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Be My Third Eye - A Smart Electronic Blind Stick with Goggles

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Abstract - *In the era of technology where each and every person strives to be independent in order to survive in this competitive world, Being independent is the utmost priority to almost all the people. Our project is designed to provide this independence to the visually challenged people. This project gives them helping end to commute safely and securely. This act as a Third Eye for the visually challenged people and make their difficult life little bit simple and safe. The project consists of Ultrasonic sensors and IR sensor used for detection of obstacles like staircase, wall and other objects. After the detection of an obstacle, it alerts the user by beep sound of the buzzer. It also detects the motion of objects using a PIR sensor and generates beep sound if motion is detected. It also consists of an emergency location tracking module which sends messages in cases of any accidents to the relatives of the blind user along with the current location of the user using GSM and GPS module.*

Key Words: **Blind Stick, Third Eye, Electronic Stick, Smart Stick, Electronic Travel Guide, Guide Cane,etc..**

1.INTRODUCTION

Vision plays an important role in human being's life. Humans get almost 83% of the information from the environment via sight. According to the 2011 statistics by WHO, there are 285 billion people have a visual impairment and among them 39 are blind and rest have low vision. The traditional methods for the people with a visual impairment include white walking canes and guide dogs. The most common drawback of these traditional methods are necessary skills and training required that makes them inaccessible to use.

With the recent developments in hardware and software, many intelligent solutions have been introduced to help the blind person navigate independently. While such existing systems do help in outdoor navigation, but the need to provide accurate results and effective performance of the system gave rise to the need for improvement with additional components to provide accurate obstacle detection. Hence, the objective of this project is to provide independence to the visually challenged people by providing a smart electronic walking aid solution which is simple to use and easy to understand. There are many existing canes that are built to help the visually blind to independent.

1.1 Literature Survey

The authors Ayat Nada, Samia Mashelly, Mahmoud A. Fakhr, and Ahmed F. Seddik have proposed the solution that uses a microcontroller, ultrasonic sensor, IR and water sensor for detection of close obstacles, small obstacles and water respectively. It uses a warning message to alert the user about the obstacles ahead.

The authors Do Ngoc Hung, Vo Minh-Thanh, Nguyen Minh-Triet, Quoc Luong Huy, and Viet Trinh Cuong have proposed the solution that uses atmega microcontroller which gets sensor data and it into the distance. The distance is then sent to the Android via Bluetooth.

The author Muriel Pinto, Rose Denzil Stanley, Sheetal Malagi, Veena Parvathi K., Ajithanjaya Kumar M. K have proposed the solution that uses atmega controller, detects the obstacle and vibrate in three intensity.

The authors M.F. Saaid, A. M. Mohammad, M. S. A. Megat Ali has proposed the solution that detects the obstacle and alerts the user with beep sound. The beep sound has a pattern depending on the distance of the obstacle. The pattern is coded in the microcontroller.

The authors G.J. Pauline Jothi Kiruba1, T. C. Mohan Kumar2, S. Kavithrashree3, G. Ajith Kumar have proposed the solution that uses sensors, gsm-GPS module, wifi module. Many sensors are used for different purposes. The wifi module is to provide internet connectivity to track the location with the help of GPS and gsm is to send the location to the contact number. The heartbeat and temperature sense the heartbeat and temperature and upload to the cloud.

Traditional methods used by visually impaired were proved inefficient in providing safe and secure navigation to them. This arises the need for new technologies that can provide safety and security to the visually impaired people.

Many existing systems were developed that ensure the safety and security in the navigation of the blind people. To overcome the inefficiencies in the traditional methods, the Electronic Travel Guide was developed. But these blind stick could not provide accurate detection of obstacles due to the limited hardware devices and insufficient knowledge. Most of the GuideCanes uses Ultrasonic sensors for long-range obstacle detection. Since Ultrasonic sensors are inefficient in detecting the nearby obstacles. Thus the need for using a combination of different sensors for providing an efficient solution.

1.2 Proposed System

Since all the above-described system has different facilities but all the useful functionalities are not found together in one model. So the reason behind this to improvise the existing models by combing their useful functionality in one model. The purpose of this project is to improvise the existing model with a more better model.

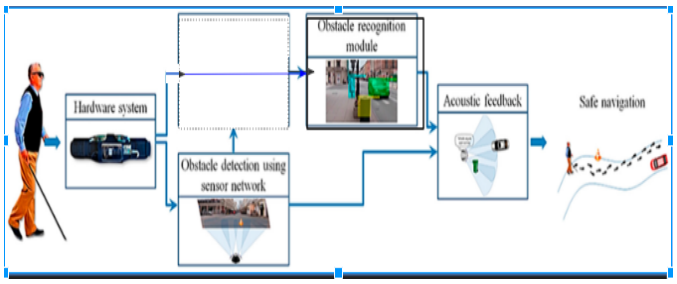

Figure 1. Overview of System. Retrieved from [7]

The working of this project model is divided into two modules Obstacle detection and Obstacle recognition module. The Obstacle detection module detects the obstacle and Obstacle recognition module characterizes the obstacle and alert the user with acoustic feedback with the help of buzzer. The obstacle recognition module detects motion and staircase and alerts with the help of buzzer. The message passing and tracking module track the location and send message to blind user's relative in case of an emergency like accidents.

2. Block Diagram

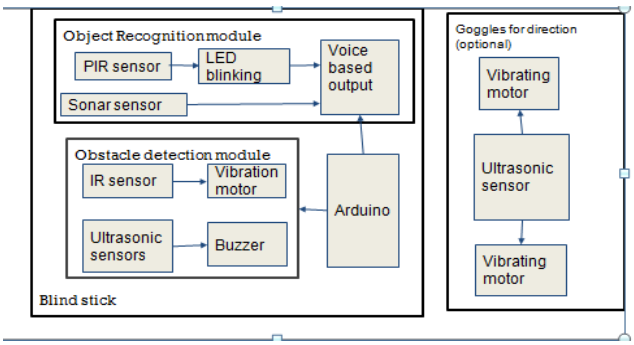

Figure 2. Block diagram of the system

The Block diagram consists of three modules: Obstacle Detection, Obstacle recognition module, and message passing and location tracking module.

1. Obstacle Detection module :

It consists of Ultrasonic and IR sensor to detect the obstacles at long and short distance

respectively. The ultrasonic sensor detects the far away obstacles with a maximum range of 25m.

2. Obstacle Recognition module:

It consists of a motion sensor and two ultrasonic sensors to detect motion and staircase. The maximum range for motion detection is up to 6 meters, 110° x 70° detection range.

Goggles for the direction of obstacles:

It consists of an IR sensor and vibrator in the left and right side to show the direction of the obstacle. They are optional, only to be used in a crowd.

3. Location tracking and message passing module:

This module consists of these two main modules: GSM and GPS module. GPS module is used for tracking the latitude and longitude coordinates of a real-world location that can help us in finding the location of the blind user using Google Maps.

This information about the Location of blind user needs to be sent to the relatives of a blind user in case of an emergency. This is done using the GSM module by sending a message with location to the specific contact.

a) Sensors:

Ultrasonic sensor: The transmitter TX emits the ultrasonic waves. If the waves reflected back and received by the receiver RX then the obstacle is

detected otherwise the path is clear. If it detects the obstacle, the buzzer will ring thus alerting the user of the obstacles ahead.

IR sensor: It consists of LED and PhotoDiode. The IR Transmitter emits the radiation and if some of the radiation reflected back. Based on the intensity of reflected light, the output of IR is defined.

PIR sensor: Light sensors are used to detect the amount of infrared light emitted by a warm object. Pyroelectric sensors in PIR induce the change in temperature due to the incident infrared light. This difference causes the output of transistor in PIR to give low output thus detecting motion and alert with the help of buzzer.

b) Staircase Detection:

Two Ultrasonic sensors are used to detect the staircase. In this both Ultrasonic sense together and if the first distance is less than the second distance then the staircase is detected otherwise if both are equal, the wall is detected.

c) Microcontroller Arduino

Arduino Uno is a microcontroller that controls the working of all the sensors. It takes the input from the Ultrasonic sensor to detect the faraway obstacle and IR sensor to detect the nearby obstacle. It senses motion with the help of the PIR sensor and alert user with the help of buzzer. It senses the staircase with the help of two Ultrasonic placed in serial connection one above the other vertically.

3. Flowcharts

A. Flowchart of motion detection

1. PIR sensor has two slots which detect the amount of infrared light.
2. If the sensor is idle,
3. both select the same amount of IR light, the amount of light radiated from the room, wall or outdoors.
4. else if a warm body like human or animal pass by, it first intercepts one half of PIR sensor which causes a positive change between the two halves, the buzzer starts vibrating indicating motion is detected and when the body leaves the sensing area causing a negative change in two halves, buzzer stop vibrating indicating motion is stopped.

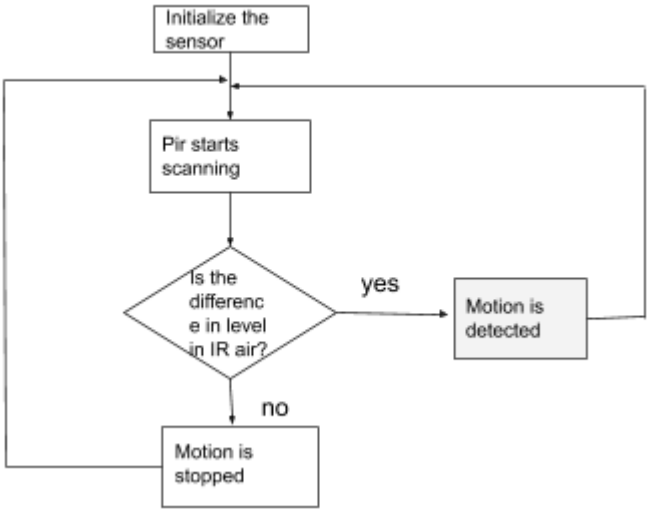

Figure 3. Motion Detection Flowchart

B. Flowchart of Object detection and recognition

1. Ultrasonic sensors are connected in serial connection one above the other vertically.
2. Sensors are initiated and the First sensor starts sensing the obstacle.
3. If the first sensor senses the obstacle, calculate the distance and store as r1.
4. The second sensor start sensing obstacle and If the second sensor also sense the obstacle

a. Compute distance and store as r2

b. Compare r1 and r2

5. If r2 > r1, object is staircase
6. else If r1 = r2, the object is wall else it is a normal obstacle to be avoided.

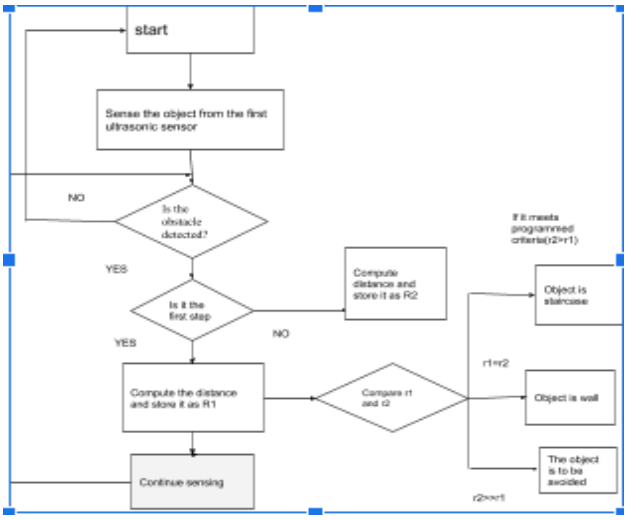

Figure 4. Object Detection and Recognition Flowchart

3.1 Schematic Diagram

The circuit consists of Arduino as a microcontroller connected to many sensors like Ultrasonic, IR, PIR sensors. The pair of Ultrasonic sensors are connected serially in vertical position one above the other to detect the different type of obstacles.

The Vcc of first is connected to 5V of Arduino, GND to the GND of Arduino, Echo and Trig pin to digital pin 3 and 2 of Arduino respectively.

The Vcc and GND of the second sensor is connected to Vcc and GND of the first sensor while the Echo and Trig pin to the digital pin 4 and 5 of Arduino respectively

PIR sensor is connected to Arduino. The Vcc of PIR is connected to 5V of Arduino, GND to the GND of Arduino, OUT to the digital pin 2 of Arduino.

The Vcc and GND of the IR sensor are to 5 V and GND of Arduino while OUT pin to digital pin 7 of Arduino. The buzzer is connected to digital pin 13.

The Vcc and GND of GPS are connected to 5 V and GND of Arduino while Rx and Tx connected to analog A0 and A1 pin of Arduino.

The Vcc and GND of GSM are connected to 5V and GND of Arduino. The antenna is connected to the NET pin and Rx and Tx connected to digital pin 9 and 10 of Arduino.

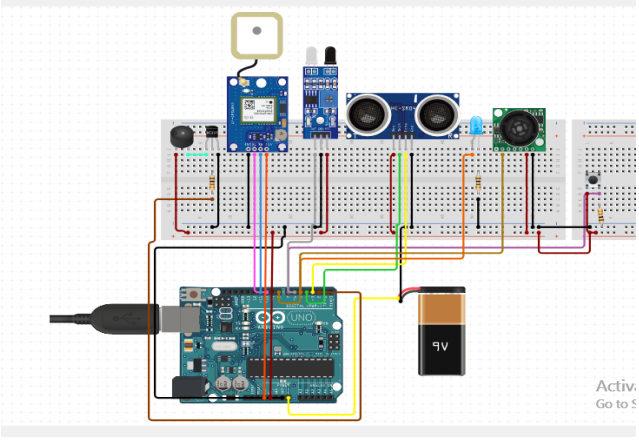

Figure 5. Schematic diagram

3.2 Results and Discussions

a. Maximum Range for following parameters

Factors	Measurements
The maximum distance of the obstacle that can be measured	Up to 24 meters
Range of motion detection	Up to 6 meters (110° x 70° detection range)

b) Timing Diagram of PIR sensor

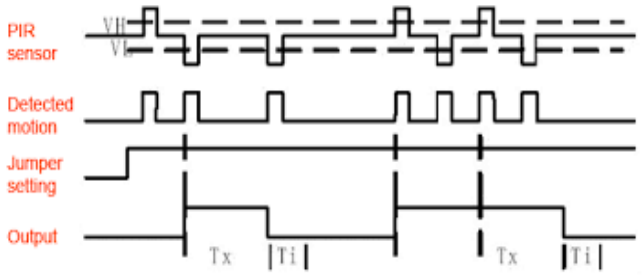

Figure 6. The timing diagram of the system. 2014. Retrieved from [6]

4. CONCLUSIONS

Thus we conclude that this project even though has many limitations, It does have useful functionalities that could be improved or further advancement can be done in order to make this project more better and useful for blind users. Many more modifications like pothole detection, water detection, etc can be added to improve the functionalities and to provide additional facilities to help the blind user more efficiently.

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