

Open CV Python Autonomous Car

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Abstract - Numerous kinds of autonomous cars for lurking motives are being created. The most challenging part of developing an autonomous car is to achieve low cost, low power and consists of many other missions. The objective of this project is to develop an autonomous car, which is capable of both navigating itself through the track and overtaking any obstacle. Our project is an open CV python autonomous car which is designed to give the human driver a calm and stress-free driving. When it comes on to designing an automobile various aspects have been taken into consideration to make a vehicle automated. In this project, we have concentrated on the application of an automated car, in which the car will detect the obstacle, traffic signal, and stop signs. It can also drive itself on the track, control, and look out the environment with the help of Ultrasonic sensors. The input is taken from the camera and ultrasonic sensors, with the help of Haar Cascade Classifiers it analyzes the objects and reports it to the raspberry pi. To test the car, some obstacles are placed on the track. The car will navigate itself and overtake all the obstacles on the track; it will also change the track when it detects any kind of traffic signs (left, right, and stop). If anything goes wrong in autonomous mode, user able to switch to manual mode to control the car. User will also be able to see the live view from the car through a webcam.

Key Words: Autonomous Cars, Open CV Python, Driverless Car, Raspberry Pi, Object Detection, Traffic Light Detection, Haar Cascade Classifier

1. INTRODUCTION

An autonomous car (also known as a driverless car, self-driving car, robotic car) is a robotic vehicle that is designed to travel between destinations without any human intervention. About 1.24 million People have killed inroads every year throughout the world. According to BUET accident research centre, the death toll every year is 10-12 thousand and a countless number of people are injured or become disabled destroying so many lives and families. The autonomous system is a solution to this problem. Here are some ways through which driverless car will change the world as follows:

1. Safety - No matter what we like to believe, humans are no good at driving. The 1.24 million people killed every year on roads worldwide are proof of that. Unlike us, autonomous cars will never get drunk, frustrated, dozed off or

competitive. In short, they will be a lot, a lot safer than we are.

2. Congestion – There are more people and cars on this little island than ever before, and they're all in a traffic jam between where you are and where you need to be. Driverless cars can travel in convoys, inches apart, without any needless dabs of the brake pedal to filter backward through traffic and create mysterious, pointless hold-ups.

3. Cost – Buying, insuring and maintaining a car is expensive. So why not let someone else do it! The future of driverless cars is likely to include sharing schemes, and affordable leasing options – cars will be more productive rather than spending 99 percent of their lives motionless outside your house.

4. Parking - No longer will it be our problem to find a space – our car will handle it. No more parking tickets, no more dented bumpers, no more endlessly driving in circles waiting for a neighbor to leave. This will unencumber urban road area for wider pavements.

1.1 Project Objective

This project aims to produce an autonomous car using computer vision technique. This car will be able to navigate itself through the track with the help of computer vision and ultrasonic sensor. User will be able to watch the live view from the webcam that will be attached to the car. A two lane track will be build and when the car detects the obstacle, it will move to another lane to overtake the obstacle. The sub-objectives are as below:

- To produce low cost autonomous car
- To produce low power consumption autonomous car.
- The car is able to navigate itself through the track and overtake any obstacles by computer vision technique.
- The main goal of self driving autonomous car is to avoid accidents.

- People are free to concentrate on other tasks or to rest during their journeys.
- The present location of the vehicle can be known using GPS

1.2 Literature Survey

- Parth Verma, a talented man did a research with the title “The Google Autonomous car”. The Google autonomous car was invented by Sebastian Thrun who was the co-inventor of the Street view mapping service. The advantage of this research was that it decreases human error while driving and result in reduced possibility of accident occurring. Better fuel efficiency is achieved when more autonomous car on the road which change the driving habits. Besides that, safety features were included in the autonomous car. Destination can be reached in less time which the car will be able to locate the shortest route. The limitations of this research are when the car is traveling at high speed which over 100mph, the car will hardly be able to differentiate the objects on the roads.
- A research was done by Michal Ruzicka and Petr Masek with the title “Real Time Visual Marker Detector and Tracker Based on Computer Vision for Semi-autonomous Convoy Purpose”. This research is based on controlling the semi-autonomous convoy by designing the computer vision method. The advantages of this research is low power consumption and efficient product cost. The limitations of this research are using 320 x 240 low resolution of captured frames which will cause the result inaccurate. Higher resolution cannot be used because of the low cost power device which does not do well in real time processing due to low frame rate. But this problem can be solve by OpenCL optimization.
- Another research was done with the title “Autonomous Three-Wheeled Robot with Computer Vision System”. The research is based on three wheel robot with computer vision. The advantage of this research is the product has many features such as GPS, accelerometer and compass which can use for data collections purpose. Higher accuracy result is achieved with higher resolution and frequency. The weakness of this research is having a bad robot control method which can change to Wi-Fi control that can support higher control range. Other than that, the robot cannot operate at dark surroundings. The robot may have problem with the movement which cannot avoid the obstacles with accurate turning angle of the robot.

2. Methodology

A Raspberry Pi board, attached with a web camera module and an HC-SR04 ultrasonic sensor is used to collect input data. The processing unit (computer) handles multiple tasks: receiving data from Raspberry Pi, object detection (stop sign and traffic light), and sending instructions to the car through a Wifi connection.

In this project we have used the Haar feature-based cascade classifiers for object detection. The Haar classifiers use the shape-based approach. Since each object requires its own classifier and follows the same process in training and detection, this project only focused on the stop sign and traffic light detection.

OpenCV provides a trainer as well as a detector. We collected the positive samples (samples which contain a target object) using a cell phone and these samples were cropped such that only the desired object is visible. However, the negative samples (samples which do not have a target object), were collected randomly. In particular, traffic light positive samples contain an equal number of red traffic lights and green traffic light.

Thus initially the car will ask the user to enter the destination. Then the main task of the car is to reach the destination autonomously through the path while stopping whenever a stop sign is detected, also if a traffic light is in the way the car should wait for a specified period of time if the traffic light is red and if the traffic light is green the car should move continuously.

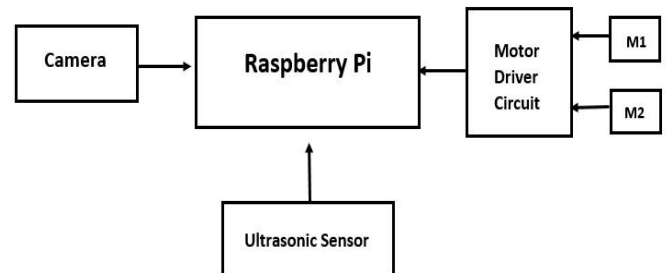


Fig -1: Block Diagram

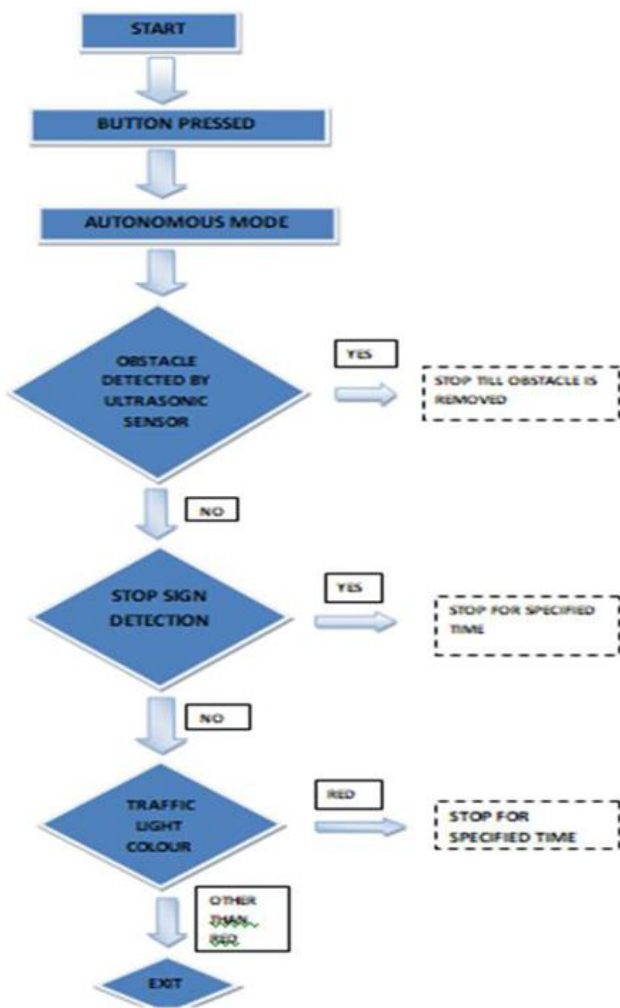


Fig -2: Workflow Model

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3. CONCLUSION

Therefore, we conclude that in this project we have made the use of different components and a basic programming language to create an autonomous car which will provide us live feed besides detecting obstacles on the track so as to represent a short model of a vehicle with less probability of accidents. This autonomous car is currently prepared in small scale but in future it can be brought to a broader scale if the project meets success. The speed of the car is however not controlled but it can be, by bringing about modifications and changes while developing it in large scale in future. This project took us through various phases of learning and project development, also we have gained a lot of new technical and non-technical knowledge.

REFERENCES

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