SMART ASSISTIVE DEVICE FOR VISUALLY IMPAIRED PEOPLE

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Abstract— This paper aims to handle the event of a device that shall help and function an efficient solution for visually impaired. Blind people face constraints in independent mobility and navigation. Daily activities are hampered by their inability to decide to their surroundings. The developed model aims to guide the blind man and prevent them from unwanted collisions with the obstacles through pre-recorded voice commands hence providing active feedback. The model consists of two modules- cane and shoe unit. Both are integrated together, working as one unit facilitated by "Bluetooth" connectivity and offers solution for orientation through digital compass. The IR ranging sensors employed in the shoe and cane units together provide information to the user. All of those measures altogether alleviate the risk of injury to the visually disabled person.

Keywords— Bluetooth, Cane module, IR ranging sensor, PIC microcontroller.

I. INTRODUCTION

The ever-increasing number of blind persons attracts the development of the many assistive devices round the world with the hope that these will help visually impaired in leading normal lives. One in every 179 people is blind. As per these statistics, India contributes to 21% of the total blind population everywhere the planet. In India itself, around 8 million people out of around 39 million people are blind. And in a very million, 53 thousand people are visually impaired, 46 thousand people have Low Vision and 6800 people have complete vision loss i.e., they're blind. And unfortunately, as per these statistics only 5% of them have access to any quite assistive technology. Given the fast-paced life now-a-days one faces many difficulties thanks to the congestion of obstacles within the environment, it'd be even worse for the visually impaired people. they typically depend on either external assistance which might be provided by humans, trained dogs or other electronic support systems for higher cognitive process. Existing systems are ready to detect obstacles at the bottom level or at the waist level or above but not together. Hence, we were motivated to develop a tool which intends to guide the human through the obstacles at both ground and waist level. We implemented two modules, one is that the Shoe Unit and therefore the other one is Cane Unit. The shoe unit is integrated with three IR ranging sensors- Front, Left and Right. While the white cane is employed usually by the blind people as an assistive device by tapping it on the bottom or by making it touch the approaching obstacle. However, it's not as efficient because it is meant to be. So, we wanted to produce further feedback to the user before he runs into the obstacle. we 've accomplished the goal by adding an IR Ranging sensor to the white cane to detect obstacles above the bottom level. the most feature of the developed model is that Bluetooth technology has been used to make both the modules work as one unit and a voice playback/ recording chip to alert the user through voice commands. counting on

where the obstacle is found, audio feedback gives a message to the user accordingly. We have used a straightforward small speaker and a buzzer for alerting the user as use of earphones or any such dedicated device may cancel the noise within the environment which can otherwise be helpful for the blind and not hamper with his/ her natural sense of hearing.

II. LITERATURE SURVEY

A.Paper I

The cane has an ergonomic design and an embedded electronic system. The electronic system uses haptic sensing to detect obstacles above the waistline. When an obstacle is detected, the cane vibrates or makes a sound. The device was designed to detect physical barriers above the waistline based on echo detection and to give tactile feedback in the form of vibration (or sound) inside the cane to warn about potential collisions. The haptic sensor and controller are embedded in the cane. Battery life was ten hours. The delay time was obtained when the echo signal arrived, and the distance to the obstacle was computed. Finally, the haptic feedback, which relies on the measured distance, was triggered.

B.Paper II

White cane can only be used to detect obstacles up to knee-level within a range of only 2-3 feet. Cane mounted knee-above obstacle detection and warning system using ultrasound beam to enhance the horizontal and vertical detection range. A detachable unit comprising of an ultrasonic ranger, vibrator and a microcontroller was developed which can detect obstacles above knee level. Distance information is conveyed to the user though a vibrator. Vibration frequency increases as the obstacle comes closer. Enables the person to effectively scan the area in front and detect obstacles on the ground such as uneven surfaces, holes, steps, walls etc. The user keeps the cane at a convenient inclination. As a result the ultrasonic detection cone is directed upwards and allows detection of knee above obstacles. Device consists of an 8051 microcontroller SRF04 ultrasonic ranger, and a vibrator. Runs on a standard Li-ion rechargeable battery. For charging the user connects an AC or USB adapter fully charged battery lasts about 10 hours of constant usage before recharging.

C.Paper III

Shoes were used to guide the blind person, fitted with an array of ultrasonic sensors around the sole. The sensors are supported by the proprietary circuit located inside the shoe of the user. The concept used in this prototype is that the obstacles will be detected by these sensors and the information about it will be given to the user in real time as physical notice. For the physical feedback, the shoe has made use of some vibrating boxes that the user can put in his/her pockets. Arduino controller keeps polling the ultrasonic sensors and provides feedback via the boxes. This information is processed and fed to the user via one of his other working

senses – here it has used the sense of touch. They've used the Arduino Mega 2560 for processing.
Advantage: keeps the user's hands free for doing other tasks.

D.Paper IV

The main features are that Blind Shoes are equipped with vibration sensors can indicate a number of obstacles. Sensors will vibrate when they encounter a number of obstacles, such as holes, vehicles, walls, and even be able to show the road markings. The sensor will vibrate when comrades blind encounter resistance at a distance of 80 cm to 1 meter and a height of 15 cm as well as on the hole or limiting the sidewalk. Blind Shoes are also equipped with a single chip microcomputer that acts as the brain that controls all of the features and data storage. Smart shoes can charge the battery automatically. Blind Shoes can charge the battery by itself through kinetic generator pinned under the soles of shoes. The battery will be charged automatically when the user step.

E.Paper V

As a battery-operated walking stick, the prototypical smart cane is equipped with ultrasonic sensors that are efficient enough to detect obstacles in an extended range, as compared to a white cane. This smart cane detects obstacles through the transmission of ultrasonic waves and the decoding of the received reflections to sense the presence of physical objects. These ultrasonic sensors make it possible to measure and detect the distances to moving and still objects. The cane is simple to operate and provides distance information directly. The detection range, including the length of the cane's tip, may be adjusted based on the user's preferences. The smart cane produces vibrotactile feedback on the handle bar. The prototypical cane had a vibrotactile actuator to generate alerts on the handle when detecting obstacles within a range of 2 m and above knee-level.

III. DESIGN METHODOLOGY & RESULTS

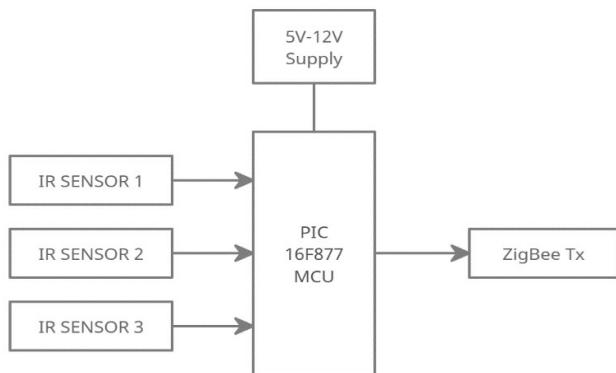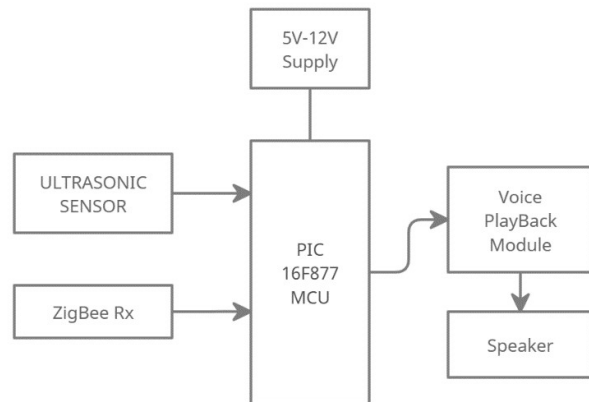Fig. 1 Block Diagram of Transmitter Module
(Shoe Module)

Fig.2. Block Diagram of Receiver Module
(Cane Module)

The Design Consists of two modules:
1.Shoe Module
2.Cane Module

HARDWARE REQUIREMENT:
1.PIC 16F877 MCU
2.IR SENSORS
3.ZIGBEE TRANSMITTER
4.ULTRASONIC SENSOR
5.ZIGBEE RECEIVER
6.VOICE PLAYBACK CHIP
7.SPEAKER
8.BATTERY

SOFTWARE REQUIREMENT:
1.MP LAB Programming Software.
2.Aurdino for testing Sensors.
3.Tinkertkat for PCB designing.

The Sharp IR Range Finder works by the process of triangulation. A pulse of light (wavelength range of 850nm +/- 70nm) is emitted and then reflected back (or not reflected at all). When the light returns it comes back at an angle that is dependent on the distance of the reflecting object. Triangulation works by detecting this reflected beam angle - by knowing the angle, distance can then be determined and in turn the output voltage.

For the voice playback/ recording chip, pin 4 is connected to the RA5 of PIC, which is digital input/output pin working as the chip select signal for the voice chip. Pin 3 is connected to the RC3 pin which is the MSSP (master synchronous serial clock) pin. Pins 2 and 3 of voice chip are connected to RC4 and RC5 which are SPI (Serial peripheral Interface) pins for input and output respectively.

The Bluetooth transfers the data from the auxiliary module and sends it to the PIC controller of the main board. PIC processes the data of the three IR sensors on the shoe as well as of that of the cane sensor and outputs the required command to the voice chip to playback the pre-recorded message.

Whenever the user encounters n obstacle in the front, the voice chip plays out "Front Sensor Activated" through the speaker. And when the obstacle is out of the way or the path becomes clear, the voice chip plays out "front clear". Similarly, for the other sensors at the top (on the cane), on the left and right side of the shoe. For the Shoe module, the

connection is almost the same except for that three IR Ranging sensors have been used instead of one. One for right, one for left and the remaining one for the front. The transmitter chip for Bluetooth is connected in the same fashion as is connected in the main board (RC6 and RC7 EUSART pins are used).

The Device Is helpful for a visually impaired person to be independent in navigation and mobility. By the voice playback alerts from the cane module by detecting obstacles from shoe module.

Fig.3. Hardware Implementation

IV. CONCLUSION

The development of the device module is done so that a visually impaired person gets a support system Controlled with PIC Microcontroller, having the Sharp IR range sensors in transmitter module and the ultrasonic sensor in receiver module for above knee level objects which is accurate in detecting the obstacle and alerting the person (using Zigbee communication) find their way bypassing every obstacle that comes on their way to destination.

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