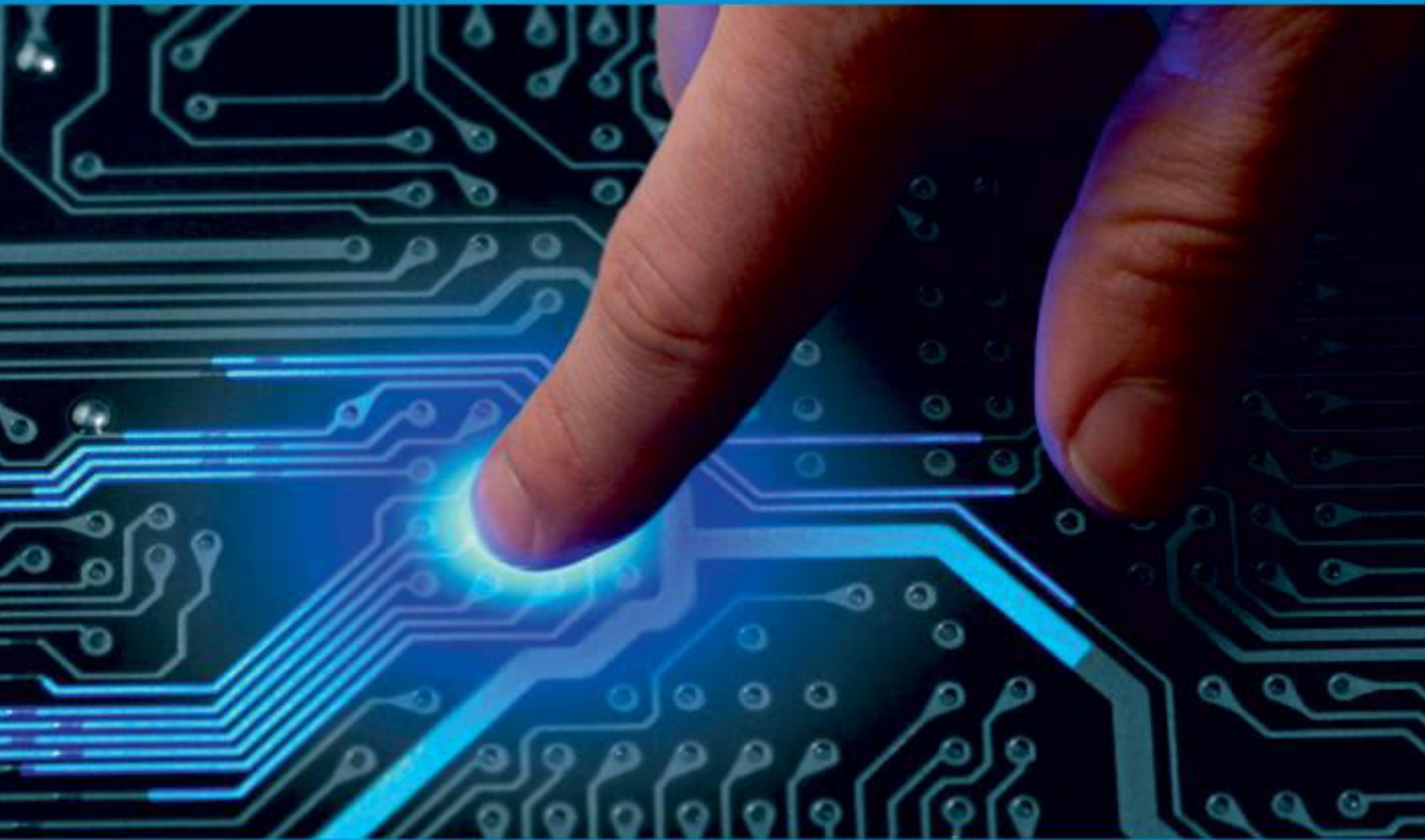
IJIRCCE

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



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 7, July 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007036 |

Smart Blind Stick : A device for Object Detection and Avoidance

Abhishek N, Ananda Theertha V, Anuhya Y, Nagavarshitha C H, Prof. Yadhukrishna

Student, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

Student, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

Student, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

Student, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

ABSTRACT: Human Vision is one of the most vital sources of collecting a huge amount of information from the real world that cant be processed by the human brain with combination of other sensor organ feedback. Blindness/Visual Impairment affects many people in the world. There are multiple instances of difficulty in the daily and social life of visually impaired people during commuting. It is extremely hard without the primary sense of vision. In the world today, there are approximately 2.2 billion people who are visually impaired, a huge percentage of them blind. There is a continuous need for an aid to assist these people which includes a wide range of navigation systems and tools. A visually impared person requires an assistance in identifying objects. Smart Blind Stick is an assistive device which mainly aims at helping the user to navigate and interact with the real world. A regular cane stick allows the user to swing it infront of them to detect any obstacle. Smart Blind Stick allows them to detect any object/obstacle ahead of the current taken by the subject, With the help of a camera attached as a part of the stick. The detected object is then identified and appropriate actions are provided to the user. Bluetooth earphones are used as a medium of providing information. Thus, the stick provides a safer and a better navigation experience for the visually challenged using an array of technologies.

KEYWORDS: Image Processing, Machine Learning, IoT, Computer Vision.

I. INTRODUCTION

In recent years, digital image processing is used to perform image processing on digitalimages. In many occasions, digital image processing has many advantages over analogimage processing. A wider range of algorithms to be applied to the input data and can avoid problems like noise and signal distortion during processing. Digital image processing may be modeled in the form of multidimensional systems since images are defined over two dimensions (perhaps more).

This paper makes use of Ultrasonic sensors, a camera and a Raspberry pi and proposes a smart obstacle finding stick for visually-impaired people, that assists a blind personby detecting the hinderance. The main objective of the stick is to aid a blind people to move more confindently by informing them about the present condition of the path that they are currently taking. .

II. PROBLEM STATEMENT

CURRENTSYSTEM: A conventional white cane to aid in navigation is currently being utilized. The drawback in the regular cane is that the information is obtained by touching the objects at the tip of the cane. Average length of a white cane depends on two factors: height of user and the extension from the floor to the person's sternum.

LIMITATIONS OF THE CURRENT SYSTEM: The current systems have the following limitations.

- Expensive
- Identification of the object is difficult

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007036 |

- Lack of security

Proposed System: The proposed system architecture (Fig 2.a) will utilize the features of microcontrollers, machine learning and IoT for its core functionalities.

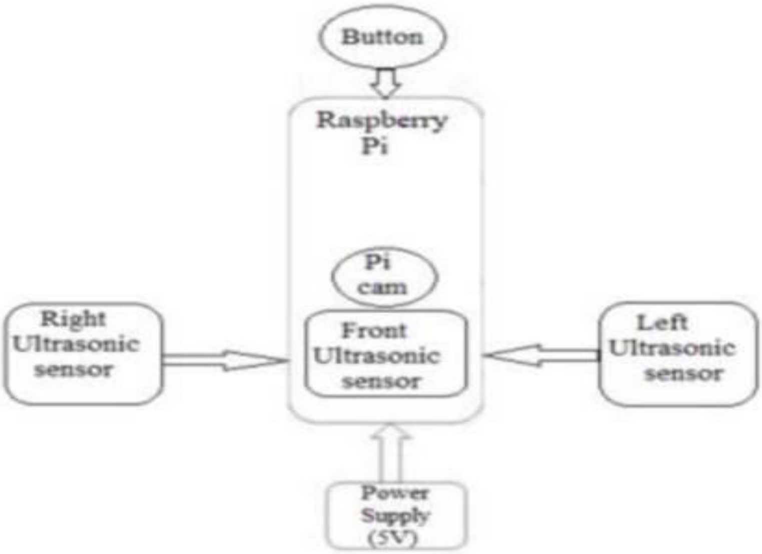


Fig-2.a: Proposed System Architecture.

Advantages of the Proposed System: The proposed system has the following advantages over the existing systems.

- Low Cost
- Very Handy
- Instruction is passed on through earphones
- Camera to detect the obstacle ahead
- Easy Navigation

.

III. SYSTEM DESIGN

The use case of the Smart Blind Stick is as shown in Fig 3.a. The stick is used by the blind person to navigate around in an environment by avoiding the obstacles. The stick is mounted with a Raspberry Pi setup. Once the obstacle is recognized, audio instruction over earphones is given to the user and asking him to slow down the two ultrasonic sensors on either side of the stick are triggered on detection of an obstacle. These are used mainly for re-directing the user. An obstacle detection approach based on Cascaded Convolution Neural Network will be designed. The approach will achieve a better performance by cascading three different Convolution Neural Networks with high accuracy.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007036 |

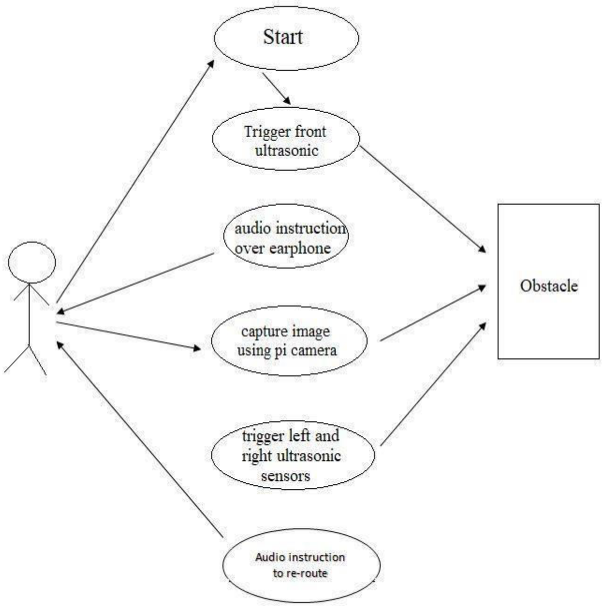


Fig-3.a: Use Case of a Smart Blind Stick

IV. REQUIREMENTS

Hardware Requirements:

- Raspberry Pi
- Pi camera
- Three Ultrasonic sensors
- Bread board
- Power bank

Software Requirements:

- OpenCV
- Tensorflow
- PuTTY
- VNC Viewer

V. PROPOSED SYSTEM

The camera is attached in the middle part of the stick and is connected to the microprocessor. It captures the images at regular time intervals and converts the rgb (red, green, blue) frame into a grayscale frame. The ultrasonic sensors judge the distance of the obstacle by the time taken by the ultrasonic signal to strike the obstacle and return. An obstacle detection approach based on Cascaded Convolution Neural Network will be designed. The approach will achieve a better performance by cascading three different Convolution NeuralNetworks with high accuracy. The data flow is as shown in the fig 5.a.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165
|| Volume 10, Issue 7, July 2022 ||
| DOI: 10.15680/IJIRCCE.2022.1007036 |

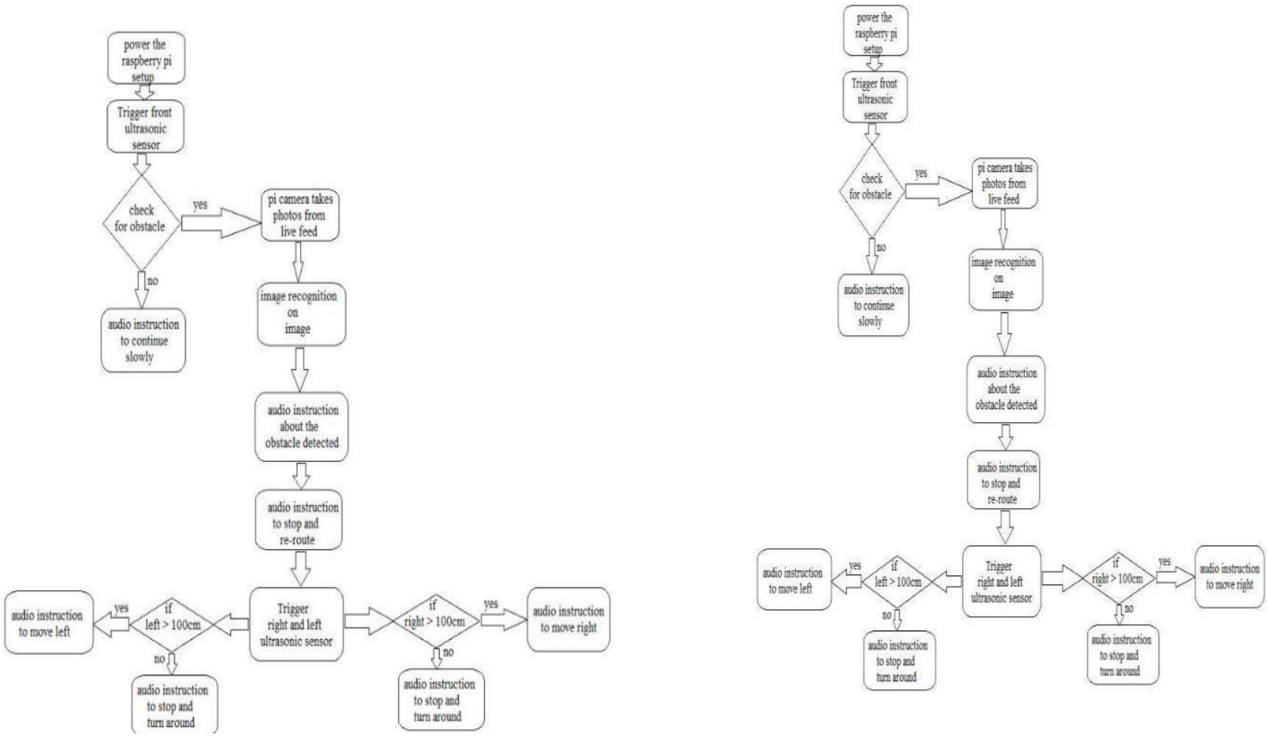


Fig-5.a:. Data Flow Diagram of Smart Blind Stick

The Convolution Neural Network will have a certain robustness to the obstacle and illumination. At the backend, a Python IDE will be used to run the Machine Learning applications. The Keras API, using the TensorFlow library as a backend, will be used to design the Convolution Neural Network (CNN) that will be trained in obstacle recognition.

Pseudocode:
prot= "MobileNetSSD_deploy.prototxt.txt" mod= "MobileNetSSD_deploy.caffemodel"
os.system("--prototxt "+ prot +" --model " + mod)
The captured image is passed to the model for detection of obstacle.

Pseudocode: GPIO.setmode(GPIO.BOARD) GPIO.setup(PIN_TRIGGER, GPIO.OUT)
GPIO.setup(PIN_ECHO, GPIO.IN)

Once an obstacle is detected in the captured image, the ultrasonic sensors are triggered to find the distance to the detected obstacle. This information is utilized to then provide information to the user to avoid the obstacle.

Pseudocode:
text='Checking for obstacle' tts=gTTS(text , lang='en')

The Google Text To Speech(gTTS) package is used to convert the text msg to audio which is conveyed to the blind person over earphones.

.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165
|| Volume 10, Issue 7, July 2022 ||
| DOI: 10.15680/IJIRCCE.2022.1007036 |

V. RESULT/ TESTING ANALYSIS

Unit Testing: This test case checks if the three ultrasonic sensors being used are working accurately, as shown in Table 6.a

Table-6.a:. Unit testing results for the ultrasonic sensors

Sl. No	Name of test	Item being tested	Sample Input	Expected output	Actual output	Remarks
1	Proxi mity sensing test	Ultrasonic sensor	Placethe obstacleahead	Respecti ve distances (16.2,21. 8,35.6)	16.2,21. 8,35.6	Pass

These test cases check as to whether the object detection module is working accurately as shown in Table 6.b

Table-6.b: Unit testing results to check Object Detection

Sl. No	Name of test	Feature being tested	Samp le Input	Expected output	Actual output	Remarks
1	Object detecti on	Image processing	Person asobstacle	Person ahead	Personahead	Pass
2	Object detecti on	Image processing	Chair as obstacle	Chair ahead	Chair ahead	Pass
3	Object detecti on	Image processing	Bottle as obstacle	Bottle ahead	Bottle ahead	Pass

System Testing: This test case checks mainly as to if the entire system as a whole is working in navigating the blind person as shown in the below Table 6.c

Table-6.c: System Test Cases

Sl. No	Name of test	Feature being tested	Sample Input	Expecte d output	Actual output	Rema rks
1	System Test	Overall smart blind stick	Stick in a natural environ ment	Re- route based on obstacles, if encount ered	Re- route based on obstacles, if encount ered	Pass

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007036 |

Validation Testing: These test cases are for the various possibilities possible on detection of an obstacle shown in table 6.d

Table-6.d: Validation Test Cases

Sl. No	Name of test	Feature being tested	Sample Input	Expect ed output	Actual output	Remarks
1	Valida tion test	Re- routin g directi ons	Obstacle to the left of the blind perso n	Instruction to re- route to the right	Instruction to re- route to the right	Pass
2	Valida tion test	Reroutin g directi ons	Obstacle to the right of the blind perso n	Instruc tion to re- route to the left	Instruction to re- route to the left	Pass
3	Valida tion test	Re- routin g directi ons	Obstacle to the either side of the blind perso n	Instruc tion to re- route by taking two steps to the back	Instruc tion to re- route by taking two steps to the back	Pass
4	Valida tion test	Re- routin g directi ons	No obsta cle to the either side of the blind perso n	Instruc tion to re- route by taking two steps to either side	Instruc tion to re- route by taking two steps to either side	Pass

VI.CONCLUSION

This project is designed to create a system using ultrasonic sensors and providing voice command through headphone to the blind people. It would help a visually impaired person navigate through a public place independently. The proposed system tries to eliminate the faults in the previous system. It aims to solve the problems faced by the blind people in their daily life. The system also takes measures to ensure their safety. The design Smart Blind Stick using ultrasonic sensors and with voice output is of great benefit to blind people when itcomes to independent mobility. The advantage of the system lies in the fact that it can prove to be very low-cost solution tomillions of blind persons worldwide. Text-to-Speech conversion is used to provide voice command as output. The blind person can easily navigate from one place to another as we are providing voice message.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007036 |

REFERENCES

[1] Divyank Yarravarapu, Tina Manghnani, Artificial Vision for the Blind using ICane Electronic Aid for Blind People, IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), Nov.-Dec .2016.

[2] Giva Andriana Mutiar1, Gita Indah Hapsari, Ramanta Rijalu, Smart Guide Extension for Blind Cane, 2016 Fourth Intl. Conference on Information and Communication Technologies (ICoICT).

[3] Radhika R, Payal G Pai, Rakshitha S, Rampur Srinath, Implementation of Smart Stick for Obstacle Detection and Navigation, Intl. Journal of Latest Research in Engineering and Technology (IJLRET), May 2016.

[4] Akhilesh Krishnan, Deepakraj G, Nishanth N, Dr. K.M. Anandkum, Autonomous Walking Stick for the Blind using Echolocation and Image Processing, Intl. Conference on Contemporary Computing and Informatics (ic3i), 2016.

[5] Rishabh Gulati, GPS Based Voice Alert System for the Blind, Intl. Journal of Scientific & Engineering Research, Vol. 2, Issue 1, January 2011.

BIOGRAPHY

Abhishek N, Student, Dept. of IS Engineering, TOCE, Karnataka, India

Ananda Theertha V, Student, Dept. of IS Engineering, TOCE, Karnataka, India

Anuhya Y , Student, Dept. of IS Engineering, TOCE, Karnataka, India

Nagavarshitha C H,Student,Dept.of IS Engineering,TOCE,Karnataka,India

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING