Iot Empowered Smart Stick Assistance For Visually Impaired People

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Abstract: Eyes are foremost blessing to enjoy the nature. Blind people face lot of hurdles in daily life. Blind people needs to depend on others to perform their normal life activities. Information technology brings revolution in every field of life with emerging artificial intelligence, internet of things, wireless sensor networks etc. Internet of Things is evolving technology that digitally interconnect the humans, machines, sensors and everything for automation. It transform manual processes to intelligent automated processes with the help of aritifical intelligence. In this research, we have developed a sensitive smart stick empowered by Interent of Things to support the visually impaired peoples. Smart stick is incorporated with ultrasonic sensor and buzzer to sense and alarm in case of any hurdle. Andorid application is developed with smart stick to generate the important notification and forward to registered numbers along with GPS location. This solution is cost effective and implemented with state fo the art hardware.

Index Terms: Internet of Things, Smart Stick, Smart Assistance, Visually Impaired, Arduino, Ultrasonic Sensor.

1 INTRODUCTION

Due to the absence of visual perception, people are deprived of enjoying the beauty of nature and lack to fulfill their desires and needs. Visually impaired people have small interactions in the surrounding area [1]. The physical movement is the combative situation of unsighted people therefore it is difficult to explain that whether they want to depend on other people for moving from one place to another [2]. According to Research, 253 million people are visually impaired and from that 36 million people are completely blind and 217 million people are living with low sight or vision [3]. Blind people face obstacles in unknown or new places and they have to take the support of a sighted person. The majority of visually impaired persons are unemployed. Scientists work decades to build up the blind stick to detect obstacles in the outdoor environment and warn unsighted people about obstacles in their surroundings. Because limited jobs are available for blinds and they have to depend on the family to support them financially. To address these problems, there is a need for affordable small sticks to assist the visually impaired peoples.

Internet of Things (IoT) brings revolution by automating the manual processes to automated processes with the help of other emerging technologies like wireless sensor networks, data analytics, cloud computing, machine learning, etc. IoT digitalizing every field of life from medicine to agriculture and education to industry. Sensors are providing the base to smart automation by sensing and transmitting information via wireless sensor networks. IoT is an appropriate technology to address the problems of visually impaired peoples by introducing smart stick for assistance. This paper is further categorized into five sections.In the first section we"ll discus the basis of the research,scope of the proboem and needs of smart stick.. Further, emerging technologies are elaborated. Section two review the literature to highlight the related work and research gap. In section three, the system design and development are shown with particular functionality. Section 4 indictaes the implementation of the system and the results obtained from the experiments. Finally we"ll conclude our paper in section 5 with some future scope of this system.

2 LITERATURE REVIEW

IoT provides assistance and support to physically disabled people in maintaining a healthy life, promoting economic and social enjoyment. Blindness is a condition where visual vision is impaired because of physiological or neurological causes. The 50 percent blindness is entitled to the lack of integration in the production of the optic nerve or visual center of the retina and the absence of visual light perception is 100 percent blindness. This population is about 180 million worldwide and according to the latest estimate the number of diabled people are increasing gradually. Many blind people in the world struggle when practicing the essential stuff of their day that could put their lives in danger during the journey. There's a need these days to give blind people protection and health. So far, few systems have been equipped to assist the blind. But, using IoT, only a handful of direction-finding systems can provide complex experiences for blind people [4]. In this paper we have provided an examination of internet of things for

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disabled people's. [5]. The classification of radio frequency ,multi-agent is demonstrated by the author Turcu et al.The Iot technology can be used to increase people's access to features,accessible hospice, minimize major medical issues , enhance more safety and security for the patients, and simplify the mechanism of healthcare [6]. Smart Stick enhances blind life as it is well-equipped with the stuff internet [7]. The stick can detect any height of static and dynamic obstacles that are in front of the human [8]. A smart stick provided a guide for a blind person in their way, consisting of a global positioning system and a global mobile communication module system [9]. Stick solution makes use of various technologies such as ultrasonic, infrared and laser [10]. The Unsighted people need to develop a skill of balancing and ability to move freely so that they are capable of walking independently using a white cane [11]. The sensor system consists of three ultrasonic sensors to acquire measurements of obstacle distance and the user can perceive distance information as a tactile sensation [12].The concept of Navbelt was given by Shoval et al.Navbelt is basically a portable laptop computer and it was mainly designed for blind people to avoid indoor obstacles.This was mainly for indoor activites but was not so helpful for the visually impaired users as it does not produce any kind of sound.[13]. Smart stick using indoor navigation infrared sensors was an idea proposed with internet. The stick created different vibrations upon identification of the barrier, and the vibration pattern was difficult to discern and rendered the individual unable to freely use both of his hands [14]. Scientific research aims to reduce the challenges of people with visual impairments. Some of the tools have already been created to meet the blind users' demand. Navguide offers knowledge about the surroundings and senses obstacles to the users at the knee and head level [15]. Smart walking stick senses obstacles on the lane, pit, and water to support the blind [16].For the identification of obstacles various companies uses Atmega328 microcontroller and some of the companies like Iwalk detects object using Arduino [17]. Numerous device uses an ultrasonic sensor and the Arduino to detect the obstacles placed in different locations. [18]. In foreign countries like the United States, They sell smart walking stick for the disabled and the elderly with various functions such as torch,Fm-radio and many more [19].The students of delhi developed a app named as smartOane for the virtually impaired with the concept of manafacturability.The main purpose to develop this app was to fulfill all the requirements of the visually impaired users.Although this stick is very useful for blind people to walk freely and in unstructured settings, without sighted assistance [20].

3 DESIGN AND IMPLEMENTATION

The first figure demonstrates that there are four sensors each with different characterstics.The characterstic of A is 11000,B-12000,C-14000,D-15000.All these sensors are located in different locations and the purpose of these sensors is used to detect the obstacles and send the distance to an Aurdino module.In this smart stick the sensor A and B are located on the front side of the stick where as the sensor C is located on the left side and sensor D on the right side of the stick.The arduino module is used to send the correct distance to the app in the mobile with the help of Bluetooth module and then the user can listen their distance through mobile app.

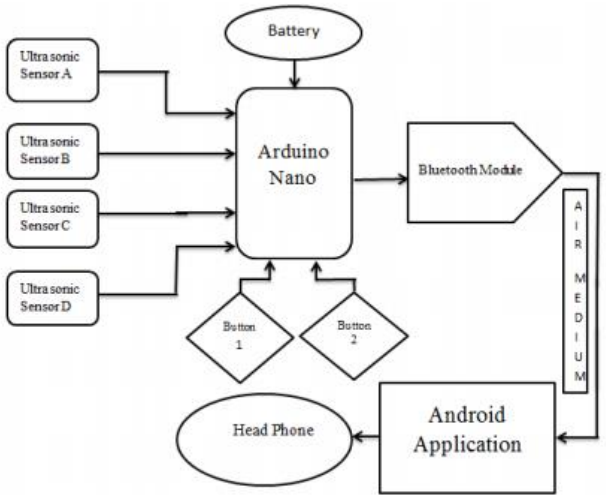

Figure 1: Block Diagram

The figure 2 shows us the built-in components i.e are ultrasonic sensor,arduino,basic terminal which is used as Bluetooth module,resistors for locating the sensors,push button,capacitors.In this to control the sensor we used variable resistor instead of V8 sps as it does not not offer any definite sensor device.A band rate of 9600 is provided when this is connected with the mobile apps through the blouetooth module.There are various arduino pins such as D4,D5,D6,D7,D8,D9,D10 and D11 and these pins are linked with the ultrasonic sensor devices.Where as the aurdino pins 2 and 3 are interrupted by two push buttons.Figure 3 is indicating is the resuts of the fundamental terminal like 122358,122426 where as the first two digits represents the number for the sensor and the next three digits indicates the distance in the centimeters.

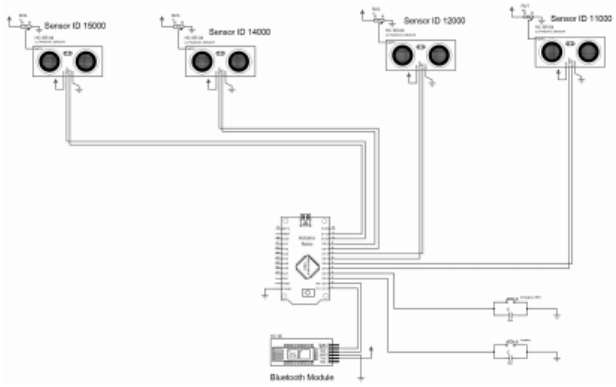

Figure 2: *Simulation via Proteus*

In this model only two push buttons are used and these are connected to the pins of the Arduino D2 and D3. The first button is used for sending necessary messages on emergency basis to a predefined phone number and the second button is used for capturing the current location of the user.For hardware accuse the ceramic capacitor are connected with each push button.The purpose of Bluetooth module is to process and receive the information received from the Arduino board.For Receiving and transmitting data signal we use UART,which is termed as Universal Asynchronous receiver/transmitter protocol.

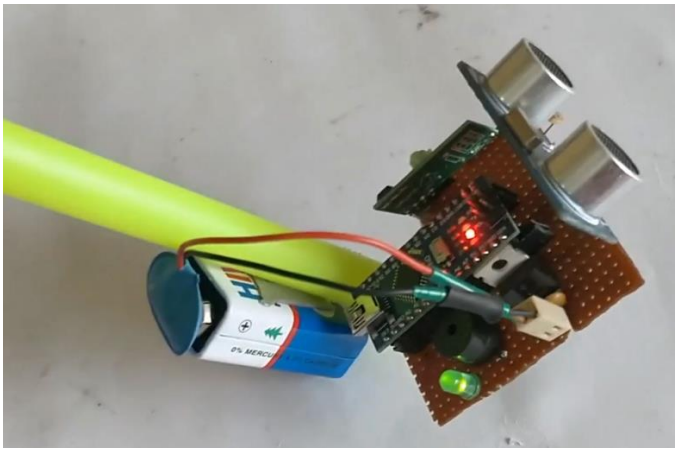

Figure 3: *Smart Stick*

When the sensors get a new interference than it will be automatically uploaded into the mobile app.Arduino nano is used as the main controller for bluetooth devices for the Tx and Rx pins.In this 9v-li lion is used for battery supply and UART protocol is used to transmit the data signals.In our project we are using an android phone for the mobile app and we will connect the phone with Arduino through Bluetooth module.The user will be able to listen the distance from the android phone and for this purpose the process of producing sound is done by the Arduino which will send data to the android application.The biggest advantage of using this application software is that in case if that virtually impaired person gets lost then this device will automatically sends a message and location to more than one family member of that virtually impaired person.
Mathematical Model:

Input: Obstacle comes in front of the sensor.
Output: Buzzer will beeps after sensor detection. Voice Assistant will direct the person for movement.Android app will track the blind person using GPS.
S = (I,O,F)
Where, S: System.
I = f I1 g are set of Inputs
Where, I1 : Distance.
F = f F1, F2, F3, F4 g are set of Function
Where, F1 : Obstacle Detection
O = f O1, O2, g are set of Output
Where, O1 : Giving Alerts About Obstacle
Success Conditions: To do proper Obstacle detection and make the user aware about it.
Failure Conditions: Headphone not connected, sensor damaged.
Figure 5 shows the prototype of implemented smart stick. While the android application is shown in figure 6. Figure 7 shows the distance voltage graph.

4 EXPERIMENTAL DISCUSSION

Our system will be working successfully.If there is an obstacle within the range from 0 to 100 cm on the way of the virtually impaired person then the system will give a intimation to the user by providing some sort of sound or vibration.The code in the Arduino is written by Using basic micro basic language.

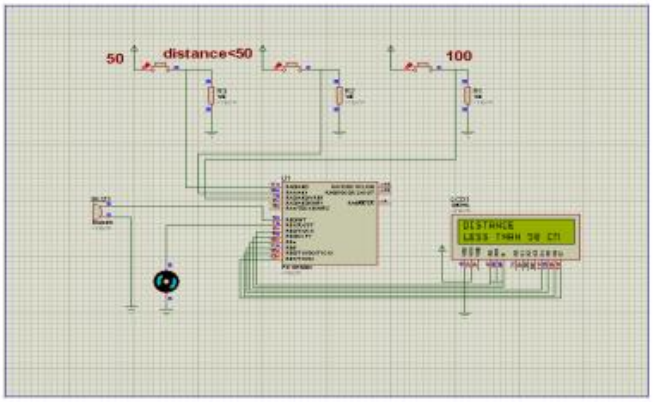

Figure 4: *Distance Measurement*

The system was functioning the way we expected it to work.The ultrasonic sensors were mimiced by using push buttons.In this system the vibration motor will only activate if the distance is less than 50cm from the obstacles.

Figure 5: *Hardware Prototype*

Figure 6: *Mobile Application*

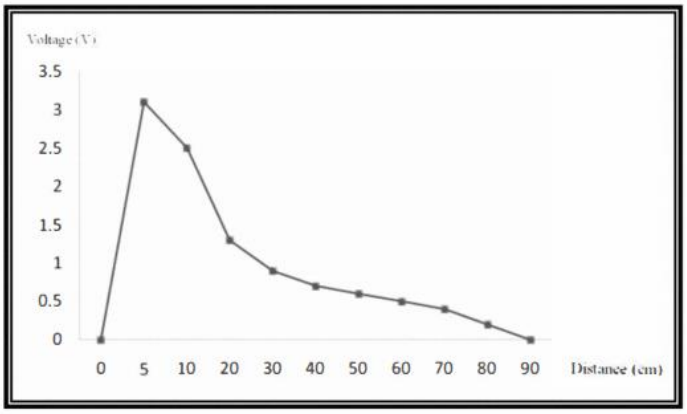

Figure 7*: Distance Voltage Graph*

5 CONCLUSION & Future Work

The smart stick for virtually impaired people has now become essential in order to make their lives more easier so the technologies behind blind sticks are upgrading day by day.Our model is designed in a way that helps the disabled person to move more easily and comfortably without any kind of risk and its designed in such a way that its very light in weight nd very easy to carry around.The most important thingis that the manufacture cost of our model is quiet low that makes the stick affordable for people of all class and age.We can also change some of the techniques to make it more reliable like We can use upgraded microcontroller instead of Arduino nano and we can also use image processing for knowing about the object patterns and the volume of the obstacles.

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