receivers to give data to the users such as displaying precise locations. By getting the GPS signals from 3 or more satellites among the availability of 24 GPS satellites, GPS receivers has the ability to triangulate the information and identify the user. The signals are received from the microcontroller through the serial port for communication purpose. Serial port transmits the information to the GPS modem. This transceiver gives correct information to the visually impaired people. If that person wants to go particular place means she/he has to press the key in keypad. GPS receivers and guides the person by giving voice information to the person for that particular place. It tells take turns left/right and obstacle information. It is most helpful for the person to go for a particular place with correct information. LCD (Liquid Crystal Display) screen is an electronic display module. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. This LCD has two registers, namely, Command and Data. It is used to display user required locations.

Using GPS the current latitude and longitude values of the path to navigate will be continuously provided to microcontroller. The map of our college for navigation is given below. We had measured latitude and longitude values of different locations in the path for navigation and stored in the microcontroller.

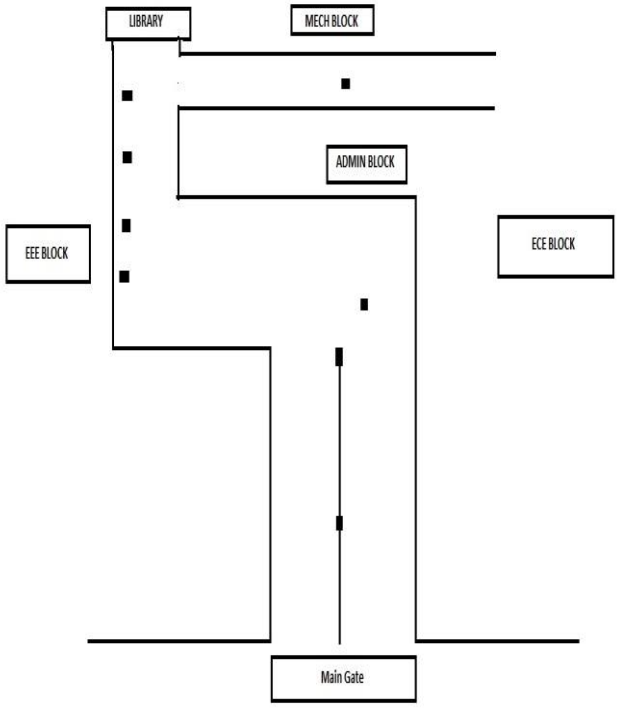

Fig-2: Map of Ammini College of Engineering

3. IMPLEMENTATION

In the voice module, user required location names and commands need to be recorded. Here, we recorded 8 location voice messages using on board MIC which was inbuilt on the voice module board. The latitude and longitude values of the path to navigate have to be stored in the microcontroller. Using key pad, user can select the required locations and GPS continuously receive the signals containing latitude and longitude values of the current location, which are displayed on the LCD connected to the microcontroller. Whenever the user want to visit those places, the microcontroller compares both stored and current values and provides commands as per the requirement. If both values are matched, then voice module gives the destination announcement and LCD displays the location.

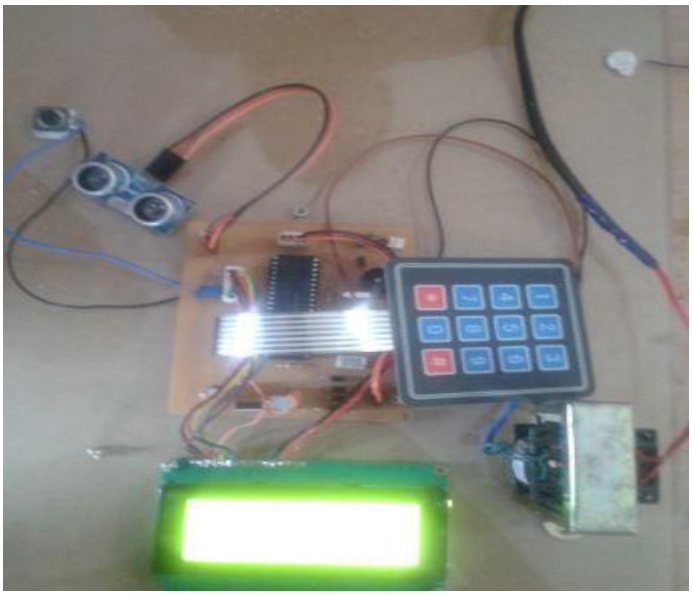

Fig-3: Prototype

The map of the path for navigation has to be stored in the microcontroller. In the keypad, each key corresponds to a location. When a person presses a key, the GPS will track the current location and is given to microcontroller. The microcontroller compares the current location and the destination location. The map of Ammini College of Engineering used for finding different latitude, longitude pair is shown in Figure 2. For obstacle detection three ultrasonic sensors are placed on the left, front and right portion on the head of blind. It works by emitting a short ultrasonic burst of sound and then listens for the echo. The Ultrasonic Sensor transmit high frequency signal which will be reflected back when it detects obstacle. The time duration between the transmission of signal and the reception of its echo is used to calculate the distance between the blind and obstacle. When an obstacle is detected, according to the map pre-programmed in the microcontroller, the microcontroller generates different control signals and thereby controlling APR9600 to produce commands. The blind can receive the voice signals produced by the voice module such as turn left, turn right…through headset mounted on the head and it makes the navigation easier. The developed prototype is shown in Fig-3.

4. CONCLUSIONS

Four of the eight locations used in the project are different blocks of Ammini College of Engineering and rests were out of the campuses. All the locations can be reached from any current locations by getting voice instructions through the headset. Ultrasonic sensors aided the feature of obstacle detection in the path. The three sensors find any obstacle to the left, right and front of the user. The sensor gives accurate results within a range of 25m.

Earlier majority of the blind people uses white canes or trained dogs for guidance and not preferred to use electronic travelling devices. The underlying reasons for this involves devices are more costs and provides poor satisfaction to users coupled with existing electronic systems. So, in the proposed system we tried to design a low cost, user friendly device for visually impaired people with highest possible precision. We have used PIC18F4520 whose processing speed is high. This device provides navigation using GPS and gives location name voice. However, there are still restrictions in the proposed system. The proposed device can't work in indoor environment since a GPS receiver receives no signals from the GPS spaced based navigation system. Further, the main challenge to be faced by the user is to monitor the battery status of the device frequently since it is working in the real time.

The future scope is that the project can be extended by using a wireless camera which can provide remote guidance for the blind people by transmitting the video to his/her relatives or a remote operator for providing real time assistance during emergency. The wireless camera has a wide video transmission range and can be extended by IoT. The transmitted video stream is coded using Indeo Video 4.5 and then stacked into TCP/IP packets and transmits over the GSM network with an internet. Then, 2-way voice communication is established between the remote operator and the user, with the audio coded using Pulse Code Modulation. Both, the voice messages and the GPS readouts are to be sent via UDP packets and we can use more accurate DGPS receivers to provide navigation

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