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SELF-DRIVING CAR USING RASPBERRY PI, CONVOLUTIONAL NEURAL NETWORK, ARDUINO MICROCONTROLLER

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Abstract-self-driving cars refers to cars that do not require human help to drive from one point to another. With the evolution of artificial intelligence has served as the catalyst in the field of technology. By using that technology we can now develop a self- driving cars.one such creation is the birth of self – driving cars. The inclusion of assistive computer technology into vehicles ,such as the use of cameras, stability control systems ,have been seen to improve the safety of passengers .This project proposes a model of self driving car which is capable of driving from one location to another location. It uses camera to take the images from real world things later it sends it to the convolutional neural network through raspberry pi and arduino decides any of the direction to steer the car and reaches the destination.

Keywords: Raspberry Pi, image processing, convolutional neural network, arduino microcontroller

1. INTRODUCTION

Every year, there are around 1.25 million deaths caused by road accidents. That's equivalent to 3287 deaths on daily basis. On top of that, there a ridiculous amount of traffic that we have to suffer through, which just creates unnecessary frustration for most people .This is where discovery of self – driving car emerged.

With self – driving cars, the goal is to be able to operate a car like human beings driver. The one catch is that there's driver behind the seat. Driving is the biggest need of our daily life. Almost all the person travel and move from one point to other through a vehicle. Vehicles are used in every field of life. A car which can accelerate itself while looking out for obstacles.

This project involves the use of image processing concept, a front facing cameras, where in which the camera will capture the images from the real world .it uses ultrasonic sensors to detect the obstacles, it uses convolutional neural network, arduino microcontrollers. Lane detection, and pothole detection animal detection is also performed in this paper.

2. METHODOLOGY

A camera module is mounted on the top of the car where the raspberry pi sends the images from the real world to the convolutional neural network which then predicts one of the following direction i.e. the right, left, forward, stops which is then followed by sending a signal from the arduino to the controller of the remote controlled cars and as a result the car moves in the desired direction.

The predicted direction is sent to Arduino and Arduino signal gets triggered which in turn helps the car to move in particular direction with help of controller.

- The raspberry pi and laptop is connected to the same network, the raspberry sends the image captured which serves as input image to the convolutional neural network.
- The image is gray-scaled before passing it to the neural network.
- A neural network makes predictions for steering based on input images.

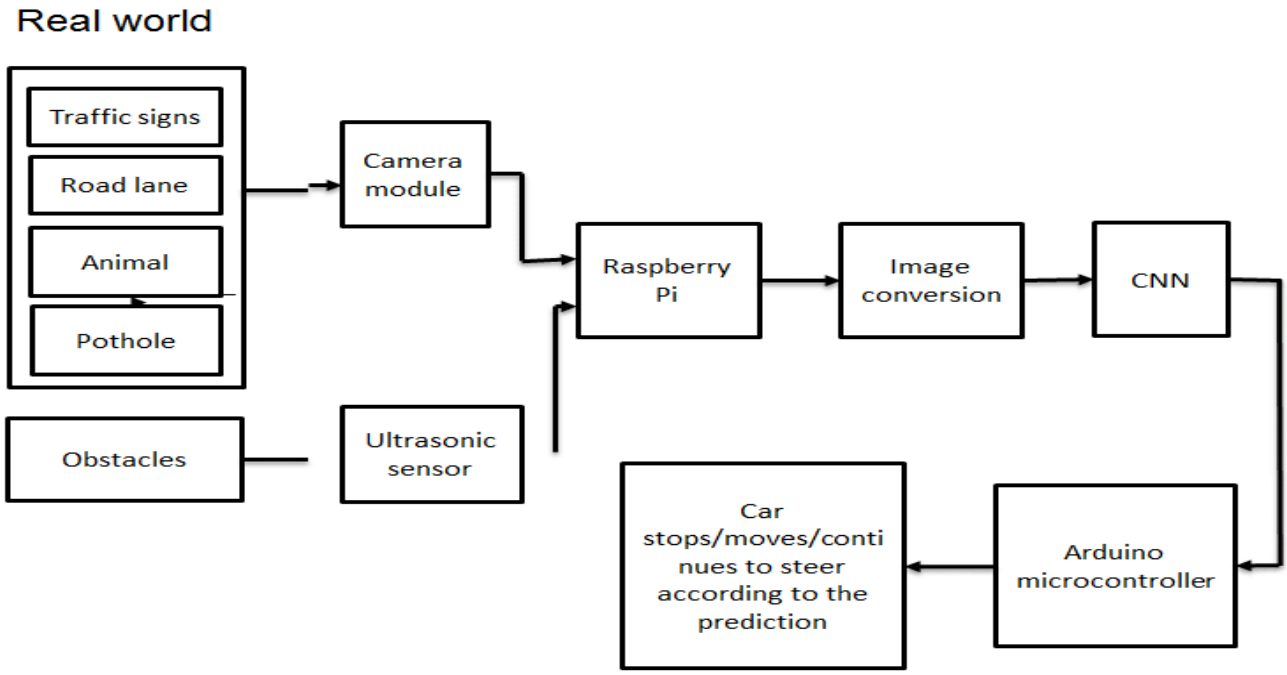
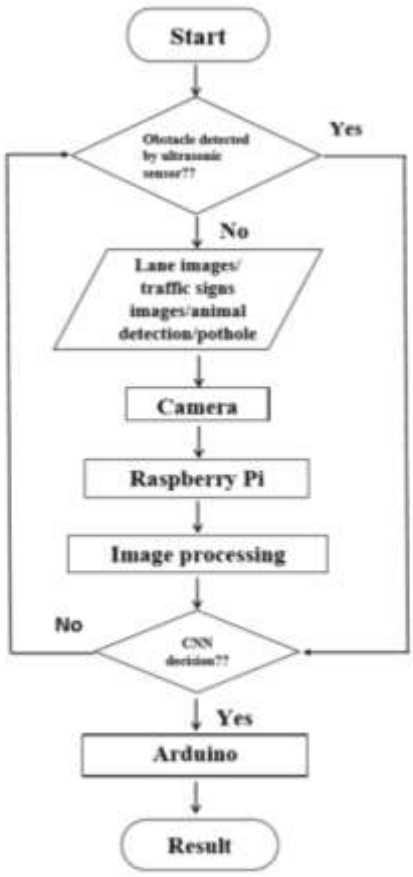


Fig 1: Block diagram of self-driving car.

3. IMPLEMENTATION

FLOWCHART



POTHOLE DETECTION

Fig 2: pothole detection

The pothole model is derived from the assumption that any strong dark edge within the extracted road surface is deemed a pothole edge if it adheres to certain size constraints. It can be seen that one of the characteristics describing the potholes is a large dark shadow area. At this point, potholes that do not have dark edges and only have different color variations within them like sand or dirt are disregarded. Size constraints are obtained using the selection of images withheld for parameter tuning. Any shape of contour that meets these conditions is deemed a pothole by the algorithm.

LANE DETECTION

The lane markers by using a web cameras to real time lane detection for driving system using image processing based on edge detection and hough transform has been developed to aid a driver in the lane departure decision-making, to reduce a loss of concentration and to prevent an accident while driving In this, we propose a method for detecting the lane markers in real time by using web camera to record the road as a video stream file. The edge

detection is a technique which is used to identify the points into sets of curved lines segments called edge. Hough transformation method is use to detect the lanes in an image for increasing the accurate lane detection and the safety driving system. The results show the performance of the proposed lane detection and tracking algorithm in various lane road conditions on video clip that used for testing.

TRAFFIC SIGN DETECTION

Traffic signs have two major features: Shape (square, circle, triangle, etc.) and Color (red, yellow, blue, green). Detecting shapes in an urban environment is very challenging and unreliable due to complications in image acquired. Also, environmental conditions play an important role in the detection procedure. On the other hand, traffic signs deliberately use raw/strong colors that stand out in any surrounding which makes its detection possible. Hence, color information can be considered as one of the better feature for traffic sign analysis.

ANIMAL DETECTION

The Image/video acquisition from the camera is done. Then it is converted into frames of images .Store the images of each animal as database which is used as training set for our program .Compare camera captured frames with the database. Then the function reads the image and preprocessing is done on that image. After that perform Blob detection on the frame and blobs are matched with images from training database images. And check if the image is matching or not. For identification of that animal is desired or not. An array is created and program is written for each animal to be identified. Finally intimation or alert of the result is made.

4. RESULTS

1) Proposed self driving car model

Fig 3: proposed model

2) Animal detection

Fig 4: animal detection

3) Convolutional neural network implementation

Fig 5: convolutional network implementation

4) Direction detection (Right and left)

Fig 6: direction detection

5) Obstacle detection using ultrasonic sensor

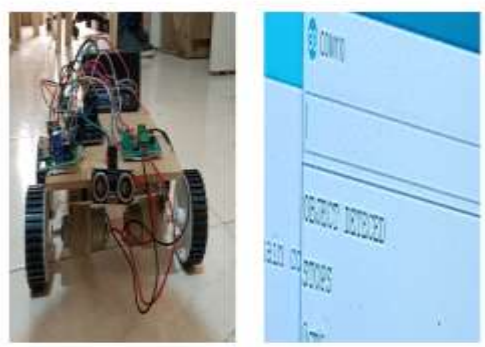


Fig 7: obstacle detection

6)Pothole detection

Fig 8 : pothole detection

5 . CONCLUSION

The different hardware components along with software and neural network configuration are clearly described. With the help of Image Processing and Machine Learning a successful model was developed which worked as per expectation.Despite the inherent benefits, autonomous vehicle technology must overcome many social barriers. Much like the issue faced by the first automobiles, the influence of metal models can impede the advancement of technology. However new legislation is creating opportunities for these cars to prove their viability.As more states legalise the driverless cars, the social obstruction will give way, allowing for the largest revolution in personal transportation since the introduction of automobiles.

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