Electronic Travel Aid for Visually Impaired using IR Sensors

K. Sai Rahul[1], Gaddam Maanas[2], Priyanka Sukhija[3], A. Jabeena[4]
[1,2,3,4]Department of Electronics Engineering
[1,2,3,4]SENSE, VIT University, Vellore, India.

Abstract— Blindness is a state of lacking the visual perception due to neurological or physiological factors. This paper presents a concept to provide a simple, cheap, user friendly, smart electronic travel aid to improve the mobility for people who are both deaf and blind by preventing any possible accidents while travel alone in two different scenarios using optical communication. The system utilizes an embedded visual system consisting of Infrared sensor, buzzer and vibratory circuit. This aid is fixed to the walking stick or gloves of the blind people. The main component of this system is the infrared sensor which is used to scan a predetermined area around blind person. This system is simple, efficient and an innovative solution affordable by the visually impaired people to navigate safely and independently.

Key words: IR Sensors, Electronic Travel

I. INTRODUCTION

In our learning process, we identified that one of the major problems that the visually impaired people experience is the trouble with the obstacles present in their way. Even if there are braille signs at the counters, the blind may not be able to find them[1]. There are some technologies for obstacle detection for the blind, but they did not give a proper solution possibly due to high cost of instrumentation and limited capabilities.

The electronic travel aid's goal is to break down these barriers by introducing a system which is relatively inexpensive and lightweight. The traveling aid uses an IR sensor to detect the obstacles in the path. We decided to continue pursuing this idea to find a solution to improve the commercial feasibility and user friendly experience for the blind. The most widely used method is a white stick for which a person is needed to train for a long time for efficient usage. The other solution is a guide dog, which is very expensive and does not provide much information[2] .In the last few decades, some models of blind mobility aids have been developed such as Sonic-Guide [3], Sonic Pathfinder [4], Mowat-Sensor [5], and Guide-Cane [6]. These are called clear path indicators or obstacle detectors since the blind can only know whether there is an obstacle in the path ahead using them [7].The paper is mainly focused upon two travel aids which can be used by a blind person in different scenarios. One of them includes a cane that can be used while travel on roads and the other include wrist mounted gloves that can be used at home or workplaces.

II. TRAVEL AID FOR OUTDOOR NAVIGATION

This device warns the person of an obstacle approaching him with the help of a buzzer. The buzzer beeps with increasing frequency when an obstacle is approaching nearer. This is done using an IR sensor which is placed on the cane .The placement of the sensor is as shown below.

The IR sensor placed on the cane detects the obstacle and gives the signal to Arduino which in turn gives a signal to the buzzer whose frequency is proportional to the distance of the approaching obstacle.

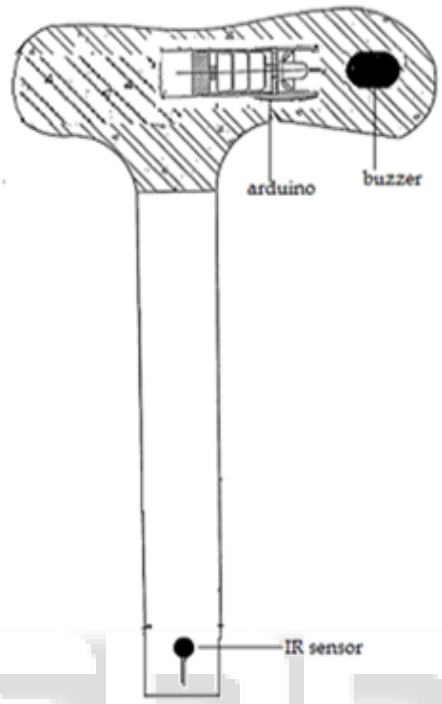


Fig. 1: Placement of IR sensor, buzzer and Arduino on cane.

III. TRAVEL AID FOR HOME AND WORK PLACES

At home or at the working places, the beeping sound generated by the buzzer can be disturbing for the people around. So a device is designed using similar mechanism as in previous scenario which helps the person to detect the obstacles through vibrations.

These vibrations are made by a half load motor which is connected to the one of the fingers of a glove that is worn by the visually impaired person.

The placement of sensor and other components are shown below

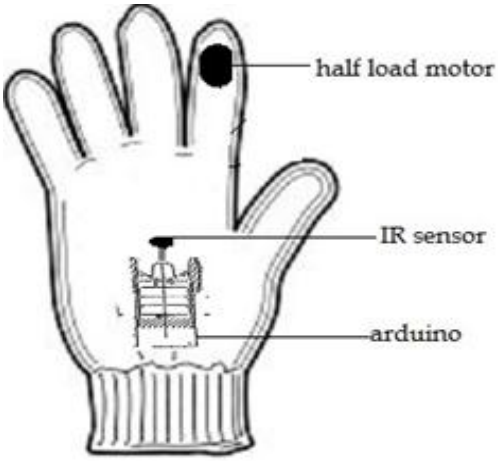
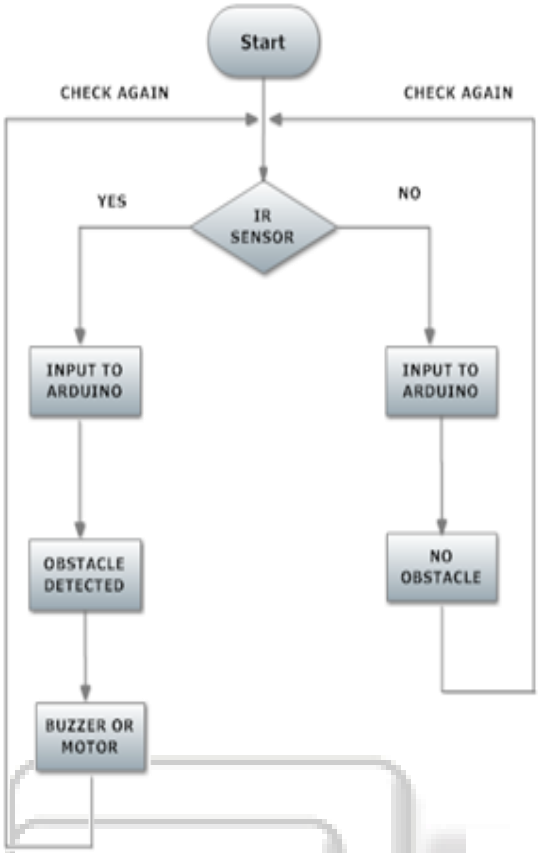


Fig. 2: Placement of IR Sensor, Buzzer and Arduino on Wrist Mounted Hand Glove.

IV. WORKING METHODOLOGY



As shown in the flow chart the IR sensor acts as an input to Arduino. When an obstacle is detected a signal is given to the buzzer as in case of outdoor navigation or to a motor (in case of home or work places) and when there is no obstacle detected, the device continuously monitors the environment surrounding it.

V. CODING METHODOLOGY

An IR sensor used here contains an IR led which is a transmitter and an IR receiver which is connected to the analog pin of the micro-controller.

The IR receiver receives the reflected light from the obstacle .The light is given out through an IR LED ,for more accurate reading more than one IR LED's can be used.

The receiver can also receive normal sunlight and values are generated in the microcontroller .As the receiver could not differentiate between the sunlight and light received due to reflection from obstacle it would result in false output. In order to reduce this interference the value received from ambient sunlight is subtracted from the values received due to reflection from an object/obstacle[9].

Initially the readings from the ambient sunlight are noted through the output of sensor without detecting the IR light which is obtained due to reflection from the obstacle.The sensor output obtained due to obstacle detection is obtained and subtracted from the former. The value due to detection of object changes according to the distance it is present. This subtracted value is given as a delay for switching on or off the buzzer/half load motor.Any microcontroller can be used for making these devices in our case an Arduino Uno [8]is being used.

VI. CONCLUSION

This project has resulted in the development of an effective, low-cost electronic travel aid for the people who are visually impaired. The main function of the device is used to define an un-obstructive path while traveling on roads or at work places with the help of IR sensors .This system is very affordable and light weight which can reduce the use of other mobility aids which are expensive comparatively. The system is easy to use by the blind people. By using more number of IR sensors, the accuracy of the system can be increased.

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