Design and Development of Smart Belt for Blind

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***Abstract*- This work proposes a technique to help the special visually challenged people in their everyday life. The main agenda of this device is to provide a convenient and safe method for visually challenged people to overcome their difficulties. Flexibility, low cost, portability, simple design and practical to user is the goal of this project. The system proposed uses ultrasonic sensors to detect the obstacle in front of the user and identifies it by image processing and alerts the user by the Bluetooth enabled audio output device, so that the person can navigate through the obstacle with ease.**

***Keywords*- Image Processing, Text-to-Speech, YOLO Algorithm,**

Object Detection, Smart Belt.

I. INTRODUCTION

Low vision, vision loss, visual impairment and blindness have drastic and a serious influence on the person experiencing such conditions. They carry with them social, emotional and other monetary issues affecting their wellbeing and making the life of such individuals difficult to even perform their daily activities.

In todays date, technology and human life cannot be separated as it has become the phenomenon of the world. As this technology can help the visually impaired people in many different ways in their daily routine, it can also help the blind to overcome their insecurities. Blind people cannot determine the obstacle that is in front of them and the exact real distance of the obstacle from them and mobility for them is said to be difficult without relying on others and they feel unsafe in new environmental conditions. The aid used by them has limited support and flexibility.

Many scientists performed several researches to help the people suffering from blindness to better their ability of exploring the environment. To overcome the problems many devices has been developed to facilitate movement without relying on others. This project is the integration of ultrasonic sensor, camera, vibration sensor, Bluetooth module, rechargeable batteries, and interfacing them with a controller. The controller receives the signal of any obstacle present with the help of ultrasonic sensors and gives a patterned output through the vibration sensor and the voice output through the Bluetooth by gTTS package.

II. OBJECTIVE

To help the blind people by developing an ETA device to make the user feel safe and secure, so that without relying on others he can walk independently. In this evolving world where, everyday new inventions are made, where people live without depending on others, we propose a smart belt for blind for them to be independent, which is economical, flexible and easy to use.

III. LITERATURE SURVEY

S.Gangwar in 2011 has designed a smart stick for visually impared people. This uses infrared (IR) sensors to produces an early warning of any obstacle sensed and alerts the user by vibration signals. While the smart walking stick is mostly fixated to detecting obstacles, it does not help in supporting the blind during emergency. And the infrared sensors are not so efficient as they cannot detect only the obstacle which are located far away.

Benjamin etal(2011) developed a smart stick which the objects are detected with the help of laser sensors ,which detect any obstrution in the path by giving the signal to the user in the form of a high tone "Beep" sound with the help of earphone.The construction is simple as it only detects obstacles and does not provides any support. It does not have any feature to guide the user as it only provide a beep sound when the obstacle is detected.

Amirul A. Talibetal and Mohd Helmyabd Wahab (2011) develope a cane that would alert the person using both the vibration as well as voice through earphone.Ultrasonic sensors detects the obstacle present in the front and then the data is send to the user through microphone. The voice input is transmitted to the person through earphone.This device is a bit complex as the voice command is only about the obstacle and not how to navigate.

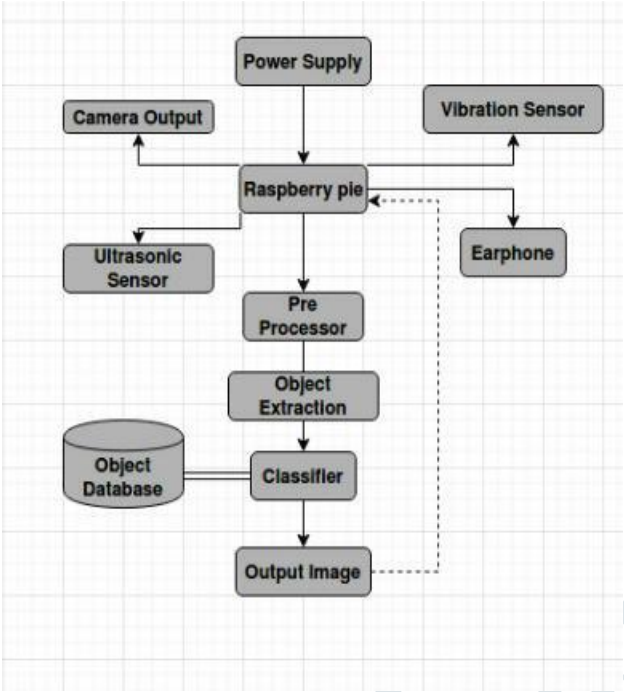
A. Sakhare along with Shruti Dambhare designed a system using object detection and artificial vision which provides real-time assistance through GPS which helps in providing a low budget and a good navigation sytem which provide the system about the objects located around the user ,later those information is forwarded to the user in terms of vibrations. In while different patterns of vibration where used for different objects. The main problem with this is that the patterns need to be learnt clearly.

IV. WORKING PRINCIPLE

The aid consists of ultrasonic sensors, camera, microprocessor, vibration sensors, bluetooth enable audio output device, and rechargeable batteries.

The obstacle detection part of the system includes four ultrasonic sensors as input and vibration sensors as a output.

The ultasonic sensors detects the obstacle within the range of 0.02 to 3.5 meters and gives a stop signal as audio output and a vibration signal.



The object identification part of the system includes camera, and output device. Object identification is related to both image processing and artificial vision that can detect the instances of different objects of a certain class in the given input frame.

Every object class different from each other due to their unique features which helps in defining the different categories – as for example all the different object which are round in a 2 dimensional plain is a circle. Object detection and identification uses those special characteristics. This method mostly falls under either deep learning or machine learning approach.

Object identification is a set a procedure of video input converted into frames which is then segmented and decomposed into image for feature extraction. The extracted feature is then compared with database by a classifier and specifies the object.

Based on the frame rate the input video is converted into images and further processing.

This involves

1. image segmentation and decomposition
2. Feature extraction
3. Classification/identification

The camera module is a portable camera which supports Raspberry Pi3. The camera module communicate with the Pi using the MIPI serial interface protocol. It is normally used in machine learning, in different surveillance or in image processing. The camera takes the input from the real time environment.

During Image segmentation the whole digital image is divided into multiple set of different segments. The main agenda of using segmentation is to simplify the image by dividing it into different segments so that the different object in the frame can be easily represented so that more meaningful data can be achieved for the research and analyze. To be precise, during image segmentation each pixel is allocated a label , while pixel having same labels also have some similar characterstics.

As a result different set of segments are collected over the whole image or a part after which the group of selected segments undergo image extraction through edge detection method . Each of the pixel in the segment in the share some similar characteristics like texture. These pixels are given a value based on colour or grayscale intensity.

Image decomposition includes compression and thresholding. Based on the threshold value only the required features are extracted for further processing.

Feature extraction is one of the import process which takes the whole image data into account and produces a dimensionally reduced set of important data which are required for the process. In this process its main function is to give more importance to some data which can help in describing the object while ignoring the rest. While analyzing the given important data one of the major problem is caused due to the large number of variable that are involved. Analysis of those large number of variable generally required a large amount of memory as well as computation power .While using Feature extraction method the data in the system is reduced which leads to decrease in the memory required, hence leading to a faster computation power, which increases the learning speed of the system.

Classification of the different objects can be done on the basis of the features extracted during feature extraction process. After the feature extraction the data acquired from it is kept into different classes depending upon the characteristics of the data, which trains the system.

The distance measuring part of the system includes the camera input and audio output device.

For knowing the distance how far the object is from camera we can use triangle similarity method.

The triangle similarity method can be described as suppose the object of known width W is at a distance D away from the camera. When a picture is taken we measure the pixel of the image as P, which help us deriving the focal length F of the camera.

$F = (P \times D) / W$

For example, when we place an object of 8.5 x 11 inches piece of paper at a distance of 24 inches away from camera and capture the image. When the width of the image is calculated it comes closely around 248 pixels (P).

Thus the focal length F of the camera can be calculated as:

$F = (248 \times 24) / 11 = 543.45$

If the camera is moving nearer or farther away from the object, then also the triangle similarity method can be applied to know the distance of the object from the camera.

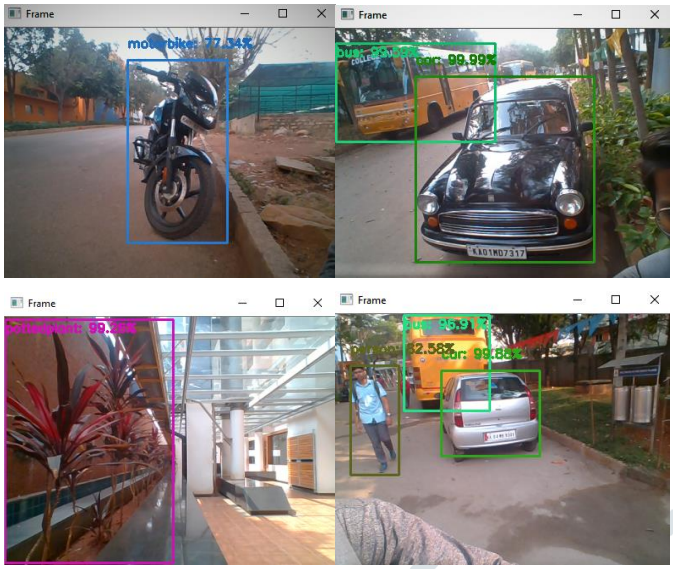
D' = (Width x Focal point) / Pixels

The above calculated focal length is used in calculating the distance of the object from the user where the camera is mounted. The calculated distance is an approximation of the actual distance.

V. RESULTS AND DISCUSSION

This system is capable of detecting the real time objects through a camera video feed input and classifies the object type according to their features and alerts the visually

impaired person through a vibration and sends an audio through a Bluetooth earphone.



VI. ADVANTAGES

1. This system is applicable for the outdoor environment.
2. Low power consumption.
3. Rechargeable batteries are used.
4. Compact and waterproof.
5. Cost effective.
6. Flexible and comfortable to wear.

VII. CONCLUSION

This system can be helpful to the visually impaired people so that can move around with ease and without depending on some other person. The system specifies the obstacle and its distance which help the blind to avoid it. It is practical, flexible and cost effective. As the system is working at real time, it is safe and secure and aims to provide a better life for those people.

VIII. REFERENCES

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