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Assistance Stick for Visually Impaired

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ABSTRACT

This device is an innovative stick designed for visually disabled people for improved navigation. This project proposes an advanced blind stick that allows visually challenged people to navigate with ease. The blind stick is integrated with ultrasonic sensor, fire sensor, water sensor and LDR and they are coupled with Arduino Uno R3 for processing proposes, and since the Arduino cannot produce sound output directly, APR9600 IC being used for providing sound output. It also contains a GPS & GSM module for location identification in emergency situations. This device will be a helpful solution to overcome their difficulties.

Keywords **-** Arduino UNO R3, Assistance Stick, GPS, GSM, Sensors, Visually Impaired

• INTRODUCTION

Blindness is a common disability among the population of the world. According to the World Health Organization (WHO) 285 million people are visually impaired worldwide, 39 million are blind and 246 have low vision. About 90% of the world's visually impaired live in developing countries. They need assistance to navigate outside and all other daily essential chores. So, the paper demonstrates a system that tries to remove the problem of blindness and make them self- dependent to do their daily chores, it is a walking stick, that is convenient to use by the visually impaired people. It is easy to maintain, affordable and it is very comfortable to use and provides user with a host of safety features and voice-based alerts for individual scenario. The power consumption is low and can be operated easily; overall the stick has greater functional features over the conventional one. The proposed device is a stick that consists of a circuit board that contains Arduino Uno R3, variety of sensors (Ultrasonic, Fire, LDR, and Water) [1], Speaker for alert, and GPS & GSM module for identification of the user location in case of emergency. The entire project is designed using Arduino Uno based upon its reliability. Arduino is a microcontroller which can do all the processing with great accuracy. Ultrasonic sensor is used to detect the object in front of the person by measuring the distance between the object and the stick. Fire sensor is used to detect any kind of sudden temperature change in the environment and if temperature rises above a predefined level, it alerts the person using the speaker. LDR is placed basically for the night purpose, if the person goes outside at night, it detects the vehicle's headlight and alerts the person. Water sensor is used to detect the wet surfaces, potholes while the person is walking, and generates a voice alert so that user can take precaution. GPS & GSM module is used to send the person's live GPS coordinate to the family members. It is operated by the user by pressing a SOS button if the user is in any kind of hazardous situation.[3]

• LITERATURE REVIEW

Blind people use a cane for they have contact with the environment, but this cane doesn't give all suitable information about the surrounding object; we can implement ultrasonic sensors and inform users by audio signals in the cane made it effective [1] For visually challenged people doing their routines would be the toughest thing. To make it finer, a traditional cane is converted into an assistive cane by penetrating an infrared sensor and Arduino UNO to it [2]. This system includes an embedded e-SOS (electronic Save Our Souls) system with an ultrasonic sensor and Arduino UNO.It works based on android application [3]. CMP compass sensor 511 is used to give information about the direction of wind flow. The output is sent as the sound, and the buzzer activates within the range of 3cm-150cm when the obstacle is detected with a speed of 0.3 sec [4].This model combines the three sensors Ultrasonic sensor, a Force sensor and a pressure sensor. The force sensor is attached to the individual shoe, measuring the distance between the stick and shoe. The pressure sensor helps to walk the individual if the

individual lost the grip on the stick handle. This trio makes the stick into an assistive one [5].It is hard to live a life with disabilities. To make blind people smart, so we are implementing so many sensors, which makes it a smart stick, which gives alarm when the user faces any obstacle and gives the audio command through speakers connect-ed by Bluetooth [6]. Travelling from one place to another place is hard for visually challenged people. They will face so many obstacles, stairs and so many crack s etc. IoT paradigm provides a medium between blind and environment. With the help of several sensors [7]. A Survey of Voice Aided Electronic Stick for Visually Impaired People. we got idea about latest technology like Graphics Positioning System (GPS) & Graphics System Messaging (GSM). Which will help for tracking the location & used for making module of smart stick for visually impaired people and it gives us idea about Voice message get from Android Phone to that blind person [8] Blind Navigation System Using Image Processing and Embedded System . We got idea from this paper for Navigation system has been developed which help to enhance mobility of blindness. This paper gives us idea for capturing live video of that person & grab video feed in front of blind person & this live video can be observe byadmin itself. [9] Smart Cane: Assistive Cane for Visually-impairedPeople. We got idea from this paper for Voice message & Vibration when person detect obstacle with help of smart stick then blind person get aware to it by understanding Vibration alert & Voice message which comes from smart phone. [10] Electronic Path Guidance for Visually Impaired People From this paper we got idea about the how range which is required for detecting obstacle or object from location of smart stick specific range is their we need to set threshold value if obstacle comes into that threshold range then it can detect successfully otherwise cannot. [11] Use of Ultrasonic Sensors in the Development of an Electronic Travel Aid so implementation and limitation of ultrasonic sensor. [12] Automated Mobility & Orientation System for Blind or Partially Sighted people From this paper we got idea about GSM, GPS of sensor like Integrated Ultrasonic sensor, Accelerometer sensor & IR sensor. Which one is more suitable & how they are perform & how they detect obstacle. [13] This paper is about providing a compatible solution for visually impaired people and help them to walk independently and confidently. The hardware elements included are Raspberry pi micro controller, obstacle detecting sensors, GPS module, speakers and other connecting components.[14] The smart walking stick helps blind people to perform navigation and to do their work easily and comfortably. In readily available devices the functionalities are not comprehensive. The device uses ultrasonic sensors to measure distance between objects. If any obstacle comes in front of blind person, he/she can know about the obstacle by hearing the sound generated by the head phone.[15]

- **METHODOLOGY**

We have tried to integrated a host of different features as discussed below.

- **ULTRASONIC SENSOR**

An ultrasonic sensor uses sound to perform a measurement. If an object (or in our example an ultrasonic sensor) produces sound, air molecules are pressed against each other and the energy move through the air particles. The distance between crest and trough of wave called frequency and is expressed in Hertz (Hz). The human ear is capable of perceiving sound frequencies from 20 Hz and 20 kHz. All frequencies from 20 kHz up to 800 MHz (800 million Hertz) are called ultrasonic sound and are not perceivable by the human ear. An ultrasonic sensor emits a sound pulse within the ultrasonic range, this sound pulse propagates at the speed of sound through air up to the moment of collision with a object. The reflected sound is then received by the sensor. By measuring the time, it takes for the sound to travel from sensor to object and back to the sensor, the distance to the object can be calculated very accurately. Fig 1 shows the ultrasonic sensor. [5]

Fig 1: ultrasonics sensor

- **FIRE DETECTION SENSOR**

A fire detection sensor can detect the light from the fire. It is based on the wavelength mechanism. The fire sensor responds to the wavelength by sensing it. Receiver of the sensor uses the (EM) electromagnetic radiation principle. It absorbs the radiation from the fire and responds to it. Fire sensor operation is accurate and quick compared to smoke sensors. You can detect Light from fire up to a distance of 60cm. Fire detection sensors usually have negative temperature coefficients which means that the resistance of the sensor decreases as the temperature increases and the speaker is used for giving the output. If the sensor detects the heat radiation it will send an electrical signal to the Arduino and thus voice alert will be generated. A photodiode is used to detect presence of fire. In the ambient light, it passes only 0.84v through it to the Emitter of the PNP transistor. When more light strikes photodiode it conducts larger amount of current. As shown in Fig 2 [8]

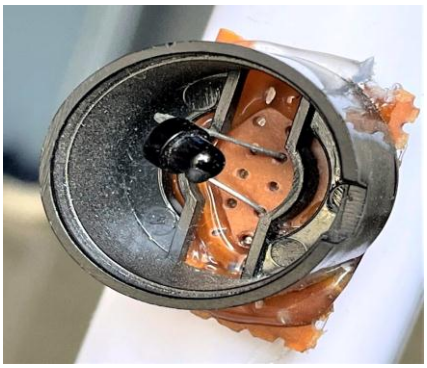

Fig 2: fire sensor

- **GPS AND GSM MODULE:**

The GPS and GSM based location tracking system helps to send SOS messages and track the blind person's location in case of emergency. By pressing the SOS button, the emergency message will be sent to the friend or family member of the person holding the stick along with live GPS coordinates (latitude and longitude).

The GPS module helps to pinpoint the exact location of the blind person and the GSM/GPRS module will be used to send the SMS along with the location to the emergency contact number. Arduino Uno R3 is used to process all the components and data. As shown in below figure.

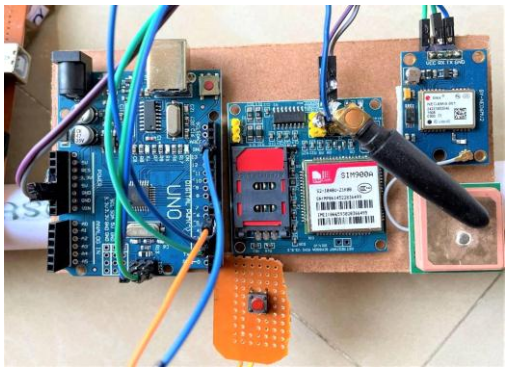

Fig 3: GPS & GSM modules

It contains several components listed below:

- NEO-6M GPS Module
- SIM900A GSM/GPRS MODULE
- **WATER SENSOR**

Water sensor in this device is used to alert the user regarding the presence of water in the vicinity or potholes. The industrial water level sensors are expensive and require larger power supply to operate, so this project comes with an alternative to this problem by using a solution that works on short circuit concept. Two thin metal plates which are connected to the circuit and when the metal plates come in contact with water the circuit gets complete thus current flow initiates so the alert Is generated by the voice module present on the device. [12]

- **LDR SENSOR**

LDR Sensor is integrated in this device to solve the problem of identifying approaching car in the night. So LDR (light dependent resistor) basically passes a low voltage current in the dark but when a high intensity beam of light such as headlight of a car shines on it, this causes the device to pass larger voltages, which can trigger an alert. LDR is connected to analog pin of Arduino since Arduino contains ADC (analog to digital converter) so it converts the analog voltage to digital values which further generates the sound alert with the help of APR 9600 IC.[8]

- **BLOCK DIAGRAM**

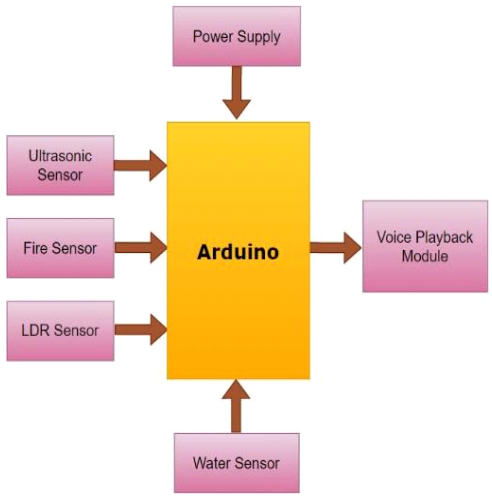

Fig 4: block diagram of main circuit

From the above displayed block diagram, the basic of the device working can be seen. We have Arduino Uno r3 as the processing component of this device along with it can be observed that we have a power supply circuit for providing regulated power to the circuit. The device also has a voice playback module to provide voice-based alerts to the users. The device has a host of sensors such as ultrasonic, fire, water, LDR sensors for providing alerts based on different scenario. As shown in Fig 4.

Fig 5: block diagram of GPS and GSM functionality

The device also has GPS and GSM functionality to alerts family members in case emergencies. The circuit has a Arduino Uno R3 as a processing component. A GPS and GSM boards. A power supply for regulating power delivery and a SOS button for sending alerts. As shown in Fig 5

- **EXPERIMENTAL SETUP**

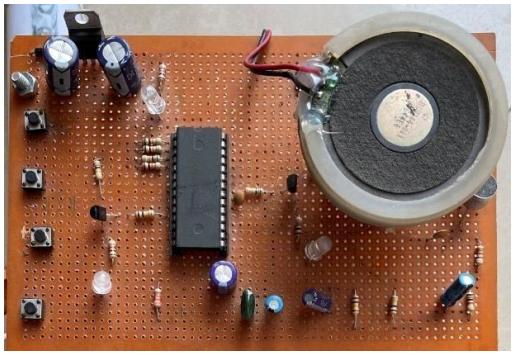

Fig 6: circuit of APR9600 IC

The sensors provide feedback to Arduino but the Arduino is incapable of generating sound output directly. So, the device uses APR9600 IC along with 4 switches for independent sensors which correspond to unique alert for each sensor. So, when Arduino receives feedback from a particular sensor it sends the signal to APR9600 to activate the corresponding switches which generates the sound output for that particular sensor.

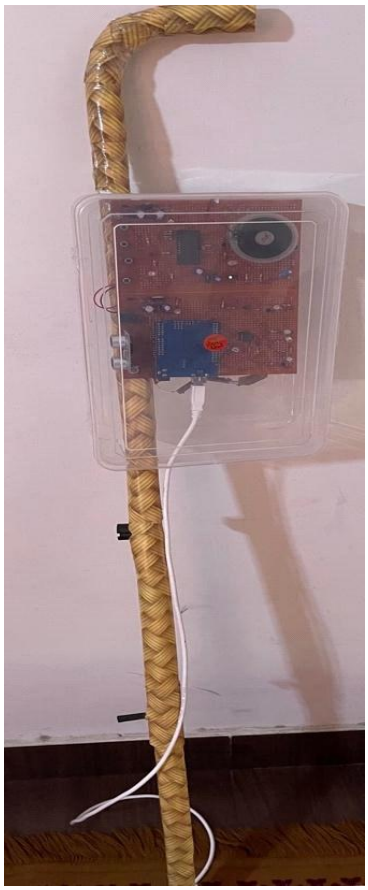

Fig 7: final device

- **RESULT AND CONCLUSION**

Every individual in the world has to lead their life comfortably. But, some of them lack their activities due to their disability. They overcome this with the usage of technology. This device proposed an idea that everyone can lead their life independently. This device makes every blind individual do their routines by themselves. They can be able to go to their destinations easily by using this device. The smart stick is lightweight, portable to use, affordable in terms of cost, and an ecofriendly device. This device is very effective and unique among all the implementation of smart guidance devices. It covers 180 degrees of an individual, senses each obstacle and hazard situation, and provides an immediate response to the individual. In addition to it, it has some special sensors which guide and protect from accidents. In case of any emergency the person can press the SOS button and with the help of GPS and GSM modules the emergency message will get generated and will be forwarded to the family members of the person.

As a result of our efforts in exploring this opportunity to work on something that will make life easy of the visually impaired. We have made a device that is capable of successfully guiding a visually impaired person in any surrounding and the user can rely on the feedback of the device because of the durable components used in the setup.

Due to the use of off the shelf components the range of this device is not as much that was expected but it can be improve with the help of advanced technology. Same goes for the size of this device. Overall, this Assistance Stick for Visually impaired proposed the concept of self-dependency and we believe that the advancement in technology in the upcoming years will further enhance the properties and range of this device.

As for the concern about finding the SOS button it is provided at grip of the stick where the natural position should be.

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