SMART BLIND STICK FOR DETECTION AND AVOIDANCE OF OBSTACLE

Submitted in partial fulfillment of the
requirements for the award of
Bachelor of Engineering degree in Computer Science and Engineering

By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with Grade "A" by NAAC

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November – 2022

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BONAFIDE CERTIFICATE

This is to certify that this Product Report is the bonafide work of **P.Purna sai (41731092)** who carried out the Design entitled **"SMART BLIND STICK FOR DETECTION AND AVOIDANCE OF OBSTACLE"** under my supervision from June 2022 to November 2022.

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Submitted for Viva voce Examination held on

Internal Examiner **External Examiner**

DECLARATION

I, **P.Purna sai (41731092),** hereby declare that the Product Design Report entitled **"SMART BLIND STICK FOR DETECTION AND AVOIDANCE OF OBSTACLE"** done by me under the guidance of **Dr. Malini Deepika,** is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in **Computer Science and Engineering**.

DATE:

PLACE: Chennai **SIGNATURE OF THECANDIDATE**

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **Board of Management** of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T.Sasikala M.E., Ph. D**, **Dean**, School of Computing, **Dr. S. VIGNESHWARI, M.E., Ph.D.,** Head of the Department of Computer Science and Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Design Supervisor **Dr. Malini Deepika.,** for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of my phase-1 project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Computer Science and Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT

Eye sight plays a major role in collecting most of the information from the real world and that information will be processed by brain. Blindness or visual impairment is a condition that affects many people around the world. Visually impaired people suffer inconveniences in their daily and social life with respect to challenges during commuting. This condition leads to the loss of the valuable sense of vision. Worldwide, there are millions of people who are visually impaired, where many of them are blind.

The need for assistive devices was and will be continuous. There is a wide range of navigation systems and tools existing for visually impaired individuals. The blind person truly requires an aid in identifying objects. Smart Blind Stick is an interactive device which mainly aims at helping the blind to navigate easily and in a safer manner. In a normal day to day situation a blind person waves the blind stick ahead of them in order to check for any objects or obstacles.

The smart stick helps them in this by detecting if any obstacle is blocking the path being taken by the subject. The device detects the obstacle with the help of a camera attached to the front of the stick. On detection of the obstacle, it is identified and appropriate instructions are provided to the user.

The instructions to the blind person are sent over earphones.Thus, using the various technologies, the stick provides a safer and a better navigation experience for the visually challenged.

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

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW :

In computer science, digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

Blind stick or white cane is introduced to blind people after the First World War as a mobility tool to detect the obstacles in the path of the user. This paper proposes a smart obstacle finding stick for visually impaired people, which helps a blind person by detecting the obstacles using Ultrasonic sensors, a camera and a Raspberry pi.

The main objective of this is to help a blind people to move more freely by informing the blind person about the circumstances & present condition of the path where he/she is walking using a reliable stick.

These days we can increase number of equipment's which can help peoples live. The use of technology for people without eye isof among essential and demanding areas for researchers. Figure:1 Smart blind stick model It is very difficult for blind people to roam around freely in the unknown places .It is need and responsibility of the researchers to develop such equipment for blind people to walk around any region with the aid of smartstick that is built and most .

emerging technologies such as Artificial Intelligence and Machine learning.This era of smart technologies such as Artificial intelligence and machine learning embedded

with suitable hardware has life of blind people easy and safer.

Our visually impaired people follow the yellow lines on the sidewalks with a wand or stick. However, this solution cannot prevent to disrespect. There are people who visually impaired that miss the lane because of the parked cars on it. As a result, they are being lost. Our aim is to give a support while alerting if there is an object on the sidewalk and to eliminate this obstacle as much as possible.

Our aim is to produce as much solution as we can produce at low cost. Another problem with this issue is the lack of understanding of pedestrian crossings and traffic signs. Therefore, people with visually impaired have a lot of difficulty in crossing a road.

CHAPTER 2

LITERATURE REVIEW

2.1 PRODUCT AVAILABILITIES:

- In the existing system, there is only technology to detect the obstacle and to notify the blind by having some warning sound.
- Majority of them are using a conventional white cane to aid in navigation.
- They were high in cost by not advancement and efficient for the blind people .
- No security of the device.
- No navigation provider system

Hence to avoid all the circumstances we are introducing the new product

CHAPTER 3

REQUIREMENTS ANALYSIS

3.1 OBJECTIVE OF THE PRODUCT:

- Robotics involves design construction, operation, and use of robots. The goal of robotics is to design machines that can help and assist humans.

- Robotics develops machines that can substitute for humans and replicate human actions. Robots can be used in many situations for many purposes, but today many are used in dangerous environments (including inspection of radioactive materials, bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space, underwater, in high heat, and clean up and containment of hazardous materials and radiation).

- Robots can take on any form, but some are made to resemble humans in appearance. This is claimed to help in the acceptance of robots in certain replicative behaviors which are usually performed by people. Such robots attempt to replicate walking, lifting, speech, cognition, or any other human activity.

3.2 REQUIREMENTS

3.2.1 HARDWARE REQUIREMENTS:

- Raspberry Pi
- Pi camera
- Ultrasonic sensors
- Bread board
- Power bank
- Connecting wires
- Resistors
- Earphones

3.2.2 SOFTWARE REQUIREMENTS:

- OpenCv
- Tensor flow
- VNC Viewer
- Yolo
- One shot object detector
- White cane
- Python programming

CHAPTER 4

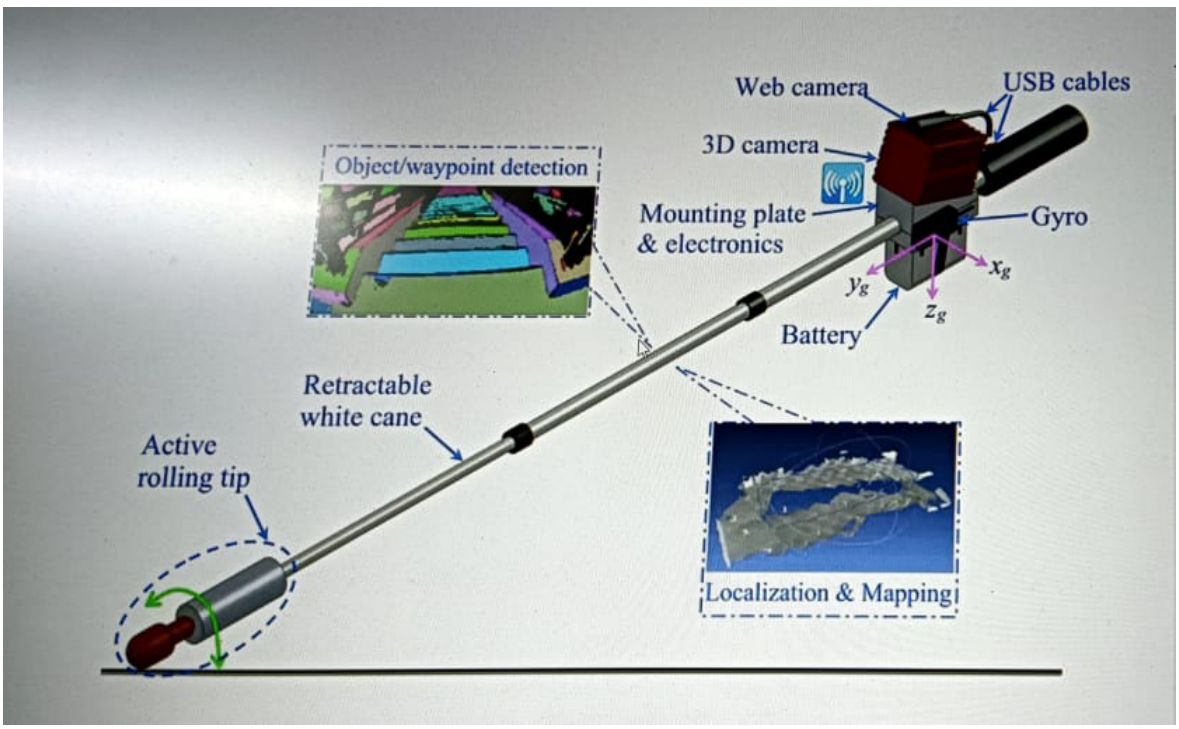
DESIGN DESCRIPTION OF PROPOSED PRODUCT

4.1 PROPOSED PRODUCT :

The proposed system architecture (Fig 1) will utilize the features of

- Microcontrollers
- Machine learning
- IoT for its core functionalities.

4.1.1 *Design Diagram of full product*



Proposed product design

4.1.2 *Various Stages:*

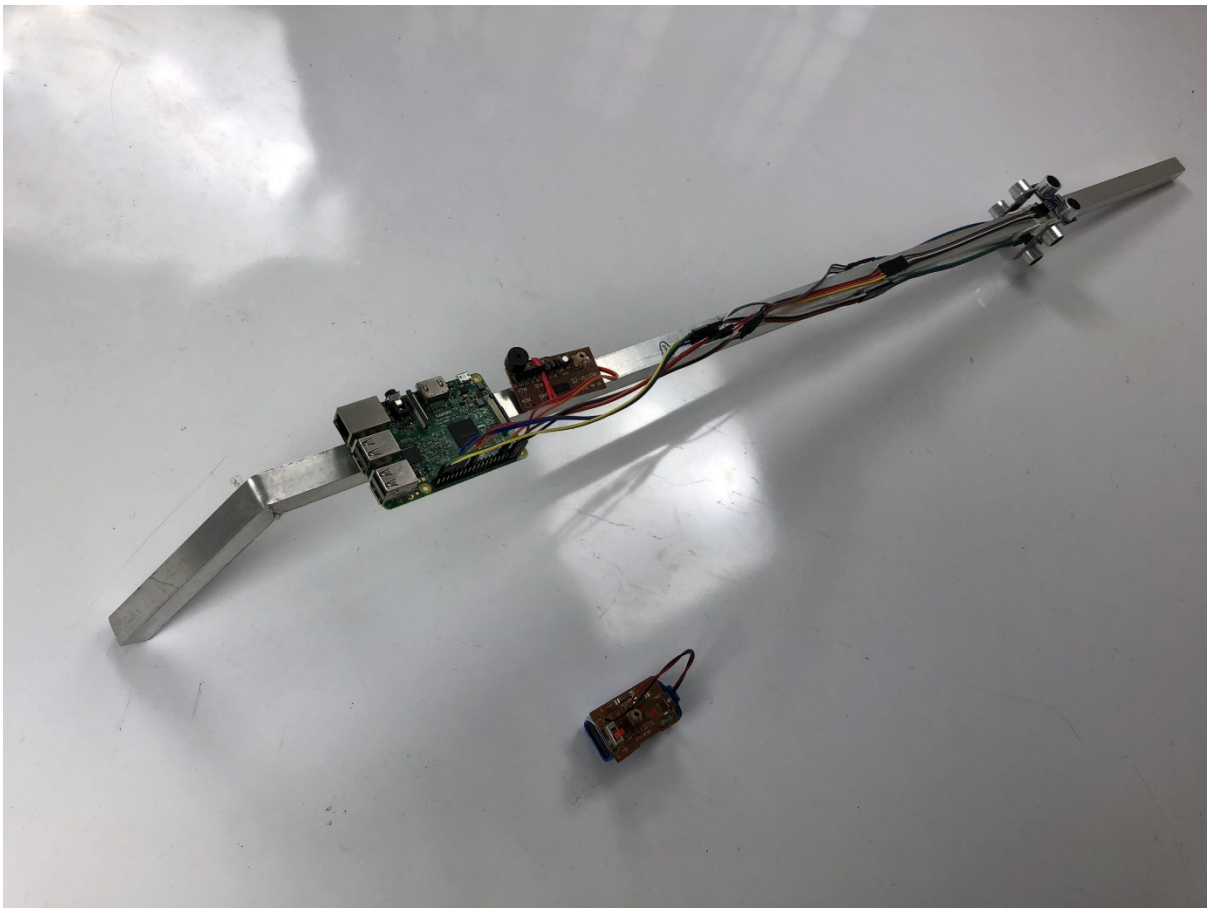
Step1: Input Image or by sensor

Step2: Sensor Reading

Step3: Input details processed by Raspberry Pi

Step4: Image details fetched by the data base or google

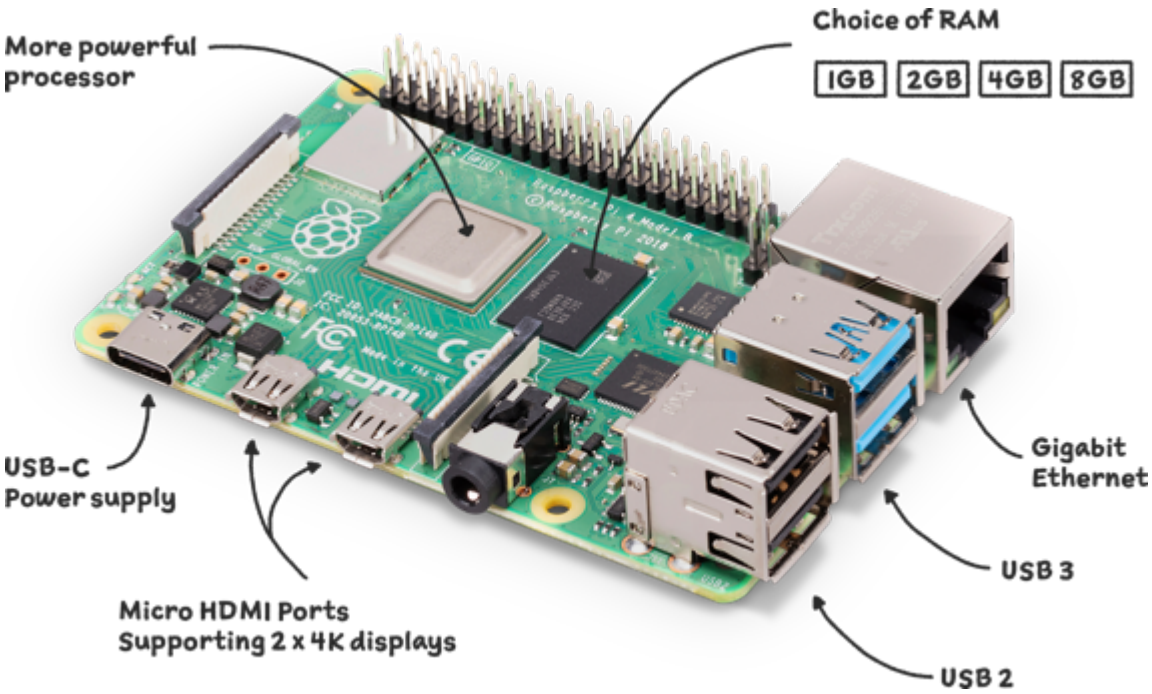
Step5: Object detail feed in voice format by earphone and vibrator



- ✔ Prototype

Raspberry Pi is defined as a minicomputer the size of a credit card that is interoperable with any input and output hardware device like a monitor, a television, a mouse, or a keyboard – effectively converting the set-up into a full-fledged PC at a low cost.

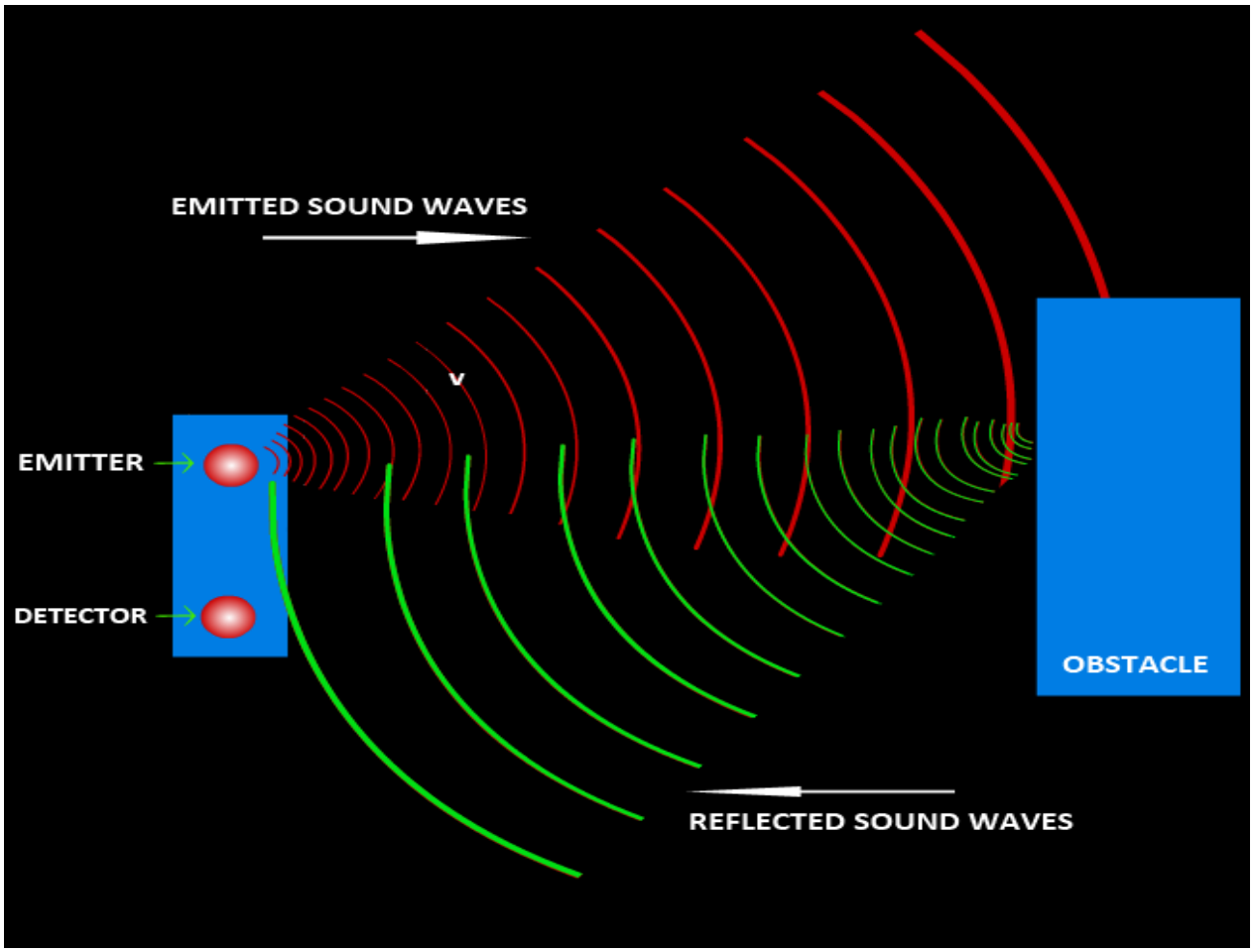
Raspberry Pi is a programmable device. It comes with all the critical features of the motherboard in an average computer but without peripherals or internal storage. To set up the Raspberry computer, you will need an SD card inserted into the provided space. The SD card should have the operating system installed and is required for the computer to boot. Raspberry computers are compatible with Linux OS. This reduces the amount of memory needed and creates an environment for diversity.

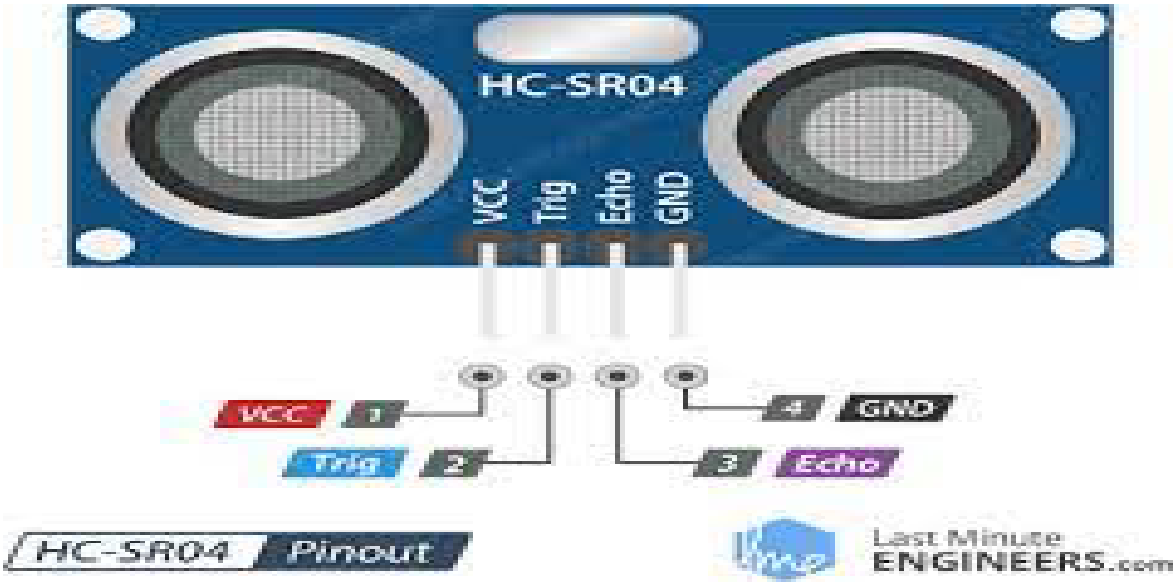


ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its

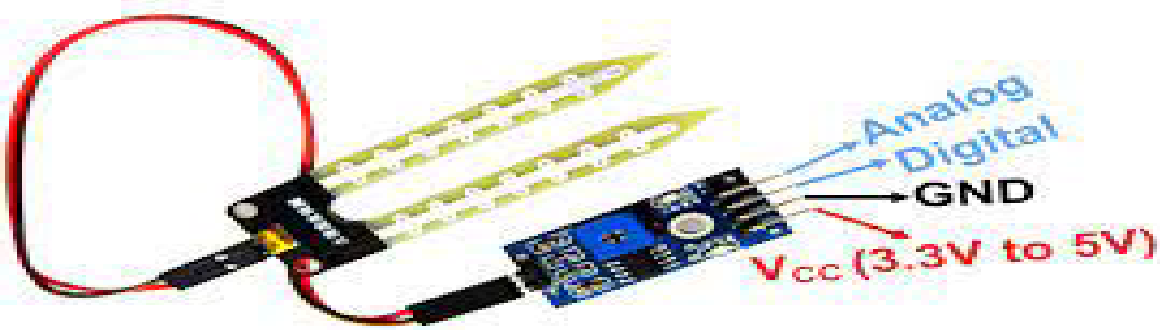
contact with the receiver. The formula for this calculation is D = ½ T x C (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second). For example, if a scientist set up an ultrasonic sensor aimed at a box and it took 0.025 seconds for the sound to bounce back, the distance between the ultrasonic sensor and the box would be:


EMITTED SOUND WAVES
v
EMITTER
DETECTOR
OBSTACLE
REFLECTED SOUND WAVES

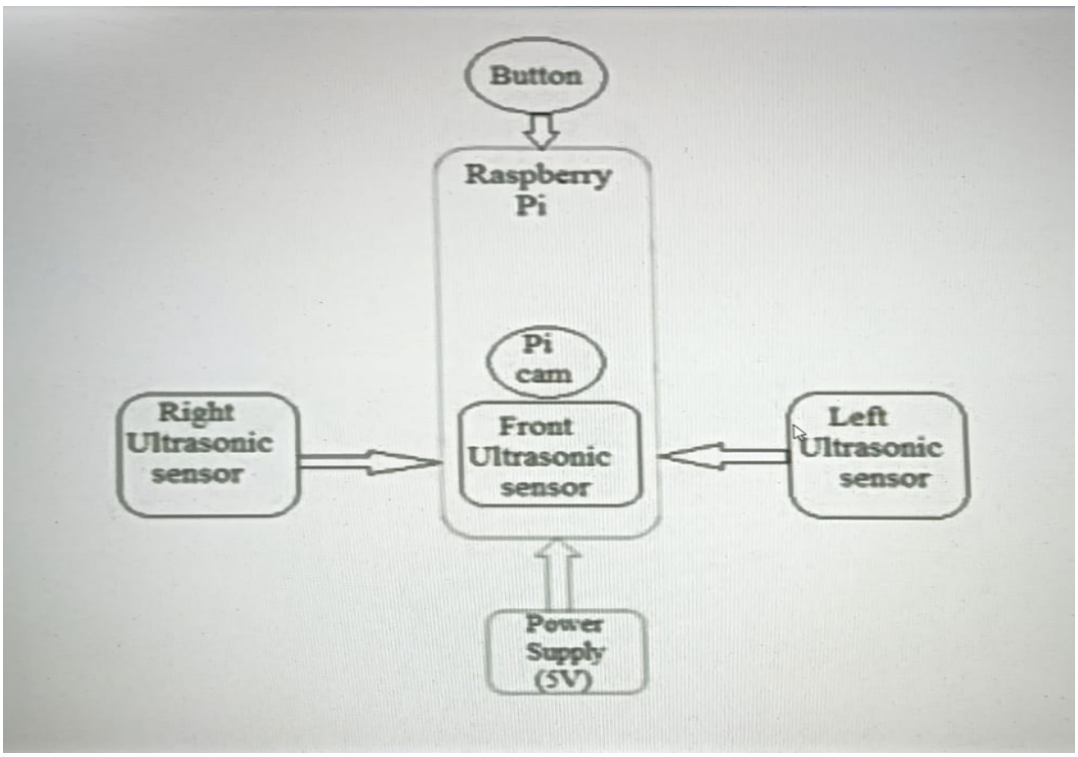


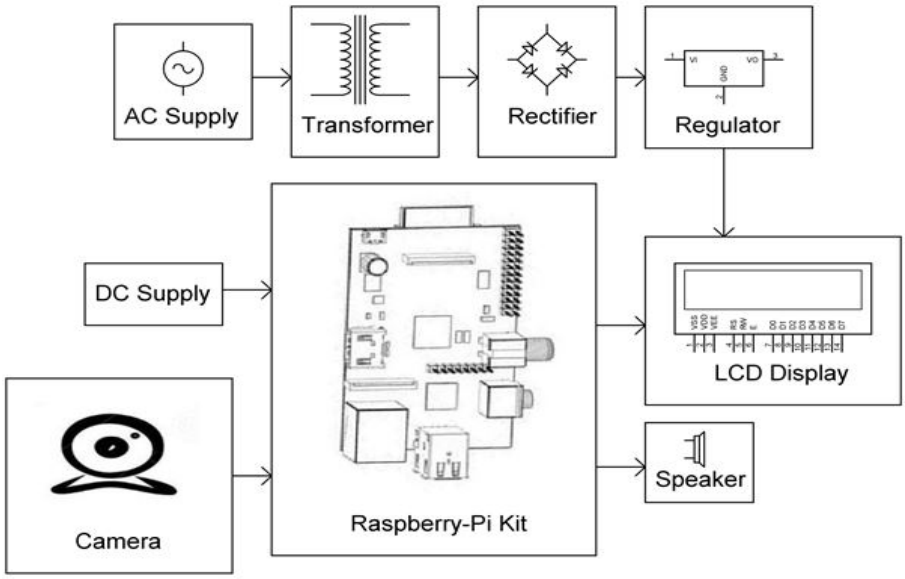
soil moisture sensor is one king of sensor used to gauge the volumetric content of water within the soil. As the straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content.

The relation among the calculated property as well as moisture of soil should be adjusted & may change based on ecological factors like temperature, type of soil, otherwise electric conductivity. The microwave emission which is reflected can be influenced by the moisture of soil as well as mainly used in agriculture and remote sensing within hydrology.



4.1.3 *Internal or Component design structure*





4.1.4 *Product working principles*

- The use case of the Smart Blind Stick is as shown in Figure 2. 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 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 Neural Networks with high accuracy.

- 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.

4.2 PRODUCT FEATURES:

- *Results on console* : When camera captures image forwards it to Rasp berry pi, where YOLO algorithm based on its trained examples classifies the image and is displayed on the console and distance of the object classified from the blind person is also displayed on the screen.
- *Audio output* : to blind person When a blind person is on pathways walking to some location, if any objects are on the path of blind person then camera captures image and forwards it to Rasp berry pi, where YOLO algorithm based on its trained examples classifies the image and corresponding name of image Viz Person, Vehicle, Bike, water etc which are in text form are converted to speech form by Rasp berry pi and this speech is heard by the blind person through head phone. Also the distance between the object classified and the blind person which is calculated by Ultrasonic sensor is heard by the blind person where he/she is alerted with what exactly object is and how far the object is for his

- Very handy and Low cost
- Easy navigation system by device
- Accurate measurement by sensor and image detection by the camera

4.2.1 *Novelty of the product*

- It is little bulky to carry .
- Price is very high ,still has high level features.
- Using the RGB-D sensor for identifying the down stairs .
- And using the moisture and temperature sensor for detect the water and any kind of heating products.
- Using the camera for detect the image by one shot technology .

4.2.2 Product upgradation

- Increasing the quality of ultrasonic sensor .
- The stick built quality can be improved by using good materials.
- Better and noise cancellation wireless communication .
- Software updates.
- Voice command navigation system.

4.3 PRODUCT MARKETING STRATEGY

- Being an advanced ultrasonic walking stick it is capable of guiding a blind person much better than any other normal stick.
- Using the yolo one shot camera object detection it make the user scare free from that objects.
- Allowing some blind people to use the demo product free of cost to increase the popularity.
- Advertising the stick in TV advertisements and commercials

4.3.1 *Product marketability plan*

- The product will be available on every online store like Amazon and Flipkart.
- An official website of the company for purchasing the stick will also be available.
- It will be available in various offline stores.
- Various Blind foundations will be provided the stick at a low price.

CONCLUSION

This project proposed the design and architecture of a new concept of Smart Electronic Guiding Cane for the Blind People.The advantage of the system lies in the fact that it can prove to be very low cost solution to millions of blind persons worls wide.The proposed combination of various working units makes a real-time system that monitors position of the users and provides dual feedback making navigation more safe and secure.

It can be further improved to have more decision taking cpapbilities by employing varied types of sensors and thus could be used fpr different applications. 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 project aspires to make the world a happy environmental for people who are crippled or make some extreme memories seeing. From the outcomes noticeable above, any blind person can purchase this product with very low cost involved, effective and simple way. There are wide styles of things that the gadget can distinguish. Subsequently it might be utilized for standard games to upgrade their experience and make a superior region for them. Later on, face images of any person can be trained and might be included, all together that if there are any familiar faces, they can be perceived.

This project also can be implemented by training the module about the words and any books that are before the module the reading of the book in audio form can be made to listen to blind person. With expanding concentrates in implanted frameworks, additional calculation in a little scope can be anticipated inside what's to come. This can extraordinarily impact the execution of AI capacities like thing discovery, face notoriety and so forth.

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