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SMART BLIND STICK USING MACHINE LEARNING

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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. Many people around the world are blind or not able to see clearly or recognition the objects properly. 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. 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, the stick provides a safer and a better navigation experience for the visually challenged.

Index Terms -Object detection, Machine Learning, IoT, Raspberry pi, pi Camera, YOLO algorithm.

I. INTRODUCTION

Digital image processing is the use of computer algorithms to perform image processing on digital images. 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 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.

II. LITERATURE SURVEY

A. Visual Assistance for Blind using Image Processing:

In this paper, the authors have given idea about device which uses ultrasonic sensors to pick any object within a 180-degree path, it will send the information to the microcontroller, including the bearing and distance from the blind user. Microcontroller will issue command to camera to take a photograph of the object, then via image identification the image information will be conveyed to the user via microphone/a pair of headphones. Hence, it makes easy to manage. It helps user to complete their day today activities easily. [1]

B. Using Artificial Tokens to Control Languages for Multilingual Image Caption Generation:
In this paper, the authors have given brief about the system for Image captioning using artificial tokens to translate the computer vision into a caption in multiple languages such as English, Japanese and Chinese (Mandarin).The images are given to the Convolution Neural Network (CNN) to extract the features of the given images, and then the feature is converted to a sentence using Recurrent Neural Network (RNN). The benefit of multilingual model makes it open for multiple users. [2]

C. Object Detection for Visually Impaired Using Raspberry Pi and Ultrasonic Sensors: In this paper, the authors have described the use of ultrasonic sensors integrating it with Raspberry Pi for detecting the obstacles. The ultrasonic starts sending the signals with minimum delay and after that, the signal returns as an echo to the sensor receiver and the Raspberry Pi estimates the time it takes to get the signal back from the sensor. Using the time taken the distance of the object is calculated and converted into speech and feedback is given through speakers or headphones. The blind person will be stopped from colliding with any object. [3]

D. Design Review of Smart Stick for the Blind Equipped with Obstacle Detection and Identification using Artificial Intelligence:
The purpose of this paper is to be visual assistance of a visually impaired person. It takes speech of a user via microphone and search for it with the help of image processing algorithm and try to locate it and give instructions to the user via headphones to reach the destination.t is a wearable device which consists of a microphone, headphone and Pi camera which is connected to Raspberry Pi to process the images and video captured by the Pi camera. So, if a user speaks, the device will listen and try to process the image and find the position or place and also guide the user to reach out. [4]

E. Blind Guider – A Smart Blind Stick:
The paper emphasizes object recognition more for object detection and recognition. It consists of an ultrasonic sensor node and object detection device. The device uses ultrasonic sensors for detecting wet flour and staircases. It detects the objects in front of the user using the camera with the help of object detection and machine learning algorithms to produce the feedback sound via headphones about the object detected. [5]

F. Electronic travel Aid for Visually Impaired People based on Computer Vision and Sensor Nodes using Raspberry Pi:
The objective of this paper is to build a device using an ultrasonic sensor, which will give the distance from an obstacle and also vibrate a vibrator if the object is too near. Also, by using direction identification, obstacle detection, path recognition and navigation system will take the users to its destination. Navigation is performed with the help of GPS and maps. [6]

III. PROBLEM STATMENT

Existing System: Using a conventional white cane to aid in navigation. The limitation in white cane is that the information's are gained by touching the objects by the tip of the cane. The traditional length of a white cane depends on the height of user and it extends from the floor to the person's sternum. CNN based model need more training and more data set. The word is full with verity of objects so prepare and train the model with such huge data set of objects is a big task.

Limitations of Existing System

- Existing systems have the following limitations.
- Very Expensive
- Difficulty to identify the object
- No security of the stick

Proposed System

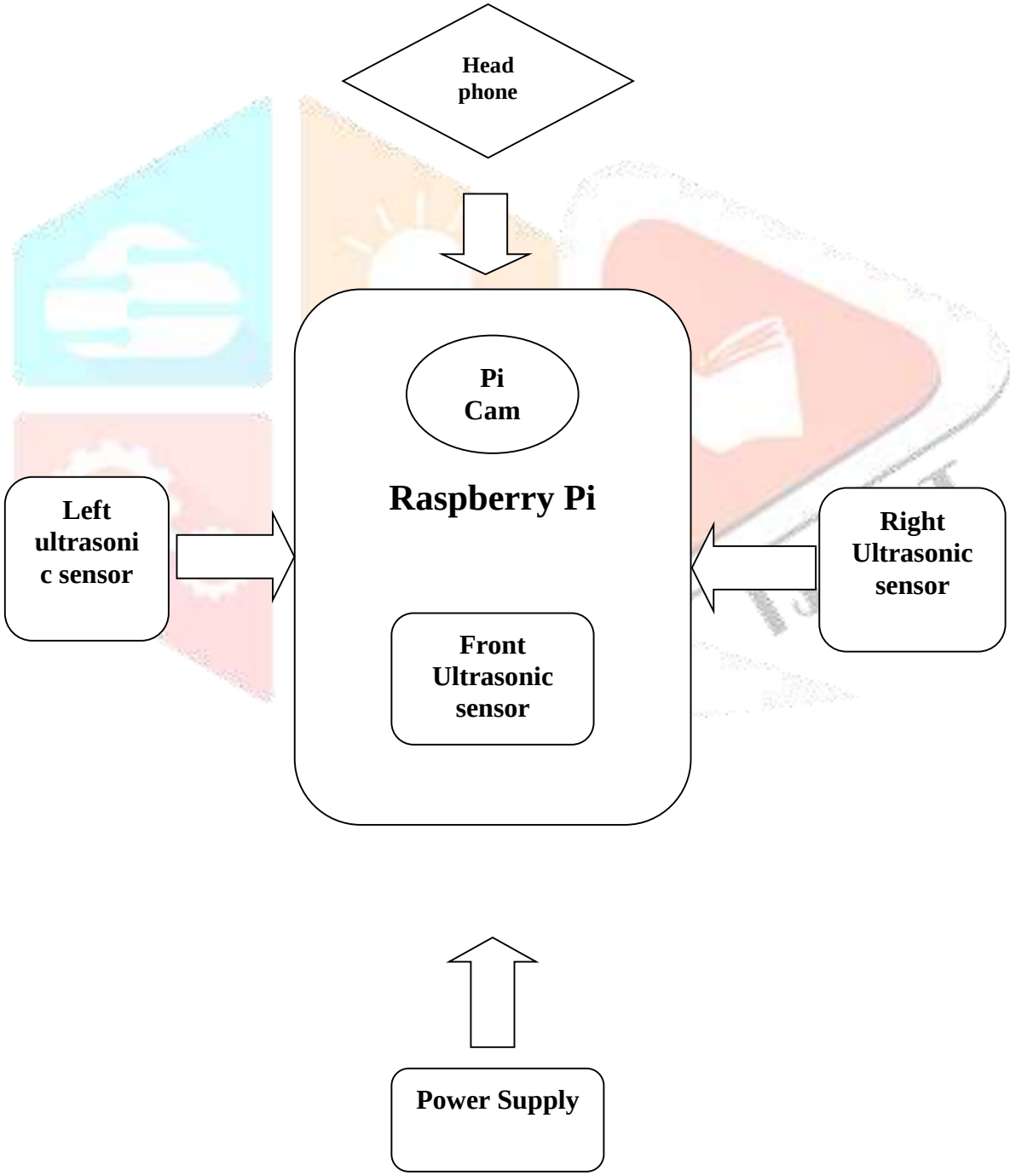

Fig a-Purposed System

The proposed system architecture (Fig a) will utilize the features of microcontrollers, machine learning and IoT for its core functionalities.et preparing and training the model with verity of objects.

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
- Can recognize any object with YOLO Algorithm SYSTEM DESIGN

The use case of the Smart Blind Stick is as shown in Figure b. 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 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 asking him to slow down the two ultrasonic sensors on either side of the stick are triggered on detection of any object.

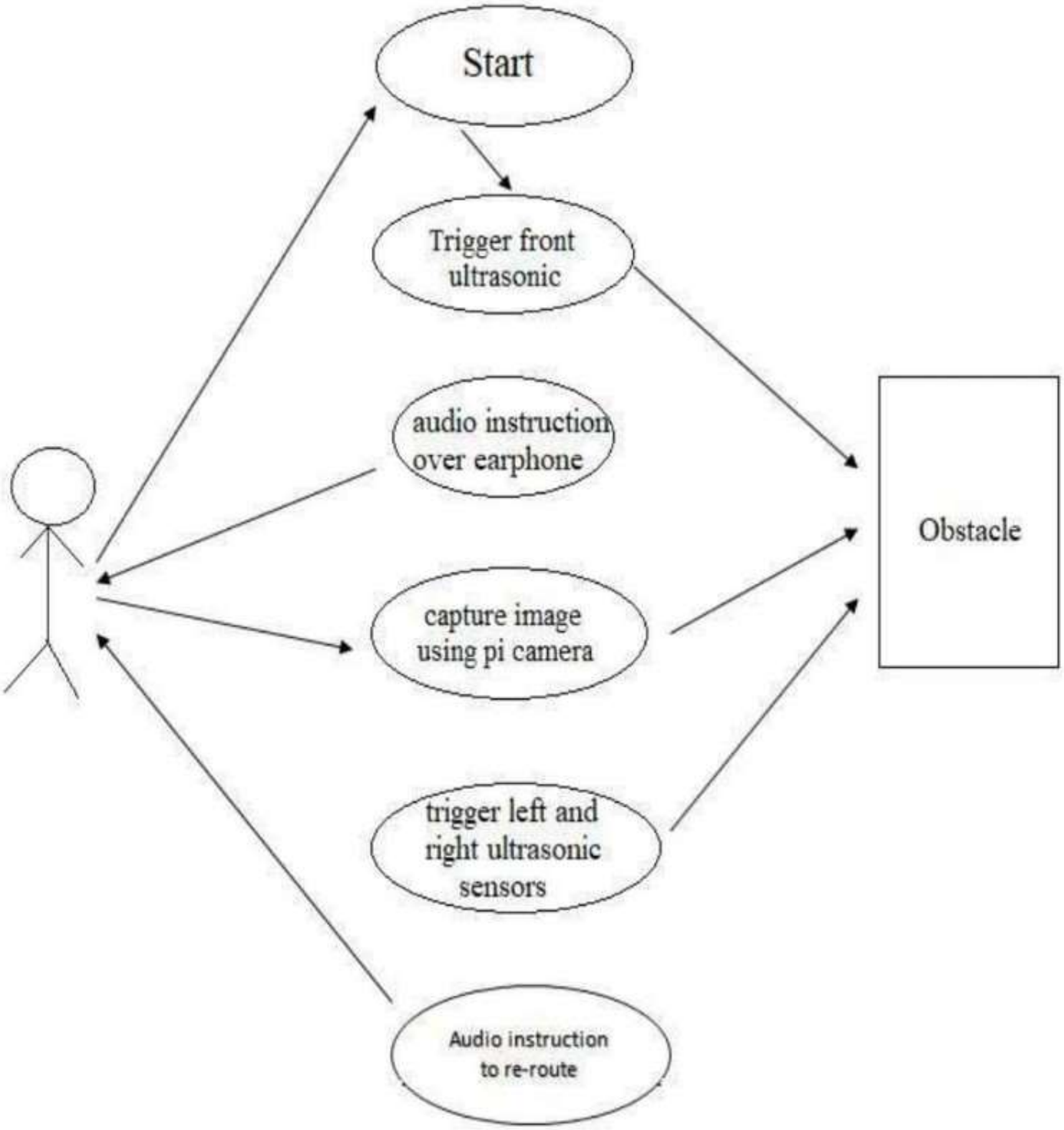

Figure 2: Use Case of a Smart Blind Stick

IV. REQUIREMENTS

Hardware Requirements:

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

Software Requirements:

YOLO Algorithm, text to voice module IMPLEMENTATION

System design is the technique of defining the elements of the system consisting of the architecture, module and components and their working and the way the records goes via the machine. The gadget may be categorized into enter unit, manage unit and the output unit. These gadgets are aligned on the blind stick for the precise item and the brink detection. The stick is embedded with sensors, raspberry pi, Bluetooth speaker, and battery bank. If the blind or the visually impaired humans is on foot together with his/her stick into his/her hand they shall recognise the limitations coming in front of them thru camera so one can do picture processing of barriers coming in their route. The sensors like Raspberry pi version four are located over the blind stick which makes its strong. If the stick of the visually impaired individual detects an obstacle within

the radius it shall give a beeping sound. A silicon ribbon is hooked up to the pinnacle a part of the stick so that it will not slip. If the blind man or woman is shifting in a particular route and in a sure course, the boundaries coming during the blind person are being acknowledged via the digicam and the audio message might be given to the blind man or woman. The stick is made artificially wise by way of photo processing method and feature extracting method. We have used Google Collab for this venture; the digital camera is initialized by using the use of OpenCV library and the digital camera starts off evolved taking pictures frames. Then the gadget makes use of YOLO v4 that is educated at the COCO dataset and darkish Neural network (DNN) to discover the item kept before the consumer. The object recognized is later transformed to an audio phase the usage of gTTs that is a python library. The audio phase is the output of our system that gives the spatial location and name of the object to the character. Now with the aid of the use of this data the individual could have a visualization of the gadgets round him. The proposed machine will even guard the individual from colliding to the objects round will cosy him from injuries deliver the space among got here.

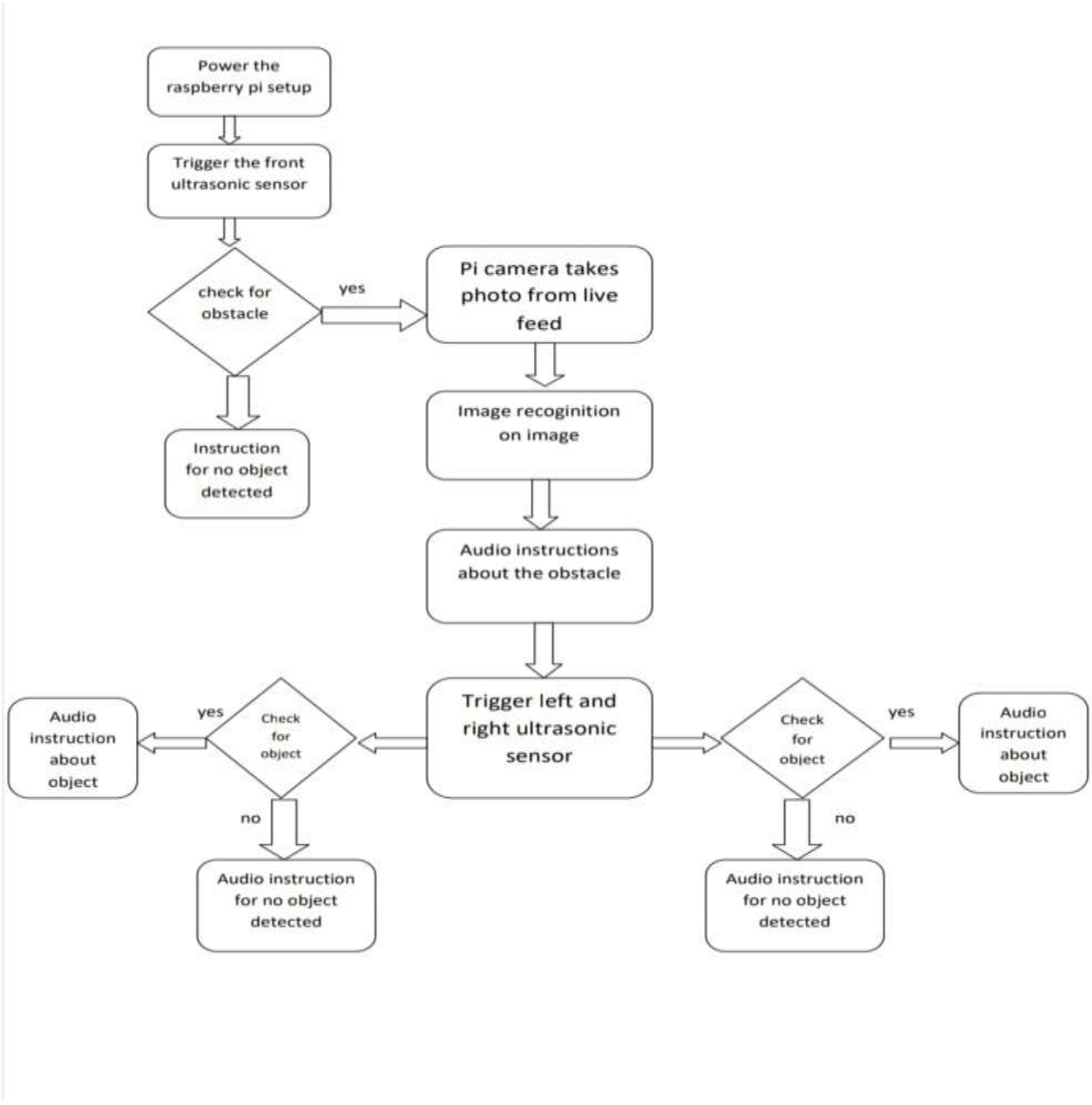

Fig-Work Flow

V. RESULT

The stick is able to detect obstacles and navigated easily to the blind. The final hardware of purposed model as shown below.

Fig-Smart Blind Stick

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 it comes to independent mobility. The advantage of the system lies in the fact that it can prove to be very low-cost solution to millions 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.

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