Abstract: Science and technology always try to make human life easier. So the main purpose of this paper is based on developing a navigation aid for blind and visually impaired people. In this paper, we design and implement a smart blind guidance system to help both blind and visually impaired people to navigate alone safely and to avoid any obstacles (fixed or moving) that may be encountered to prevent any possible accident. The location of the blind and real-time assistance is determined via GPS and GSM modules. Our proposed system includes a wearable equipment consists of a hat and mini hand stick. The implemented system is simple, fast, cheap, and friendly user.

Keywords: Ultrasonic sensors, Microcontroller, Mp3 shield, GPS, GSM.

I. INTRODUCTION

Many people suffer from serious visual impairments preventing them from travelling independently. Therefore, they need to use a wide range of tools and techniques to help them in their mobility. There is an international symbol tool of blind and visually impaired people just like the white cane with a red tip which is used to enhance the blind movement [1,2]. However, this tool has several constraints: long length of the cane, limitations in recognizing obstacles, and also difficulty to keep it in public places. Recently, many techniques have been developed to enhance the mobility of blind people that rely on signal processing and sensor technology [3-12]. These called Electronic Travel Aid (ETA) devices help the blind to move freely in an environment regardless of its dynamic changes. ETAs are mainly classified into two major aspects: sonar input (laser signal, infrared signals, or ultrasonic signals) and camera input systems (consists mainly of a mini CCD camera). The way these devices operate just like the radar system that uses ultrasonic fascicle or laser to identify height, the direction, and speed of fixed and moving objects. The distance between the person and the obstacles is measured by the time of the wave travel. However, all existing systems inform the blind to the presence of an object at a specific distance in front of or near to him/her through tone signals and/or vibrations that need to training. These details permit the blind to change his/her way only, but they are not comfortable and safe.

Our work offers a simple, efficient, configurable electronic guidance system for both blind and visually impaired people to help them in their mobility regardless of where they are, outdoor or indoor. Furthermore, the user of the system does not need to carry a cane or other marked tool. He/she can just wear a hat and hand mini stick (size of a pen) just like others. The proposed system utilizes four ultrasonic sensors (three in hat and one in pen) bring the reflected signals to a microcontroller to produce different voice messages through earphone based on the sensors output to inform the blind about the object details. In addition, the proposed system uses GPS and GSM modules to enable the blind to communicate with the home or any preferred mobile number during emergency and follow up him/her. Also, it enables the blind to be alarmed or a preferred mobile phone if he/she is outside a certain area.

II. THE PROPOSED SYSTEM

Our proposed system allows blind and visually impaired people to travel through familiar and unfamiliar environments without the assistance of guides. The block diagram of our proposed system, as shown in fig.(1), consists of eight blocks: Four ultrasonic sensors, microcontroller, Mp3 shield, earphone (speaker), GPS/ GSM module, and power supply. The system gathers data about the environment using the ultrasonic sensors to the microcontroller. The microcontroller extracts the visual information from the data by executing a certain program stored in it. This visual information is then transformed into voice messages by the MP3 shield and conveyed to the blind by earphone (speaker). We put three ultrasonic sensors (front, left, and right) in hat and one cylinder ultrasonic sensor in pen (Tracking objects). The GPS/GSM module is interfaced to the microcontroller to detect the blind person location. The GPS will be sending the location information to the microcontroller continuously. The same information will be routed to the GSM modem through the microcontroller. The GSM will forward this information to a preferred mobile number for the blind. If the preferred person wants to know the location of the blind, he has to send one SMS message "GPS# LOCATION" and immediately he will get blind location coordinates as shown in fig.(4).

III. SYSTEM CIRCUIT DIAGRAM

The circuit diagram for our proposed system is shown in fig.(2) for both (Hat & pen) and Bag.
IV. SYSTEM FLOW CHART

Fig.(3): Flow chart for Pen sensor.

Fig.(4): Flow chart for Hat sensors.

V. SYSTEM COMPONENTS

- Four ultrasonic sensors (HC-SR04).
- MP3 Shield.
- Arduino – uno.
- Battery 9V.
- GPS/GSM module (SIM908).
- Arduino-ADK.
- Rechargeable battery.
VI. SYSTEM PROTOTYPE
The prototype of our proposed is shown in fig.(5) for Hat, Pen, and Bag.

Fig.(5): Proposed system prototype (Hat, Pen, and Bag).

(a): Hat and Pen prototype

(b): Bag prototype

Table (1): Saved messages in MP3.

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Left object</td>
</tr>
<tr>
<td>M2</td>
<td>Right object</td>
</tr>
<tr>
<td>M3</td>
<td>Front object</td>
</tr>
<tr>
<td>M4</td>
<td>Near object</td>
</tr>
<tr>
<td>M5</td>
<td>Normal object</td>
</tr>
<tr>
<td>M6</td>
<td>Far object</td>
</tr>
<tr>
<td>M7</td>
<td>Away object</td>
</tr>
<tr>
<td>M8</td>
<td>Fixed object</td>
</tr>
<tr>
<td>M9</td>
<td>Toward object</td>
</tr>
<tr>
<td>M10</td>
<td>Slow object</td>
</tr>
<tr>
<td>M11</td>
<td>Fast object</td>
</tr>
<tr>
<td>M12</td>
<td>Please stop and use Pen</td>
</tr>
</tbody>
</table>

VII. RESULTS AND DISCUSSION
The proposed system is designed and configured for practical use. The system is able to handle twelve states that may face the blind people. The system will respond to each state according to a specific program which is coded and installed in the microcontroller. Table (1) shows the twelve messages that will be conveyed to the blind by earphone according to the twelve states. Fig.(6) shows a test for determining the blind location using the GPS/GSM module. A comparison between our proposed system and the currently used systems is shown in table (2).

Our proposed system has the following three categories:

a. Complete system with free navigation system (using two microcontrollers).
b. Complete system with wired navigation system (using one microcontroller).
c. System without navigation system (hat & pen only).
Table (2): Comparison between currently used systems and our proposed one.

<table>
<thead>
<tr>
<th>System</th>
<th>Structure</th>
<th>Components</th>
<th>O/P Response</th>
<th>Features</th>
</tr>
</thead>
</table>

VIII. CONCLUSION

This paper has described a system to transform visual information for the obstacle details acquired by the ultrasonic sensors to voice information through earphone. A simple, cheap, configurable, easy to handle electronic guidance system is proposed to provide constructive assistant and support for blind and visually impaired people. The main functions of this system are clear path indication and environment recognition. The US sensors have been fully utilized in order to advance the mobility of blind and visually impaired people in safe and independent way. The system is designed, implemented, and tested. The results indicate that the system is efficient in specifying the details of the objects that may encounter the blind. The proposed system is a real-time system that monitors position of the blind and provides dual feedback making his/her navigation more safe and secure.

IX. REFERENCES


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