AN IMPERCEPTIBLE EYE FOR THE VISUALLY IMPAIRED INDIVIDUALS USING IOT

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Abstract

Visual deficiency is a condition individual loses the visual observation. Autonomy is a building technique in accomplishing objectives and dreams in life. Flexibility and self-dependability for the visually impaired and blind people has always been a problem. In this paper a brilliant ETA (Electronic travelling Aid) called "smart Blindar" has been proposed. This brilliant ETA enhances life of visually impaired as it is all around furnished with internet of things (IOT) and is intended to help the outwardly disable and oblivious in regards to stroll without requirement in close and in addition open condition. "Smart Blindar" is a highly efficient, reliable, quick reacting, low power consuming and cost effective device for the visually impaired individuals. Ultrasonic sensors have been utilized to detect the obstacle and potholes within a range of 4m.Gps and ESP8266 Wi-Fi module has been utilized for sharing area location with the cloud and navigate them to reach the destination. MQ2 gas sensor is utilized for detecting fire in way and a RF Tx/Rx module for finding the stick when it is lost. Arduino Mega2560 is the microcontroller utilized, which has 54 digital I/O pins which makes the interfacing of components simple.

Index Terms: Smart Blindar (stick), GPS, ESP8266, Blindness, IOT, RF 433MHZ TX/Rx, MQ2 gas sensor, TTS

I. INTRODUCTION

As showed by the report from World Health Organization (WHO) in 2014 there were 285 Million people who were visually impaired and out of those 39 million were blind and 246 million were low blind. With the progression in the cutting edge innovations, distinctive kinds of devices are accessible for the mobility of visually impaired and blind. These devices are known as Electronic Travelling Aid .The ETAs have sensors which caution the visually impaired in Progress about the peril with sounds or Vibrations. With the Presentation of such Electronic Traveling Aids (ETA). There is an expansion in visually impaired's wellbeing and self-assurance.

A portion of the visual guide gadgets incorporate K sonar, Ultra stick[3], Palmsonar, iSonic stick, Laser stick[3] ,and Virtual Eye (utilizing Image handling). These gadgets are not all that client benevolent and simple to deal with. Laser sticks and Virtual Eye Aids are expensive and not all that client friendly. This paper proposes the gadget called 'smart BlinDar'[1].which is an ETA.It goes for enhancing the life of visually impaired and causes them to self-navigate without contingent upon somebody.

Not at all like previously, blind people will now have the capacity to lead life as ordinary individuals. Aside from that the relatives of the blind people will likewise have the

capacity to track him at any minute and will have the capacity to get the correct area of him from" smart Blindar" is IOT based[7] and is exceptionally financially savvy, proficient and easy to use. The gadget for the most part comprises of an advanced blind Stick with Arduino Mega2560 microcontroller.

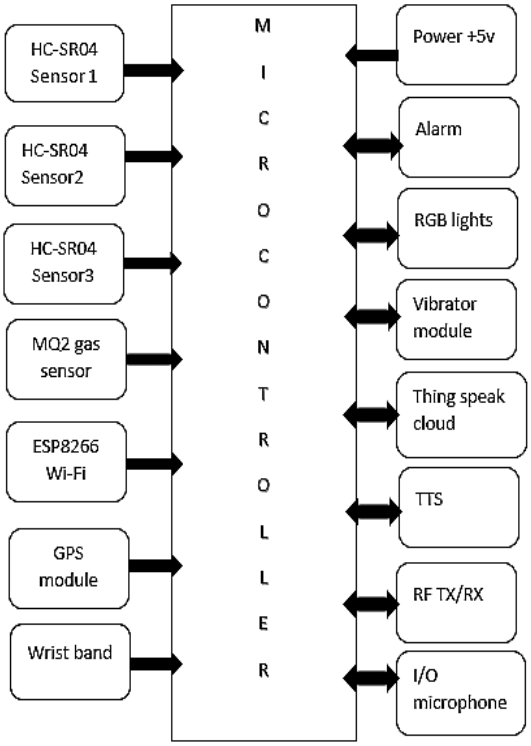


FIG1.BLOCK DIAGRAM OF "SMART BLINDAR"

II. PROPOSED SYSTEM FEATURES

The proposed system provides the following features:-

- Fast reaction of the hindrance sensors in close range up to 4m.
- Light weight segments incorporated on sticks which makes it easy to understand with low power utilization.
- Circuit isn't complex and utilizes basics of C/C++/Java to program microcontroller.
- There is a possibility when the visually impaired walks around an uproarious place what's more, can't hear the alarm sound from the framework.
- A smart wrist band is presented alongside the stick. A vibrator is joined to it which cautions him of the snag by vibrating at various power.
- RF Tx/Rx module is connected for finding the stick in close premises, for example, home. In the event that the stick is lost, a key is on the wrist band which on pressing will activate the buzzer on the stick which helps the person to locate the stick depending on the intensity of sound.
- A GPS module attached for area location sharing to the cloud. Location is updated every 20ms.
- GPS navigation will help the blind people to reach the destination.
- MQ2 gas sensor for detecting fire in the path or at home.
- A danger alarm is presented which helps the visually impaired individual from any first moving hindrances.
- This "smart Blindar "is cost effective.

III. COMPONENTS USED

A. Arduino Mega2560 Microcontroller (ATmega2560):

Arduino Mega2560 is a microcontroller based on the ATmega256[8]

The Architecture incorporates the –

i. 54 digital input/output pins (out of which 15 can be used as PWM outputs).
ii. 16 analog inputs.
iii. 4 UARTs
iv. USB connection,
v. power jack,
vi. Reset button.

B. Ultrasonic Sensor (HC-SR04):

Ultrasonic sensors (HC-SR04) depend on the estimation of the properties of acoustic waves with frequencies over the human audible range; regularly at around 40 kHz. They generate high frequency pulse of sound waves, then receive and evaluate the properties of returned echo waves [6]. The principle highlight of this sensor is that it has effective angle <15.

We utilize the Ultrasonic sensors for various detecting reason.

They are –

- Time of Flight (for detecting distance)
- Doppler Shift (for detecting speed)
- Amplitude Attenuation reason

a. TIME OF FLIGHT (TOF):

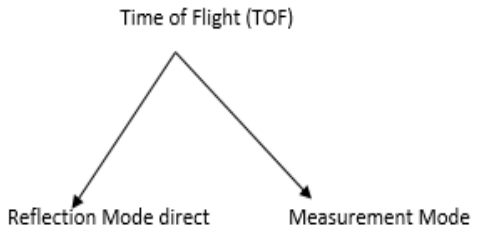
Time of flight (TOF) in sensors is fundamentally utilized for deciding the closeness of items. It figures the distance of the reflector utilizing the speed of sound in air and the emitted pulse and echo arrival times. Time of Flight (TOF) is the techniques for estimating the probable distance

between the sensor and obstacle based on the time difference between emitting signal from sensor and its return after hitting the obstacle.

$$r = c * t \quad \text{..... (i)}$$

Let,

R-distance
C-Speed of light
t- Time of flight



b. DOPPLER SHIFT:

Doppler Effect (otherwise called the Doppler shift) is a marvel which is observed when there is a relative movement between the source and the onlooker that outcomes in a change in the frequency of the waves discharged by the source. At the point when the source moves towards the onlooker, each progressive wave will be discharged from a position which is nearer to the spectator than the past wave.

$$v = (f * c) / (2fo * \cos\theta) \quad \text{..... (ii)}$$

f= Doppler frequency, fo= emitted frequency,

θ= angle between the ultrasonic beam and obstacle

At the point when the source moves from the onlooker, each progressive wave will be transmitted from a position which is farer from the onlooker than the past wave. As a result, the time required by the wave to achieve the onlooker continues expanding and thus the time between the entries of progressive wave's increments

C. MQ2 Smoke Gas Sensor:

Gas sensor module is helpful for gas spillage identification (In home and industry).It is appropriate for detecting H2,

LPG, Smoke or propane, Alcohol.

Because of its high sensitivity and quick reaction time, estimation can be taken at the earliest opportunity. The sensitivity of the sensor can be adjusted by potentiometer.

The features of MQ2 gas sensors –

- High sensitivity and Fast response.
- Wide range of use.
- Stable and Long life.

D.RF 433MHZ Rx/Tx Module:

The RF module works at radio frequency level. It contains of a RF receiver and RF transmitter. It varies from 30 KHZ to 300 GHZ. The preferred of RF over an IR module is that the signal is transmitted over a large area. It's appropriate for long distance application. In this system we are using Amplitude Shift Keying method. This RF operates at 433 MHZ range.

E.ESP8266 WI-FI Module:

The ESP8366 Wi-Fi module is an ease Wi-Fi chip with full TCP/IP stack and MCU (Micro Controller Unit) ability. It is a UARTs (Universal Asynchronous Receiver Transmitter). The ESP8266 is broadly to interface with any Wi-Fi system.

F.GPS Module:

GPS is known as Global positioning system. This module is equipped for accepting signs from GPS Satellites and gives the geological area with high precision.

D. Navigation:

Through microphone user gives the command where he wants to go. GPS will take the voice command and converted in to text command .Then it will calculate the root and navigate the blind people to reach the destination using TTS system.[5]

E. ALARM:

In our model we have utilized KY-006 small passive Buzzer module. The Buzzer module is electronic transducer which is used to deliver a caution sound in the scope of 1.5 KHZ- 2.5 KHZ sound alarm. A danger alarm is presented which the visually impaired individual from any first moving hindrances.

F. TTS system:

TTS is Text-to-speech synthesis module. Content to-Speech module is utilized to change over the coded message as an input to the module to an output from of human speech. In our venture we have utilized the EMIC-2 TTS module. It comes in 9 distinct voice and 2 unique dialects.

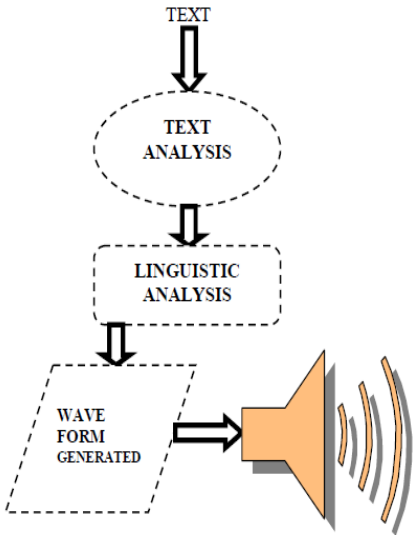


Fig.2 Flowchart of TTS systems

IV. MATHEMATICAL EVALUATION

The obstacle distance is figured utilizing ultrasonic sensors. The sensor sends a trigger pulse and echo beats.

Let, Threshold distance =$D_{thr.}$

While coding if the distance comes below D_{thr} the alarm system will activates.

Now,

Distance= ((pulse duration time x speed) / 2) *m……..(iii)*

Or, Distance = ((pulse duration time x 340) / 20,000) *cm*..(iv)

Or, Distance = ((pulse duration time / 2) /29.1) *cm ……..(v)*

C-speed of light (340 m/sec)

Time-echo time……..(a)

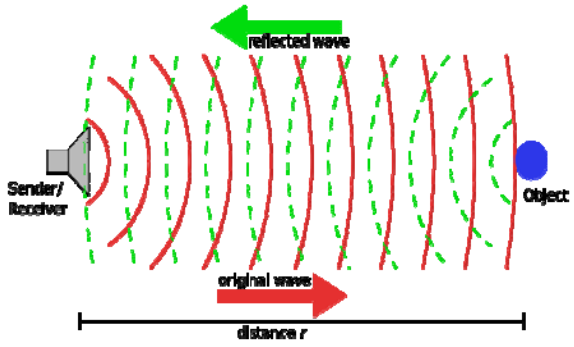


Fig3.ultrasonic trigger and echo waves

IV.FLOWCHART

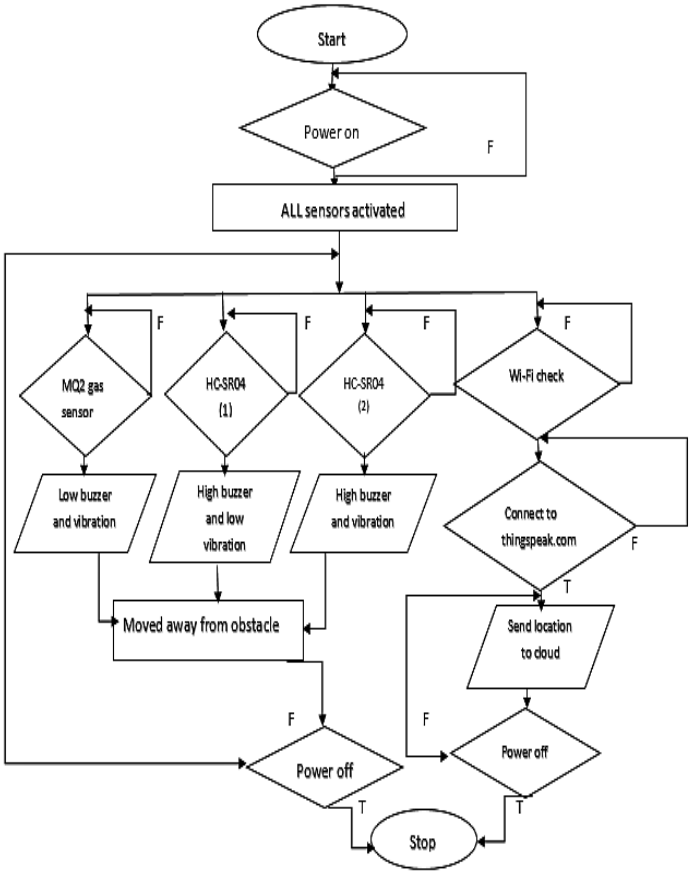


Fig4.Flowchart of "smart Blindar"stick

V. FUTURE SCOPE

The Internet of Things (IOT) is an extremely encouraging method. It is clarified as the system of genuine or virtual elements implanted with hardware, sensors and programming's with arrange network which empowers these elements to gather furthermore, trade information, in this manner giving availability at whenever. In a nation like India where the quantities of potholes are dispense with the ecological, social and navigational issues looked by the visually impaired and outwardly hindered individuals. The visually impaired needs a gadget which is keener, multipurpose, userfriendly furthermore, financially savvy. The "smart BlinDar" is an extraordinary decision and most reasonable contrasting option to white sticks and other ETA's.

We can use machine learning to detect the loose gravels and small particles.

V.RESULT

The HC-Sr04 ultrasonic sensor was tried. They were customized in Arduino IDE condition and the code was transferred to the microcontroller board. The edge remove
(Dtr) was set as 100cm.

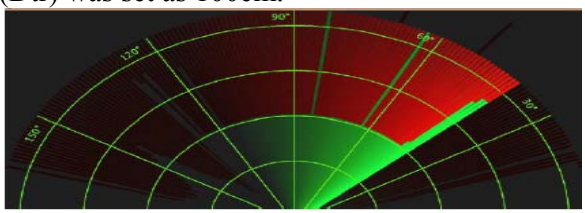


Fig5.HC-Sr04 Testing output

At the point when a question comes quite close to the limit esteem ; ready sound from bell was heard with a speech output 'Obstacle Ahead'. The handling IDE output is appeared in fig 5. The red lines show the deterrent is inside the limit separate.

At that point MQ2 gas sensor was tried. The limit estimation of smoke thickness was set and at whatever point the smoke thickness limit esteem was crossed, a ringer sound and vibration in wrist band with various power was detected with a speech output telling 'Fire ahead'.

The GPS module and ESP8266 Wi-Fi module was associated
to a Wi-Fi organize and was tried through AT charges.
The information from GPS module was additionally sent to the Thing Speak cloud. To reach the destination navigation will help by calculating the root with a speech output "go left/go right".

VI.CONCLUSION

In this paper, a point by point clarification about the "Smart BlinDar" keen stick has been given. With the presentation of this model, the life of the outwardly impeded will progress toward becoming substantially less demanding and free.The fundamental disadvantage of the visually impaired is that they deny themselves what they deserve."Smart BlinDar" encourages them in giving certainty and freedom. This item utilizes the innovation of IoT, which is one of the most requesting subjects in the present situation. It is userfriendly, effortlessly versatile and has multipurpose usefulness.

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