AUTONOMOUS WAY DETECTION AND EMERGENCY DEVICE FOR VISUALLY CHALLENGED USING MACHINE LEARNING ALGORITHM

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Abstract *- This device presents a Smart system for visually impaired, that make use of ultrasonic sensor and camera. The primary aim of this project is to design a voice based alerting system for the blind people. Visually challenged individuals find navigation difficult as they struggle day to day in performing actions for avoiding obstacles and hurdles in their path. In order to help visually challenged people navigate safely and quickly this system is proposed. Ultrasonic sensor is placed on the system which is used for obstacle detection with distance indication. The camera module is used to detect the object in front of the blind people and alert them using speaker connected to APR voice module. This system prevents the blind people from accidents and identifies the obstacle in front of them.*

Key Words **- Blind people, Ultrasonic, Indicators and Obstacles, Arduino, Tracker.**

I. INTRODUCTION

ACCORDING to "Global Data on Visual Impairments 2010" by World Health Organization (WHO), the population of visually impaired people all over the world is 285 million, out of which 39 million are blind and 246 million have low vision. Dis-function of such an important organ leads to several difficulties. Those who are visually impaired have to face problems in education, mobility, employment and independent living on a daily basis. But moving around freely is probably the most difficult challenge for them as they are not capable of depending on their own eyes. Some studies also reveal that of the 39 million people across the globe who are blind, over 15 million are from India thus, making the country the home to the largest population of blinds. Researches are being conducted all over the world to help the physically disabled people live a normal life. The most prevalent technique for locomotion of the visually impaired is the usage of White Canes. It is an ancient method that is still being used by many. White Cane has definitely proven to be effective but there are certain disadvantages and limitations for it as well like it is incapable of detecting obstacles above the waist level and is also prone to easy breakage. In a crowded place, carrying a White Cane is almost impossible as it requires space. The distance of detecting the obstacle is also limited for the White Cane. Often the blind people also use a trained pet dog for moving around on the roads which is quite a costly affair. Through our project we are aiming to help those who do not have the luxury of a perfect eyesight. Ours is a voice based alert system for blind peoples. Ultrasonic sensor is used to detect the range of objects and camera module captures the obstacles in front of them. Image processing is carried out and type of obstacle is informed to them using APR module and speaker. GPS and GSM helps them during outdoor navigation. In the following system Section I discuss about the basic introduction of Deep Learning and Machine learning concepts. Section II about System Model and Section III about Working of the Components and section IV concludes the process. In section V discussed the future Scope of this system.

II. SYSTEM MODEL

A. EXISTING SYSTEM:

The existing systems largely use white cane and trained dogs to help blind people visualize and walk as smoothly as possible. However, many of the innovations take advantage of computer vision, a technology that enables computers to recognize and interpret the complex assortment of images, objects and behaviors in the surrounding environment. There exists a device Eye-Cane [1] which is very similar to white-cane where the device is attached to a traditional white cane; the device senses the obstacle from 2 different directions at the same time and the information is conveyed to the blind person using the cane via audio frequencies; another such innovation deals with the ancient way of using Braille System but in a smart way which actually converts braille text to text messages and vice-versa [2]. However, these existing systems has their own pros and cons, cons mostly being too costly which is not affordable for the blind population, the white-cane might break, the dogs needs a lot of training and the eye-cane increases the overall weight of the white cane.

B. PROPOSED SYSTEM

The proposed system can detect the obstacle and also the type of obstacle using ultrasonic sensor and camera module. The camera module captures the obstacle and image processing is performed and type of obstacle is indicated to visually challenged people using APR module and Speaker, the proposed system allows the visually impaired person to walk safely in both indoor and outdoor. The system reduces the complexity of the blind person and guides them automatically.

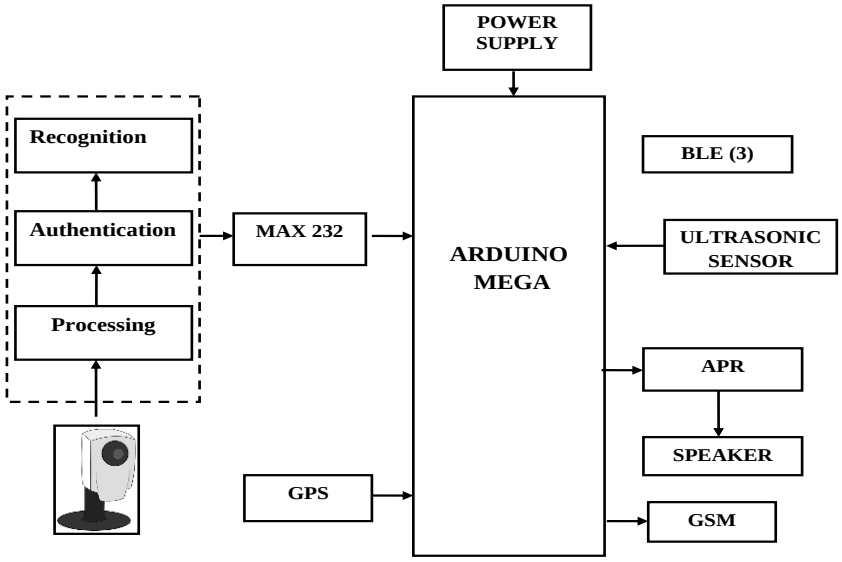


Fig.1 Block Diagram of the Proposed System

C. COMPONENTS

Fig. 2 shows the different components used for the device setup. Table I has the various components listed.

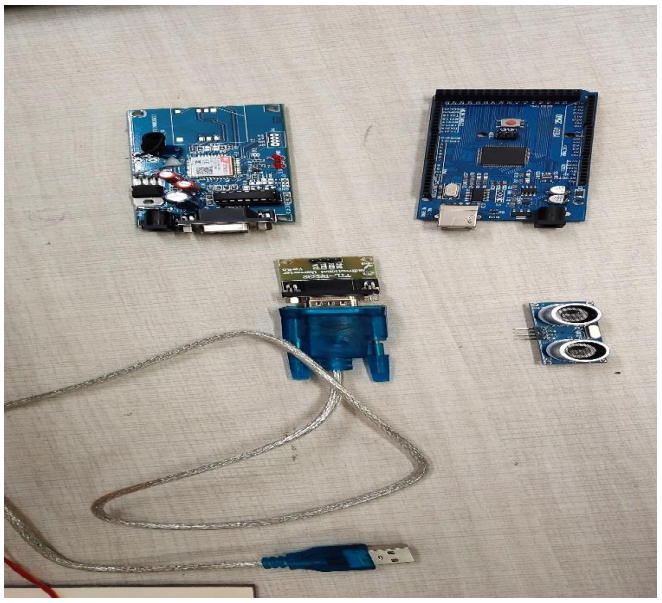


Fig. 2. components used

The circuit consists of components such as Arduino mega, Camera, Ultrasonic Sensor, Speaker, APR module, Max 232, BLE, GPS and GSM. The circuit requires +5v power supply. The Ultrasonic sensor sends ultrasonic waves to the obstacle in front and detects the distance of the obstacle and Camera module captures the object in front and performs image processing. It is done in three steps such as Processing, Authentication and Recognition. The camera is connected to Arduino via MAX 232 which is used for digital signal conversion to be recognized by Arduino Microcontroller. Then the obstacle type is indicated to the person using APR module and Speaker. The APR module is used for recording and playing audio system (Speaker).Thus the obstacle is identified and indicated using the System. Then the GPS and GSM is used for location tracking of the blind person. When the panic button is pressed the GPS and GSM activates and sends the location of the visually challenged person to the caretaker.

TABLE I COMPONENTS USED

Sl.No.	Components
1.	Arduino Mega
2.	Camera
3.	GPS module
4.	Ultrasonic Sensor - HC SR04
5.	GSM
6.	APR module
7.	Bluetooth Low Energy(3)
8.	Speaker
9.	Jumper Wires
10.	MAX 232
11.	TTL

III. WORKING

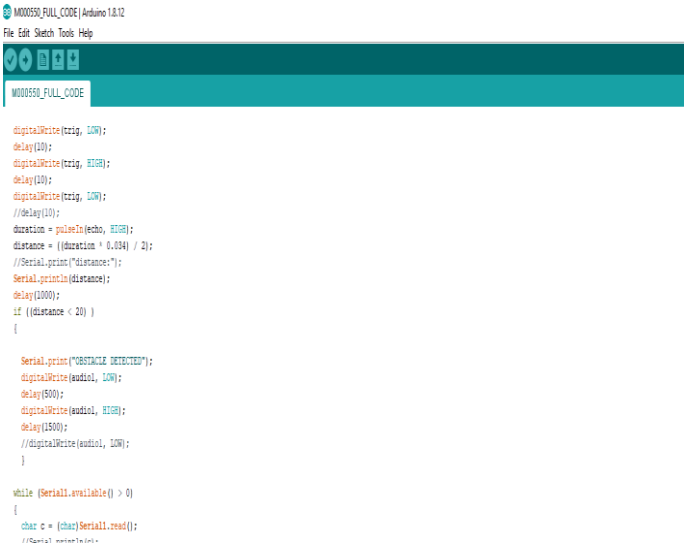
This device consists of equipment like Arduino Mega, Speaker, Camera, Max232, GPS, GSM, Bluetooth low energy module, Ultrasonic Sensor, APR module an connecting wires

A.TESTING WITH ARDUINO MICROCONTROLLER

Initially, the circuit was experimented using an Arduino Uno shows in Fig. 4 Each of the components like Ultrasonic Sensor, Speaker and APR module, Camera was tested individually. For testing results four components namely Arduino microcontroller, LCD module, APR module and Speaker are connected. LCD module is connected to pins [8 to 13] of the microcontroller. Speaker and Apr module are connected together and APR module is connected to the microcontroller on pins 2,3 and 4. The microcontroller is given power supply and ground is connected. Thus the system is ready to function. The program code is written in Arduino IDE and is uploaded to the Microcontroller. The input is given in form of serial input on Aruduino Uno. The corresponding voice output is acquired.

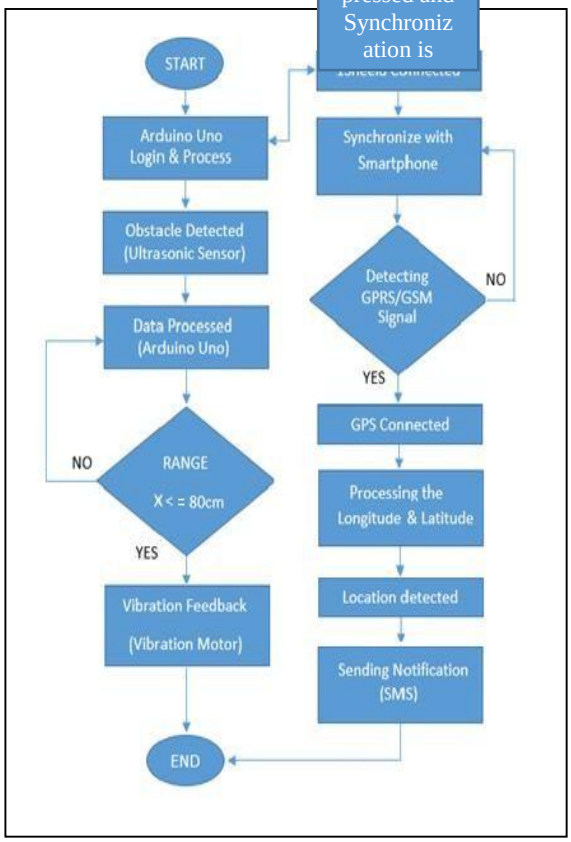
Fig. 4. Circuit testing with Arduino Mega

Similarly, when the different inputs are given in serial, corresponding voice outputs are heard such as bus, chair and pit. LCD module displays the voice output for verification.



B. MODEL DESIGNING AND WORKING

The model was designed in such a way that the components are all connected with microcontroller as main component. TTL is a component which connects the system and the overall prototype circuit. The power supply circuit is the primary component to power the overall system. The GPS and GSM are connected to the microcontroller. GPS will be working without breaks and signal will be received simultaneously. The image processing program is written using MATLAB and Serial communication and location detection program in written using Arduino IDE. Thus the program is uploaded into the microcontroller. The Obstacles to be recognized are first trained using the camera module and the objects are converted to matrix format of 64 values. Overall feature matrix will be obtained by the training process using SURF algorithm. Then the actual real time obstacle detection will be carried out. The camera module will capture the real time object and it is captured by the system. Then using KNN classifier, the captured image will be compared to the trained image to identify the Point of Interest and indicate the user about the type of the obstacle using the APR module and Speaker. The APR module is used for recording and playing the voice output for particular objects. Ultrasonic sensor is used to detect the object within specific range and it will produce the voice output as Object Detected. Thus the overall system together will recognize of obstacle in the front and BLE will be used for indoor navigation and finally the emergency device is used for location detection. This is the designing and working of the model.



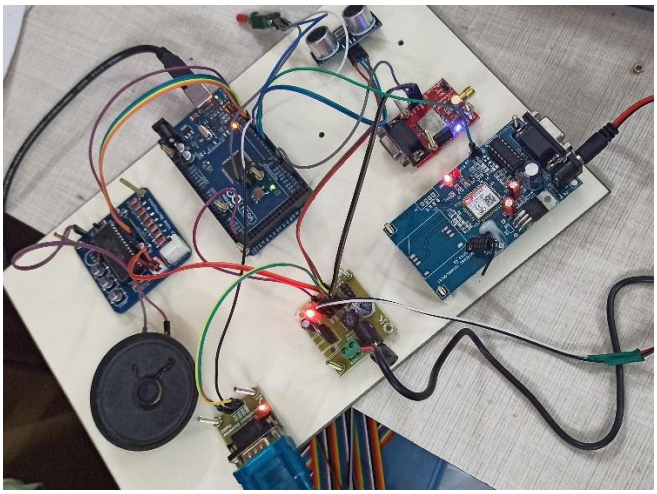
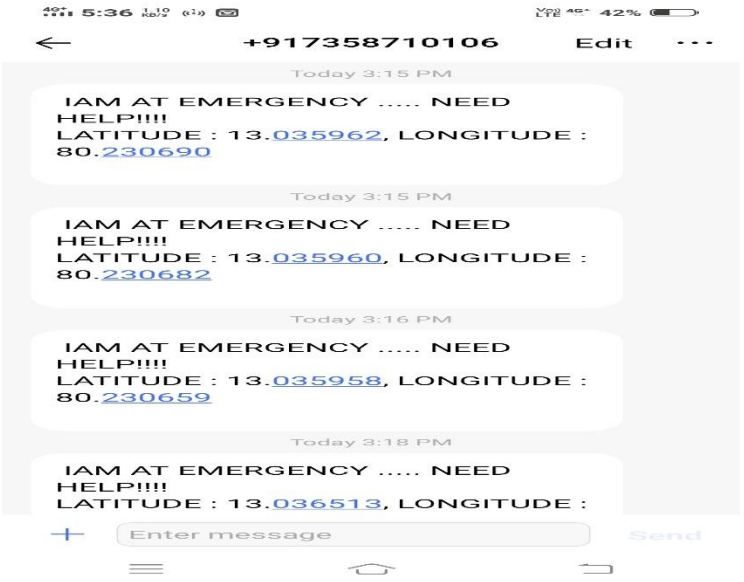
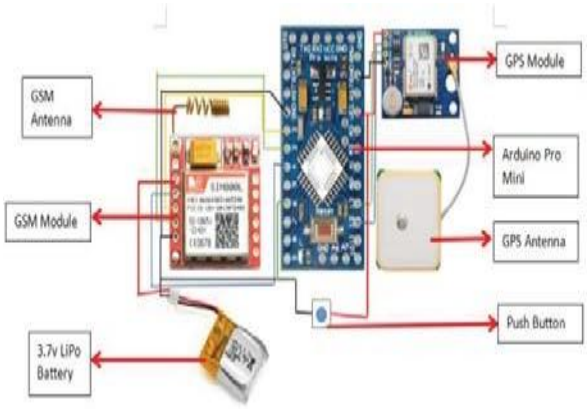


Fig. 5. Device Prototype Circuit

C.TRACKING SYSTEM

Apart from the system to identify the type of obstacle through speaker, a safety device was also added, which could track the exact location of the wearer through a message notification. Keeping in mind the privacy of an individual, this safety device was connected to a push button which switched ON and OFF the tracking device. So, in case of an emergency the button could be pressed by a visually impaired person. This device comprised of a GPS module and a GSM module SIM800L shows in Figure. When the push button was pressed, at first the GSM module was set to SMS mode. Then, the GPS module got connected to the satellites to fetch the location data, that is, the Latitude and Longitude of the device location. Then this location data is sent to the user family and friends by sending an SMS to the mobile number mentioned in the program code. Thus the person can be tracked and necessary help can be provided.





GPS - GSM Circuit Diagram

IV. CONCLUSION

This system presents a simple circuit to detect the obstacles in the proximity of the user using an Ultrasonic Sensor with the help of a micro-controller - Arduino Mega, Camera, APR and Speaker. For additional safety of the blind, a Tracking System has also been installed. Considering the problems faced by visually impaired people and comparing the pros and cons of existing systems, this system was fabricated. Thus providing them a smart way to tackle their problems. The blind person can detect the object and its type so that they can navigate safely.

V. FUTURE SCOPE

For now, we have designed the circuit on a prototype board. For better designing and a more compact version, we will design the circuit on a Prototype board. Thus, we will achieve a more reliable and lighter device at a lower cost. For future modification of the device, it can be improvised in such a manner that the device is able to tell the blind people at how much distance the obstacle lies and will also provide navigation instructions in the same way. The navigation instructions is to be conveyed to the blind person via sound messages.

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