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Smart E-Stick for Visually Impaired

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Abstract— In this work, a simple, cheap, friendly user, smart blind guidance system is designed and implemented to improve the mobility of both blind and visually impaired people in a specific area. The objective of this work is to provide a reliable, portable, artificial guidance system by using GPS module, GSM module and IR sensor which is attached on a stick.If the person feels that he is in danger then he can press the panic key by which the location of the blind person send to registered number. It has a buzzer when any object will be in front of the blind person then the buzzer starts sound with the help of proximity sensors. It is has a microcontroller and a rechargeable battery.

Keywords— Microcontroller, IR sensor, Global System for Mobile Communication (GSM), Global Positioning System (GPS), Buzzer.

I. INTRODUCTION

Many people suffer from serious visual impairments preventing them from travelling independently. Accordingly, they need to use a wide range of tools and techniques to help them in their mobility. The cost of these tools is very high and they are complex to use; it is difficult for many of blind and visually impaired persons to use them or to afford them because the average income of the visually-impaired people is relatively small. So, this research is to provide a simple smart electronic walking stick having a buzzer in it, when any obstacles is detected along the pathway of the blind people in the range of approximately 100–550 cm then the buzzer starts sound with the help of IR sensors. It is has a microcontroller and a rechargeable battery. This smart e-stick is based on embedded system having a GPS system which helps to track the blind person and it has a GSM system which will help the blind person to send the current location to the mentor when he feel that he is not on right path, blind person can easily send the location by pressing the panic key placed on the head of the Smart e-stick. This walking smart e-stick is an aid for blind people. The system will provide artificial vision to a blind person. It will help them in object detection along the way, real time assistance via global positioning system (GPS), safety provider using GSM. The aim of the overall system is to provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of objects around them.

II. EXISTING SYSTEM

This section describes appropriate related works on the development of smart canes intended for visually-impaired people. According to, technology can help in reducing many barriers that people with disabilities face. These kinds of technologies are referred to as assistive technology (AT). There are many types of disabilities, including physical disabilities, hearing impaired, and visually-impaired. AT has been utilized in assisting them. However, developing an AT is expensive, making their selling price high. According to Mazo and Rodriguez the Blind Cane is one of the assisting tools for the visually-impaired and it is really important. According to Herman , one of the main problems of the visually-impaired, is that most of these people have lost their physical integrity. Also, they do not have confidence in themselves. This statement has been proven by Bouvrie, in which an experiment name “Project Prakash” has been carried out. It was intended at testing the visually-impaired to utilize their brain to identify set of objects. According to Chang and Song , this can also be applied to different situation. When the visually-impaired walk into a new environment, they will find it difficult to memorize the locations of the object or obstacles. These examples demonstrate the difficulties of visually impaired people. The Guide Cane is designed to help the visually-impaired users navigate safely and quickly among obstacles and other hazards. Guide Cane is used like the widely used white cane, where the user holds the Guide Cane in front of the user while walking. The Guide Cane is considerably heavier than the white cane, because it uses a servo motor. The wheels are equipped with encoders to determine the relative motion. The servo motor, controlled by the built-in computer, can steer the wheels left and right relative to the cane. To detect obstacles, the Guide Cane is equipped with ten ultrasonic sensors. A mini joystick located at the handle allows the user to specify a desired direction of motion. Guide Cane is far heavier than the ordinary white cane and also it is hard to keep because it cannot be folded. Smart Cane is one invention which was originally the creation of a common blind cane but it is equipped with a sensor system. This invention resembles Guide Cane where this invention has a number of ultrasonic sensors and servo motors. This invention is designed with the aim at helping the blind in navigating. Ultrasonic sensors need to detect and avoid obstacles or objects located in front of the user. Meanwhile the fuzzy controller is required to determine the instructions that will be executed for example to turn right, left or stop. Like Guide Cane, this

invention also has a control button on the handle, and the button has four different directions. This invention has the same weaknesses as the Guide Cane where there will be a problem to save space or to place the smart cane. Besides that, cost is also a weakness in this project as it uses ultrasonic sensors and a number of servo motors. If the cost is too high, users are not able to afford for it because the average income of the visually-impaired people is relatively small. Smart Cane has been designed by students from Central Michigan University where this invention uses Radio Frequency Identification (RFID). RFID is used to detect objects or obstacles in front of the user and detects the RFID tag that has been placed in several areas to navigate the users. This invention is just like a normal stick but is equipped with a bag, wornby the user. The bag supplies electricity power to the invention and informs the user through speakers inside the bag. For users who do not have the ability to hear, there are special gloves that will vibrate at every finger, in which different vibrations in each finger have different meanings. However, this invention has several weaknesses and is only suitable for small areas. This is because it only detects the area with RFID tag otherwise this invention only works as a regular blind cane. In addition, this invention requires a high cost if it is used in the external environment because the larger area that need to be tagged, the higher cost is needed. Mechatronic Blind Stick is a guiding system, designed to facilitate the daily work among the visually-impaired people. This invention has many similarities with the Smart Blind Cane. In which this invention uses ultrasonic sensors and sound vibrations. However, this invention also has several weaknesses; it cannot be folded and difficult to keep. In addition, this invention is not equipped with sensors to detect the water areas. Software Techniques used is MPLAB software that is used to develop the source code of the PIC microcontroller. The hardware requirements are Ultrasonic sensors that generate high frequency sound waves and evaluate the echo which is received back by the sensors. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. Ultrasonic is like an infrared where it will reflect on a surface in any shape. However, the ultrasonic has a better range detection compared to infrared. In robotic and automation industry, ultrasonic has been accepted well because of its usage. Magori and Walker state that the endurance and accuracy of the sensor is not affected by physical contact. Comparing with other sensors, the ultrasonic is more accurate. Han and Hahn have proven that the distance and angle measurements of ultrasonic are highly reliable by proving that the relative errors and variances of the measurements are within a reasonably small range. These discussions explain that the ultrasonic is suitable for developing the Smart Blind Cane. Microcontroller is a single chip that contains the processor (CPU), non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an I/O control unit and time. It is designed for a small set of specific function to control a particular system.. The aim of this paper is to discuss on a development work of an assistive tool for the visually-impaired people that alerts them of the obstacles in front, which is named Smart Cane. This section elaborates the background foundations of the works in this study. Related works are discussed in supports of this study. Next, the steps in developing the assistive cane are addressed in detail. Further, the experiment including results and findings are elaborated at length. Finally, this paper concludes by discussing some possible works for the future.

III. PROPOSED SYSTEM

The proposed system consists of five main units:

- Microcontroller (ATmega16)
- IR Sensor unit.
- GPS unit
- GSM unit
- Buzzer

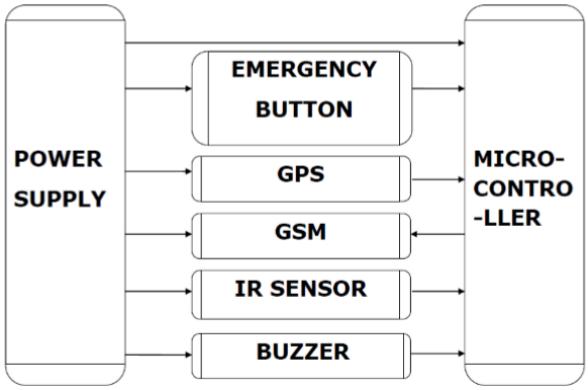

Fig. 1 Proposed Block Diagram

1. Microcontroller (ATMEGA16)

The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

2. IR Sensor Unit

The IR Sensor-Single is a general purpose proximity sensor. Here used for collision detection. The module consists of an IR emitter and IR receiver pair. The high precision IR receiver always detects an IR signal. The sensitivity

of the IR Sensor is tuned using the potentiometer. Tuned sensitivity of the sensors is limited to the surroundings. Once tuned for a particular surrounding, they will work perfectly until the IR illumination conditions of that region nearly constant. When an obstacle is encountered, the output of IR receiver goes low; IR signal is reflected from the obstacle surface. This drives the output of the comparator low. This output is connected to the cathode of the LED, which then turns ON.

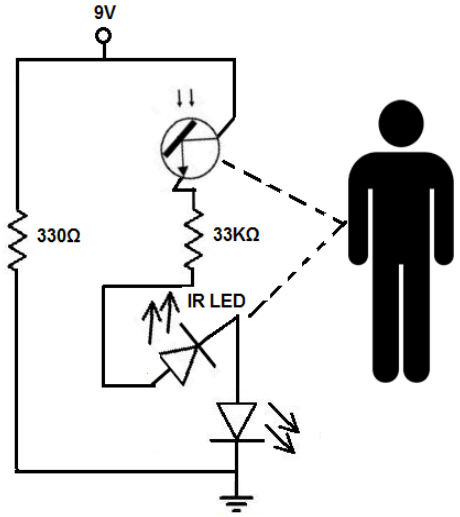

Fig. 2 IR sensor Schematic Diagram

3. GPS unit

GPS is used to navigate the location and direction for individual. The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defence. GPS unit can receive the radio signals that the satellites broadcast. These helpful electronics ensure that you don't get lost.

4. GSM unit

GSM stands for Global System for Mobile Communication. It is a digital cellular technology used for transmitting mobile voice and data services. GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world. GSM makes use of narrowband Time Division Multiple Access (TDMA) technique for transmitting signals. This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. It can be used to send and receive SMS or make/receive voice calls.

5. Buzzer

It is an electrical device that makes a buzzing noise and is used for signalling. when any object will be in front of the blind person then the buzzer starts sound with the help of proximity sensors.

There are these two systems, System for localization and positioning of vehicles using system responds to it by transmitting its current coordinates in the form of Latitude and Longitude using a reply SMS to same Cell phone .And the device uses the sensors to detect obstacles within the designed range to avoid the blind person through the issuance .Therefore using these concepts we come up with blind person and also get information about his location using GPS and provide the same to his relatives via SMS using GSM technology. This project presents a theoretical model and a system concept to provide a smart electronic aid for blind people .We design an intelligent device which alerts the person on occurrence of obstacles based on distance between the person and the obstacle .Here, this intelligent device not only alerts but also traces the location of the person and informs the current position of the person to his/her relatives.

IV. RESULTS AND DISCUSSION

The experiments were conducted to evaluate the performance of the proposed method. The results presented in this paper mark the beginning of our efforts to build a compact travelling aid that allows the visually impaired to negotiate everyday environment. As previously mentioned, the sensor circuits give information about the environment. The circuit that has been designed for the object detection has provided an accuracy of 1 meter.

V. CONCLUSION

With the proposed architecture, the blind people will able to move from one place to another without others help, if constructed with most accuracy.. It will act as a basic platform for the generation of more such devices for the visually impaired and it will be cost effective in future. And as far as the localization is concerned, if a blind get lost it will be able to provide accurate details of their location with help of GPS.. The developed prototype gives good results in detecting obstacles paced at distance in front of the user. The solution developed is a moderate budget navigational aid for the visually impaired. However minimizing cost leads to compromises in performance. Before commercial production design improvement are suggested .Some improvements that could be made are as follows:

- Implementing a technology for determining the speed of approaching obstacles and increasing the range of ultrasonic sensor.
- To increase the number of routes stored synchronization with external memory can be provided.
- Speech recognition can be used for voice control.

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