Braille Assistance System for Visually Impaired, Blind & Deaf-Mute people in Indoor & Outdoor Application

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Abstract—Navigation in outdoor and indoor is certainly an challenging task for visually impaired, blind and deaf-mute people, indoor navigation itself is certainly becoming an harder task for blind, visually impaired people and dead-mute people . As far as observed for the non-visually impaired, it is even worse for the visually impaired. People with visual disabilities or blinds are often depending up on external assistance like trained dogs, humans, or special devices as support systems for making decisions. Hence blind people need an assistive device that will allow blind user to navigate freely and this requirement has become crucial. Here the interfacing of different sensors and actuators along with Braille keypad which is user friendly application to these peoples is done with ARM LPC-2148 and it helps in minimizing the problems faced by blind people by maximizing the use of technology. The walking stick used by the blind people has multiple sensors incorporated in it, with the help of which it is possible to enhance more features and technology to the walking stick. The main features are to detect the obstacle for collision avoidance, along with certain other sensors for pit whole detection, fire detection, and water detection. Panic switch is the emergency button that sends an SMS from the GSM module to the caretaker with the present particular location (GPS coordinates) of the blind, visually impaired and deaf mute person. The work goes for giving the safest route to blind persons, visually impaired person or deaf-mute person, by designing a more flexible assistance system and cost effective system that helps them in improving their navigating skills in outdoor and indoor application and also not to depend on none during walking in even unknown areas.

Keywords: BRAILLE KEYPAD, GSM, GPS, ARM LPC-2148

I.INTRODUCTION

Vision is the most important part of human physiology as 83% of human information being gets from the environment is via sight. There is a significant increase in cases of blindness in the world in general. The statistics shown by the World Health Organization (WHO) estimated that there are 285 billion people in world with visual problems, out of which 39 billion of them are blind and 246 of them are with low vision. The majority of people with poor vision in the developing world is over the age of 50 years and about 90% of the world's visually impaired live in developing countries. Blindness can mean different for different blind people because few people are blind from birth and few lose their vision due to some diseases gradually at a later stage. A person who is blind from birth can see nothing not even black For visually impaired people or blind people, a cane or a stick is the main source for them in navigation since it helps them to avoid obstacles and detect them in their pathway. During their walking with the cane from one place to another place, they guess and sense the directions, locate places by sniffing smells in the air, by hearing different sounds surrounding them , by the feel they get during touches , counting footsteps they walk, or by memorizing the events that had happened earlier . Based on this real context or condition the focus is on to develop a assistive technologies that may help blind individuals in becoming independent and contributing actively towards the development of the country.

Apart from being blind there is chance of having a multiple disabilities for an individual. Multiple disabilities like Deaf-mute and Deaf-blindness also makes difficulties to their daily travelling. Deaf-mute is a person who was either deaf using a sign language or both deaf and could not speak. Such people communicate using sign language. Also deaf-blindness may seem as if a person cannot hear or see at all. The term actually describes a person who has some degree of loss in both vision and hearing. The amount of loss in either vision or hearing will vary from person to person. Deaf-blindness comes in varying degrees and varying levels of communication needs. It can also result in many communication challenges. Some example of individual with multiple disabilities is as mentioned above. This proposed work goes for giving the assistance to blind persons, by designing a cost effective and more flexible navigation system and helps them in improving their communication ability.

The main objectives are:

- To design and develop a low cost blind assistance model to carryout daily activity of blind person.
- To design Braille keypad in the system to provide conditional assistance required by them and to provide the information of emergency faced by them to their parent, guardian or care-taker.

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- To develop a system using Global Positioning System (GPS) and Global System for Mobile (GSM) for navigation assistance by providing location support during emergency conditions in outdoor application.
- To alert the user through buzzers, voice based alerts, obstacle detection in front of the user.

II. LITERATURE SURVEY

Ali Jasim Ramadan *et.al* [1] has proposed a wearable smart system that helps the visually impaired persons (VIPs) to walk through the street all by themselves, or to navigate in public places. The proposed system consists of sensors that helps to alert the obstacles in front of the user and also to track the path of the user . The user gets alerted by a sound that is emitted through a buzzer and also by the vibrations caused by the device present on the wrist of the user, which is helpful for the user in case of any emergency situations.The main drawback of this work was that sensors induced in the system were less and Braille keypad was used only for note saving.

Rupali A Tanpure *et.al* [2] proposed a system for the blind and also got the visually impaired people which focused mainly on giving a voice based output for obstacle prevention and also for navigation using ultrasonic sensor. He had also used GSM.GPS module, voice i.e., mike and buzzer using which alerts the visually impaired, blind person. The proposed system had only navigation system included in it and did not include any sensors for obstacle detection.

Mohammed Azher Therib *et. al[3]* in this work, most of the problems that may face the blind people are solved like the barriers or people in front of him at a certain distance because they may cause a collision[3]. The other problem is due to the presence of ponds that may immerse the feet of the blind in it and cause injuries too. In addition, holes or stairs in the way of the blind that will cause him to fall are another problem. GPS and GSM technology was not included in the system, smoke and fire sensor was also not included.

S. Dhananjean *et.al* [4] presented his work, which consisted of ultrasonic and RFID combined, which helps the blind and also the visually impaired to navigate[4]. The objects around the visually impaired persons can be detected with the help of sensor in the system. Setting up of an RFID Information Grid for navigation is technically and economically bit problematic. The cost of RFID tags and its relevant technology is high which itself is a major drawback.

Alma S *et.al* [5] paper presents a breakthrough guide and assistance aids for the blind and visually impaired person to communicate the object location and physical location using voice-based module for this system user in-order for them to have a safer navigation in the outdoor and indoor application [5]. In this method they have developed an android application which can be activated and deactivated through a button provided on the white cane. This proposed system didn't have any kind of sensors or devices to detect obstacles above abdomen level.

Deepak Sharma *et.al* [8] in his article he has proposed a system for dead and dumb people that reduce the barrier of communication between normal people and deaf-dumb [8]. This paper mainly tries to solve various problems faced by deaf and dumb people. The final system designed is portable since the whole operation is performed on the microcontroller and it consists of a glove which is used for gesture recognition. The main advantage of this device is that it eliminated the need of interpreter and also avoids miscommunication for the deaf-dumb people.

Liang-Bi Cen et.al proposed a paper that provides an emergency system for deaf-mute people during emergency conditions [9]. A real-time mobile emergency assistance system for helping deaf-mute people and elderly singletons has been proposed in this paper. The proposed system assists deaf-mute people or elderly singletons in the shortest possible time to report; the report also uses short message service (SMS) intimate to achieve offline report. This work can also be used to send the particular location of the user to the user's caretaker, which is useful in case of emergency times.

III. IMPLEMENTATION

The system implementation consisted of integrating the different components outlined in the previous subsections. The ARM LPC2148 and selected components allow a straightforward integration. Hence, proper compatibility and functionality are guaranteed, given the iterative process of testing and debugging. Arm-integrated development environment and its version of the C language to program the system have been used. Functions such as communications and GPS readings are available as libraries, which simplify the code and implementation. Then, the power supply for all the integrated components and controller composing the proposed system is made. The sensors, which were connected to the microcontroller, retrieve signals that trigger the predefined events.

Powering directly the infrared sensor from the battery is done as it is constantly active. In addition, the in-device alarms were connected to the microcontroller, which commands its operation on the basis of the sensor events. Likewise, the GSM module was activated whenever required, whose SMS information included an updated reading from the GPS to retrieve the current location.

The microcontroller operates in the range of 1.8–5.5 V and has a low power consumption, which is aimed to optimize for every function. The alarms, including sound, vibration, GSM, and GPS operation, are triggered by the sensor events and therefore consume power during short periods, with the vibration motor being the most power-consuming actuator, and the GPS being the most consuming component when retrieving information.

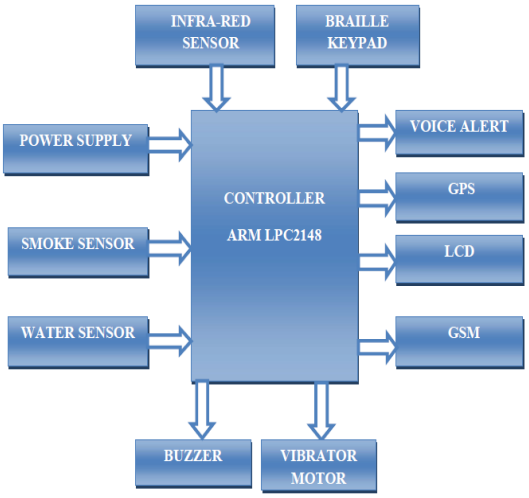

Figure 1: Block Diagram of Braille assistance system

Implementation of the Braille Assistance System for Visually Impaired, Blind & Deaf-Mute people by Using GPS and GSM Technology in Indoor & Outdoor Application requires hardware components like microcontrollers, buzzer, LCD, IR sensors, Water sensor, Fire sensor, Braille keypad, power supply, GPS and GSM modules, voice module, vibrating motor and power supply as well as software components like Embedded C and Flash Magic. The components description is given below:

Microcontroller (LPC-2148): The microcontroller is a 16-bit/32-bit ARM7TDMI-S with embedded trace support and real-time emulation, that combines the microcontroller with embedded high-speed flash memory ranging from 32 KB to 512 KB.

Buzzer: The Piezo buzzer produces sound based on reverse effect of the piezoelectric effect.

GPS MODULE: The GPS module stands for Global Position System; in this system GPS is used as a receiver to identify the location of blind, in terms of their longitude and latitude. This location is then sent to the user if any assistance switch is pressed by the user from the keypad.

Smoke sensor: The presence of fire or smoke is detected by these sensors, which alerts the user of the preceding danger.

Water sensor: Detection of water or moisture also plays and important role .this sensor alerts the user if there's any presence of water or moisture in the direction of navigation by the visually impaired people.

Braille Keypad: The Braille is the main source of language for the visually impaired or blind people, in this system incorporating Braille in the keypad system which allows the user in critical situations is done. It provides the predefined location guidance in outdoor as well as in indoor application.

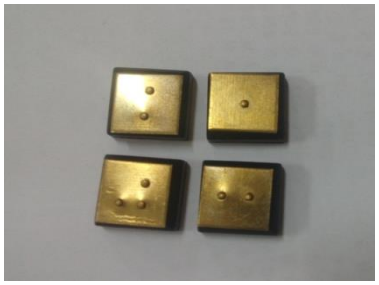

Figure 2: Designed Braille switch

IV. METHODOLOGY

The proposed system that implemented in this paper consists of Arm microcontroller, IR sensors, for obstacles and for holes detection. The moisture sensor for ponds detection process, fire/smoke sensor for detection of fire or smoker and vibrator motor are also used for alerting the blind. Braille keypad is the main source of visually impaired people for reading and studying, here using Braille keypad as an assistance source is made. Panic button can be indulged within Braille keypad with the help of which user can inform his caretaker or guardian in case of emergencies. LED placed in the cane of the user, alerts the neighbor peoples around him.

The Flow chart shown below in the figure 3 gives us the idea about how sensor, GPS& GSM modules, panic switch are working. Initially when the blind or the visually impaired person starts walking a step, three important processes are to be considered namely start of obstacle detection process ground level, panic switch and detection of obstacles above head level.

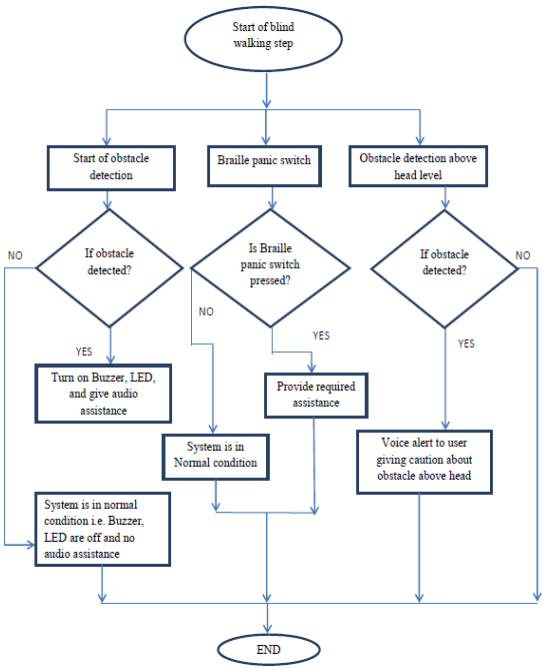

Figure 3: Flow chart of system operation

In obstacle detection process the device checks for obstacles in front of the user, if there is any obstacle in front of the user within the range of less than 10m , It alerts the user through buzzer ,vibrating motors and LED's . If there are no obstacles in front of the user then buzzers, vibrating motors and LED's remain inactive. Panic switch in the device which when pressed helps the user to alert the care-taker or guardians, by sending an SMS to them with the link containing the user's location, for different difficulties such as personal assistance and medical assistance are said to be integrate for different Braille numbers.

When user is in emergency and if press keys from Braille keypad containing predefined information like the type of difficulties he is facing, a message will be sent to the care takers number along with the location of the user from that particular place with the help of GPS and GSM module. Additionally to display caretakers numbers a Braille switch is incorporated..If the control is YES then operation flows forward, for NO the system said to be in normal condition and the outputs are shown by using LED's, Buzzers, Vibrating motors etc.

V. RESULT

The main aim is to assist blind or visually impaired people to move safely among indoor and outdoor applications such as obstacles, holes, ponds and other hurdles faced by them in their daily life. The result of the hardware implemented system is shown in below figure 4.

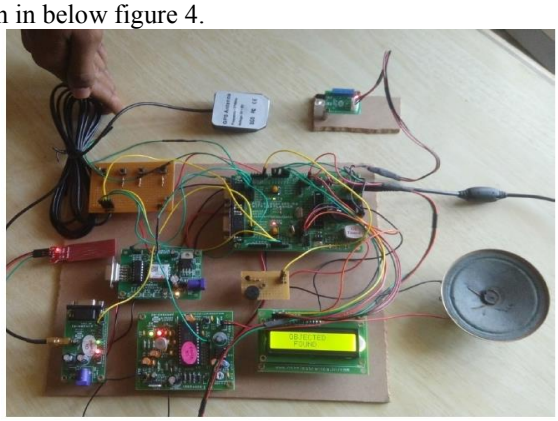

Figure 4: Obstacle detection

The above figure 4 depicts when any obstacle comes infront of the blind person the proposed model will alarm the user about the obstacle detection

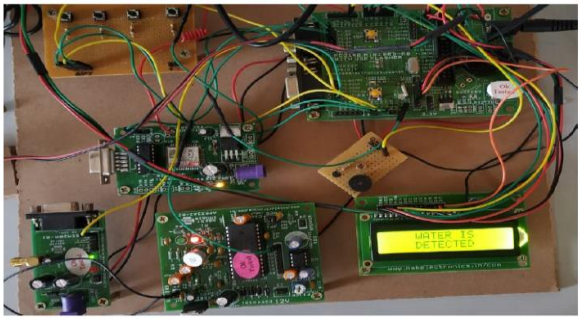

Figure 5: Water detection

The above figure 5 shows whenever a blind person will come across any pond or traces of water, the model will alarm the user with the help of buzzer and audio assistance.
Whenever the Braille switch is pressed the outputs corresponds to the conditional emergency. The conditional emergency as output messages is sent to parent or guardian and the same is displayed on LCD display to help the user by nearby persons. They are displayed as shown figure 6 below:

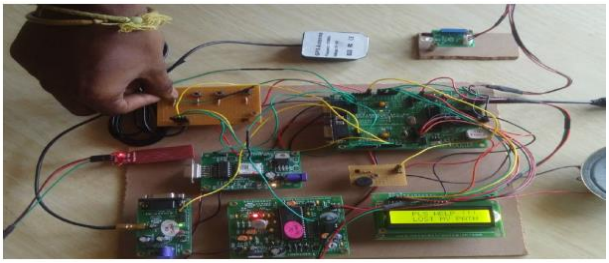

Figure 6: Braille switch operation

Whenever the blind person misses his path and then the location of corresponding person will be send to their care takers through the GPS module which adopted in our module. The Figure 7,8 and Figure 9,10 will show the message and the exact location of the blind person upon requiring any medical and personal assistance..

Figure 7: LCD display of message showing lost my path

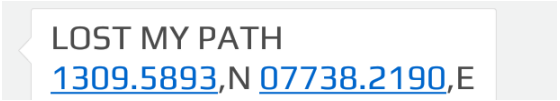

Figure 8: Location coordinates sent to care-taker as message showing lost my path

Similarly there are other message outputs they are:

Figure 9: LCD display of message showing message of medical assistance

Figure 10: Location coordinates sent to care-taker as message showing of medical assistance

Figure 11: LCD display of message showing message of need of personal assistance

Figure 12: Location coordinates sent to care-taker as message showing need of personal assistance

VI. CONCLUSION

The paper focuses on developing an assistance system to assist blind, visually impaired and/or deaf-mute people to safely travel from one place to another and it is also seen that the main advantage of the system is the fact that it can provide a very low cost solution to millions of blind people worldwide. Developed system is a user-friendly assistive aid for them. The Braille keypad system used here is the advanced, time saving and reliable approach in this system. This system will be very useful for the blind, visually impaired and deaf –mute people in leading life independently without help of any person even in unknown places. This system provides necessary feedback to the user and also to the caretaker or guardian making navigation especially through outdoor more precise, safe and secure. It is an important and user friendly device in navigating and obstacle detection aid for blind and vision impaired person in their day to day life.

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