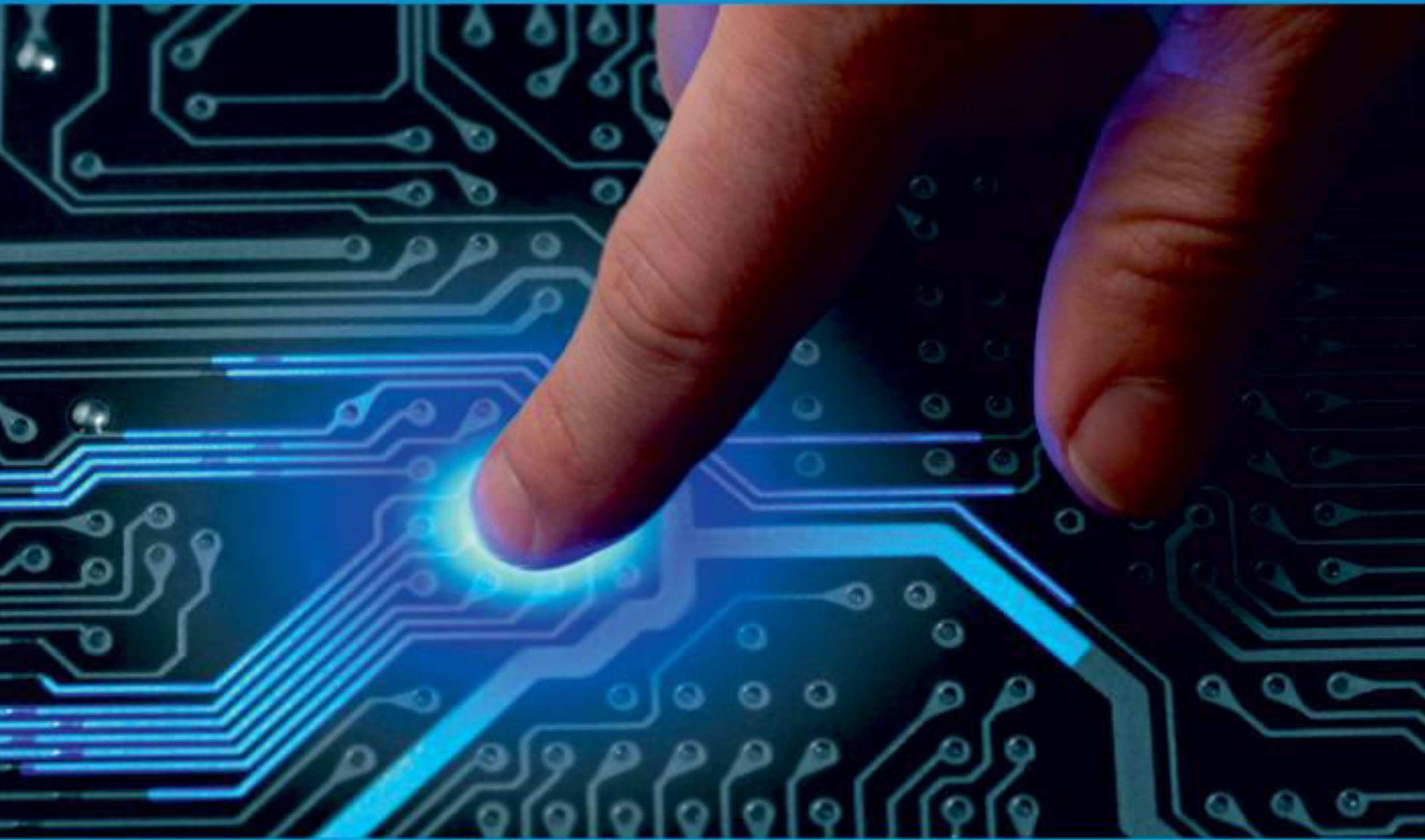
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 7, July 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.542

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907094 |

Smart Stick using IoT, Artificial Intelligence and Image Processing for Visually Impaired Persons

Prof. Sheetal Patil[#1], Tejas R. Anikhindi[#2], Govindraj Jamkhandi[#3], Aishwarya Rajput[#4], Abhilasha Naik[#5]

Department of Computer Science, Visvesvaraya Technological University Belagavi. Angadi Institute of Technology & Management Belgaum, India[#1,2,3,4,5]

ABSTRACT: Visually challenged people often face problems while navigating around the places and on roads. Moving along the unknown terrain is a great challenge to such people and therefore keeping these things in mind, the smart stick has been designed to minimize the difficulties of visually challenged people. In this paper, a smart stick based on Traffic Light Detection and Facial Recognition has been proposed for the navigation and guidance of visually challenged individuals while walking through roads and crossing traffic lights. The smart stick features obstacle detection using an ultrasonic sensor, traffic light color detection using a camera module. All these modules have been embedded into the Raspberry pi microcontroller. The camera is used for facial recognition, and the image obtained through the camera will be captioned and presented to the user in the form of audio. This audio will tell what that image is and what should be done if it is an obstacle; thus, working as a virtual eye for blind people. The stick is proposed to be embedded with voice recognition and GPS guiding systems in the future.

KEYWORDS: -Visually challenged person, Ultrasonic Sensor, Facial Recognition, Pi-Camera.

I. INTRODUCTION

The interconnection of the physical objects, buildings, vehicles and other items that are embedded with electronic sensors, software and network connectivity which thus allows the objects to collect and exchange data is referred to as the Internet of Things (IoT)[1]. The term Internet of Things was coined by Kevin Ashton. IoT has a large number of applications in the modern world such as healthcare, agriculture, smart cities and so on[4]. IoT has played a vital role in the lifestyles of people. IoT has also contributed a lot to minimize the difficulties of people with disabilities. There are many IoT devices such as smart canes, smart glass, speech synthesizer based IoT devices, smart shoes, and so on for physically disabled people to assist them in theirlivelihood. Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The 2011 statistics by the World Health Organization (WHO) estimates that there are 285 billion people in the world with visual impairment, 39 billion of which are blind and 246 with low vision. Presently, blind people use a white stick as a tool for directing them when they move or walk. Here, we develop a tool which can serve as a blind stick being more efficient and helpful than the conventional one. This will assist the blind persons during the walk and provides an alarm if any hurdle is detected within the set range.People with disabilities struggle a lot for their survival and in performing their day to day activities. For visually challenged people, travelling independently from one place to another and to cross traffic lights [2] is one of the most challenging tasks.Considering the situation of visually challenged persons, a smart stick has been developed that can assist them to walk on roads and cross the traffic light safely and independently. The theoretical approach to help visually impaired people by developing an electronic model [5].This smart stick is capable of detecting obstacles with the help of an ultrasonic sensor to pick any object within a 180-degree path[5][6], detecting the traffic light color and facial recognition with a camera module using Image Processing[9]. A speaker is embedded to give an audio output whenever an obstacle is detected, during traffic light detection and facial recognition. The smart stick follows the HAAR CASCADE algorithm as described in the methodology.

II. METHODOLOGY

HAAR CASCADE ALGORITHM: -It is an Object Detection Algorithm used to identify faces in an image or a real time video. The algorithm uses edge or line detection features proposed by Viola and Jones in their research paper

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907094 |

"Rapid Object Detection using a Boosted Cascade of Simple Features" published in 2001[3]. The algorithm is given a lot of positive images consisting of faces, and a lot of negative images not consisting of any face to train on.

- Positive images – These images contain the images which we want our classifier to identify.
- Negative Images – Images of everything else, which do not contain the object we want to detect.

Haar Cascade Detection is one of the oldest yet powerful face detection algorithms invented. It has been there since long, long before Deep Learning became famous. Haar Features were not only used to detect faces, but also for eyes, lips, license number plates etc. The models are stored on GitHub, and we can access them with OpenCV methods.This algorithm is also used for traffic light detection using all the HAAR features. The pictorial representation of the traffic light detection is shown in figure 1.

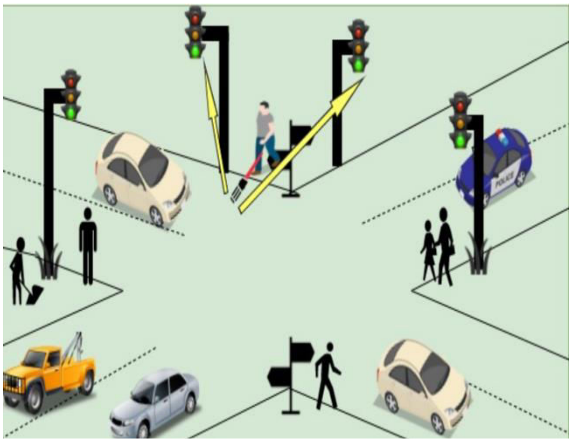
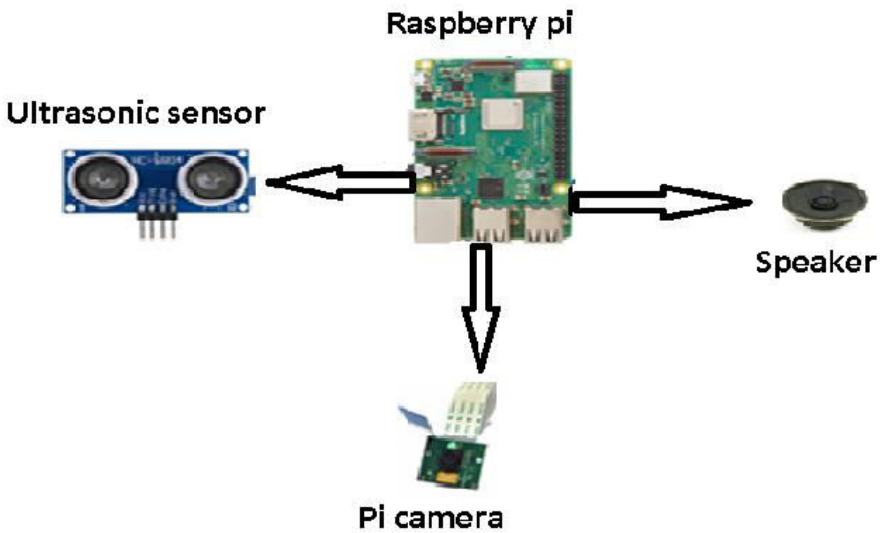


Figure 1: Pictorial Representation of Traffic Light Detection.

This section describes the flowcharts, methods and working principles used for the implementation of different modules. It also describes some major components used in the circuit.

A. System Architecture



This paper attempts to design a system whereby obstacles are detected in front of the user using sensors and where obstacles are currently using a camera. The proposed system will perform image captioning on the scene captured through the camera. This system will be using a Raspberry Pi, Ultrasonic Sensors, Camera Module and an Audio Device. Here the sensors start sensing at the same time, so it does not cause any delay between any sensor. If there is an

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907094 |

obstacle detected, then the sensor sends the echo signal to the Raspberry Pi. Then the Raspberry Pi calculates the difference between the time of transmitting the burst signal and receiving the echo signal, using this time the Raspberry Pi calculates the distance between the user and the obstacle by using Distance= (Speed of Sound*Time)/2. Then it checks whether the distance of the object is less than the specified limit. If neither of the sensors is below the minimum distance, the whole process starts again. If any sensor is less than the specified threshold distance, it tracks the direction of the obstacle and uses a camera to image the direction of that point. The proposed system will perform Face recognition on the scene captured through the camera. This system will be using a Raspberry Pi,Ultrasonic Sensors, Camera Module and an Audio Device.This system is using button to toggle between the operation of the Raspberry pi.

B. Experimental setup

1) **Obstacle detection:** For obstacle detection, the ultrasonic sensor (HC-SR04) is interfaced with Arduino Uno. The working of the Ultrasonic sensor is based on SONAR (Sound Navigation and Ranging) and RADAR (Radio Detection and Ranging) principle. This sensor has been used to determine the proximity of an object by generating higher frequency sound waves (Ultrasound). The sensor's receiver senses the reflected echo after the ultrasound waves strike an obstacle.

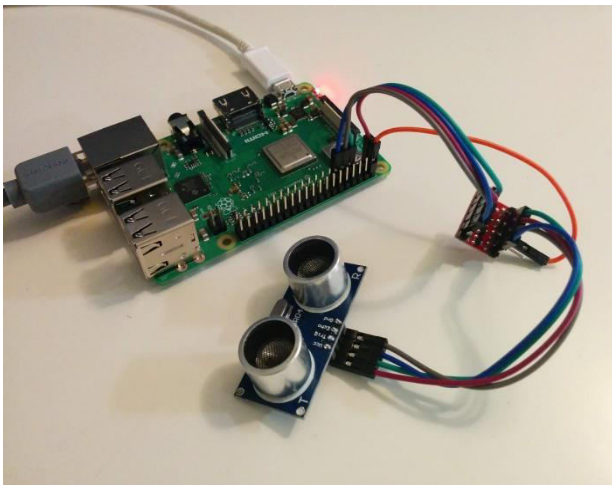


Figure 2: Ultrasonic Sensor Module interfaced with Raspberry Pi for obstacle detection.

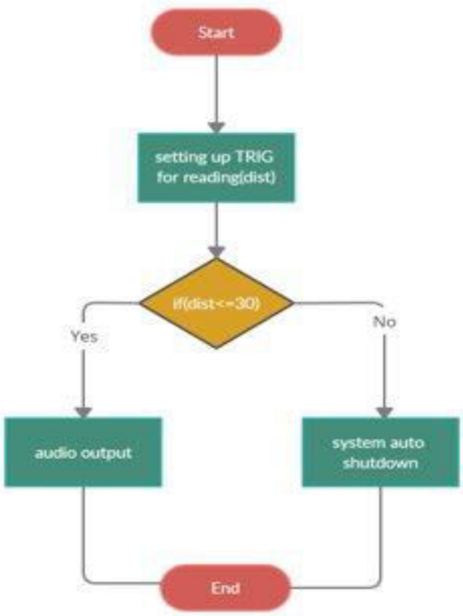


Figure 3: Flowchart of obstacle detection.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907094 |

2) **Audio Device:**For the audio alert system, a speaker of 5V is interfaced with raspberry pi for the audio alert when an obstacle is detected. An amplifier is used for the amplification of the audio output. This audio device also helps the visually challenged person to receive an audio alert of the detected traffic light and from facial recognition.

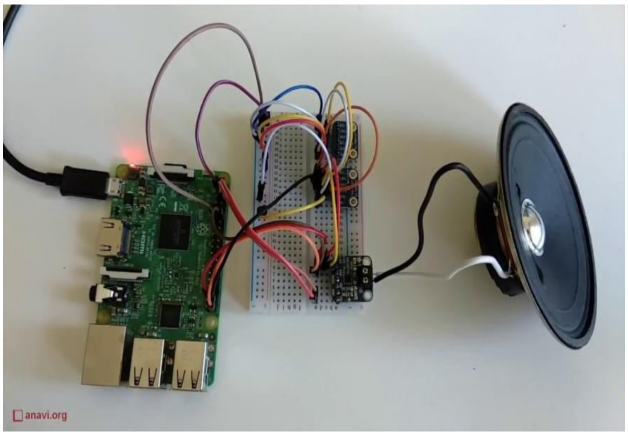


Figure 4: Speaker interfaced with Raspberry Pi for Audio alert.

3) **Pi-Camera Module**: Pi camera module which is widely used to take high-definition photographs, as well as high-definition video. It has a resolution of 5 megapixels**.** For the facial recognition system and traffic light detection system, the Pi camera module is interfaced with raspberry pi. Both processes will use the Pi camera module.Whenever a face is detected or a traffic light, i.e., RED/GREEN light is detected, audio output is generated for the same. A button is incorporated with the stick to toggle between these processes to optimize the performance of the raspberry pi.

Figure 5: Pi Camera interfaced with Raspberry Pi for Facial Recognition and Traffic Light Detection.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542
|| Volume 9, Issue 7, July 2021 ||
| DOI: 10.15680/IJIRCCE.2021.0907094 |

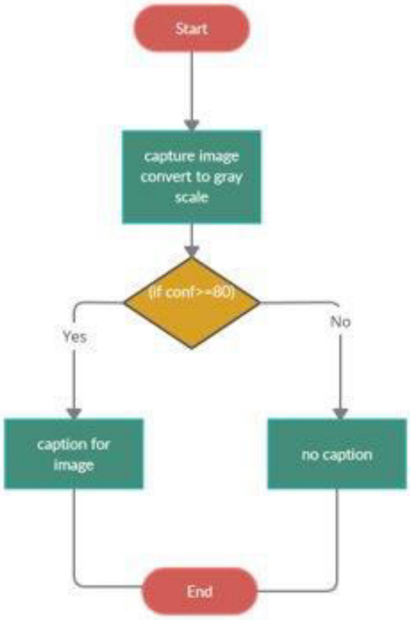


Figure 6: Flowchart of Facial Recognition.

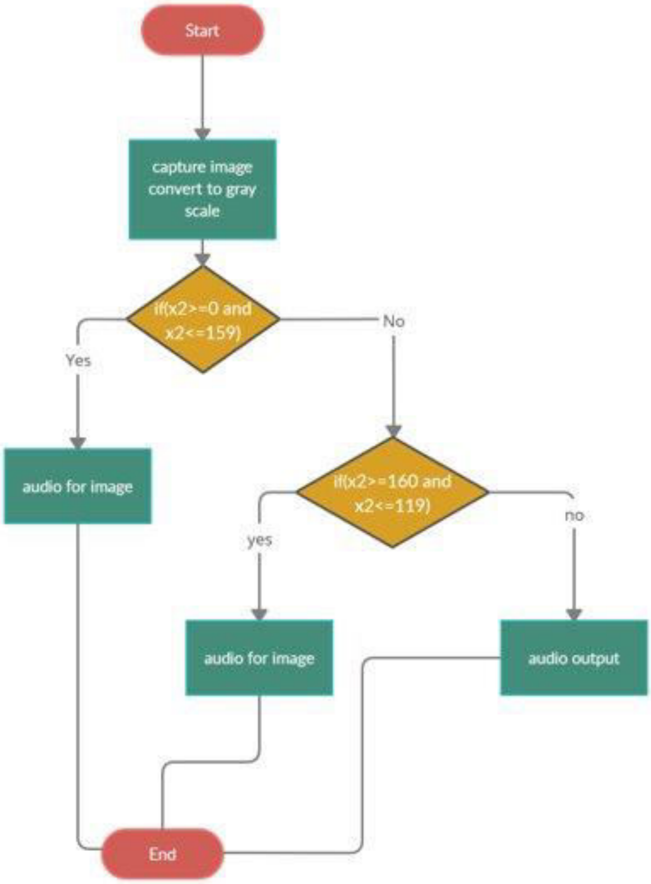


Figure 7: Flowchart of Traffic Light Detection.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907094 |

IV. CONCLUSION AND FUTURE WORK

In this system the prototype of a smart stick has been designed to assist visually challenged persons to walk on roads and to cross traffic lights independently. The main aim of this system is to act as a secure guard and help the blind to be aware of their surroundings. In the future, it is also proposed to integrate all these modules into a well-designed smart stick to meet real life requirements of visually challenged people.The smart stick can further be embedded with GPS navigation and guiding system, voice recognition system, security and privacy providing features.

REFERENCES

[1] https://en.wikipedia.org/wiki/Internet of things
[2]1Rahul Johari, 2Nitesh Kumar Gaurav, 3Sapna Chaudhary, 4Apala Pramanik" Smart Stick based on TLC Algorithm in IoT Network for Visually Challenged Persons"SWINGER: Security, Wireless, IoT Network Group of Engineering and Research Lab University School of Information, Communication and Technology (USIC&T), 2020.
[3]ACCEPTED CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION 2001 Rapid Object Detection using a Boosted Cascade of Simple Features by Paul Viola and Michael Jones.
[4] Kumar, S., Tiwari, P. and Zymbler, M., 2019. Internet of Things is a revolutionary approach for future technology enhancement: a review. Journal of Big Data, 6(1), p.111.
[5] Mala, N.S., Thushara, S.S. and Subbiah, S., 2017, February. Navigation gadget for visually impaired based on IoT. In 2017 2nd International Conference on Computing and Communications Technologies (ICCCT) (pp. 334-338). IEEE.
[6] Saquib, Z., Murari, V. and Bhargav, S.N., 2017, May. BlinDar: An invisible eye for the blind people making life easy for the blind with Internet of Things (IoT). In 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT) (pp. 71-75). IEEE.
[7] Subbiah, S., Ramya, S., Krishna, G.P. and Nayagam, S., 2019, February. Smart Cane For the Visually Impaired Based On IOT. In 2019 3rd International Conference on Computing and Communications Technologies (ICCCT) (pp. 50-53). IEEE.
[8] Karmel, A., Sharma, A. and Garg, D., 2019. IoT based Assistive Device for Deaf, Dumb and Blind People. Procedia Computer Science, 165, pp.259-269.
[9](IRJET) Smart Blind Stick using Image Processing Bhushan Chaudhari 1, Priyanka Dorugade2, Hrushikesh Konde3, RehanKondkari 4, Prof. Deepti S. Lawand5, 2020.

Impact Factor: 7.542

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

Scan to save the contact details