

Technocane - guide for the visually Impaired

Rajat Butola^{#1} , Ketan Lohani^{#2} , Ankita Sakhuja^{#3}

Abstract: Blindness is a state of visual impairment in which a person is not able to visualize objects around him. The people who are visually impaired face a lot of difficulties while walking as they are not able to see things properly and need someone's help or have to stay confined to four walls of a room. They cannot venture out on roads alone as they are more vulnerable to accidents and are at a great risk of losing their lives. In this work, a easy to use and cost effective technocane has been designed and developed which transforms the simple cane or plastic stick used by the visually impaired people to a smart stick equipped with sensors. The techno-cane makes use of ultrasonic sensors, infrared sensors light detector resistor integrated with AVR microcontroller. The overall aim of the techno-cane is to provide a convenient and safe method for the blind to overcome their difficulties in daily life while walking and thus improving their mobility.

Index Terms: Techno-cane,Ultrasonic Sensor, Light Detector Resistor, AVR microcontroller

I.INTRODUCTION

Walking safely and confidently without any human assistance in urban or unknown environments is a difficult task for blind people. Imagine walking into an unfamiliar airport. The places we have to search for, airline ticket counter, security check-in, boarding gate, are difficult to find even with signs. Imagine how much of a challenge this would be if you cannot even see the signs! Everyday situations present similar challenges. While shopping malls often have building maps, they are usually stationary displays that are useful only when one can locate and read the display. Many medical and academic buildings lack even this kind of navigation assistance. Challenging for a sighted person, the task of finding a way in such a building for an unassisted person with visual impairment becomes nearly impossible. Blindness acts as a hindrance in the mobility of a person. There are

increased chances that the person will get hit by a vehicle or an obstacle and can sustain injuries which can prove to be fatal for him. according to a study of world health organization as of 2012, The estimated number of people visually impaired in the world is 285 million, 39 million blind and 246 million having low vision; 65 % of people visually impaired and 82% of all blind are 50 years and older. 285 million is a whopping number and there are still thousands who die due to accidents daily. The technocane to a great extent can help in reducing these numbers and become an all time guide for the blind people. Dynamic objects produce noise while moving blind people develop their sense of hearing to localize them. A visionless person commonly uses a white cane or walking cane for navigation. The walking cane is a simple and purely mechanical device to detect static obstacles on the ground, uneven surfaces, holes and steps through simple tactile-force feedback. This device is light, portable, but its range is limited to its own size and is not usable for dynamic components. Another option that provides the best travel aid for the blind is the guide dogs. There are a large number of devices available for the purpose of navigation like simple white cane which comes with a feature of folding or guide dogs to travel independently.

The first special relationship between a dog and a blind person is lost in the mists of time, but perhaps the earliest recorded example is depicted in a first-century AD mural in the buried ruins of Roman Herculaneum. There are other records from Asia and Europe up to the Middle Ages, of dogs leading blind men. Guide Dogs help their users to travel around independently and safely, giving their users more independence, freedom and confidence. Guide Dogs make navigating streets much less stressful by assisting their users to find locations, avoid obstacles and stop at kerbs. Guide Dogs make it easier for the person who is blind or vision impaired to use public transport, navigate shopping centres and buildings,

find doors, seats and pedestrian crossing buttons. Guide Dogs provide companionship and promote social inclusion .Making friends becomes easier when you have a Guide Dog. Members of the public often show an interest in a Guide Dog and stop to chat but these dog guides are still far from being affordable, around the price of a nice car, and their average working time is limited, an average of 7 years .

The techno-cane is cost effective as well as very reliable tool that can be used for the navigation by the blind. In this techno-cane embedded system plays a major role. It comprises a sensor system of ultrasonic sensor, infrared sensor and light detector resistor. All these sensors are interfaced with the Atmega 8 AVR microcontroller, the whole system comprises of voltage regulators, relays and battery.

Ultrasonic sensors works on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. That signal is send to the embedded systems.

An Infrared (IR) sensor is used to detect obstacles in front of the robot or to differentiate between colours depending on the configuration of the sensor. The sensor emits IR light and gives a signal when it detects the reflected light.

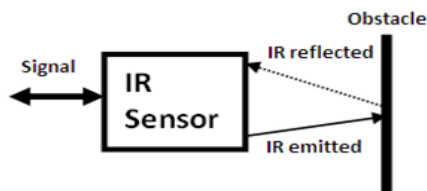


FIG 1.1 BLACK BOX DIAGRAM OF IR SENSOR

A Light Dependent Resistor (LDR, photoconductor, photocell, or photo-resistor.) is a device which has a resistance which varies according to the amount of light falling on its surface, when light falls upon it then the resistance changes.

A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Relays are found hidden in all sorts of devices.

II. PROPOSED SYSTEM

The proposed system consists of a Sensor unit. The figure depicts the proposed design of an embedded technocane . The system elements consist of various sub systems.

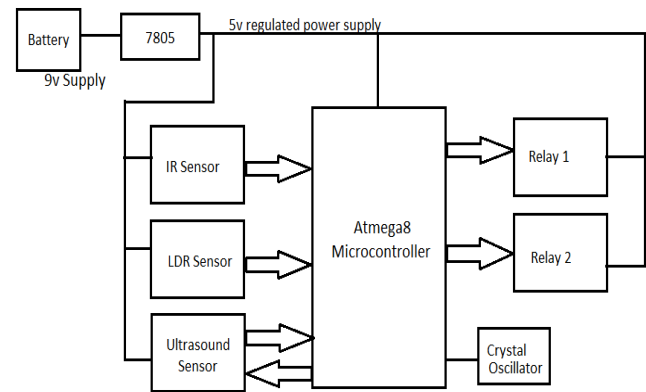


FIG 2.1 BLOCK DIAGRAM OF TECHNOCANE

2.1 SENSOR UNIT:

The device uses ultrasonic sensor and it can detect any object that lies on the ground, situated a distance of certain meters from the user. The minimum size of the object that can be detected should not be less than 3 cm width (or diameter). In operation a beam of ultrasound of 40 KHz frequency is transmitted at a regular interval in the forward direction. The ultrasound will be reflected from a nearby object, if any. The sensor will then detect the presence of any object that lies within that meters by detecting the reflected sound beam. The time intervals at which the transmitter will transmit ultrasound depend on the walking speed of the user. For water indication electrodes are fitted at the bottom of the stick these electrodes are sensing water and conveying information to blind people. Light detector resistor will facilitate movement in dark at night or in a dark room ,So that the person don't get hurt by an obstacle. When light falls on ldr then it's resistance varies very rapidly thus indicating an alarm and alerting the person.

2.2 Hardware requirement

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. It is a true computer on a chip. It contains al the necessary components required to make a digital computer. For example, microcontroller is used in wheelchair to controller the motion using remote control. The reason of using microcontroller is because the microcontroller has the ability to store and run unique programs make it extremely versatile .Microcontroller uses a much more limited set of instructions that are used to move code and data from internal memory to ALU. The techno cane developed uses a 8 bit AVR microcontroller.

RESULTS AND DISCUSSION

The experiments conducted to evaluate the performance of the proposed as well as developed prototype of techno-cane. The results were satisfactory, this paper mark the beginning of our efforts to further enhance this 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.

CONCLUSION

With the proposed architecture, if constructed with at most accuracy, the blind people will able to move from one place to another without others help. If such a system is developed, it will act as a basic platform for the generation of more such devices for the visually impaired in the future which will be cost effective. It will be real boon for the blind. The developed prototype gives good results in detecting obstacles paced at distance in front of the user. This techno-cane developed is a cost effective, within budget navigational aid for the visually impaired. However minimizing cost leads to compromises in performance. Further improvements will lead to greater modifications in future. Some features that could be incorporated are:

- Increasing the range of the ultrasonic sensor and implementing a technology for determining the speed of approaching obstacles.
- Provision for voice control using speech recognition

REFERENCES

[1] G.Gayathri, M.Vishnupriya, R.nandhini, Ms. M. Banupriya”smart walking stick for visually impaired”,IJECS,Vol.3, Issue 3,March 2014.

[2] Mohd Helmy Abd Wahab, Amirul A. Talib, Herdawatie A.Kadir, Ayob Johari, A.Noraziah, Roslina M. Sidek, Ariffin A. “Smart cane: assistive cane for visually impaired people”, IJCSI, Vol.8 Issue 4, July 2011.

[3] Yuan, D.; Manduchi, R.; “Dynamic environment exploration using a virtual white cane”, in Computer Vision and Pattern Recognition, 2005. CVPR 2005. IEEE Computer Society Conference.

[4] F. van der Heijden, P.P.L. Regtien, “Wearable navigation assistance - a tool for the blind” MEASUREMENT SCIENCE REVIEW, Volume 5, Section 2, 2005

[5] Kenneth Ayala,”The 8051 Microcontroller”3 Edition , Eighteenth Indian Reprint.

[6] Sandra Mau, Nik A. Melchior, Maxim Makatchev, Aaron Steinfeld“ BlindAid: An Electronic Travel Aid for the Blind” May 2008

[7] World health Organization” Global data on Visual impairments”2010

[8] Sylvain Cardin, Daniel Thalmann and Frederic Vexo, “Wearable Obstacle Detection System for visually impaired People”.

