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IOT BASED SMART GLOVES FOR BLIND PEOPLE

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Abstract— The study hypothesizes a smart walking gloves that alerts visually-impaired people over obstacles, pits thus this device could help them in walking with less accident.GPS technology is integrated with microcontroller which will help their loved ones to keep eye on them. In this system ultrasonic sensor, GPS receiver, vibrator, PIC controller and battery are used. The overall aim of the device is to provide a convenient and safe method for the blind to overcome their difficulties in daily life.

Keywords: Internet of Things, ULTRASONIC SENSOR, GPS, PIC

I.INTRODUCTION

Blindness is the condition of lacking visual observation due to neurological and physiological factors. For blind pedestrian secure mobility is one of the biggest challenges faced in their daily life. According to the World Health Organization (WHO) in 2012, out of 7 billion global populations there were over 285 million visually impaired people and 39 million were totally blind out of which 19 million are children and this number is growing at an alarming rate[l]. So, some navigation system is required to assist or guide this people. Many researches are being conducted to build navigation system for blind people. Most of these technologies have boundaries as its challenge involves accuracy, interoperability, usability, coverage which is not easy to overcome with current technology for both indoor and outdoor navigation. The disability and technology are considered as two cooperative words: by exploiting advances in bioengineering technology, smart solutions have been proposed for reducing the disease impact (artificial body parts, augmented reality sensors, etc). Due to the big effort in improving the usability of technological devices for impaired people, the uncanny valley has been filled up and we are facing at threshold of a new era in adopting these cyber-physical systems. This paper focuses the problem of visually impaired people, proposing a smart device able to improve their mobility. Visually impaired people use worldwide the white cane as tool for mobility: it is used not only to detect obstacles, but also to alert others as to the bearer’s visual impairment.

Despite the large research literature in developing system for improving the mobility of visually impaired people, the white cane still remains their main tool. All the solutions proposed in literature, indeed, are focused on equipping this tool with heavy and expensive devices. As a consequence, these smart tools turn to be unaffordable for most of the impaired people and lost their primary functionalities. In some cases, the solutions are uncomfortable and increase the feeling of being different.

The glove is equipped with rangefinders to explore the surroundings: it provides a vibro-tactile feedback on the position of the closest obstacles in range by means of vibration motors. The system is designed to operate with the white cane, enhancing the reliability of this traditional tool.

The signals send by the sensor detect obstacles and let user knows by vibrating a motor. Following evaluation, it is clear that the proposed design can be developed further to be used as a convenient and low-cost travel aid for the visually impaired as it is cost effective and user-friendly. The results of the testing demonstrate that the smart glove can be used to guide the visually impaired for indoor. The system will not let the user make use of keyboard instead will work only on mouse operation and speech conversion to text. Also this system can be

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used by any normal person also for example the one who is not able to read. The system is completely based on interactive voice response which will make it user friendly and efficient to use.

Mobility of visually impaired people is restricted by their incapability to recognize their surroundings. According to the World Health Organization (WHO) in 2012, out of 7 billion global population there were over 285 million visually impaired people and 39 million were totally blind out of which 19 million are children (below 15 years). This means that someone in our world goes blind in every five seconds and a child in every minute. Over 90 percent blind children obtain no schooling. Recent survey source India is now became the world's large number of blind people.

The population of India has reached 120 Cr. of those 8.90 Cr. people are visually impaired. 90%of those cannot travel independently. In this paper, we present a survey of navigation system of visually impaired people highlighting various technologies with their practical usefulness, design and working challenges and requirements of blind people. The aim of this paper is to provide a better understanding to identify important research directions in this increasingly important social area for future research.

Usually blind people use white canes which are very limited in its ability to provide navigation assistance to the user and cannot easily detect obstacles. Mobility of visually impaired people is limited by their inability to perceive their surroundings.

Therefore the purpose of this project is to build a navigation system that will be able to guide a visually impaired person safely and with ease, in an indoor and outdoor environment. This goal has been realized through the use of an ultrasonic device to determine the range of obstacles and also a microcontroller to act accordingly. The system includes a warning system through voice rendering and through generation of vibration.

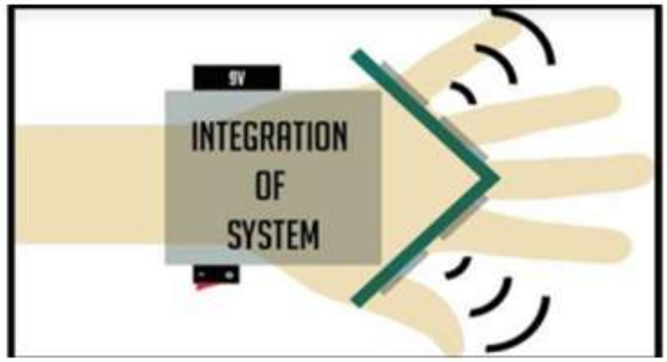

Figure 1 Visually Impaired

It was intended at testing the visually-impaired to utilize their brain to identify set of objects. According to Chang and Song , this can also be applied to different situation. When the visually-impaired walk into a new environment, they will find it difficult to memorize the locations of the object or obstacles. These examples demonstrate the difficulties of visually- impaired people.

The Guide Cane is designed to help the visually-impaired users navigate safely and quickly among obstacles and other hazards. Guide Cane is used like the widely used smart gloves, where the user holds the Guide Cane in front of the user while walking.

Another real-time technology developed to alert visually impaired user by the presence of static dynamic obstacles in a few meters surrounding, which works without depending on any Smartphone, uses camera for background motion detection. This system is robust to complex camera and background motion and does not required any prior knowledge about the obstacle size, shape or position. This camera based image processing system can be a better option but it requires lot processing power and hence system becomes bulky, costly and it must be transportable.

There are three main categories of these systems: Electronic travel aids (ETAs), electronic orientation aids (EOAs), and position locator devices (PLDs). This paper presents a comparative survey among portable/wearable obstacle detection/ avoidance systems (a subcategory of ETAs) in an effort to inform the research community and users about the capabilities of these systems and about the progress in assistive technology for visually impaired people. The survey is based on various features and performance parameters of the systems that classify them in categories, giving qualitative–quantitative measures.

II. ULTRASONIC SENSOR

HC-SR04 distance sensor is commonly used with both microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc. The following guide is universally since it has to be followed irrespective of the type of computational device used.

Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information the distance is measured as explained in the above heading.

Figure 2Ultrasonic Sensor

III.VIBRATION SENSOR

Vibration sensor is used originally as vibration switch because of its high sensitivity; it is sensitive to environment vibration, and generally used to detect the ambient vibration strength. When module did not reach the threshold in shock or vibration strength, D0 port output gets high level and when external vibration strength exceeds the threshold, D0 port output gets low level. Small digital output D0 can be directly connected to the microcontroller, for the microcontroller to detect low level, thereby to detect the ambient vibration. Small digital output D0 can directly drive the relay module, which can be composed of a vibration switch.

Vibration causes havoc in many applications. From machine shafts and bearings to hard disk performance, vibration causes machine damage, early replacement, low performance, and inflicts a major hit on accuracy.

Using vibration analysis as a tool to determine the specific cause and location of machinery problems can expedite repairs and minimize costs. Vibration sensors can measure and analyze displacement, linear velocity, and acceleration. These parameters are mathematically related and can be derived from a variety of sensors. Selection of a sensor proportional to displacement, velocity, or acceleration depends on the frequencies of interest and the signal levels involved.

USB to Serial Cable

USB to serial RS232 adapters are often used with consumer, commercial and industrial applications and USB to serial RS485/RS422 adapters are usually mainly used only with industrial applications. Currently, USB to TTL-level UART converters are used extensively by students and hobbyist as they can be directly interfaced to microcontroller.Adapters for converting USB to other standard or proprietary protocols also exist; however, these are usually not referred to as a serial adapter.

The primary application scenario is to enable USB based computers to access and communicate with serial devices featuring D-Sub (usually DB9 or DB25) connectors or screw terminals, where

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security of the data transmission is not generally an issue.

USB serial adapters can be isolated or non-isolated. The isolated version has opto-couplers and/or surge suppressors to prevent static electricity or other high-voltage surges to enter the data lines thereby preventing data loss and damage to the adapter and connected serial device.

The non-isolated version has no protection against static electricity or voltage surges, which is why this version is usually recommended for only non-critical applications and at short communication ranges.

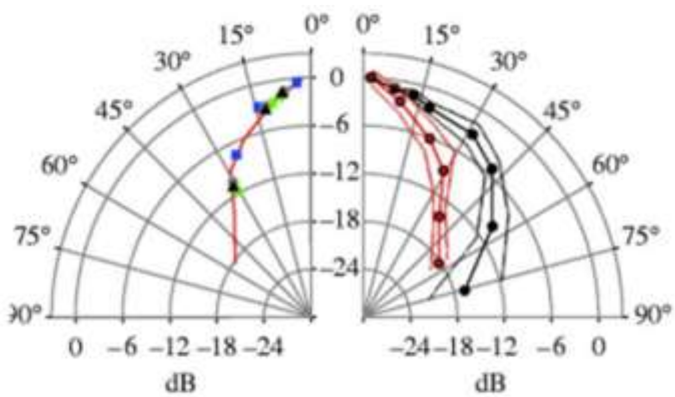

Figure 3 Ranges

IV. DATA FLOW DIAGRAM

The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.

LEVEL 0

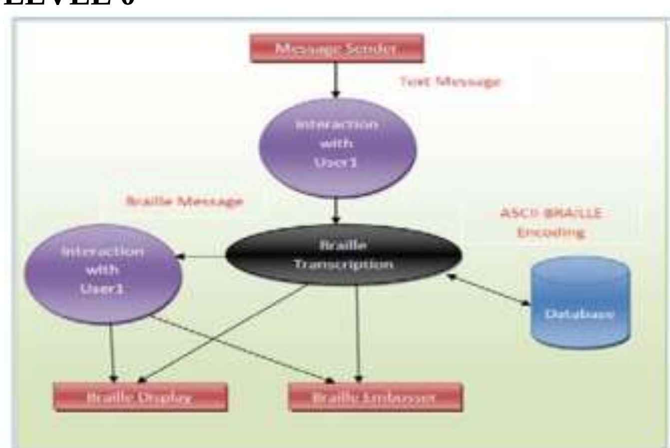

Figure 4 Data flow diagram for Level 0

LEVEL 1

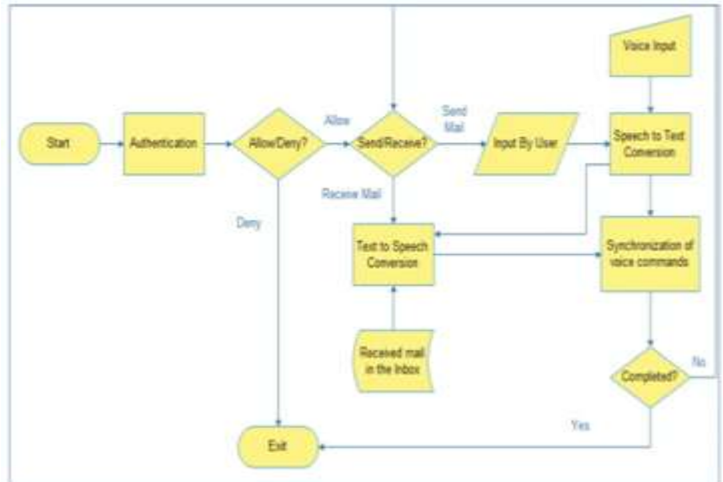

Figure 5 Data flow diagram for Level 1

V. SEQUENCE DIAGRAM

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

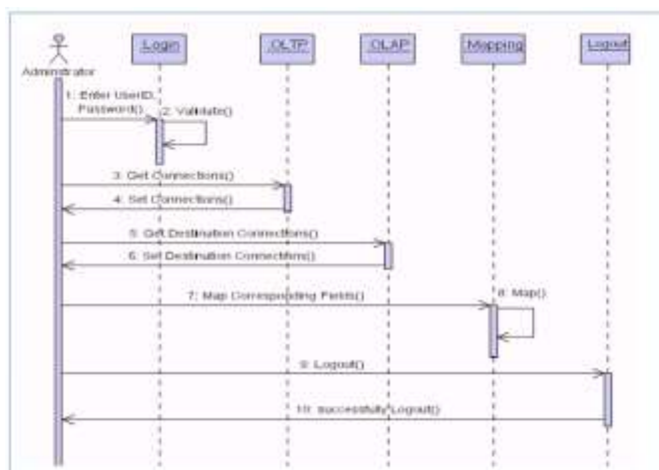

Figure 6Sequence Diagram

VI. THE PROPOSED WORKFLOW SEQUENCE

- Ultrasonic sensor
- Servo motor
- Slot Sensors
- Microcontroller

1) ULTRASONIC SENSOR

This type of ultrasonic sensor has an ability to determine the distance of objects with high accuracy and provide stable reading of data. The sensor widely used for the blind because it does not affected by environmental noise. It works by transmitting an ultrasonic burst and provide output pulse which correspond to the time required for the burst echo to return to the sensor. The distance to the target or objects can be calculated by measuring the echo pulse width.

2) SERVO MOTOR

Servo motors are great devices that can turn to a specified position. Usually, they have a servo arm that can turn degrees. Using the Arduino, we can tell a servo to go to a specified position and it will go there. Servo motors were first used in the Remote Control (RC) world, usually to control the steering of RC cars or the flaps on a RC plane. With time, they found their uses in robotics, automation, and of course, the Arduino world.

3) SLOT SENSORS

The slot sensor used here is MOC7811. A slot sensor is an Opto-isolator module, with an Infrared (IR) transmitter & a photodiode mounted on it. It performs Non-Contact Object Sensing. This is normally used as a position sensor switch (limit switch) or as Position Encoder sensors used to find the position of the wheel. It consists of Infrared (IR) LED and Photodiode mounted facing each other, enclosed in plastic.**(**object detectingsensors that have the transmitter and receiver built into the opposing**)**

4) MICROCONTROLLER

(small computer on a single integrated circuit.**)**

The microcontroller development board is the processing unit of the proposed design. All the conversion algorithms for the system are stored in the microcontroller. This forms the control unit of the system. The slot sensors and the vibration motors have to be interfaced to this development board. Therefore, this is the most important component of the system.

VII. RESULT AND DISCUSSION

1) Obstacle sensor with IOT board

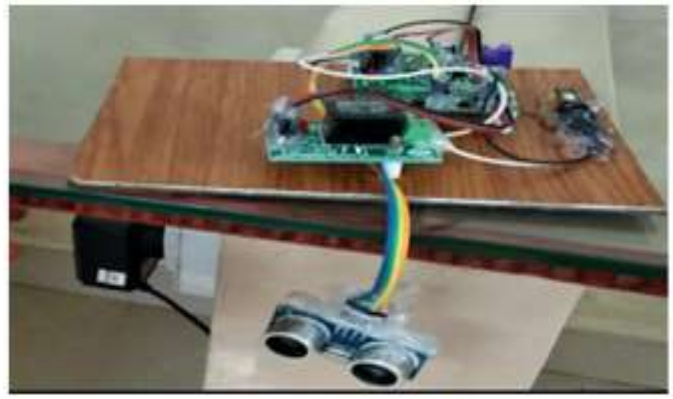

Figure 7.Obstacle sensor with IOT board

2) User authentication

Figure 8 User authentication detail

3) Home page

Figure 9 Home pagedetail

4) Obstacle Sensor values

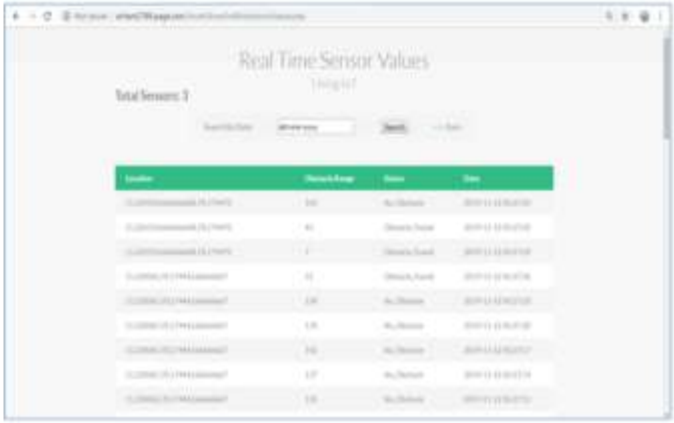

Figure 10 Obstacle Sensor values detail

5) Location tracking

Figure 11 Location Tracking detail

6) Location map

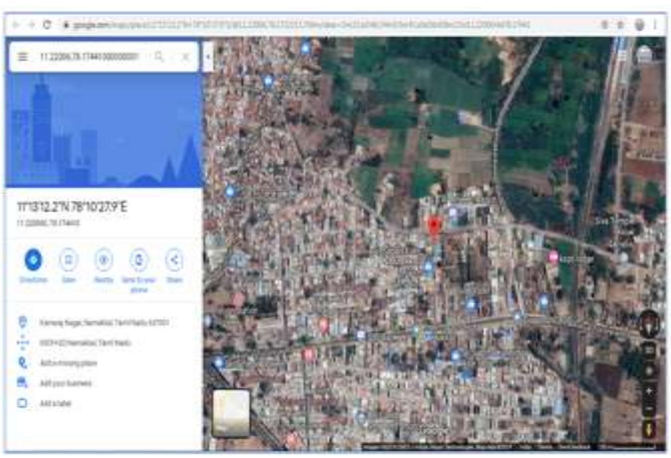

Figure 12 Location Map detail

7) Location summary

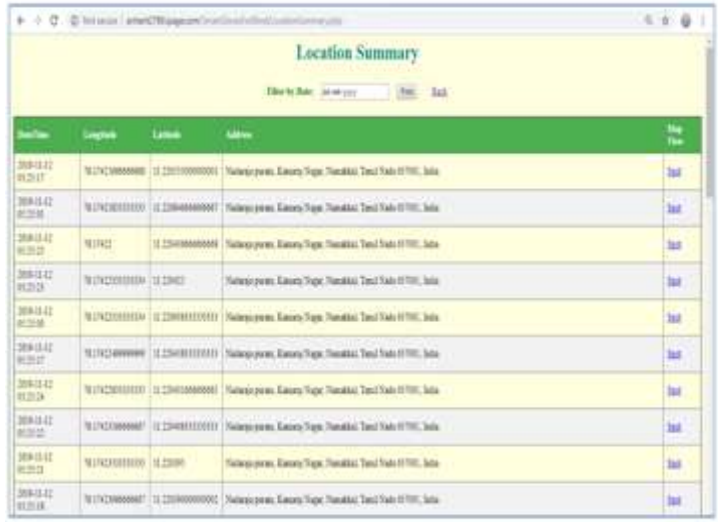

Figure 13 Location detail

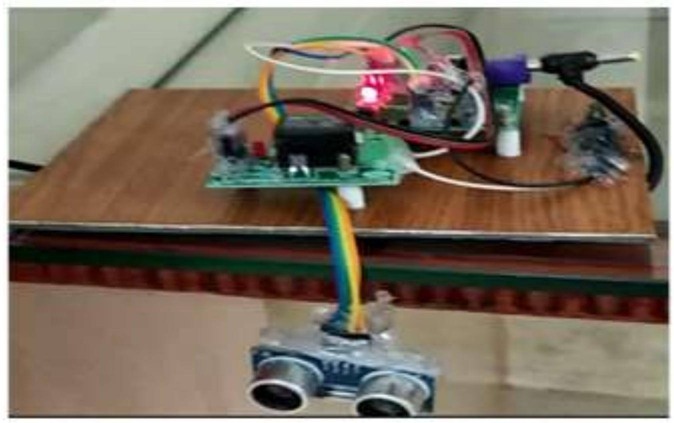

Figure 14 Sequence Diagram

VIII.CONCLUSION AND FUTURE ENHANCEMENTS

1) CONCLUSION

Smart glove for the blind project is to help blind people walk and estimate the distance from obstacles. Main component for this project are Arduino UNO, Vibrator motor and ultrasonic sensor. Based on the experiment that has been conducted, there are few advantages and limitations of this project. One of the advantages of this project was the use of ultrasonic sensor. This sensor was very sensitive and will trigger faster when it detect obstacles. Besides that, the cost to develop this project was low and can be afforded by blind people. The limitation of this project was the ultrasonic sensor used can only detect the obstacles but cannot illustrate the shape of the obstacles. Furthermore, this assistive glove can only be used by blind people but not the blind and deaf people. Future improvement can be made to increase the performance of this project.

2) FUTURE ENHANCEMENTS

The results are also compared to the functionalities of the products. Section VI, Conclusion and Future Work, delivers the summary of results with regard to aim of the project. It discusses the methods used and also suggests the future work.

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