Chapter 1: Introduction

1.1 Introduction to Self-Driving car:

A self-driving car can analyze surrounding without any human interactions and take decisions accordingly without any human interactions. A number of sensors are combined and are used to identify the pathway and road signal from the surroundings. An autonomous car is has reduced costs due to less wastage of fuel, increased safety, increased mobility, increased customer satisfaction and that's why it has more advantage than traditional cars. The biggest benefit of using a self-driving car is significantly fewer traffic accidents. More than 90% of all accidents are caused by some degree of human error, including distraction, impaired driving, or poor decision making. With self-driving cars making decisions and communicating with one another, the number of accidents should reduce.

1.2 Problem Statement:

In this project a low cost prototype of self driving car is proposed and implemented. The car will have a camera on board and with the feed video the analyzer

computer can detect traffic signal (turn right , turn left , stop) and give correct decisions to the car.

Chapter 2: Necessary Components

2.1 Arduino Uno:

The Arduino Uno is an open-source microcontroller board based on the
Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

2.2 ESP 8266 (Nodemcu V0.9)

The ESP8266 is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability, produced by Espressif Systems in Shanghai,China. The chip first came to the attention of Western makers in August
2014 with the ESP-01 module, made by a third-party manufacturer Ai- Thinker.

2.3 Motor Driver L298

L298 Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298 Module can control up to 4 DC motors, or 2 DC motors with directional and speed control

2.4 DC Motor

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical
energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some
internal mechanism, either electromechanical or electronic,
to periodically change the direction of current in part of the motor. Two 5V DC motors are used in this project.

2.5 Camera

An onboard camera was used to feed live video of the pathway to the analyzer pc via wifi

2.6 Traffic Signs

Three different traffic signs were used as sample traffic signals.

2.7 Chassis for any robot (LFR/Obstacle Avoider)

A hard chassis for any line follower robot or obstacle avoider robot can be used for the prototype.

Chapter 3: Process of Implementation

3.1 Flowchart of Implementation

Getting Data from camera

Sending data to image processor via TCP server

Recognizing Data from
database by image
processing

Sending proper instruction
to prototype vehicle via
TCP server

Executing the instruction
Received via
TCP Server

3.1.1 Getting Data from Camera:

For sending feed data a mobile camera and an app (Commercially known as DroidCam) which sends feed data to the desired TCP server is used.

3.1.2 Sending data to image processor via TCP server

A wifi module (esp 8266 – nodemcu v0.9) for

creating a tcp server, which worked as a communication channel between image processor and the prototype car.

3.1.3 Recognizing Feed Data from Database by Image Processing:

Traffic Sign Detection: To determine the traffic sign from the real time video, the feed video is divided into some frames differing 30 milisecond. As the number of sign to be detected is small enough (only 3 - stop , turn left and turn right) , a somewhat simpler approach – correlation is taken. This task can be divided into several subtasks as follows.

1) Acquiring Training Image: Around 10 image of each sign, extracted the sub rectangle containing the sign from the image, and saved the image matrix as matlab file. Each image was resized as 600x600 pixels.

2) Dividing the Real Time Video: An image after every 30 milisecond apart is taken and worked with the frame to detect

the traffic sign.

3) Detecting Circular Objects from an Image: The circle Hough

Transform is used to detect circles in the frame. The circle Hough Transform (CHT) is a basic technique used in Digital Image Processing, for detecting circular objects in a digital image. The circle Hough Transform (CHT) is a feature extraction technique for detecting circles. It is a specialization of Hough Transform. The purpose of the technique is to find circles in imperfect image inputs. The circle candidates are produced by “voting” in the Hough parameter space and then select the local maxima in a so-called accumulator matrix. This technique is implemented in matlab function imfindcircles that we used.

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4) Correlation: Then we correlate the extracted circle with each sign. Thresholds were chosen to detect each type of sign through trial and error. The matlab codes for the project can be found here.

3.1.4 Sending Instructions to the Prototype The action for the recognized signal is then sent to the prototype via tcp server. The Arduino uno was used to drive the dc motors according to the actions.

Chapter 4: Final Assembly of the Prototype

The prototype was assembled in simple LFR making procedure and the following car was made.

Chapter 5: Area of Improvements

The prototype was assembled in simple LFR making procedure and the following car was made. A good number of improvements can be made to the prototype according the field of use. Instead of a separate computer, on board raspberry pi can be used for image processing. There is a small number of instructions for the prototype. The instructions can be increased and machine learning algorithm can be implemented for further self sustaining improvements.

Conclusion

In this project a simple prototype of a self driving car is demonstrated. The prototype car can recognize three separate signals – turn left, turn right and stop with greataccuracy and take decision accordingly. The prototype can be further improved by including more signals and using ML approach.