International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
***Article Received**: 28 April 2023 **Revised:** 15 June 2023 **Accepted:** 28 June 2023*

Empowering the Visually Impaired: Arduino Mega Enhanced Accessibility Device

S. Irin Sherly[1], P. M. Kavitha[2], S. Jayachandran[3], M. Robinson Joel[4], R. Jeena[5]
[1]Department of Information Technology
Panimalar Engineering College
Chennai, India
irinkutty@gmail.com
[2] Department of Computer Applications
SRM Institute of Science and Technology
Ramapuram, Chennai, India
pmkavimca@gmail.com
[3]Department of Computer Applications
SRM Institute of Science and Technology
Ramapuram, Chennai, India
jai.nov86@gmail.com
[4]Department of Information Technology
Kings Engineering College
Chennai, India
joelnazareth@gmail.com
[5]Department of Artificial Intelligence and Machine Learning
Saveetha School of Engineering
Chennai, India
rjeenait@gmail.com

Abstract People with vision impairments find their life to be so difficult that they must rely on others even for the most basic tasks. When a user is in trouble, the developed system may identify obstacles and persons, play an audio message, and notify the carer. It delivers auditory output in order to help blind individuals recognise persons and text using Open CV and face recognition. Real-time image processing requirements are met by using a small amount of memory and extremely little processing time. The suggested system delivers a very competitive performance that matches the advantages of portability and ease of use, according to the performance comparison.

Keywords- Vision-impaired people; GPS tracker; GSM; Person Identification; Text Identification.

I. INTRODUCTION

As the population of blind people grows, the problems faced by them also soars. In 2015, approximately 36 million people were blind, in 2020, the rate increased to 39 million and currently 1 billion of world's population is blind [7] [22]. The interaction of blind people with their immediate surroundings is often challenging [6]. The life of blind has always been strenuous, they always require a constant assistance from others to even carry out a simple task, from the time they wake up to the end of the day. These assistances are provided by people, dogs, etc. Nowadays these assistances take different forms like electronic devices, IOT and embedded devices [11] [17].

In today's technology enhancements the needs of the blind are being met, making their life simpler day by day. The Braille system was introduced to make reading easy for the blind now, the technology provides the necessary means to help them get on with their daily task. Latest technologies have made blind people's life progress with number of smart gadgets, which helps them with their education, daily activities and other tasks. The purpose of this work is to present a tool that will aid blind persons in navigation [19] and obstacle detection [16].

The proposed system comes with a number of sensors to detect the object, people or any obstacles like fire, water in the way of the blind. By integrating an ultrasonic sensor [20] [25] and microcontroller system into a walking stick, we plan to deliver a working model [26]. Through the application of ultrasonic waves, the ultrasonic sensor can identify impediments. When the sensor notices obstructions, it transmits the information towards the microcontroller. The data are analyzed by the microcontroller, which then determines whether the blockage is close enough. The system is attached with alert system which helps them to notify the caretakers of the status of blind people. It also

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
***Article Received**: 28 April 2023 **Revised:** 15 June 2023 **Accepted:** 28 June 2023*

provides person identification and text identification with the help of camera. The circuit does not work if the obstruction is too far away. A microcontroller will transmit a signal of alert to the blind person if an obstruction is nearby. The blind person taps a button on the stick to call a family member whenever they experience any difficulty while navigating [7]. Additionally, many aspects of human activity have made use of the GSM-GPS [1] [19] [22] module, including the management of visually impaired individuals moving on foot and the routing of automobiles. This has allowed them to avoid obstacles and arrive at their destination [23]. In this way, rather than relying on the use of vehicles, it provides a further guide to assist the blind in efficiently obtaining assistance through the usage of GSM and GPS .for the area following method [21].

On the way to assist and alert persons who are blind of potential dangers and to offer location data, researchers have been working on developing an intelligent and smart stick for decades. Research has been done on new gadgets over the last few decades to develop a noble and trustworthy system for visionless people to recognize barriers and notify them on risk spots. The primary goal of the system is cost reduction and improving the situation for people who are blind. The usage of the device will provide the necessary support for the blind without the need of constant assistance from others.

The left behind part of the paper is ordered as follows: Section 2 defines associated survey of our planned system. Methodology is described in section 3. Outcomes are discussed in section 4. Conclusion and future enhancements are defined in section 5.

II. RELATED WORKS

Patil et al. [1] proposed smart blind stick in which system works using the GSM and GPS. It has microcontroller connected to various sensors. This technology is designed to recognize obstacles and transmit the user's current location in the event that they stray from their planned location. Every time a blind person encounters an obstruction, a buzzer notifies him to it. If there is emergency, the individual's precise location is recorded by GPS and relayed to the care taker via the GSM module. The microcontroller and various modules are constantly in communication with one another.

The stick that Shravan et al. [2] suggested is designed to serve as both an false vision and alert system. The method consists of five components: an ultrasonic sensor, a vibrator motor, a water sensor, a light LDR sensor, and a microcontroller that converts the inputs from the sensors into short pulses and transmits them to the Arduino pins that are linked to buzzers, vibrators, and voice alerts. A mobile device with GPS navigation can help the blind find new and unfamiliar places.

An assistive smart-stick for people with visual impairments was created by Biswas et al. [3]. The system uses an ultrasonic sensor to help blind individuals discover impediments like dumps and staircases, and a sensor to detect fluid. A buzzer on the stick sounds when an obstruction is detected.

Yerkewar et al. [4] established the model of implementation of smart stick for visually disabled people. It comprises microcontroller and sensors such as ultrasonic and water sensors. The system contains GSM and GPS for finding location of blind person when he is in danger situation.

Saranya et al. [5] advanced the system with smart navigation system in which the system contains microcontroller and sensors such as ultrasonic and water sensor. The system's key goal is to give an effective navigational support to visionless people that give them a sensation of vision by providing evidence around their environments and nearby things.

Shreya Singh et al. [7] presented the clever sightless rod for blind people in which various sensors are used to detect the obstacles. It uses pothole detection and obstacle detection to improve the accuracy level to determine obstacle. The expected model is created with Arduino UNO microcontroller. The aid-stick is cheap and weightless. The stick comes equipped with three ultrasonic sensors aimed at locating barriers and one ultrasonic sensor for spotting potholes. The Android software connects to ultrasonic sensors to alert users about potholes and obstacles.

Tirupal et al. [8] came up with smart blind stick using ultrasonic sensor which receives and sends echo waves and calculate time between them. An Arduino mega microcontroller is used in proposed system which is highlighted. An Arduino Mega attaches an ultrasonic sensor on a stick in order to attempt to detect any obstructions in the way. The receiver's production serves as input to the microcontroller once the sensor detects an obstruction, allowing the microcontroller to detect this change.

Oladayo [9][28] proposed an enhanced and advanced multidimensional voice-guided ultrasonic sensor network walking assistance for blind people. The model suggests the multifunctional stick with voice guidance and it uses different sensors to detect the obstacle and warns them with voice module. A microcontroller used here is Arduino UNO. The addition of a warning light and voice direction signal that are transmitted to a tiny headset enhances the

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
***Article Received**: 28 April 2023 **Revised:** 15 June 2023 **Accepted:** 28 June 2023*

performance and functionality. The recorded voice informs the user of the obstruction's existence and/or directions. The multidimensional walking aid prototype could detect obstacles to the left, right, and front of the stick at a distance of 0 to 1 meters and sound the relevant audible alarm. The stick's ability to properly instruct its user was shown by the prototype's test results.

Astitva et al. [10][29][32] presented the ultrasonic blind stick with GPS and GSM tracking system in which the model is created with sensors and it uses GSM and GPS for the location detection. The proposed system uses vibrator to alert the user to be aware of obstacle. A microcontroller used here is Arduino UNO. The GPS sensor has been created and developed in such a way that, based on the place it can access, it can provide an idea of the optimal route. The incredible option of selecting sites from a list of locations that have been saved in the system's database has been made available to the user. Ultrasonic sensor, GPS, and GSM tracker have all been used in this stick-style tracker. The device's overall objective is to offer a more secure and comfortable way for those who are blind to get around obstacles in daily life.

Suleiman et al. [12] suggested the progress of hindrance and ditch identifying ultrasonic rod for the sightless. The model uses ultrasonic sensor to detect obstacle and pit. For system control, ultrasonic sensors and an Arduino microcontroller were coupled. Collision rate test is implemented to differentiate the collision rate between conventional stick and ultrasonic walking stick [34]. The system is made up of both hardware and software. A blind person can depend on the ultrasonic walking stick for household use.

Blind or visually impaired people can use an ultrasonic sensor incorporated into a walking stick to identify obstacles in their path using the system of smart walking twig for blind people utilising Arduino suggested by Chiranjevulu et al. [13]. It will warn a visionless individual to stay clear of any obstacles and offer the warning in the form of a voice module every day in numerous aspects, enabling folks to walk freely and securely. This blind stick makes walking more secure. For usage by blind individuals, the stick has a second LDR sensor that can distinguish between day and night. The speech module is wired to the Arduino pins on the microcontroller transforms sensor signals hooked on brief pulses.

Varghese et al. [14][31][27] brought forward the smart cane for visually impaired people; the white walking stick is presented as a solution that should assist those who are blind in identifying hazards when walking and creating threats in the environment. The device is designed to serve as both an alarm and an image processor. A buzzer and vibration motor are connected to a water sensor, an ultrasonic sensor, and an Arduino microprocessor, which also receives and short-circuits signals from all of these sensors. When a person is missing, a GPS-GSM module is utilized to transmit SMS location messages to an extension phone. IoT-based animal penetration monitoring was added to Irin Sherly et al.'s system. The fauna is photographed with the use of a camera. Along with the alarm, a GSM alert is received telling the forestry department that a creature has been discovered in [30].

III. MATERIALS AND METHODS

In the proposed system, the use of gyroscope sensor enables angle finding and sends an automated alert to the caretaker using GPS and GSM module in case the user falls. The Open CV and Face Recognition library is used in person and text identification. It performs person identification by capturing the image of the person and matching it with the images of people. Text identification is performed by taking the copy of the text and reading out the text from the image in terms of audio output. To make the system efficient the above features is combined with multiple sensors like ultrasonic, IR sensor and sensor to the Arduino Mega Board. The devised system combines all the useful features of existing systems into a single system for the benefit of the vision-impaired people.

A. Working

The system's central element is an Arduino Mega, which also consists of the following elements such as Ultrasonic sensor, IR sensor, Moisture Sensor, also Gyroscope sensor. Ultrasonic sensor identifies the object, person or any obstacle that the user faces and it uses camera for person identification. After detecting the person through camera, it lets the user know who the person is by speaker through APR voice module which relays a recorded voice.

The camera also captures the text from a book, paper, mobile, etc., and converts into speech. The IR and Soil Moisture sensors intimates the user of any fire and water related. Gyroscope sensor uses angular velocity to identify in case the user falls. As soon as the obstacles are encountered by the above mentioned sensors, it intimates the user of the impending obstacle through vibration motor where the user senses the vibration, hence vibration motor and APR voice module both cross checks the safety of the blind person. A GPS as well as GSM unit is used to SMS the caretaker where the person is.

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
***Article Received**: 28 April 2023 **Revised:** 15 June 2023 **Accepted:** 28 June 2023*

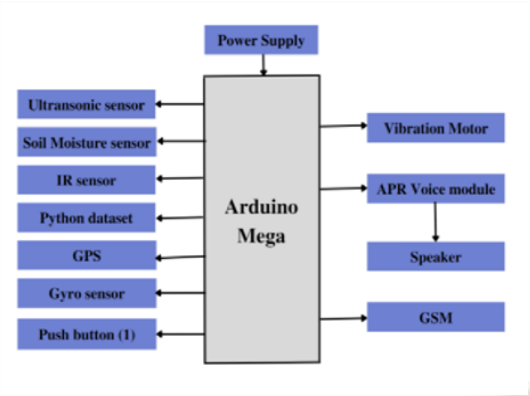

Figure.1 A schematic diagram for the suggested system

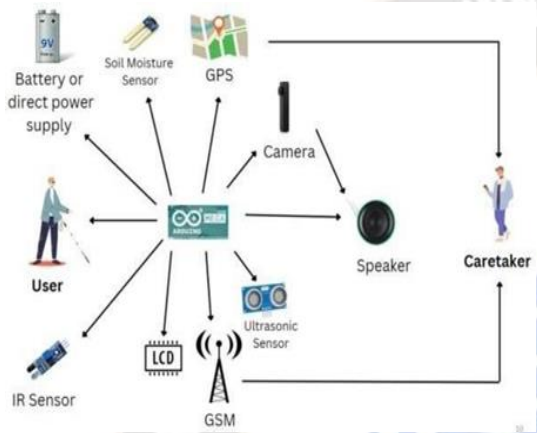

Figure.2 Architecture of Working System

There is a buzzer [24] or push [15] button which when pressed by the user sends a manual alert to the caretaker through GPS and GSM. The automated alert is send to the caretaker in case the user is met with an accident. All the mentioned components are interfaced with Arduino Mega Board with a direct power supply.

B. Proposed System

1) Identification of Location

The Global Positioning System (GPS) uses signals from satellites in space and ground stations on Earth to pinpoint its exact location. This component is given to find the location of the user. The live status of the user is found using the GPS module. If the user is met with an accident then the location is sent immediately and on the face of any threats, the user can intimate through the push button which sends the location to the caretaker.

2) Detection

The detection is carried out by the sensors i.e., ultrasonic, IR and soil moisture sensor of the impending obstacles such as object, person, fire, water, etc. The person and text identification is carried out using camera.

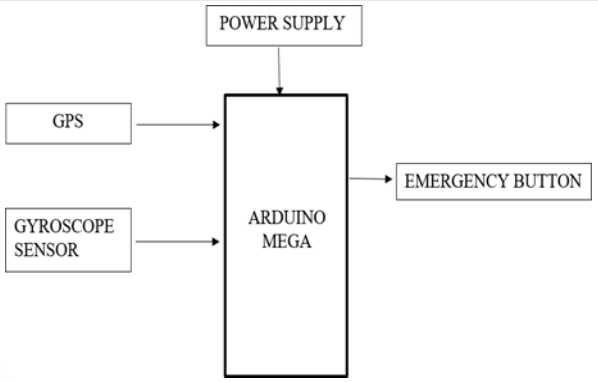

Figure.3 Block chart for Identification of Location

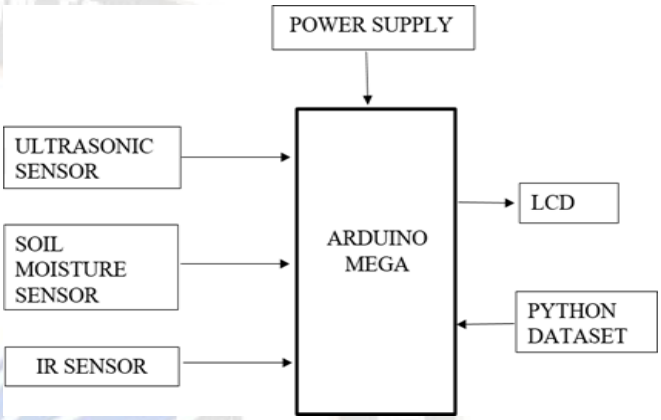

Figure. 4 Block chart for Detection

3) SMS module

Short Message Service (SMS) enable a person to send and receive messages. In this system the GSM is coupled with GPS module that enables to send the location via text message. Whenever the user falls or presses the buzzer button the messages will be automatically sent to the caretaker. The caretaker receives a SMS through GSM that intimates the location of the blind where about.

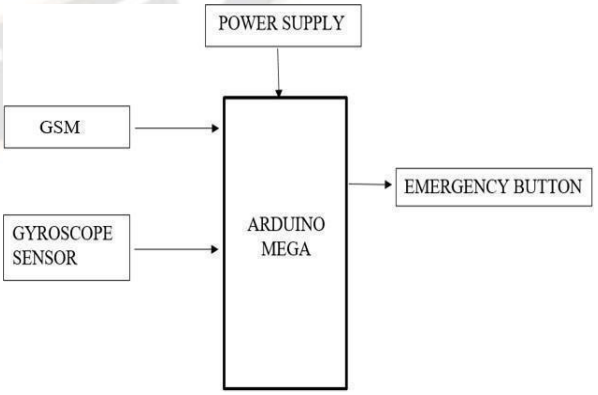

Figure.5 Block chart Diagram for SMS

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
***Article Received**: 28 April 2023 **Revised:** 15 June 2023 **Accepted:** 28 June 2023*

4) Intimation

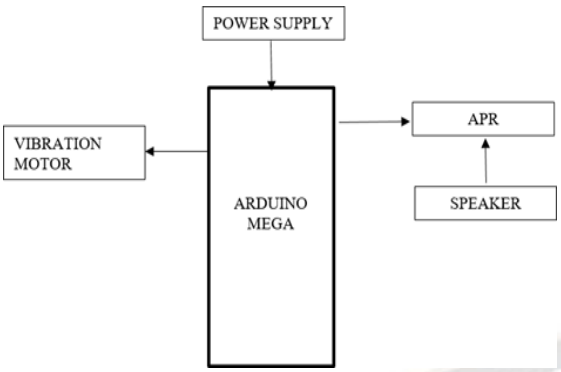

Figure.6 Block chart for Intimation

APR voice module and Vibration motor intimates the user of the obstacles in their horizon. The speaker plays the recorded voice which alerts user who the person is. The vibration motor vibrates every time the sensors i.e., ultrasonic sensor, IR sensor and soil moisture sensor senses the respective obstacles.

C. Sensors

1) Arduino Mega

Figure. 7 Arduino Mega2560

An open-source microcontroller board called the Arduino is built around the Atmega 2560 CPU is shown in Figure 7 [1]. The ATmega2560, an 8-bit microprocessor, is what it is. The Arduino programming language is built upon the popular and widely used programming language C++. It has 54 digital input/output pins, of which 15 can be used as PWM outputs, 16 analogue inputs, 4 hardware serial ports (UARTs), a 16 MHz crystal oscillator, a USB connector, a power jack, an ICSP header, and a reset button [27]. The main advantage of this board is its enhanced processing power, which enables us to manage many sensors at once [27]. As a result, this panel's power supply can be accomplished by using a USB cable to link it with a PC, a rechargeable battery, or a DC to AC adapter. This board can be protected against an unwanted spark with a base plate.

2) Moisture Sensor

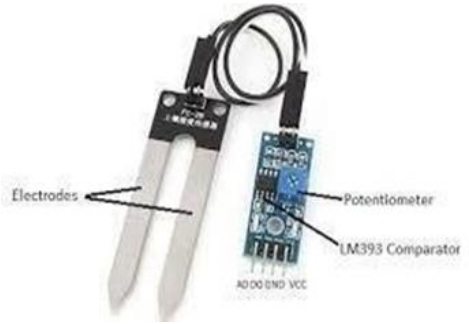

Figure. 8 FC-28 Moisture Sensor

The soil moisture device [16] can be used to determine the moisture content of the soil. When the soil lacks water, the module's output is high; otherwise, it is low. This sensor can be used to irrigate any plants that require automatic irrigation, including flower plants. Soil moisture sensors calculate how much water is present in the soil. Soil moisture sensors use another characteristic of the soil, such as electrical resistance, dielectric constant, or association with neutrons, to determine the amount of water in volume of the soil as described in Figure 8.

3) Ultrasonic sensor

Figure.9 Ultrasonic sensor HCSR04

Ultrasonic sensors operate on a similar basis to radar and sonar, which determine a target's characteristics by analyzing the echoes of radio or sound waves, respectively as in figure 9. These technologies are also referred to as transceivers when they send and receive data [11]. Ultrasound sensors produce high-frequency sound waves, which they then decode by listening for echoes. To calculate the distance to an object, the sensors compute the time elapsed between the signal's emission and reception of its echo. Tank capability, either water or air velocity, the direction and speed of the wind can all be determined by this method. A gadget employs many detectors to measure the velocity or direction and calculates the velocity based on the distances between airborne or submerged particle targets. To determine the volume of fluid in a chamber, the sensor processes the remoteness from the fluid's surface. Additional

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
Article Received: 28 April 2023 Revised: 15 June 2023 Accepted: 28 June 2023

presentations include sonar, medical ultrasonography, burglar alarms, humidifiers, and non-destructive evaluation. Most systems use a transducer that transforms electrical energy into sound waves in the ultrasonic range, reaching 20,000 hertz. The transducer then converts electrical energy into sound waves that may be measured and displayed after receiving the echo. Surface geometry, material density is limitations of the method. For illustration, foam on a liquid's surface in a tank could cause a reading to change.

4) IR sensor

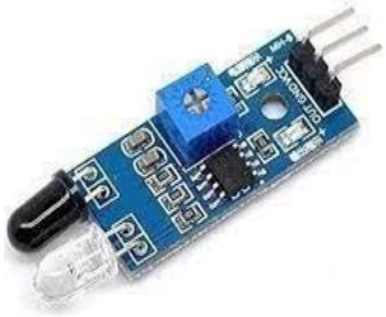

Figure. 10 Infra-red sensor

A sensor is an electronic device that emits infrared light for identifying a certain aspect of the environment [5]. The motion and heat of an object can be detected using an IR sensor. These sensors, often known as passive IR sensors, just measure infrared radiation rather than emitting it. The majority of items emit some form of infrared heat radiation. Despite being undetectable to the human eye, these radiations can be detected by an infrared sensor. The detector is merely an IR photodiode that is capable of detecting infrared light of the exact same spectrum as that emitted by the IR LED, and the emitter is just an IR LED. The amount of IR that reaches photodiode then strikes it directly affects the resistances and these output voltages.

5) Vibration sensor

Figure.11 Vibration sensor

A vibration sensor [18] is an unidirectional highly sensitive sensor. The circuit will get severed when there is motion, and its final result will drop. To suit your preferences, you can also alter the sensitivity concurrently. The sensitivity can also be changed concurrently to suit your own requirements. The vibration switch that opens when vibration is detected and closes when there is no vibration.

6) Gyroscope sensor

Figure.12 Gyroscope sensor

A gyroscope device is an instrument that can gauge while maintaining track of an object's rotation and velocity of motion. Compared to accelerometers, these are more new. Although they can only track linear movement, accelerometers can assess an object's tilt and horizontal orientation. The terms "angular rate sensor" and "angular velocity sensor" are also used to refer to gyroscope sensors. When it is challenging for human beings to determine an object's orientation, these sensors are used. The change in the object's rotational angle per unit of time, measured in degrees per second, is known as angular velocity.

Table: 1 location tracking, water and flame detection

Coding for location tracking, water and flame detection
void loop() {
reading_data();
if (button == 0) { a.clear(); a.setCursor(0, 1);
a.print(" EMERGENCY "); gsm("6385112364", "~~~LOCATION~~~");
}
if (ir == 0) { a.clear(); a.setCursor(0, 1);
a.print(" FLAME DETECTED ");
digitalWrite(VIB_MOTOR, HIGH); delay(3000); digitalWrite(VIB_MOTOR, LOW);
}
if (soil == 0) { a.clear(); a.setCursor(0, 1);
a.print(" WATER DETECTED ");
digitalWrite(VIB_MOTOR, HIGH); delay(3000); digitalWrite(VIB_MOTOR, LOW);
}
gyro();
if (GYX > 10 && GYX < 30)
{
a.clear(); lcd.setCursor(0, 0);
a.print(" BLIND PERSON "); lcd.setCursor(0, 1);
a.print(" FELL DOWN ");
gsm("6385112364", "~~~BLIND PERSON FELL

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
***Article Received**: 28 April 2023 **Revised:** 15 June 2023 **Accepted:** 28 June 2023*

```
DOWN~~~EMERGENCY ... ");
    }
    delay(1000);
    }
```

IV. RESULTS AND DISCUSSION

A. APR voice

The Apache Portable Runtime (APR) library is needed to operate the Apache web server. It provides numerous APIs that are specially designed for different operating systems. APR will offer an emulation in cases when the operating system lacks a specific function.

B. Algorithm

This algorithm includes the combination of multiple modules which is used in detecting the obstacles and intimating it through voice. The sensor inputs are taken in terms of 0s and 1s and passed into Arduino board for computation. The computation involves flagging the input of the sensors false and if a particular sensor detects any obstacle it is flagged to true and the output is printed. The data from external device is passed through the interface i.e., the TTL which is passed to the Arduino and in turn to APR module that gives voice output. Whenever the flagged input for IR, ultrasonic and soil moisture sensors are true, the vibration motor vibrates.

C. Open CV framework and face recognition module

Open CV is the most extensively used computer vision library and it is open-source. It is an image processing technique used to recognize faces, objects, and so on. Open CV includes a face recognizer, which includes face recognition techniques and also contains an already trained Cascade Classifier fro face detection. In this system, Open CV is used for image capture, scaling, and other preprocessing. A face recognition module is used to recognize and change faces. This module is used to find an individual within a crowd. The library compares two faces by turning the characteristics into Euclidean distances.

An easy to use interface facilitated for face revealing is provided by python library. In order to use face_recognition library one need to install dlib library also which contains numerous machine learning tools and algorithms. The face_recognition library has numerous functions or methods that automatically helps to detect face features i.e., eyes, nose and mouth. If fed images it would recognize faces among a group of people, objects, etc., In the proposed system, the usage of Open CV, face_recognition and dlib library is prominent which is used for processing of image followed by detecting the face and recognizing it. An images of a person is fed along with their name which then recognizes them with their name whenever the person appears.

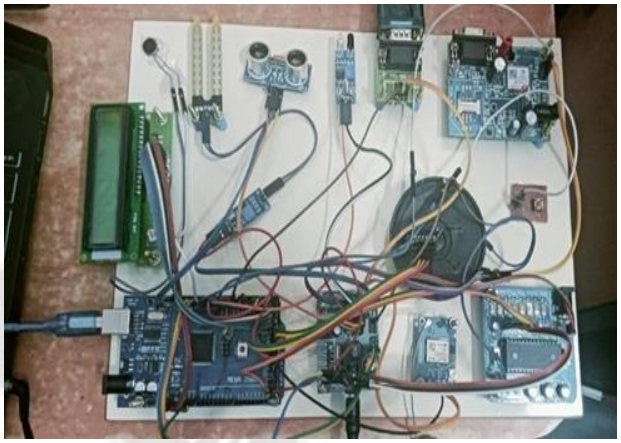

Figure.13 The proposed system before sensing object

Figure 13 describes the proposed system before sensing the object where arduino mega microprocessor is connected with all the sensors, pushbutton and battery. It is shown that the circuit when object or person is not sensed and displays nothing.

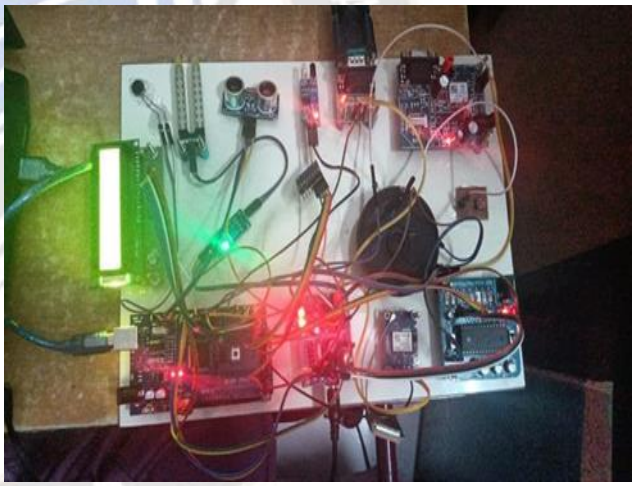

Figure. 14 The proposed system after sensing object

Figure 14 describes the proposed system after sensing the object where arduino mega microprocessor is microprocessor is connected with all the sensors, push button and battery. It is shown that the circuit when object or person is sensed and displays and warns that object is presented near the blind person.

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
***Article Received**: 28 April 2023 **Revised:** 15 June 2023 **Accepted:** 28 June 2023*

Figure 15. Location and emergency message

Locating the blind individual and sending an emergency message to the caretaker. It is demonstrated that the caretaker is sent the location of the blind individual. Along with the position of the blind person who is in danger, the emergency message about the blind person is also transmitted to the caretaker when they fall.

V. CONCLUSION

Vision-impaired people find their lives taxing that even to carry out a simple task they need to depend upon others. The usage of our device will provide the necessary support for the blind without the need of constant assistance from others. We have compared multiple existing system and provided an optimized way to overcome the hurdles that were encountered. The proposed system implements person and object identification and automated fall alert system which were not present in the existing system. In the proposed system whenever the user approaches near an object the device vibrates, in future we can intimate the user using audio output of what object it is. The system can be made more efficient by using Raspberry Pi.

REFERENCES

[1] Patil, Sneha, Uday Patil, Pratik Patil, Najim Mullani, Sangram Bhosale, and N. S. Jadhav, "Smart blind stick", International Research Journal of Modernization in Engineering, Technology and Science (2022), pp: 3245-3250.

[2] Mohite, Shravan and Patel, Abhishek and Patel, Milan and Gaikwad (Mohite), Vaishali, " Smart Walking Stick for Visually Impaired People", October 29, 2018.

[3] M. Biswas et al., "Prototype Development of an Assistive Smart-Stick for the Visually Challenged Persons," 2022 2nd International Conference on Innovative Practices in Technology and Management (ICIPTM), 2022, pp. 477-482, doi: 10.1109/ICIPTM54933.2022.9754183.

[4] Yerkewar, P. N., Diksha Vaidya, Nikita Bandhekar, Ragini Jadhao, and Vaishnavi Nile. "Implementation of smart stick for blind people", International Research Journal of Modernization in Engineering Technology and Science, Volume:04, Issue:04, April 2022.

[5] Setty, Sreenivasa, A. Chetan, D. Dinesh, I. S. Dhanik, and

[6] K. Maruthi. "Object recognition and localizing for blind people." International Research Journal of Modernization in Engineering Technology and Science, Volume:04, Issue:07, July 2022.

[7] Saranya, R., M. Devaki, K. Keerthika, S. Jaswanthra Samyuktha, and T. Aarthy. "Smart navigation system." International Research Journal of Modernization in Engineering Technology and Science, volume:04, Issue:08, 2022.

[8] Shreya Singh, Sneha Singh, Sudhansu Shekhar," Smart Blind Stick For Visually Impaired People", IJCRT, Volume 6, Issue 2, April 2018.

[9] T. Tirupal, B. Venkata Murali, M. Sandeep, K. Sunil Kumar, C. Uday Kumar," Smart Blind Stick Using Ultrasonic Sensor", Journal of Remote Sensing GIS & Technology, Volume-7, Issue-2 (May-August, 2021).

[10] Olakanmi O. Oladayo, "A Multidimensional Walking Aid for Visually Impaired Using Ultrasonic Sensors Network with Voice Guidance", I.J. Intelligent Systems and Applications, 2014, pp:53-59

[11] Astitva Awasthi, Gagan Sharma, Babeet, Shreya Agrawal," Ultrasonic Blind Stick with GPS and GSM Tracking", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 10 Issue I Jan 2022.

[12] Rahul Johari, Nitesh Kumar Gaurav, Sapna Chaudhary, Apala Pramanik," START: Smart Stickbased on TLC Algorithm in IoT Network for Visually Challenged Persons", IEEE,2020.

[13] Suleiman A. Yahaya, Lydia J. Jilantikiri, Gbenga S. Oyinloye, Emmanuel J. Zaccheus, Joy O. Ajiboye and Kareem A.Akande, "Development of obstacle and Pit detecting ultrasonic walking stick for the blind", Journal of Engineering and Technology, Volume 4, Issue 2,September 2019.

[14] D. Chiranjevulu, D. Sanjula, K Pavan Kumar, U Bala Murali, S Santosh Kumar, K Komali, "Intelligent Walking Stick for Blind People Using Arduino", IJERA, Vol. 10, Issue 03, March 2020.

[15] Anjaly Treesa Varghese, Iyrin Sara Varghese, Shilpa Susan Binu, Rekha Subash," Smart Cane for Visually Impaired People",IRJET,Volume:08 Issue:07, July 2021.

[16] Ms. A. Indu, Mr. B. Neel Kamal, Ms. CH. Udhayini, MR. S. Sivaiah, " Arduino based Safety Device for Visually Challenged", IRJET, Volume: 07, Issue: 05, May 2020.

[17] Sai Supreeth YK, Raghuvarya S, Shwetha Baliga," Enhanced Smart Cane for the Blind" IRJET, Volume:07, Issue:05, May 2020.

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 8s
DOI: https://doi.org/10.17762/ijritcc.v11i8s.7223
***Article Received**: 28 April 2023 **Revised:** 15 June 2023 **Accepted:** 28 June 2023*

[18] Harshita Shetty, Richa Khade, Rohini Bhosale, " Design and construction of Arduino based aid for visually impaired people", IRJET, Volume: 07 Issue: 05, May 2020.

[19] M. Ghana Shyam, Shravan kumar G M, Ashabee, Kodal Ashwini, Ravi Kumar H M," Blind guide stick using GPS and GSM module", IRJET, Volume: 07 Issue: 06,| June 2020.

[20] C.Banupriya, S. Sumathi, P. Frances Antony Selvi3, " Multipurpose Guide for Visually Impaired People using Raspberry pi", IRJET, Volume: 07 Issue: 07, July 2020.

[21] Dada Emmanuel Gbenga , Arhyel Ibrahim Shani, Adebimpe Lateef Adekunle ," Smart Walking Stick for Visually Impaired People Using Ultrasonic Sensors and Arduino", IJET, Vol 9, No 5, Oct 2017.

[22] Prof. Bharat Dhak, Mansi Kakde, Pranal Rewatkar, Harshini Putta, Dolly Mahore, Prachi Mudholkar," Smart Walking Stick for Visually Impaired People", IJSRSET, Volume:07, Issue:02, 2020.

[23] Ayush Saini, Ali Majaz, Nikhil Kumar, Manik Choudhary and Sulekha Saxena. "Assistance Stick for Visually Imapired", International Research Journal of Engineering and Technology, Volume: 09, Issue: 06, June 2022.

[24] P.Abima, R, Aslin Sushmitha, P.Sivagami and Dr. A. Radhakrishnan. "Smart Assistant for Visually Challenged People", International Research Journal of Engineering and Technology, Volume: 07 Issue: 08, August 2020.

[25] Priyansh Kamal, Sudhir kumar Chaurasiya, Yash Saini, Manoj Kumar Yadav" A Smart Stick for Assisting Blind Peoples", IJRASET, 2022.

[26] Namrata Kataki and Dibyani Darsha Borah. "Design and implementation of a Smart Stick for visually impaired person using Arduino", International Journal for Modern Trends in Science and Technology 2022, 8(04), pp. 162-165.

[27] Rutvik B Nikam, Divyanshu M Bochare, Prajwal R Sawle, D.V. Rojatkar", Smart Stick for Blind Person using Arduino Uno", International Journal of Innovative Research in Science, Engineering and Technology, Volume 11, Issue 7, July 2022.

[28] S.Irin Sherly, G.Mathivanan, "ECG Signal Noises versus Filters for Signal Quality improvement", 2021 International Conference in Advances in Electrical, Computing, Communication and sustainable Technologies, 10.1109/ICAECT49130.2021.9392621.

[29] S.Irin Sherly, G.Mathivanan, "An Ensemble based heart disease prediction using gradient boosting decision tree", Turkish Journal of Computer and Mathematics Education, Vol 12, No 10(2021), 3648-3660.

[30] Jackson Daniel, S. Irin Sherly, Veeralakshmi Ponnuramu, Devesh Pratap Singh, S.N. Netra, Wadi B. Alonazi, Khalid M.A. Almutairi, K.S.A. Priyan, and Yared Abera, "Recurrent Neural Networks for Feature Extraction from dengue Fever", Evidence-Based Complementary and Alternative Medicine, Volume 2022, Article ID 5669580, 2022.

[31] S.Irin Sherly, M.Haripushpam, B.Infantina Rinie, D.Jyotsna Devi, "Wildlife Intrusion and Early Fire Detection System Using IoT", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 6, Issue 2, February 2018.

[32] S. Irin Sherly, G. Mathivanan, "An efficient honey badger based Faster region CNN for chronic heart failure prediction", Biomedical Signal Processing and Control, 79, 2023.

[33] G.Revathy, Sophiya, M.P.Thiruvenkatasuresh, C.P Thamil Selvi, ,Mrs S Irin Sherly, "Drugs For Corona Virus Prediction With Artificial Intelligence and Machine Learning", Nat. Volatiles & Essent. Oils, 2021; 8(5): 4583 – 4587.

[34] S. Irin Sherly, G. Mathivanan, "ECG based multi modal framework for heart disease detection", Journal of Theoretical and Applied Information Technology, 2023; 101(9): 3601 – 3614.