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Smart Stick for Visually Impaired People

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Abstract - *Internet of Things is one of the major technologies that are growing right now. We can find all kinds of Iot devices around us. Not only in technological industry but Iot is also contributing in health sector too. In this study we build a Smart Stick for visually impaired people which is a major enhancement on the default stick which is available in the market right now. We designed a Smart Stick which can be easily be afforded as well as usable by the visually impaired people. The design architecture uses the Arduino processor along with Ultrasonic Sensors which will be responding with the help of a RF transmitter and receiver. Further it can be also used to respond to the sensitivity of light.*

Key Words: Internet of Things, Smart Stick, Arduino, Ultrasonic, Sensors.

1. INTRODUCTION

Internet of things is everywhere now and is predicted to be reach every corner of the world soon. It has transformed the way our devices work. Now each device in our house is connected to every other device only because of technological advancement in Internet of Things. Iot has not only helped in transforming technological sector but also in the health sector too. They developed TalkingTransit (TT) -- a location-aware system which enables users to obtain real-time service status and timetables of public transit in Tokyo [1]. There system can be used in off-the-shelf smart-phones without requiring a dedicated hardware. It provides in-station information using Bluetooth low energy (BLE) technology to help users identify a right platform or exit [1]. Also in another paper they proposed a three location-based services (LBS) that can be used with smart-phones without requiring additional hardware. They demonstrated how can Internet of Things (IoT) infrastructure for positioning, and web APIs for retrieving relevant information based on user's context can facilitate independent travel for visually impaired [2]. There has been developement for a navigation gadget also. In paper [3] they proposed a theoretical model and system concept to provide an electronic aid for visually impaired people. There work relied on developing a gadget that is, a walking stick and a Bluetooth headset (wearable), for visually impaired people that helps them to walk around without any difficulty [3].

The Internet of Things is a intercommunication between various systems where the communication is being carried by means of network or some of signals. The current position of the vision loss humans can be found by using Global Positioning System (GPS) which is embedded in the stick [3]. Internet of Things can significantly help visually impaired in their day to day life. They can do their day to day walking on their own without the help of others. In paper [6], authors presented a paper on smart Electronic Traveling Aid (ETA) called BlinDar. There smart guiding ETA ameliorates the life of blind as it is well equipped with Internet of Things (IoT) and was meant to help the visually impaired to walk without constraint in close as well as open environments [6]. In paper [10], authors proposed an intelligent system that can assist the blind in walking. There system consist of three ultrasonic sensors which are not used to just detect the obstacles but also the visually challenged will be directed in the direction (front/right/left) which has no obstacles, when other two directions are blocked by an obstacle [10]. Or also when there is an obstacle in only one direction then the distance of other two directions will be calculated and he/she will be directed to go in a direction at which the distance is longer [10]. Also the Mq2 gas sensor is also included in the system to help warn the user in case he is too drunk and make them wary [10].

Motivated from these researchers we developed our own model which is reliable, cost efficient, scalable and easy to use device which can be used by impaired people easily. In our model we have used Arduino Nano board which is then assembled with Ultrasonic sensors and LDR(Light Dependent Resistor) which would be controlled with the help of a RF remote controlled by the person. The simplicity of this model as well as the affordability will help each and every disabled person to walk easily. And also our Smart device can be easily attached to person own stick if they want to.

2. PROPOSED METHODOLOGY

We designed a smart stick with the help of Arduino programming. We used a Arduino Nano board as our processor which will be used for processing the various data which will be stored and used by the device to detect obstacles and also the intensity of light. The Arduino Nano is small, complete, and breadboard-friendly which is based upon ATmega328 (Arduino Nano 3.x). This has almost the same functionality as of the Arduino Duemilanove, but has

a different package. It thus lacks only a DC power jack, and works with Mini-B USB cable instead of a standard one. The Arduino Nano is powered by Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is also automatically selected to highest voltage source.

Arduino Nano each of 14 digital pins on Nano are used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They will operate at 5 volts. Each of the pin can provide or receive maximum of 40 mA. It also has an internal pull-up resistor (disconnected by default) of 20-50 kilo-Ohms. Also some other pins have specialized functions.

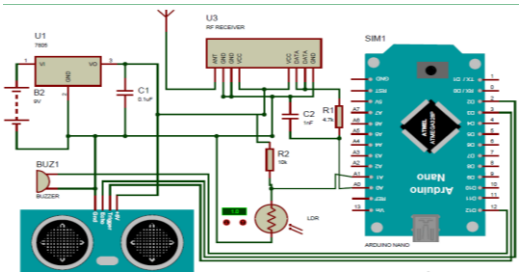

Fig -1: Circuit Diagram.

The Arduino will be used to control all the sensors and LDR. The board is completely powered by a 9V battery which is regulated by using a 7805 voltage regulator. Ultrasonic sensor is also powered from the 5V source. LDR is connected with resistor of value 10K which form Potential divider and difference in which voltage is read by Arduino ADC pin A1. The ADC pin A0 is used as to read signal from RF receiver. The output of board is given by the Buzzer which is connected to pin 12.

There is RF remote controller which will be used by the blind person to reset the Smart Stick. Also this buzzer will be used to press the button to stop the buzzer from beeping.

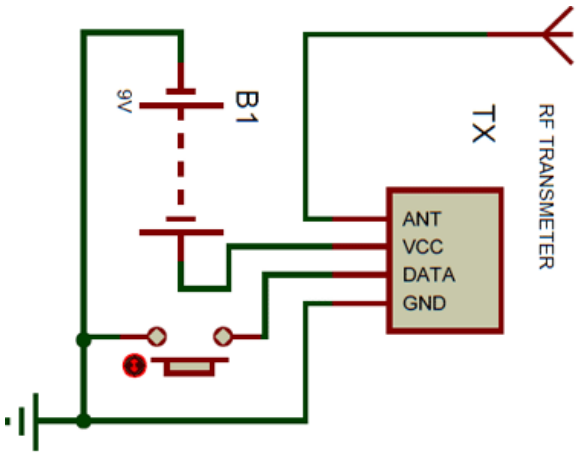

Fig -2: RF remote Circuit Diagram.

The Data pin of transmitter is connected to Ground of the supply. The data pin of the receiver is passed through an RC filter and is given to Arduino. Whenever the button is pressed , Receiver outputs some constant ADC value. This repetition will not be observed when button is not pressed. Then we write Arduino program to verify for repeated values to detect if the button is pressed. In this way a Blind person can track his stick.

3. CODE USED:

In the void setup() we start with the initialization of the pins in our system.

```
{
Serial.begin(9600);
pinMode(Buzz,OUTPUT);
digitalWrite(Buzz,LOW);
pinMode(trigger, OUTPUT);
pinMode(echo, INPUT);
}
```

Fig -3: Void Setup() configuration

Now to calculate the distance from the obstacle we will be using the following code.

```
calculate_distance(trigger,echo);
Signal = analogRead(Remote);
Intens = analogRead(Light);
```

Fig -4: Distance Calculation

Now we write the code for the remote response system. This code will show how the circuit will react upon the use of the remote circuit.

```
//Check if Remote is pressed
int temp = analogRead(Remote);
similar_count=0;
while (Signal==temp)
{
 Signal = analogRead(Remote);
 similar_count++;
}

//If remote pressed
if (similar_count<100)
{
  Serial.print(similar_count); Serial.println("Remote Pressed");
  digitalWrite(Buzz,HIGH);delay(3000);digitalWrite(Buzz,LOW);
}
```

Fig -5: Check if remote is pressed

Now we write the distance code for at which the circuit will respond to the buzzer. At a distance less than 50cm the circuit will start buzzing.

```
if (dist<50)
{
  Serial.print(dist); Serial.println("Object Alert");
  digitalWrite(Buzz,HIGH);
  for (int i=dist; i>0; i--)
    delay(10);
  digitalWrite(Buzz,LOW);
  for (int i=dist; i>0; i--)
    delay(10);
}
```

Fig -6: Distance after which beep starts

4. RESULT

We were successful able to build the required design for our Smart Stick for visually impaired people to help them walk easily with the help of Internet of Things. Our model is cost efficient, easy to use, portable, i.e. the main circuit can also be attached to the blind man shoe. All the available code be easily modified like we can modify the distance and LDR detection based upon the requirement which the user want.

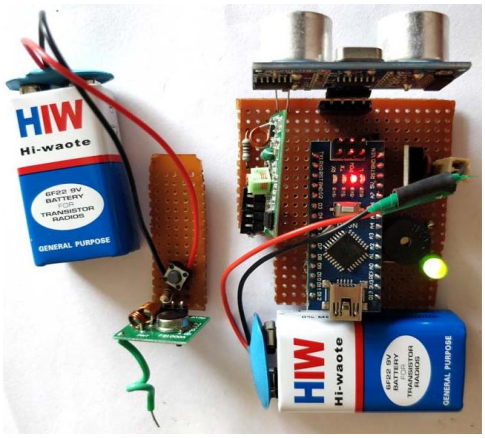

Fig -7: Result Image

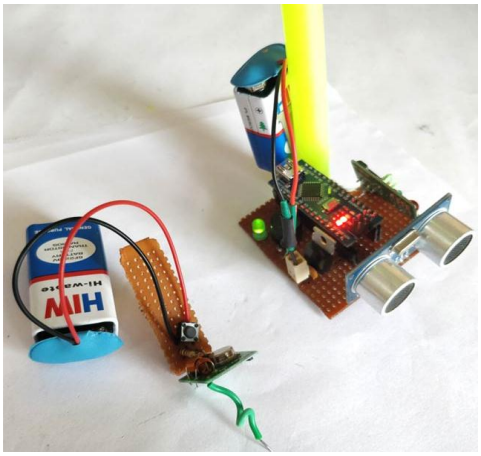

Fig -8: Result Image - 2

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