IR Sensor-based Ultrasonic Vision with Morse messages (Aid for visually challenged people)

Suryansh Saxena
School of Engineering and Technology
Sharda University
2018011700.suryansh@ug.sharda.ac.in

Sanskar Jain
School of Engineering and Technology
Sharda University
2018010135.sanskar@ug.sharda.ac.in

Rahul Kumar
School of Engineering and Technology
Sharda University
2018005024.rahul@ug.sharda.ac.in

Abstract— The human vision is one of the most important necessities that one can have. The fact, though is, there are a large number of people who suffer from partial or complete blindness. Walking canes and guide dogs are basically two mobility aids for people with vision impairments. Now what these methods lack the most is the difficulty to use them and the amount of training required. Also, they tend to cover up for a very little and barely survivable amount of information to add to the aid. With the rapid advancements of modern-day technologies, there is now a huge potential to provide intelligent navigation capabilities. In recent times, several Electronic Travel Aids (ETA) have been designed exclusively to facilitate the blind in navigating independently and safely. Numerous elevated solutions have recently been introduced to assist blind people in traversing independently. Ultrasound can be used in many blind guidance systems because it is noise resistive. Ultrasound is also popular because technology is relatively inexpensive, and ultrasound emitters and detectors are small enough to be transported without requiring a complex circuit. Moreover, no device exists to tackle the concerns faced by deafblind people.

Keywords— *PIR Sensor, Ultrasonic Sensor, Morse codes, PiCamera, Raspberry Pie.*

1. INTRODUCTION

The rapid developments in the field of technology are not something one has not witnessed. Almost anything can be helped today with the right amount of innovation put in the right place. One such good idea is required to get the deafblind help they really need. There exist some IoT devices too using ultrasonic vision mainly for their distance analyzing properties.

The proposed system will act as an intervention for the deafblind. The main objective is to develop a means for the impaired to bring some ease to their lives. This system will analyze the distance and motion of different objects and act accordingly to help them by giving specific instructions through voice assistant and in Morse codes using vibration patterns simultaneously. As a result, it will act as a third eye for the user that will try and provide a considerably descriptive image of the area.

2. PROBLEM STATEMENT

Despite the fact that technology has advanced to a greater level, devices to assist visually impaired individuals have not progressed to the point where they can assist people living a normal life. In addition to that, there is almost no solution for deafblind people. Still, significant research is being conducted in order to develop supportive equipment that are affordable to the general public. As a result, we planned to develop an innovative device that would aid in their navigation. Such individuals encounter numerous challenges in carrying out their daily activities, specifically when travelling alone. In this rapid world with traffic volume, there are numerous possibilities for them to be involved in accidents or collide with objects in their path. So, we intend to provide an effective solution for all such people.

3. EXISTING SYSTEM

The existing systems are good supporting devices for blind people but they are not effective in the way of giving full support to visually challenged people. In some of the existing systems, people with poor eyesight will have a tough time recognizing what is in front of them while walking alone on the highway. This could cause a lot of problems. The smart stick has an infrared sensor that detects stairwells and two ultrasonic sensors that detect anything other placed in front of the user. When an impedance is detected on the path, the microprocessors send out warning messages and activate the vibration motor. This walking stick has taken the role of the traditional walking cane. The same two sensors are used as well as an Arduino UNO, voice playback module, LCD display, voltage regulator, and voltage regulator. The Arduino UNO allows for quick, accurate, and efficient calculations. The distance between the obstruction and the stick must be measured, and an ultrasonic sensor is used to do so. A small-range infrared sensor can be utilized to

identify things on the left and right sides. The reason for employing an IR sensor instead of an ultrasonic sensor is to avoid the mathematical issues that come with using too many ultrasonic sensors. With the use of speech playback, the person can get to their location. The ultrasonic rangefinder is used in the ultrasonic haptic vision system. This sixth sense system enables the user to navigate through the corridors and interacts with the body in an intuitive and user-friendly manner even without sight, allowing the user to move around without eyesight. An Arduino Nano-based obstacle-finding stick for visually impaired persons assists a blind person by detecting obstacles using ultrasonic sensors and an Android mobile app. It can provide information to a blind person about the circumstances and current state of the path on which he or she is walking. The blind user uses an electronic stick-like guide. A thumb-operated switch that allows a blind user to send a general message to a saved mobile number for assistance.

The existing system uses ultrasonic vision and/or IR sensors to detect the distance and motion of objects. This garners some data to act as an input for the device which in turn will advise the user of the necessary steps, he/she should take in the situation. This system gives output through small speakers and gives instruction as to how to act. In the event that the user needs assistance, they send a notification to the user's closest friend. All the existing systems deal mostly with the outdoor challenges i.e., crossing roads or walking pavements, of the blind and not their regular day to day home courses.

Among other missing factors, no system provides a solution for the deafblind which will be one of the major features of the proposed system. Also, it will be able to recognize some people by their names and faces, alerting the user about it. The system will also be able to notify the user when anyone is talking to them.

4. PROPOSED SYSTEM

The system put forth gives people an edge over conventional devices. The proposed gadget will use the ultrasonic sensor to calculate the distance between an object and the user. After this, passive IR sensors will be used to detect the motion of that particular object. It will be able to detect the speed of the approaching object and alert the user accordingly. Furthermore, the system will also be able to recognize different people the user meets. It will help the user respond when someone known approaches him or someone is talking to him. It will help the user react naturally to such social situations. OpenCV, dlib and face recognition will be used with the Raspberry Pi to achieve this objective.

To add to all this, a feature will be added especially for the deafblind i.e., in addition to the voice output, morse codes will also be used in vibration patterns to easily communicate with such people. All in all, the device will take input from the surroundings, analyze and process it, and will provide apt output to the user. It will help the user to socialize with friends etc., and also try to provide the closest to the real vision situation possible.

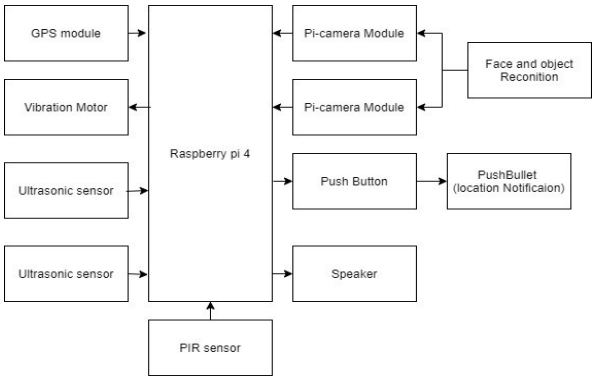

Fig.1. Block Diagram of the proposed system.

5. METHODOLOGY

The components used in the “IR Sensor-based Ultrasonic Vision with Morse messages” are the Ultrasonic sensor, DC vibrator motor, Raspberry Pie 4, PiCamera, Passive IR sensor.

A. Ultrasonic Sensor

The working principle of ultrasonic sensors is very simple, it sends waves and when they collide with obstruction and return it utilizes the time-span to find the distance from that object shown in the figure. This ultrasonic module correctly measures distances between 0 and 400 cm, with a gross error of 3 cm. It is a useful sensor for distance measurement and mapping because of its small size, higher range, and ease of use. The module is simple to connect to microcontrollers, with only two pins required for triggering and measurement. The sensor emits an ultrasonic wave and generates an output pulse equal to the time it takes the burst echo to return to the sensor.

Fig.2. Ultrasonic sensor.

B. DC Vibration motors

The vibration motor operates on a 3-volt dc. The microcontroller sends the signal to the vibration motor. The vibration motors are utilized to give input to the human wearing the cap. At the point when the sensor detects any object nearby within the range then the vibration motor of that specific angle begins vibrating and gives a sign to the person that there is a threat of collision at that point.

Fig.3. DC Vibration Motor

C. Passive IR Sensor

Passive infrared (PIR) sensors measure heat energy in the surroundings using a pair of pyroelectric sensors. These two sensors are placed next to one other, and the sensor will engage when the signal differential between the two sensors changes (for example, if a human enters the room). This might mean it sounds an alarm, alerts authorities, or turns on a floodlight. A series of lenses created as the sensor's enclosure focus IR radiation on each of the two pyroelectric sensors. These lenses increase the sensing area of the gadget.

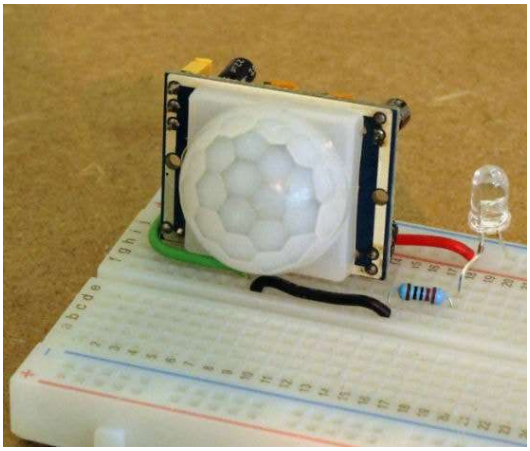

Fig.4. Passive Infrared Sensor

D. Global Positioning System (GPS)

The Global Positioning System (GPS) is an acronym for Global Positioning System. When the user is caught in an emergency situation, GPS is used to discover the individual's location so that it can be sent as a message to the user's specified friends. It operates on the trilateration idea. It calculates the position based on satellite distance measurements. It uses light to communicate with satellites and then uses that information to calculate the distance between the satellites and the device. As a result, the precise position is determined.

Fig.5.Global positioning system

E. PiCamera

The Pi camera module is a small, light camera that works with the Raspberry Pi. The MIPI camera serial interface protocol is used to communicate with the Pi. It's commonly utilized in image processing, machine learning, and surveillance applications. Here the Pi camera we are using is for capturing continuous images in front of the user in order to detect the objects and/or a known person in front.

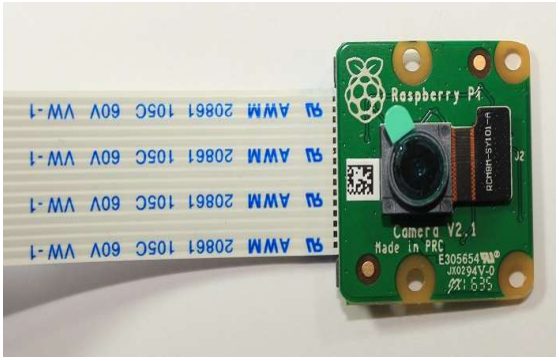

Fig.6. Pi camera

F. Raspberry Pi 4

Raspberry Pi has a number of advantages, including the fact that it is inexpensive but still functions as a computer. It is portable because it is the same size as a credit card. It simplifies operations and provides a solid foundation for learning numerous computer languages. It can also be hooked up to a computer display or television. When placed into the Raspberry Pi, an SD card can function as a hard drive. The Raspberry Pi is mostly used to determine what type of object is present, based on the image captured by the camera. The user receives the information via a headset.

Fig.7. Raspberry Pi

6. RESULT

The Pi Camera would take visual input of the surroundings while the ultrasonic sensors and PIR sensor would detect the motion and distance of the objects around the user. A voice output and morse output using vibrations to let the blind/deafblind know about the area around him. Finally, a GPS would let the desired family or friends know about the location of the user. Also, if someone known to the user is in front of him, he would be notified accordingly.

7. FUTURE SCOPE

The majority of blindness is caused by congenital abnormalities that cannot be remedied at this time. Blind persons face numerous challenges. Because they are blind, they are unable to read and write normally, and they are unable to travel or navigate without the assistance of an external device such as a walking stick or a guiding dog. The goal of this project is to create a product that will be extremely valuable to persons who are deaf or visually impaired and must frequently rely on others. It detects obstructions and allows the user to walk freely. In the future, we can add that the sensor integrated into the helmet detects the pressure exerted to it as a result of the accident and that this pressure is then transmitted to the GSM module, which is connected to the mobile phone. An alert will sound immediately after the accident, and if it is not switched off within 15 seconds, it will send a message to friends/family and the nearest ambulance with specifics about the accident location.

8. CONCLUSION

The rapid developments in the field of technology are not something one has not witnessed. Almost anything can be helped today with the right amount of innovation put in the right place. One such good idea is required to get the deafblind help they really need. There exist some IoT devices too using ultrasonic vision mainly for their distance analyzing properties.

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