SMART BLIND STICK WITH OBJECT DETECTION AND ASSISTANCE

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College ***:*** *The Oxford College of Engineering, Bengaluru -560068*
Branch ***:*** *Department of Information Science and Engineering*
Guide(s) ***:*** *Prof. Mr. Yadhukrishna M R*
Student(S) ***:*** *Mr. Bhishek N*
Mr. Ananda Theertha V
Ms. Anuhya Y
Ms. Nagavarshitha C H

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Introduction

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. Ultrasonic sensors are used for proximity detection of the obstacle. The stick vibrates on approaching an obstacle. This adds to the safety of the blind person. The appropriate instructions to the blind person is given over Bluetooth earphones. Thus using the various technology, the stick provides a safer and a better navigation experience for the visually challenged.

Objective

A blind stick is a tool that helps the blind people to navigate and move around in public areas. The blind person is expected to move the stick in front of him to ensure no obstacle is in his way. When the stick comes in contact with an obstacle, it is an indication for the blind person that he needs to change the path he was moving in. The smart blind stick aims at giving the blind person a better understanding of the path he is moving in. We achieve this by using a camera and a few ultrasonic sensors. The stick, with the help of a camera, detects the obstacle the blind person is approaching.
The smart blind stick aims at giving the blind person a better understanding of the path he is moving in. We achieve this by using a camera and a few ultrasonic sensors. The stick, with the help of a camera, detects the obstacle the blind person is approaching. This obstacle is detected and analysed and this data is retrieved on an android device. The data received, which is the obstacle detected, is converted to speech and appropriate instructions are given over Bluetooth earphones to the blind person.

The ultrasonic sensors placed at either side of the stick are used to detect the obstacles present in the sides. This helps us in giving a more efficient instruction to the blind person as to how he can evade the obstacle in front of him in a safe manner. The data of the ultrasonic sensors are manipulated using an Arduino UNO.
With the help of the data processed using these technologies, we aim at providing a better and more convenient method of navigation for the blind person. This stick helps them achieve a higher rate of self-dependency. The system gives a priority to safety and comfort and is also cost effective.

Methodology

1. Obstacle detection:
Object detection is the main module of the project. The module mainly aims at finding the right models for detection of the obstacle. There are multiple algorithms that can be used to detect the presence of the obstacle. These models are loaded on to the Raspberry Pi. The obstacle detection actually takes place on the Pi.

2. Obstacle Recognition:
This is the second step once the detection of the obstacle is completed. The models used for the recognition can be trained to recognize custom objects that are required by us. The training is done by feeding the network of the model with enough images of the required object, which allows the m0del to learn from it. Once the model has learnt from the training data, it makes prediction on an image or a video fed provide by us. The model can also be used to refer obstacle in real time as well.

3. Distance sensing:
Ultrasonic sensors (HCSR04) are used for distance sensing. The Ultrasonic sensors have an echo and a trigger. The trigger Pin sends out an ultrasonic signal out on starting the sensor. The signal on encounter of an obstacle, returns the signal. This signal is captured by the echo terminal of the USs. Based on the time taken by the signal to travel from the trigger and back after hitting the obstacle, is used to calculate the distance. This distance is used to trigger the obstacle detec6 and obstacle recognize modules on the stick

4. Text to Speech:
This is a small but a vital module of the project. This is used to convert the text messages to speech. These instructions are given over an earphone to the user. The google API GTTS (Google Text-to-Speech) is used for this purpose.

5. Obstacle avoidance:
This is the final module of the project. This mainly deals with the instructions given to the user based on the detected obstacle and also the distance to the closest obstacle on either side to re-route. These are converted to speech using gtts. These instructions are given to the blind person over earphones.

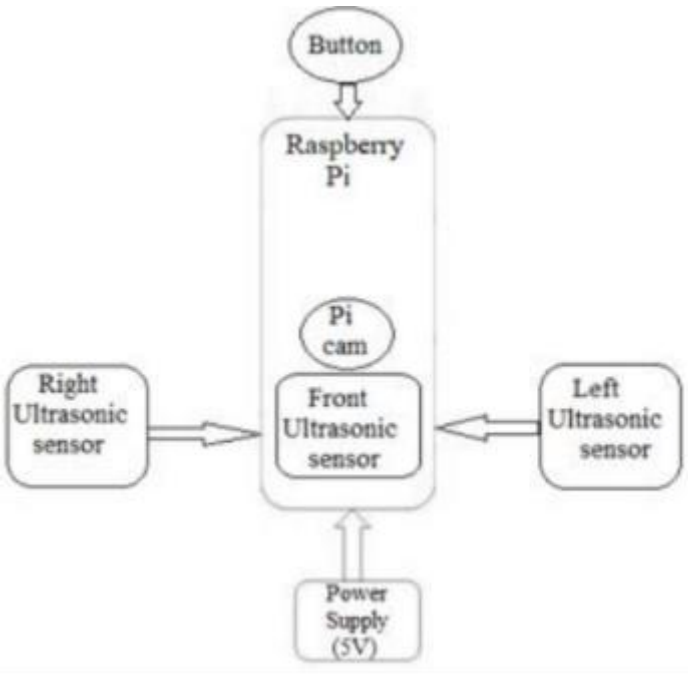

Figure: System Architecture

Results and Conclusions

The figures shows the Pi camera detecting obstacles that its detecting in the initial run with the following confidence percentages. The outcomes of test results for a variety of user interactions with the application are seen below:

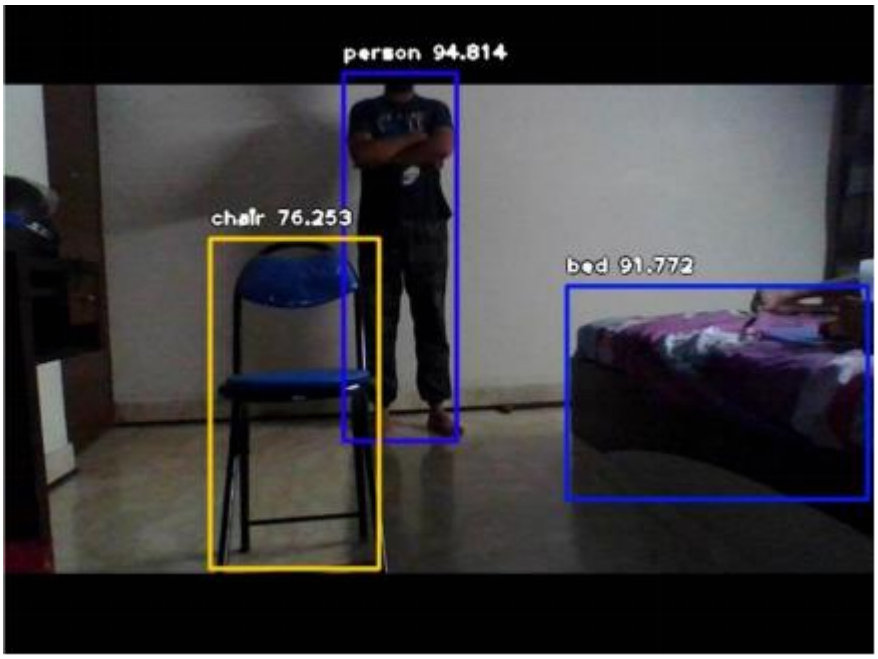

Figure: Object detection

Figure: Car object detection

Figure: Potted plant detection under night light

The next figure shows the model being loaded into the Raspberry Pi for the first time as it begins object detection with the action and reaction time in detection being calculated and displayed. The front sensor is responsible for detection of an object.

Scope for future work:

The stick can be enabled with GPS which can help the blind for better navigation. The smart blind stick can be trained for more number of objects which in turn would help the blind person to move around in various neighborhoods with increased level of safety. In the future, the stick can be used for face detection. This increases the safety of the blind person in knowing the identity of the person in front of him.