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Assistive Smart Hearing Aid - For Blind People

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ABSTRACT

In the absence of vision, blind or visually impaired people rely on hearing. This project presents the design of Assistive Smart Hearing-Aid for the blind and visually impaired. The objective is to assist in multiple daily tasks. The main methodology of the project is divided in to 3 modules-a) Object Detection, b) Fall Detection and c) Location Finding. The laser sensor-based obstacle detection method is used in the object detection module. Accelerometer helps in detecting the fall as there will be a sudden change in velocity and GPS module is used for finding location. Headset connected to the audio jack of Raspberry Pi helps in conveying information to the user. The processed data of the above two modules is sent to a remote server for further analysis through an IOT- enabled module.

Keywords: Accelerometer, GPS module, Laser sensor, Raspberry Pi.

1. INTRODUCTION

The human senses are a means of contact to the environment. Among the five senses that humans have, the most important sense is the sense of sight. Some people are completely blind, but many others have what's called legal blindness. People with vision impairment typically ask for aid from others to continue performing their everyday responsibilities. The most important aspect is that, as they explore a new area, they should be aware of the location of any barriers and other items in their path to ensure their safety. One of the most challenging situations for people with vision impairment in the real world is secure and safe transportation. Due to their inability to identify and avoid obstacles in their path, individuals frequently fall prey to unanticipated problems that could result in emotional distress or uninvited incidents, undermining their frequent mobility. As a result, they require help from others or assistive technology to carry out their daily responsibilities.. Globally, among 7.79 billion people living in 2020, an estimated 49.1 million were blind. Aging is the main factor for blind people and 19% of the world's population, which are above 50 years old are more exposed to lose their vision. Therefore, several methods and devices have been developed and employed to serve blind people as guidance or in any other life aspects. The rapid intensive use of technology nowadays has led into a dramatic increase in the demand of its usage in our daily life and make it more comfortable. There are large numbers of visually-impaired people, which led us to develop such system in order to help them to avoid obstructions. Smart technology has helped blind people in many different life aspects.

Blind and visually impaired people lose the sense of sight. This makes it difficult for them to perform simple tasks like avoiding obstacles while 2.LITERATURE SURVEY

walking, finding the location when travelling and getting aid when they fall down. So in order to make these simple tasks easier for them, an assistive device is required which can help them avoid obstacles, help them navigate easily and to inform their guardians in need of aid when they fall. The authors Md. Atikur Rahman, Muhammad Sheikh Sadi wrote a research paper that is "IoT-Enabled Automated Object Recognition for the Visually Impaired". The design and implementation of various sensors and algorithms that aid the blind and visually handicapped in safe navigation are covered in this study. In this study, they created a prototype for a device that can support the visually impaired person when they trip or fall and help them avoid obstacles and move securely.

Well-known IoT Development Platforms

Any development board you take into consideration for an IoT project needs to have a few key components. Which are:

processing strength A CPU, microcontroller, FPGA, or other CPLD could be used for this. For programming your gadget, a microcontroller is useful because many manufacturers offer the necessary IDE.

Wireless capabilities: Without a built-in transceiver module, this capability offers wireless connection. Among the popular protocols are Wi Fi , Zigbee, Bluetooth, and others.

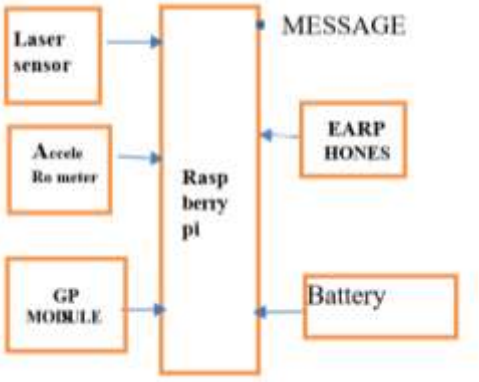
store a lot of data. A good board will support the connection of a Mini SD or MicroSD card for data enhancement.

As their name suggests, distance sensors are used for determining the distance of an object from another object or obstacle without any physical contact involved.3. **MATERIALS AND METHODS**

The device has been created by a unique design for assisting the blind people. It has been divided into three modules for enhancing the experience of the user with the device. The device consists of three modes and three modes are used to help the blind people. Each mode is separately dedicated for the blind people. The device is designed to make the user feel individualistic, self-reliant and self-sufficient. The main component of the device is raspberry-pi [14]**.**

Laser sensors connected with Raspberry Pi are used to detect the objects in the proximity. Pi camera Connected with Raspberry pi is used to capture the image and process it and notify the user through Bluetooth module. GPS module is used to find the city, state, and country names of the current location of the user and notify the fall location message to his/her guardian [15].

3.1 ARCHITECTURE



The prototype is designed as shown in Fig . These sensors are used to reduce the power and cost. It is used to detect the fall detection that depends on the movement. And also, it is possible to easily embed with any component or circuit. The fall detection is detected by the accelerometer sensor and the movement action is stored in the raspberry-pi. Earlier the output voices are stored on the voice processor unit. By using earphones, the output will be displayed depending on the motions and also displayed the message in a mobile phone [3]. Likewise, the laser sensor and GPS module can work according to their functionality. These all sensors are interfaced with the raspberry pi and output will be observed by using earphones [4].

3.2 HOW GPS WORKS

Get GPS Location using Raspberry Pi Let's interface the GPS module with Raspberry Pi and will extract GPS information. We can interface the GPS module to Raspberry Pi using Python and C [5].

The Global Positioning System (GPS) uses signals transmitted by satellites in orbit and ground stations on Earth to pinpoint a user's location on the planet. The GPS receives radio frequency signals that are transmitted by satellites and ground stations. These signals are used by GPS to pinpoint its precise location. There is no need for the GPS to transmit any data. Time stamps indicating the time at which the signals were delivered are included in the signals that are received from satellites and ground stations [6]. through the calculation of the time difference between the signal's transmission and reception. A straightforward distance formula can be used to calculate the distance between the satellites and the GPS receiver using the speed of the signal

The GPS's position can be triangulated. Refer to the topic GPS Receiver Module in the sensors and modules section for further details on GPS and how to utilise it. The GPS receiver module communicates with a controller or PC interface using UART.. GPS receiver uses a constellation of satellites and ground stations to calculate accurate location wherever it is located. These GPS satellites transmit information signal over radio frequency (1.1 to 1.5 GHz) to the receiver. With the help of this received information, a ground station or GPS module can compute its position and time. Today, those who are blind or visually impaired are navigating more independently than ever before. GPS devices use satellite technology to provide auditory feedback to individuals regarding their position, direction of movement to the guardian.

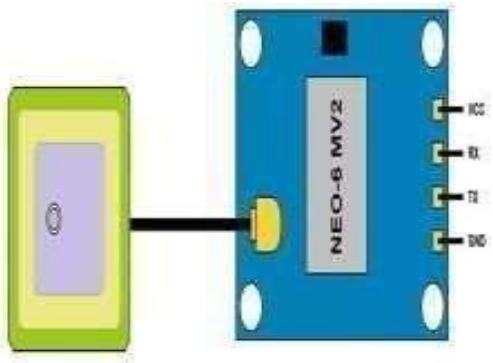


FIG1.GPSMODULE

3.3 LASER SENSOR:

The laser sensor works based on the triangulation principle. With a laser sensor you can measure the length of a road, a distance's length and positions, without any contact. This happens at a very high resolution. Laser sensors also dispose of various linearities, in addition to the various resolution. Laser sensors can be ideal for collision avoidance, level measurement for liquids and solids, conveyor belt profiling, proximity detection, positioning and equipment monitoring, or even altimetry applications. A proximity type laser sensor, also called a **laser photoelectric sensor**, is commonly used to detect presence of a part, but is not the focus of this discussion. The focus, figuratively and literally, is on laser distance sensors, that as the name implies, measures distance [8].

FIG2.LASER SESOR

3.4 ACCELEROMETER:

An accelerometer works using an electromechanical sensor that is designed to measure either static or dynamic acceleration. Static acceleration is the constant force acting on a body, like gravity or friction. These forces are predictable and uniform to a large extend. An accelerometer is a device that senses the different types of accelerations or vibrations. Acceleration is the change in velocity caused by the movements of a body. An accelerometer absorbs the vibrations created by the body and uses it to know the orientation of the body. A piezoelectric accelerometer has two types which are high impedance output accelerometer and low impedance output accelerometer. On the basis of the working mode, it is mainly of three types. The compression mode, the capacitive mode, and the shear mode. All of them work on sensing the vibrations [9].

FIG3.ACCELEROMETER

3.5 GPS MODULE

GPS receiver module gives output in standard (National Marine Electronics Association) NMEA string format. It provides output serially on Tx pin with default 9600 Baud rate. This NMEA string output from GPS receiver contains different parameters separated by commas like longitude, latitude, altitude, time etc. Each string starts with '$' and ends with carriage return/line feed sequence [10].

The NEO-6MV2 is a GPS (Global Positioning System) module and is used for navigation. The module simply checks its location on earth and provides output data which is longitude and latitude of its position.It is from a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine.

4.RESULTS AND DISCUSSIONS

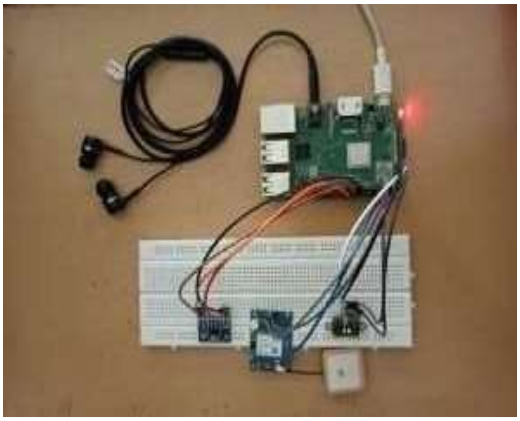
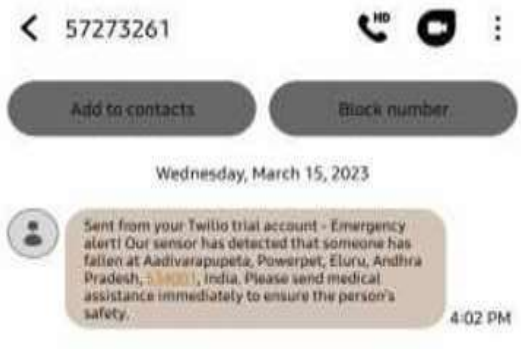


FIG5: PROTOTYPE

Results of various modules in the proposed project are shown along with the result of the whole project.



The Location Finding Module NEO-6MV2 is connected to the Raspberry Pi Model 3B+ Microcontroller with the help of jumper cables. The interfacing of Raspberry Pi with NEO-6MV2 GPS Sensor Module is shown in Chapter 3. Below is the image of the GPS Sensor Module that is connected to Raspberry Pi with the help of a bread board and jumper cables. Headphones or Headset are connected to the audio jack of the Raspberry Pi so that the Location from the GPS Module is sent to the user as an audio output. Once the required packages are installed to enable the NEO- 6MV2 interfacing with Raspberry Pi, then a Python Module is developed in such a way that it reads the data sent from the GPS Sensor module and displays the output by

decoding the data. Figure 37 shows the output obtained from the GPS Module. This output is converted into speech and is given as an audio output to the user from time to time.

```
VL53L0X_GetDeviceInfo:
Device Name : VL53L1 cut1.1
Device Type : VL53L1
Device ID :
ProductRevisionMajor : 1
ProductRevisionMinor : 15
```

The Accelerometer ADXL345 is connected to the Raspberry Pi Model 3B+ Microcontroller with the help of jumper cables. The interfacing of Raspberry Pi with ADXL345 Accelerometer is shown in Chapter Below is the image of the Accelerometer that is connected to Raspberry Pi with the help of a bread board and jumper cables. Once the required packages are installed on the Raspberry Pi for Accelerometer implementation, a Python module is developed so that the data from the accelerometer fall detection sensor is used to detect the fall of the user. Once the fall is detected, then this accelerometer collects location from GPS module and sendsan SMS to the user's guardian stating that the user had fell down at a particular location. Figure 39 shows that the user had fell down and the message is successfully sent to the Guardian.

```
There is an object at a distance 966 millimeters
There is an object at a distance 550 millimeters
There is an object at a distance 796 millimeters
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The Laser Sensor VL53LXX is connected to the Raspberry Pi Model 3B+ Microcontroller with the help of jumper cables. The interfacing of Raspberry Pi with VL53L1X Laser Sensor is shown in Chapter 3. Below is the image of the Laser sensor that is connected to Raspberry Pi with the help of a bread board and jumper cables. Once the required packages are installed a Python module is created. In that, many inbuilt functions from the packages are used to enable the working of laser sensor. The data from Laser sensor is collected with the help of this module. The data is modified and then it is given as an output. The output of this module looks like Figure 35. This output is given as a voice output to the user once the headset or earphones are connected to the Raspberry Pi

5. CONCUSION

This project is designed to assist the blind. This prototype consists of a laser sensor which helps in detecting the obstacles in front of the person, accelerometer sensor which helps in detecting the fall of the user and a GPS sensor to find the location. With the help of the headset connected to the prototype, the user can hear the assistive voice which informs the impending obstacle and the location that the user is in from time to time. When the user falls down, it is detected with the help of accelerometer. When the fall is detected, location is collected from the GPS Module and sent to the guardian as a message.

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