A New Designing Approach of SAVI (Sensing Aided for Visually Impaired)

(Hardware and Software Implementation)

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***Abstract*— As we recognise that feel of vision to man or women is an essential factor in our life, however there's a few humans who have loss of mobility due to blindness. In this paper we recommend a navigation device or tool that's useful for blind persons. They can discover obstacle in the front of them, they also can move in known as well as unknown area with the assist of that blind stick, it is able to stumble on the obstacle with the assist of IR sensors & blind person get conscious with it when cell phone get vibrated, or provide a few voice message to him or her.**

Keywords*— Arduino Uno R3, HC-05 is a bluetooth module (6 pin -> State, Rx, tx, Vcc, Gnd, EN), HC-SR04 (Ultrasonic Sensor), LDR Sensor, Water Detection Module, Ublox NEO 6m GPS Module.

INTRODUCTION

Mobility and freedom for visually impaired human beings can be described because the capacity to transport with confidence, walking speed and safety via his surrounding environment independently, however, it isn't viable without technology. We carried out one machine that is beneficial for that blind man or woman[3]. Those human beings can locate obstacle in the front of them and make steady to him/her and his acquainted and non-acquainted man or woman also can track that blind man or woman from house[1] In modern region also for that we make on software for android phone or laptop that is carried by blind individual and admin with the assist of GSM/GPS[2]. We can track the area of a blind person and one extra characteristic is brought which is all-time video capturing, we are able to grab the feed in the front of the blind character and admin can examine from its house[4].The smart working stick can help people to odentify the obstacles in front of him and as per the guidance they can move in propoer direction[5].

I. OVERVIEW CONCEPT

A. Arduino Uno R3

An open source embedded system design provided by the Arduino hardware and software company. The microcontroller Board used in this project is Arduino Uno R3 which consists of an Atmel 8-bit AVR microcontroller with 13 Digital I/O pins and 6 Analog I/O pins.[6] The board has also been supplied by a DC power jack input and a USB interface. The board has an on-board voltage regulator of 5V and 3.3V. It also has In-system Programming (ISP) also known as In-circuit Serial Programming (ICSP) which allows us to program the board while installed into the computer. Arduino Uno R3 in our project provides the logical pathway for the inputs to be analysed and gives the desired output to aid in our SAVI project.

B. GPS Module(Ublox NEO -6m)

GPS Sensors are the receivers with antennas that use a satellite-based navigation system with a network of 22 satellites in orbit around the earth to provide position,velocity & timing information[11].At heart of the module is a NEO-6M GPS chip from u-blox. It can track upto 22 satellites on 50 channels & achieves the industry's highest level of sensitivity i.e. -161 dB tracking,while consuming only 45mA supply current. Unlike other GPS modules,it can do upto 5 location updates a second with 2.5 m Horizontal position accuracy. The u-blox 6 positioning engine also boasts a Time-To-First-Fix(TTFF) of under 1 second. One best features the chip provides is Power Save Mode(PSM). It allows a reduction in system power consumption by selectively switching parts of the receiver ON & OFF.

C. LDR Sensor

The LDR Sensor or the Light Dependent Resistor is implemented using a potential divider circuit and with the help of an Analog I/O pin the output voltage from the potential divider is read. The value of the LDR changes with the change in the intensity of the daylight present. Simultaneously, the voltage output from the potential divider also changes. The connection is made such that when there is ample daylight, the LDR will act as a closed circuit with almost zero voltage drop against it as the resistance drops to few ohms[7][10].The Analog I/o pin will measure the voltage and will pass it through a 10- bit ADC for the Arduino to understand and according to the voltage read if the voltage is greater than 0.9V (180 after ADC conversion) the LED will remain OFF. During the night, when there is no presence of daylight or then the LDR will act as an open circuit with its resistance value as high as Megaohms. The Analog I/O pin will then read the voltage, and then pass it through the 10-bit ADC. If the read voltage is less than 0.9V then it turns the LED ON which will notify the passers-by about the presence of the blind person during the night.

D. Water Sensor

Through a water sensor, the stick can detect if there is a presence of water in front of the blind person or not. The sensor is placed at the end of the stick, so when that stick gets in touch with water or goes down into water upto a certain level it can detect the same and sends a vibrating feedback which the blind person will be able to detect with the help of a connected wristband.

E. Ultrasonic Sensor(HC-SR04):

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound(i.e.sound that humans can hear). This is a 4-pin module,viz. Vcc, Trigger, Echo, and Ground. HC-SR04 Ultrasonic Sensor Module is a very popular module used in many applications where measuring distance or sensing objects are required and also can be used for Radar applications too. [8]The module has two eyes like projections in the front which is the on-board Transmitter and Receiver which Transmits and Receives ultrasonic waves respectively.

F. BlueTooth Module(HC-05)

The HC-05 Bluetooth module is one of the most popular and inexpensive modules used for RF communications and it is easy to implement in your projects. The module has a range of 10 meters, and can be easily set using AT commands and can be programmed both as master and a slave. [9]The module allows it to transform a UART \ USART port more commonly known as serial into a Bluetooth port, generally with SPP (Serial Port Profile) profile, thus becoming a serial over Bluetooth. Normally this device is used when you want to communicate with a microcontroller like Arduino with the outside world, where the outside world can be a SmartPhone, a Personal Computer, or other device equipped with a Bluetooth connection

II. PROPOSED MODEL

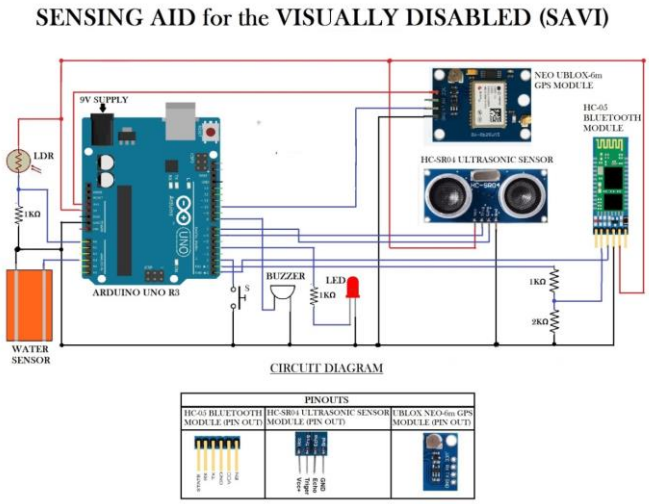

Fig 1 – Circuit Diagram

A. Operating Principle

The Ultrasonic Sensor (HC-SR04) is made to send out an Ultrasonic wave through its transmitter by stimulating the Trigger pin of the module with a pulse having a period of 14us and having a duty cycle of 71.428%. The transmitted wave after it bounces back from an obstacle is received by the Receiver section of the module. During this duration the Echo pin is held HIGH by the HC-SR04 module and the same is read by a Digital I/O pin of the arduino. This duration of the Echo pin held high in microseconds which is then used to calculate the distance to the obstacle using the formula:

. Distance (in cm) =(Duration/2)*0.034

Based upon the distance the Arduino takes a decision. If the obstacle is in a close proximity of less than 30 cm, it gives out audio feedback through a piezo buzzer. The threshold for the proximity can be set as preferred by the user by changing the code

B. Function of Water Module

The water module is based on the principle that water is a great conductor of electricity. There are two connections that

are disconnected initially and the same is completed after the two disconnected pins are connected by the water present and conduction of the current through the water starts. The Arduino detects this output and whenever the output voltage is greater than 4.8V, it gives a vibrating feedback via. a wristband to the blind person.

C. Performance of GPS Module

The GPS module fetches the data associated with the location of the stick and keeps on updating the data in the Arduino. A separate communication is set up between the Arduino and the GPS module so that the Serial Communication is not disrupted by the activity of the GPS module. The NeoSWSerial library helps us to declare Digital I/O pins 10 and 11 as Rx and Tx respectively. The NMEAGPS library helps to find the location of the stick and returns the location of the Latitude and the Longitude respectively in Degree Decimal which is the supported format for the Google Maps. The value of the latitude and the longitude is manipulated by some string manipulation techniques to give the required format of the Latitude and the Longitude which is then stored in String variables in Arduino for future use in fetching the location of the blind person.

D. Significance of SEVI

The SAVI android application will help to connect to the bluetooth module present along with the Arduino and will stimulate the same with an input from the mobile so that the bluetooth module sends the then fetched location of the blind person. For the location to be searched using Google Maps there are few manipulations that are made by the Arduino before sending the location data using the bluetooth module. The Latitude and the Longitude values which are present in the Arduino as String datatype, are further concatenated with other strings to form a complete Google Map link, for example the Latitude value is stored in LAT variable and the Longitude value is stored in LON variable, then the concatenation is done as follows: "https://www.google.com/maps/place/" +LAT+","+LON

E. Application of Bluetooth

The Bluetooth module is connected to the Serial Port and once the Serial port is available for data exchange, the Arduino reads through the Serial port to which the mobile sends a signal whenever it wants to fetch the Location.

F. Mobile Application:-

In the android application the GUI consists of basic layouts displaying the application name following which there is a button in the form of a List Picker which when the bluetooth of the device is ON, shows the available devices that can be connected and paired with to exchange data. Once the connection between another bluetooth and the mobile is established a Disconnect button will pop up using which the mobile user will be able to Disconnect from the paired bluetooth. The Fetch Location button will send a char value to the Arduino via. the connected bluetooth, and as soon as the char value is detected by the Arduino, the Arduino then sends the Location (after the string concatenation mentioned in the Arduino Code section) in the form of Google Map link to the via. the bluetooth to the paired mobile. This link will be shown in the application GUI in the mobile in the text window and there will be a button which will pop up simultaneously which upon pressing will redirect the user to the Google Maps to pinpoint the location of the blind person

III. SIMULATON & RESULT

The output of the Simulation t is as shown below:- .

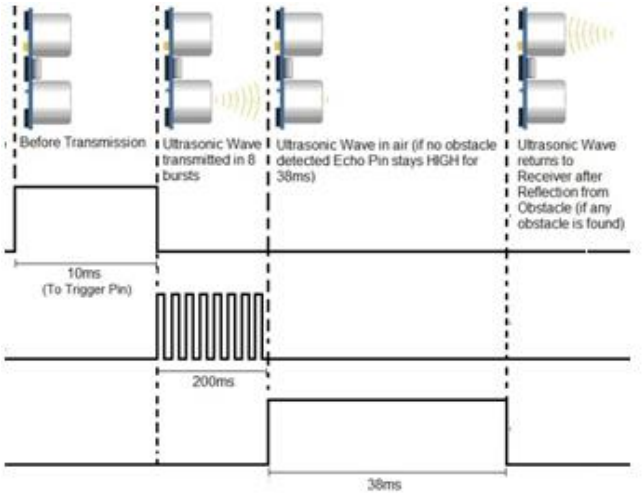

Figure2:- Response of HC-SR04 Ultrsonic Module

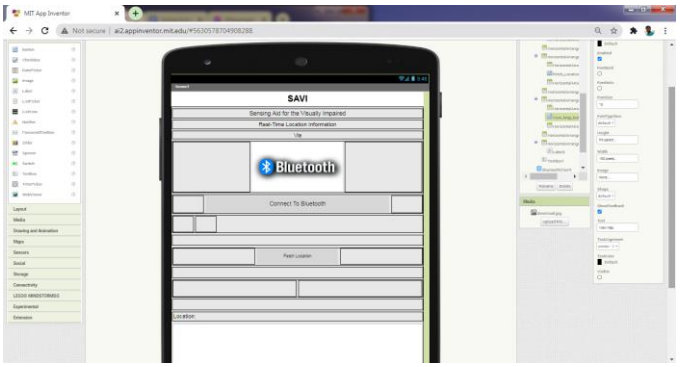

Figure -3:- Mobile Application of Bluetooth

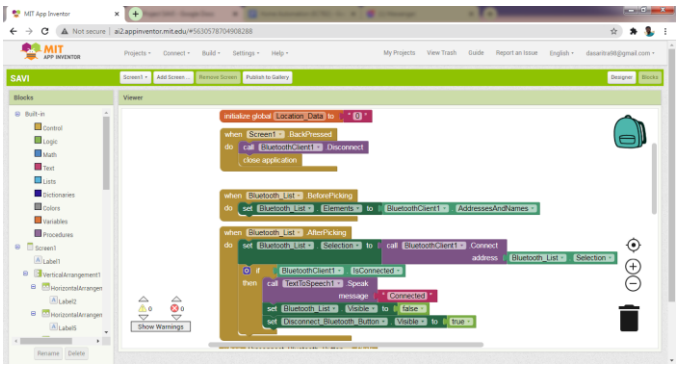

Figure 4: Block Diagram of MIT App Inventor: Coding Logic Implementation

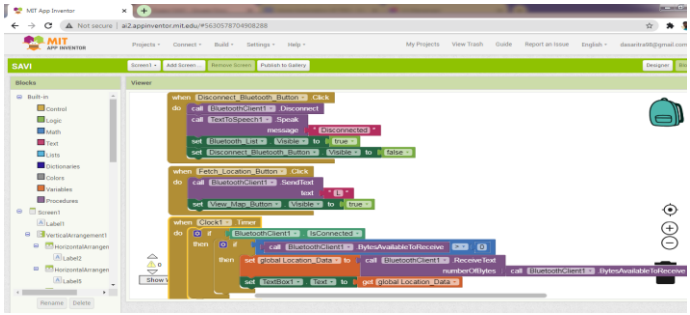

Figure 5:- MIT App Inventor Coding Logic Implementation

Figure 6:- MIT App Inventor Coding Logic Implementation

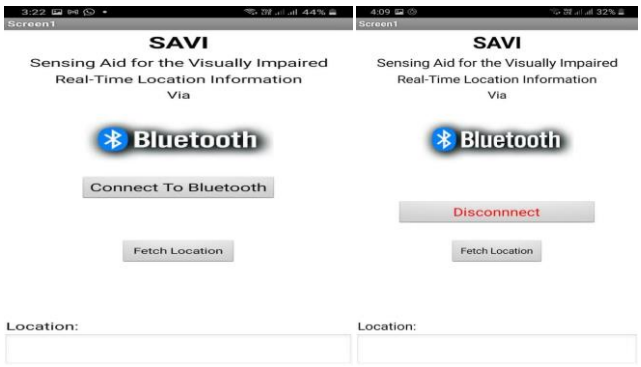

Figure 7:- SAVI Android App Before and After BT Connect

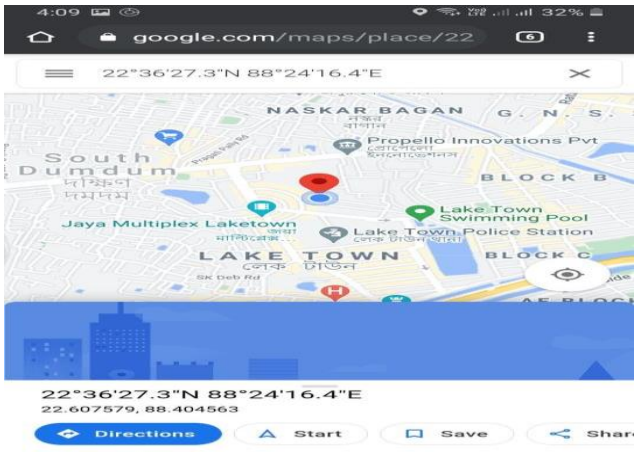

Figure 8:- Location Fetching and viewing it through View Map Button on Google Maps

CONCLUSION

In our paper SAVI we tried to implement is a Smart Walking Stick that would blind persons to sense their surroundings in a better way, so that they do not have to be dependent solely on their instincts. This type of device can fetch a huge positive social impact as it can gives the old and handicraft person a better prosperity of life

FUTURE SCOPE

The SAVI project has a scope for future research by updating the technologies used like the sensor triggered feedback to the blind person could be an audio one which will be given using audio jacks. Similarly the sensors could be replaced by different AI technology like image detection along with a camera to detect the obstacles which would help to achieve two targets like reduction in the number of sensors used and also the functioning complexity. Also implementation of GSM and 6 key Braille keyboard would enable the blind person to establish contact with any emergency contact during any need or emergency.

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