Smart Walking Assist for Visually Challenged People

Dr. G. L. N. Murthy[1], M. Sravani, M. Durga Bhavani, K. Madhu, V. Dileep
Department of Electronics & Communication Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram, Andhra Pradesh, India

Abstract **-** With the help of developing technology day by day, humans are overcoming their disabilities through technological innovations. There is approximately 36.9 million people in the world are visually impaired according to the survey conducted by World Health Organization (WHO). They need help from the other people to move from one place to another place. So, they have to depend on other people. Or some people use white cane for their navigation. The limitation of using the stick is that the information is gained by the visually impaired by only touching the objects by the tip of the stick. Blind people face so many problems when they are moving on the road, sometimes accidents also happen to them if they are not assisted with another person. So, we want to do a project which is very helpful to the blind people for their navigation.

I. INTRODUCTION

Identifying a location and tracing the location by choosing specific directions are prominent aspects of any human life. Human visual system is designed in such a way to discriminate the situations or environment that is either safe or risky. With ever increasing diabetic problems as well as the visual impaired by birth are the challenges for human beings to perform daily tasks. Factors like genetics, infection or injury may result in either temporary or blindness. Such a people have a difficulty in navigating to areas where they are not yet acquainted. The problem is serious if the impaired person need to spend in an environment i.e., crowded with people or in a traffic area. They are not able to identify the presence of an object in the surrounding environment. Even if the effected person tries to walk over the footpaths, the presence of vendors, animals and other obstacles cause difficulties. According to a survey by World Health Organization (WHO), nearly 285 million people have visual problem majority of them are suffering with low vision.

With the development of technology, effects have been made to develop such a system which can help the blind people to perform their daily activities without any assistance. Developing an electronic system for visually challenged people is one among the significant research area these days. The system developed should be economical as well as simple in operation. The current work aims at developing a smart stick i.e., capable of eliminating from any hazardous situations like mud pits /water, fire and obstacles in the vicinity of his/her surroundings.

II. EXISTING WORK

The fundamental requirements of a visually challenged person were addressed in[1]. It was mentioned that the device developed should be non noisy and capable of detecting the obstacles effectively. The distance between the person and obstacle is calculated by using optical triangulation.

A movable cane embedded on wheel platform was developed in [2].Pair of ultrasonic sensors are utilized for sensing the obstacle in the path of the blind person that automatically moves by rotating the servo motor. The direction of travel is decided by the user who predefines the way of travel.

A navigational system that helps the shopping by a visually challenged person eases was presented in [3].Laser beam is used in the process of determine the distances between the person and the object by means of which the location is tracked accurately.

The experiences of person suffering from visual impairedness were shared and included in developing technology that assists blind person as presented in [4]. All the considerations that were needed for improving the accuracy of navigation by blind people were addressed.

A handset that is capable of guiding for fully as well as partially impaired persons in visualization, was described in [5].Little large in size than a mobile handset, the designed system has proven its accuracy in the process of effective positioning.

A system that supports the needs of blind people in navigating is presented in [6].The systems made use of minimum hardware with less weight and is capable of adapting to training as and when required ultrasonic sensors are used in the process identifying obstacles in multiple direction.

In [7], the vibration of the phone as well as alerting through messages to the impaired persons is used as the precautionary measures in the process of developing a supporting system. In addition to identifying the where about the needy person, live streaming through video is also implemented in the developed system.

Wearable ultrasonic An obstacle finder based on ultrasonic sensors was proposed in [8]. This system uses ultrasonic sensor which is attached to the both sides of goggles. This project can detect the vehicles which is present in front of the blind person. This is very difficult to wear and it cannot detect the presence of fire .Fig. 1 depicts the implemented view of the system.

Figure 1: Wearable ultrasonic obstacle sensor for visually impaired

A smart stick for the blindwas proposed in [9] that consists of Ultrasonic sensor and Arduino board. When the blind person is near to the obstacle the ultrasonic sensor senses it and the vibrator starts beeping. The limitation of using this system is that it doesn't give any information about the location of visually impaired. It just alerts the person about the presence of obstacle.

In[10] , Object detection stick for visually impaired was presented that inherits the basics of image analysis in the process. This system consists of camera, memory element as shown in Fig.2. The camera is attached to the stick which is capable of taking 15 images per second and the object is detected based on the concept of image processing. The disadvantage of using this system is that it requires a memory element for the storage of images and the system is very costly because here we are using a camera.

Figure 2: Object detection stick for visually impaired

III. PROPOSED SYSTEM

The process of getting acquainted with the surroundings is made feasible by the usage of devices or elements that can grab the variations in relevant parameters in the nearby and convert them to useful form. Sensors play a major role in this regard.

In the current work, different kinds of sensors are used to recognize different parameters like water, fire, obstacles in his/her surroundings. The blind stick is integrated with ultrasonic sensor along with fire and water sensors. If the obstacle is 2 - 4 meters away from the visually impaired, the ultrasonic sensor senses it. If the distance is small, the system doesn't do anything, if the distance is in the range 2 - 4 meters, the sensor passes the data to the Arduino board and it process the data and it alerts the person with the help of buzzer or vibrator to stop or to change his direction. In the same way if the fire sensor senses the presence of fire, it passes the data to Arduino board and the program codes starts working and it alerts the person. Whenever the stick touches the water, the water sensor senses it. The block diagram of the proposed system is shown in Fig.3.6. The major components that were being incorporated in the current work are sensors that are supported by Arduino Uno board and GSM as well as GPS. The role of GSM is to inform the relatives whose number is programmed already, about the prevailing situations in the vicinity of the impaired person.

The sensors that were being incorporated in the current work are as described below along with their specifications:

A. Moisture Sensor - In order to detect the ponds or mud pits, the water sensor was put at the edge of stick to detect the presence of water. Water sensor that is shown below detects the water content on the road. The water sensor detects the presence of water based on the parameters such as electrical resistance, dielectric constant, or interaction with neutrons. The threshold value will be adjusted by using the potentiometer.

Operating voltage: 3.3v -5v,

It gives the output in digital form i.e., when the water level is above the threshold value it alerts the blind person.

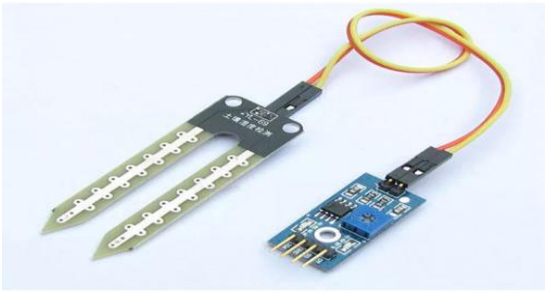

Figure 3: Moisture sensor

B. IR Fire Sensor - It is used to detect the presence of fire in the surroundings of visually impaired. When the sensor detects the fire, it sends the information to the Arduino and the program code starts working and it alerts the blind person through a buzzer. The specifications of Fire sensor are:

- Operating voltage: 3.3v-5v,
- Detection angle: 60^0
- Detect distance 80cm,
- It can also be adjusted with a potentiometer.

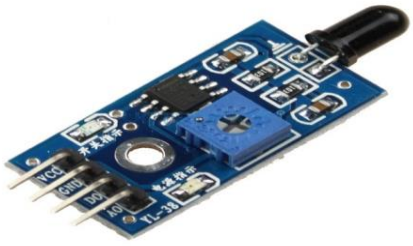

Figure 3: IR Fire sensor

C. Force Sensor - The Force sensor technology was invented by Franklin Eventoff in 1977. Fire sensor works on the property of changing its resistance based on the force applied to it. If force is applied to a surface of sensing film, then the particles touches the conducting electrodes and thus the resistance of the film changes.
So, whenever the person feels any threat to him he can apply the force to this sensor so that arduino starts working and sends a message to his family members or friends.

Figure 4: Force sensor

D. IR Obstacle Detection Sensor - For the detection of obstacles, we are using IR obstacle detection sensor, which is used for detecting the presence of obstacles in the vicinity of the blind it also provides the output in the digital form.
The specifications of this sensor are:
Operating Voltage: 5V
It can be interfaced with Arduino, Rasberry pi, AVR etc.Threshold voltage can be adjusted with potentiometer.

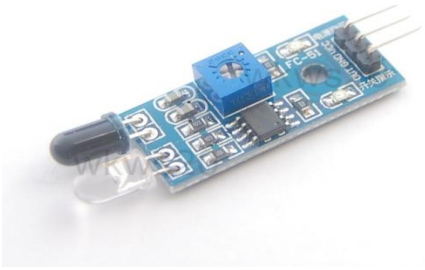

Figure 5: IR obstacle detection sensor

E. Arduino - The Arduino is used to process the data coming from the sensors. It is programmed to control the unit task receives data from the sensors, processing and sending orders to the used actuator. The processor subunit used in this system is the Atmel MCU (ATmega328), the Arduino platform that contains the ATmega328 MCU is used which is easy to use in terms of software and hardware. The most important specifications of the MCU are:
Digital I/O 14 Pins,
Analog Input 6 Pin (10-bits ADC),
DC Current per I/O 40 mA,
Flash Memory 32 KB,
Clock Speed 16 MHz.
MCU is programmed through the Arduino programming language, which is Integrated Development Environment (IDE). The MCU was programmed to control the unit tasks and receives data from the four sensors, processing this data and sending orders to the buzzers, which is used to alert the person.

Figure 6: Arduino UNO

Block Diagram:

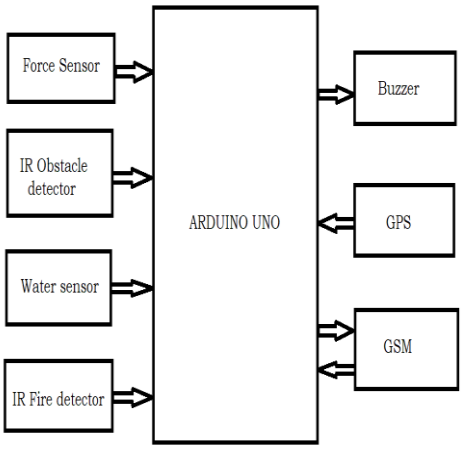

Figure 7: Block diagram of the proposed system

F. Project Outlook –

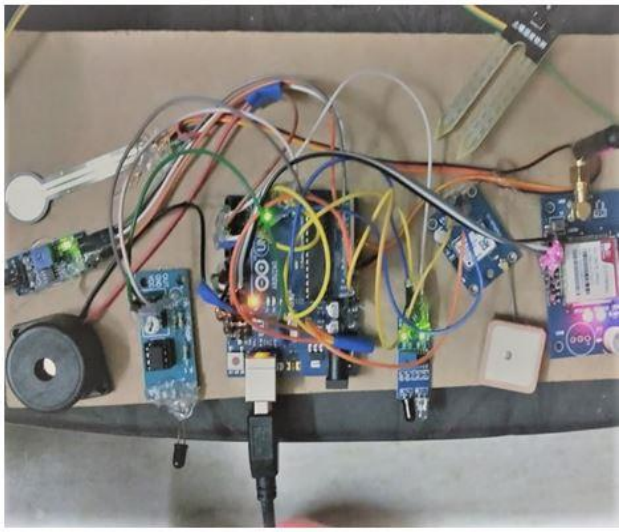

Figure 8: Outlook of Project

IV. RESULTS & CONCLUSIONS

The current paper was aimed to provide assistance to the people suffering from visual disability. The existence of fire was traced up to a distance of 2m- 4m with the usage of IR fire sensor. The system alerted the user by sounding the buzzer in regular spans of time. The IR Obstacle detector helps in detecting the obstacle in the travel path or nearby environment. Obstacles in the vicinity of 2cm-4m are accurately identified by virtue of which the impaired person is alerted. After the identification, if the blind feels any threat the person can inform his relatives by sending SMS through GSM by applying the force on the force sensor.

Output:

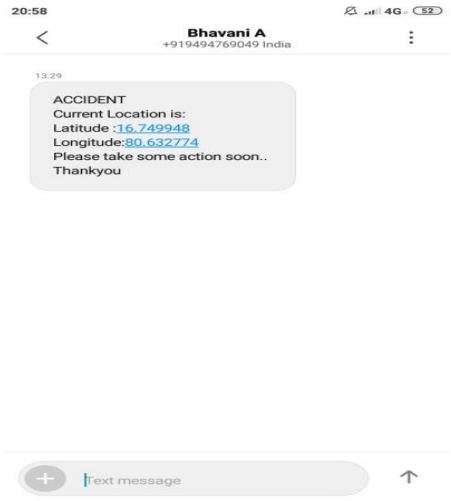

Figure 9(a): Output

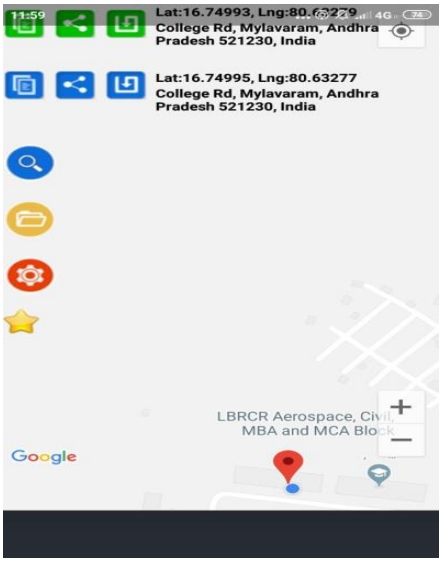

Figure 9(b): Output

V. REFERENCES

[1]. Benjamin J. M., Ali N. A., Schepis A.F.,- "*A Laser Cane for the Blind*", Proceedings of the San Diego Biomedical Symposium, Vol. 12, 53-57,1967.

[2]. Johann B., Iwan U.,"*The Guide Cane – A Computerized Travel Aid for the Active Guidance of Blind Pedestrians*", Proceedings of the IEEE International Conference on Robotics and Automation, Albuquerque, NM, 1283-1288,1997.

[3]. Kulyukin V., Gharpure C., and Nicholson J., - Robo- Cart: "*Toward Robot- Assisted Navigation of Grocery Stores by the Visually impaired"*, IEEE/RSJ International Conference on Intelligent Robots and Systems, Edmonton, CA.,2005

[4]. Shinohara, K.- "*Designing assistive technology for blind users*", In proceedings of the 8th International ACM SIGACCESS Conference on Computers and accessibility, ACM, 293-294, 2006.

[5]. Madad A. Shah, Sayed H. Abbas, Shahzad A. Malik, - "*Blind Navigation via a DGPS based Hand-Held Unit*", Australian Journal of Basic and Applied Sciences, 4(6): 1449-1458, 2010.

[6]. Kang. S. J., Ho. Y. K., & Moon. I.H., "*Development of an Intelligent Guide - Stick for the Blind"*. Seoul, Korea, IEEE March 2013.

[7]. ShrutiDesai,Mrunali Bichukale,Shraddha Kamte, Archana Borate,A.G.Nadapah, "*Smart Blind Stick for Visually Impaired People with Live Monitoring"*, IRJET,Volume:03 Isuue:09,Sep-2016.

[8]. Akhila. S,,Divyashree. D ,Disha M Rani ,Varshini.S. "*Smart Stick for Blind using Raspberry Pi*", International Journal of Engineering Research & Technology (IJERT),Volume 4 , Issue 22, 2016.

[9]. Anjali J Suresh., Sruthi A., Revathy Prasannan, Malavika Bhasy., Soumya Murali. "*Smart Cane for Blind*", International Research Journal of Engineering and Technology Volume 05 Issue 05. 2018.

[10]. D.Sathya,S.Nithyaroopa,P.Betty,G.Santhoshni,S.Sabharinath, M.J.Ahanaa,"*Smart Walking stick for blind person*", International Journal of Pure and Applied Mathematics Volume:118 No:20.,2018.[10]