AUTONOMOUS CAR USING RASPBERRY PI

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Abstract: A variety of autonomous cars have been created for different purposes. So, the aim is to achieve and build an autonomous car with good features and low cost. In the proposed system we will be using Raspberry Pi, Arduino as control units for our car. The car will be camera enabled for which a PI Camera is used. The car will be able to navigate by its own. It will be able to follow the traffic signal. As it will be camera enabled obstacles will be avoided by the car by using the neural network technique.

Keywords: Raspberry Pi, Pi Camera, Arduino, Neural Network.

I. INTRODUCTION

An autonomous or self-driving car is a vehicle that must be able to navigate by its own without the inputs from human being. There is rapid growth of autonomous cars in the automobile industry because of the automation and the need of human to make everything easier. The self-driving car can be helpful in anonymous ways like increasing efficiency, allowing faster speed, minimizing traffic jams and accidents. Most the reputed car companies have started taking safety seriously.
To tackle all such problems that are faced by humans while driving a car the proposed system represents a minor version of a self-driving car with most of its features. The Raspberry Pi will be the master device while the Arduino Uno will be our slave device. The Arduino will be responsible for the control of the motors. For the purpose of lane tracking, we will be using OpenCV computer vision technique for image processing. To avoid the obstacles the car will be trained by using neural network. In this system we have used algorithms like Canny Edge Detection and Haar Cascade Model.

II. LITERATURE SURVEY

Michal Ruziicka, Petr Masek. "Real Time Visual Marker Detector and Tracker Based on Computer Vision for Semi-autonomous Convoy Purpose".
A research was done by Michal Ruziicka and Petr Masek with the title "Real Time Visual Marker Detector and Tracker Based on Computer Vision for Semi-Autonomous Convoy Purpose". This analysis is about the control of the semi-autonomous convoy by designing the computer vision method. The strength of this research is low power consumption and low-cost product.
Limitation: The weakness of this research is using 320x240 low resolution of captured frames which can cause the result not correct. Higher resolution can't be used due to the low-price power device which doesn't do well in real time processing due to its lower frame rate. But this drawback can be solved by OpenCL optimization.

K.N.V. Satyanarayana "Based on machine learning Autonomous car using raspberry-pi Open CV Python Neural network Autonomous car". International Journal of Engineering Research and Applications (IJERA).vol 7,no.12, pp. 76-82.
The system had an Pi Camera, Ultrasonic sensors mounted to the car to take the inputs and Raspberry Pi was used to do the processing.
Limitation: Problems occurred when the car wanted to steer itself.

Tiple Anjali Hemant, Tiple Hemant P, Gurav Sagar Hanumant "Prototype of Autonomous Car Using Raspberry Pi" International Journal of Engineering Research in Electronics and Communication Engineering(IJERECE) Vol 5, Issue 4, April 2018.
A way is set for marked road edges are explained in well relying upon OpenCV. Cars that drive themselves can improve road safety, fuel potency, increase productivity and accessibility; the self-driving technology helps to reduce accidents by addressing the main causes of collision: Driving error, distraction and sleepiness.
Limitation:

- The car can avoid the obstacle but it also need to overtake so additional advanced algorithmic program is needed.
- Multilayered processors should be used for quick process.

III. PROPOSED SYSTEM

The following diagram shows the block diagram of the proposed system.

1. The Pi Camera will be mounted on the car. It will be connected to Raspberry Pi 3B+. The camera will capture all the images and send the data to the Raspberry Pi for processing.

2. The Raspberry Pi will be powered by a 5V power supply. We will install the Raspbian Stretch OS. The Genny editor will be used for the programming purpose. The programming language will be C++.
3. The Raspberry Pi will process the data received from the Pi Camera and the output will be send to Arduino UNO for further processing.
4. The Arduino will receive the data and it will send necessary instructions to the L293D motor driver.
5. The L293D motor driver will start the dc motors according to the instructions received from Arduino.

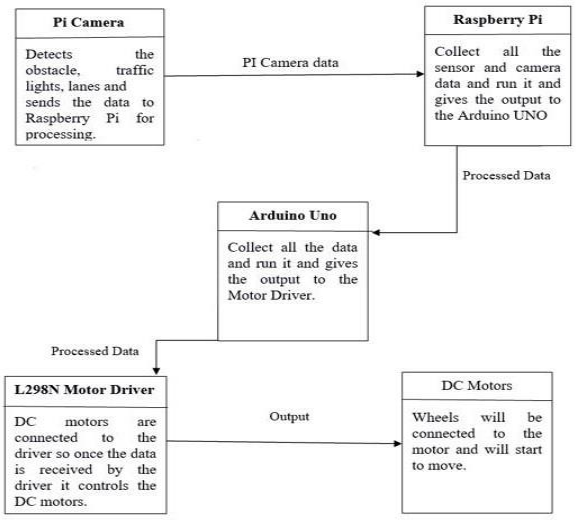

Fig.1 System Architecture

A. Pi Camera: The Pi Camera will be used to detect the objects. It comes with 5 Mega Pixel and 8 Mega Pixel variant. The angle of the 5 Mega Pixel is set at 54 x 41 degrees. The maximum video mode is 1080 at 30fps with codec H.264.

B. Raspberry Pi: The Raspberry Pi 3B+ works as a minicomputer. It has a 1.4GHz 64-bit quad-core ARM Cortex-A53 CPU. It has a dual-band 802.11ac wireless LAN and Bluetooth 4.2. This version of Raspberry Pi has an improved thermal management. It has 40 GPIO pins that can be used for different purposes. It has a HDMI port, 4 USB ports and a LAN port. It also has an audio jack embedded on it.

C. Arduino UNO: It has 14 I/O pins from which 6 of the are PWM. The Arduino has USB so it can be connected to the computer. It requires a supply of 5V.

D. L293D Motor Driver: The IC L293D can be used to run 2 motors at same time. It can control and give direction to the motors. It also has thermal shutdown feature.

IV. METHODOLOGY

A. Image Processing using OpenCV:

In the proposed system we will use OpenCV. It is a library of programming functions mainly dedicated to computer vision or image processing. This library is cross platformed. We will use the OpenCV module to train the cascade classifier, to detect stop sign and traffic lights. OpenCV is written in C++.

B. Lane Tracking:

The lane tracking can be done by using image processing technique. The first step is to convert image signature. Region of interest needs to be created as shown in Fig.2. The next step is to create a perspective transformation which is also known as Bird Eye View. Some threshold operations are needed to be performed. The proposed system uses the Canny Edge Detection Algorithm. This algorithm is used to detect the edges.

C. Stop Sign Detection:

The stop sign detection is carried out by the neural network training. It requires a cascade training software. The training is done by using the Haar Cascade Model. An image classifier program is needed. To calculate the distance linear equations can be used.

D. Obstacle Detection:

For the object detection there is a need to extract positive samples for the object. Then cascade training for object detection can be done. To calculate the distance between the car and the object linear equations can be used. The lane change operation is the next step for the detection.

V. RESULT

After performing various operations, we got the following output. The first output gives the region of interest for the tracks. The second frame shows the perspective eye view and the final view after using Canny Edge detection is shown in the final view. The last frame gives the FPS and the direction of the car which it needs to move.

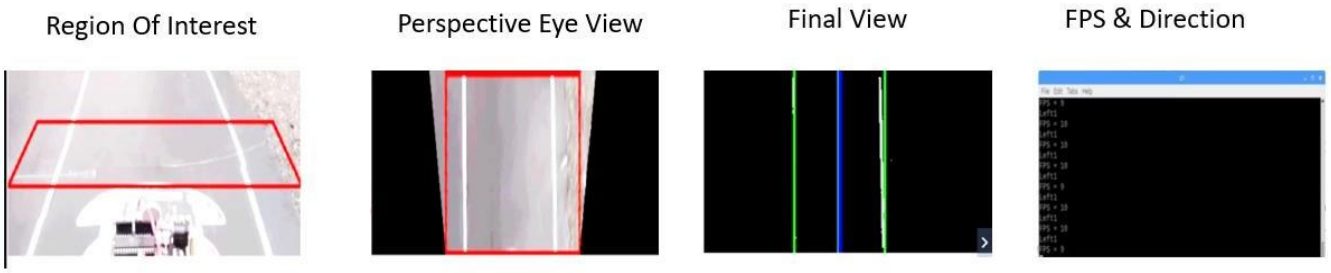

Fig.2 Results

VI. FUTURE SCOPE

1. The proposed system uses a Pi Camera in future a standard camera can be used which also as night vision feature.
2. Ultrasonic Sensors can be used for object detection purpose.

VII. CONCLUSION

While studying about the autonomous car we found that there is not one algorithm for the system but we need number and combination of algorithms to perform various operations. We were able to run the car successfully.

VIII. REFERENCES

[1] S. Hollborn. Intelligent transport systems (its) in japan. Technical report, Technische Universitat Darmstadt, pages 1–38, 2002.

[2] J. Njord, J. Peters, M. Freitas, B. Warner, K. C. Allred, R. Bertini, R. Bryant, R. Callan, M. Knopp, L. Knowlton, C. Lopez, and T.Warne. Safety applications of intelligent transportation systems in Europe and Japan. International Technology Scanning Program, pages 1–54, 2006.

[3] F. Y. Wang. Building an intellectual highway for ITS research and development. IEEE Transactions on Intelligent Transportation Systems, 11(1):2–3, 2010.

[4] F. Y. Wang. Parallel control and management for intelligent transportation systems: Concepts, architectures, and applications. IEEE Transactions on Intelligent Transportation Systems, 11(3):630–638,2010.

[5] J. Zhang, F. Y. Wang, K. Wang, W. H. Lin, X. Xu, and C. Chen. Datadriven intelligent transportation systems: A survey. IEEE Transactions on Intelligent Transportation Systems, pages 1–16, 2011.

[6] H. Kress-Gazit, D. C. Conner, H. Choset, A. A Rizzi, and G. J. Pappas. Courteous cars. IEEE Robotics and Automation Magazine, 2008.

[7] R. Sayed and A. Eskandarian. Unobtrusive drowsiness detection by neural network learning of driver steering. Proceedings of the Institution of Mechanical Engineers. Part D, Journal of Automobile Engineering, 215:969–975, 2001.

[8] A. Eskandarian and A. Mortazavi. Evaluation of smart algorithm for commercial vehicle driver drowsiness detection. Proceedings of the 2007 IEEE Intelligent Vehicles Symposium, pages 553–559, 2007.

[9] T. Akerstedt and M. Gillberg. Subjective and objective sleepiness in the active individual. International Journal of Neuroscience, 52:29–37, 1990.

[10] Y.Lin, H.Leng, and et al. G.Yang. An intelligent noninvasive sensor for driver pulse wave measurement. IEEE Sensor Journal, 7:790–799, 2007.