Intelligent Assistive Shoes For Blind

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Abstract- *The proposed system presents an idea about dealing the problems faced by visually impaired individuals through assistive device in form of shoes. According to the many surveys, there is estimated that millions of people are partially or completely blind. Therefore, there is a need to introduce an assistive device for these people which will guide them in their needed activities. The device will encounter the nearby hurdles and simultaneously send a message to the receiver in vibration form. So, it helps these people to acquire the extra knowledge about the obstacles around them without any help or any guidance. The device can be equipped with global positioning system which helps the person to reach destination from source with comfort. It also contains special arrangement which enables the person to link his/her Aadhaar Card or other identities with proper authentication of the person. The project will operate to help these people in the world to make them easier to walk with less collision anytime. This will facilitate the user to sense his surroundings and alerts by providing the message not only to them but also to concerned people when they tap a button on shoe.*

Keywords- NodeMCU, Arduino IDE, Ultrasonic sensor, Wi-Fi module, GPS Receiver, Android App.

I. INTRODUCTION

The eyes are addressed as the window of the soul. We know the importance of an eye in a human body which enables a person to know about the surroundings. Blindness hampers a Person ability to do daily chores and earn wages for their Survivor. The population of partially and completely blind in the world has reached too many millions and for sure going to increase in future days. It is clear that how big is problem of blindness in this world. The blindness can be considered of two types, Partially blindness and totally blindness. Partially blindness refers to condition in which a person is only able to perceive a part of visual light and totally Blindness refer to complete absence of visual light interception. People suffering from total blindness are not able to do even simple task. The main problem with blind people is loss of self-esteem and physical integrity due to which they loss self-confidence. Whenever they enter in new environment, they need to memorize the position of each and every object of their need and obstacle. Accordingly, they need some device and technique which aid them in their movement and in doing daily activities efficiently. The method of using a blind stick which is quixotic because of its sectional range.

II. LITERATURE SURVEY

1] "Smart Shoe for Visually Impaired"
Author: Saloni Mohanty, Malavika Karunan, Ibtisam Sayyad, Shlesha Khursade, Prof.B.B.Gite.
Published in: 2017, International Journal of Advanced Research in Computer and Communication Engineering.

This paper proposed android based navigation shoes system. Wearable electronic kit is proposed. Bluetooth connection is provided and electronic part can be connected.

2] "Integrated smart shoe for blind people".
Authors: M.V.S Divija, M.Rohitha, Monisha.H, Prof.Ravindra.
Published in: 2018, International Journal of Management, Technology and Engineering.

This paper aims at development of electronic travelling aid (ETA) kit and poor efficiency of IR sensor and dependency on stick are overcome.

3] "Smart-not only intelligent", design direction for smart footwear".
Author: Tizina C Callari, Louise Moody, Paul Magee, Danying Yaang.
Published in: 2019, International Journal of fashion design, Technology and education.

This gives information about the qualitative research approach and journey mapping is considered. Key priorities for assistive smart footwear have included solutions to inform the user about the risk of falling and change in balance.

4] "Smart Assistive Shoes and Cane: Sole mates for the blind people".

Author: Shubham Rastofi, Pankaj Sharma, Partha Dhall,Rishav Agarwal, Shrishti Thakur.

Published in: 2017, International Journal of Advanced Research in Electronics and Communication Engineering.

This paper has combined both shoes and cane and are connected with each other via Bluetooth technology to act as a single system.

The outcome from the above papers shows complete and reliable sensing system for obstacle detection can value a lot from the collective usage of numerous types of sensors, especially from the active-passive combination. The smart stick focused only for hindrance detection but it is not assisting for emergency purposes needed by the blind. The major limitation of the existing technologies is that they are big-budget and cause execution problem when acquired in actual world.

Motivation

Millions and millions of people are approximated to be partially or completely blind worldwide. Most of the assistive devices for the visually impaired are touch based. But the proposed project works on the basis of information given by sensors which is more precise and error-free.

Problem Statement

The biggest problems that the visually impaired encounter is while travelling since they are not well aware of information about their location and obstacles on their way unlike the normal individuals. The project consists of the quick-witted shoes that alerts the user over impediment coming between their track and could lend a hand to them in stroll.

III. METHODOLOGY

In the proposed system, ultrasound sensor, GPS module and buzzer are the key components integrated to a central NodeMCU based controller. Ultrasonic sensor and GPS module are integrated to the shoes. The ultrasonic has two projections, one of them which emit ultrasonic waves. In the case of no obstacles, the waves travel away. But if there are any obstacles, the waves are reflected back. The sensor computes the time taken and in turn returns the distance. In the presence of any hurdle, ultrasonic sensor sends a feedback signal to the controller when it detects the presence of any obstacles.

The ultrasonic sensor measure the distance between the object and the person. The ultrasonic sensor calculates the distance and sends the signal to the microcontroller. The microcontroller collects the distance value and compares it with the predefined distance. If the distance is lesser than the predefined value, microcontroller activates the buzzer and starts the vibrator. We have two types of alerting system one through buzzer and another using vibrator. The vibrator motor is assembled beneath the sole of the shoe, it creates equal vibration and this helps to alert the person.

When the person need help or he wants to contact their caretaker, he just need to press a button on the shoe placed on side of the shoe without using hands. When the person hits the switch, microcontroller receives the signal and sends the command to the WIFI module to send the notification to the custodian using cloud server and android app.

In interfacing of app, care taker receives a pop-up notification on the press of the button. After pressing the button, the microcontroller collects the geo location details of the person using GPS module and sends the data to the android app where the Google map is integrated and points out the exact location of the person.

The methodology flows by the following steps:

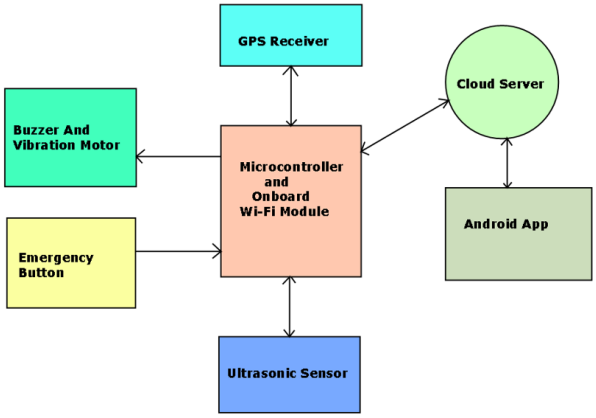

Figure 1: Block Diagram

IV. IMPLEMENTATION

Programming Layout-Arduino IDE

Arduino Integrated Environment is cross -platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is an open source software that is used for writing and compiling the code into the various processor modules. It is used to write and upload programs to

Arduino compatible boards, but also, with the help of 3rd party cores.

Figure 2: Arduino IDE

The Arduino IDE supplies a software library which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program main() into an executable cyclic executive program.

Hardware interface

- One of the pin of the controller will be used to send signal to generate the waves through ultrasound sensor and other will be used to receive response signal.
- Whenever a response signal is received, it senses that an obstacle is detected and the signal will be sent. If the barrier is in the range of detection, the buzzer and vibrator motor will be turn on.
- There are mainly three sections in the code section; assigning pins, declaring variables and program logic. Programs (sketches) written using Arduino Software (IDE), the unit of code that is uploaded to and run on an Arduino board. The IO pins that are utilized for the interfacing are assigned to required variables. In declaration sections, the assigned IO pins are configured either as input or output pins based on the connection of the peripheral.

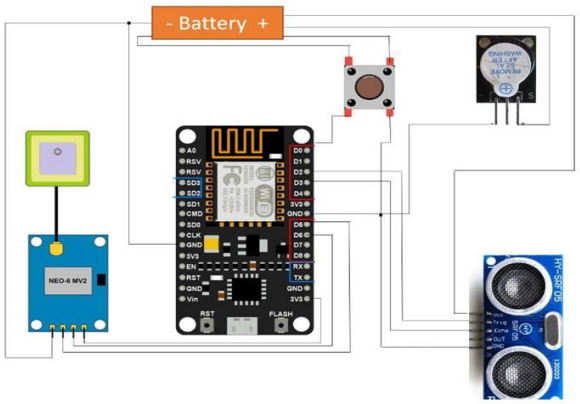

Figure 3**:** Schematic circuit interface

- The RX (receiver) and TX (transmitter) pins of the GPS module and button will be connected to digital pins of controller. When the user clicks the button, a signal will be sent as an interrupt to the controller. The controller captures the location the user and will be shared to the concerned person or relatives.
- In the android app we are using Google map API to find the geo locations, the microcontroller simply sends the latitude and longitude values to the android app. The Google map API collects the latitude and longitude data and points the person using a symbol on the map.

Figure 4: System assembly

- The GPS module tracks the real time location of the end user and in case of extremity if the person strikes the button, the caution will be sent to the related persons. Here button acts like an interrupt for the controller. When the button is pressed, the controller receives a signal and in turn captures the coordinates of the person and sends it to the guardian as a intimation.
- A vibrator motor will mounted inside the shoe, which will create continuous periodic vibrations.
- The buzzer is placed behind the controller, which provides ample of space for other components.
- Other circuit elements like voltage regulators, resistors, are placed at bottom of the PCB.

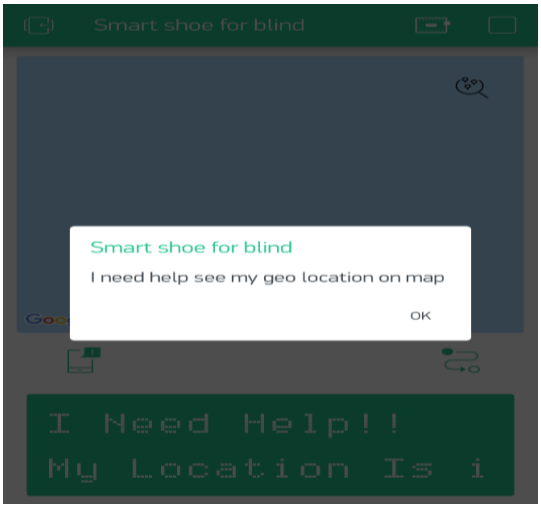

Figure 5: Pop-up notification received on press of button

- The GPS does not require the user to transmit any data, and it operates independently of any telephonic or internet reception. GPS is a network of about 30 satellites orbiting the Earth at an altitude of 20,000 km. In any given time, at least four GPS satellites are visible at any time. Each one transmits information about its position and the current time at regular intervals.
- These signals are intercepted by the GPS receiver, which calculates how far away each satellite is based on how long it took for the messages to arrive. Once it has information on how far away at least three satellites are, the GPS receiver can pinpoint the user's location.
- 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.

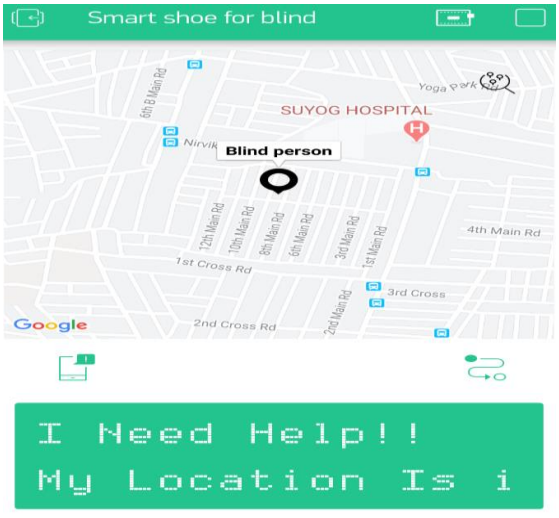

Figure 6: GPS location

- We connect the GPS module to the PC via USB to Serial converter or DB9 connector. Also, it is necessary to keep antenna of GPS module on proper location

The main advantages of the proposed system are:

- The proposed project will have a major impact on the lifestyle of the visually impaired.
- The system ensures that the person can move around without much difficulty.
- The design is compact and enables easy mobility to the user.

V. CONCLUSION

The put forward idea helps the presbyopic and becomes a good companion for the blind and works intelligently. The presented system is designed and will be configured for practical use. The ultrasonic sensor has been fully employed in order to advance the mobility of the blind in safe and autonomous. This system does not require a huge device to be hold for a long distance, and need not be specialized for usage. The paraphernalia worked on helps not only the end user; it also helps the other people nearby, for instance, if someone is moving towards the user, and the user if not notices, a connected vibrator's noises notify them.

Figure 7: Overview of proposed system.

The system comprises of the sensors that receives signals and then send commands to the controller which executes it further about the direction. Connecting the device to the mobile application by GPS technology, and also saving the current location and translating the voice command and enhancing the mobile application by growing the database which allows the user to record more than one location. The room for improvement still wide and open in this area. In future, we can implement the prototype as a System-on-chip (SoC) and a more compact system can be implemented.

VI. ACKNOWLEDGMENT

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