Project Report on
‘Driverless Cars’

BY

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For partial fulfillment of CS F266 Study Project

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani

May 2019

Acknowledgment

We would like to thank our supervisor **Dr. J L Raheja, Chief** Scientist, CSIR-CEERI Pilani, for the patient guidance, encouragement, and advice he has provided throughout our time as his students. We have been extremely lucky to have a supervisor who cared so much about our work, and who responded to our questions and queries so promptly. We have been fortunate enough to have such extremely and utterly helpful supervisor to guide us through this study project.

Also, we would like to thank the CSIS department, BITS Pilani for providing us the opportunity to do this project in our field of interest.

Driverless Cars

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***A*bstract:** In today's world where everything is being digitalized and there is an unsaid attempt to make everything mobile based so as to ease the daily working. One such void exists in the driving and motor industry. Although it has advanced a lot in the past couple of decades, still the dream of fully driverless cars remains at a distance. There have been attempts to make it but still no major success has been made. With the ever growing traffic on the roads, increases the number of accidents on daily basis and so increases the chances and number of causalities. Also, it is seen many a times that the person driving the car is either not sober or too under rest to drive making it risky for both him and all the people that are there on the road driving at that time. This code aims at detecting even the slightest mistakes made by the driver while driving so as to beware him of what all wrong steps he is taking. It tells him about the lanes, the ends of the roads, detects traffic signals and tell about the velocity and acceleration of the vehicles in sight. Not only this, it also tells about the steering angle and notifies if there is abrupt braking or acceleration. It is a huge step in the direction of automization of driving and it will greatly help in identifying drunk drivers.

1. Introduction

2. Why Driverless Cars?

How many car accidents have been caused by some sort of human error, be it speeding, driving recklessly, inattentiveness, or worse, impaired driving? Turns out that an overwhelming majority of accidents have been caused by humans. In fact, a study by the National Highway Traffic Safety Administration (NHTSA) revealed that 94% of accidents were caused by the drivers themselves.

Self-driving cars, on the other hand, are purely analytical, relying on cameras, radar, and other sensors to navigate. There's no emotion involved, and certainly no distractions like cell phones or impairing factors like alcohol to affect driving performance. The computers in a smart car simply react quicker than our minds can and aren't susceptible to the many potential mistakes we can make on the road. As a result, a future full of self-driving cars will be a safer one.

More and more businesses are operating remotely these days, or are at least allowing people to work from home more often, and for good reasons, not the least of which is increased productivity. On average, Americans spend 26 minutes commuting to work each day. That's almost an hour each day, and it largely goes wasted. In 2014, Americans spent an astonishing cumulative total of 29.6 billion hours commuting. Imagine what we could do with all that time back.

While many already commute on buses or trains, a whole lot of people still travel to work in their own cars. A self-driving car would allow them to get some work done, knock a few emails out, or even get a little extra sleep if they have to wake up early to get to work. Many people find themselves tempted to look at their phones while driving anyway, so why not at least do it safely in a self-driving car?

We've already talked about the benefits self-driving cars will have on the fuel economy of your vehicle, but the improved efficiency of travel thanks to self-driving cars stretches far beyond that benefit. For one, since self-driving cars are connected to the internet, their navigation will use GPS programs like Google Maps to automatically generate the quickest possible route.

The deliberative architecture in self-driving cars' software means the car is also intelligent enough to detect delays and accidents before you arrive at them, so it can reroute the vehicle's path without running into any impediments.

Speaking of delays, if we really reach a future where the road is occupied only by self-driving vehicles, even stops at traffic lights and intersections will become a thing of the past. With sensors and scheduling nodes at traffic intersections, along with the ability of cars to communicate back and forth, it's possible that in the future we could see a perfectly efficient roadway featuring only autonomous intersections, in which the car would never have to stop until it reached its destination.

3. Our Implementation

Software and Hardware Requirements:

1. Any Linux based pc
2. Python 3.5+
3. Pip
4. Tensorflow (Python library)
5. Keras

Steps for software installation:

1. Open a terminal window
2. Runsudoapt-getinstallyad
3. Checkifpython3.5+isinstalled and if not refer https://www.python.org/downloads/source/

4. Ensurethatpipisinstalled
5. Changetotherootofprojectfolder
6. pip install --uservirtualenv
7. virtualenv --python=python3venv
8. sourcevenv/bin/activate
9. pip install slixmpp

Steps of execution

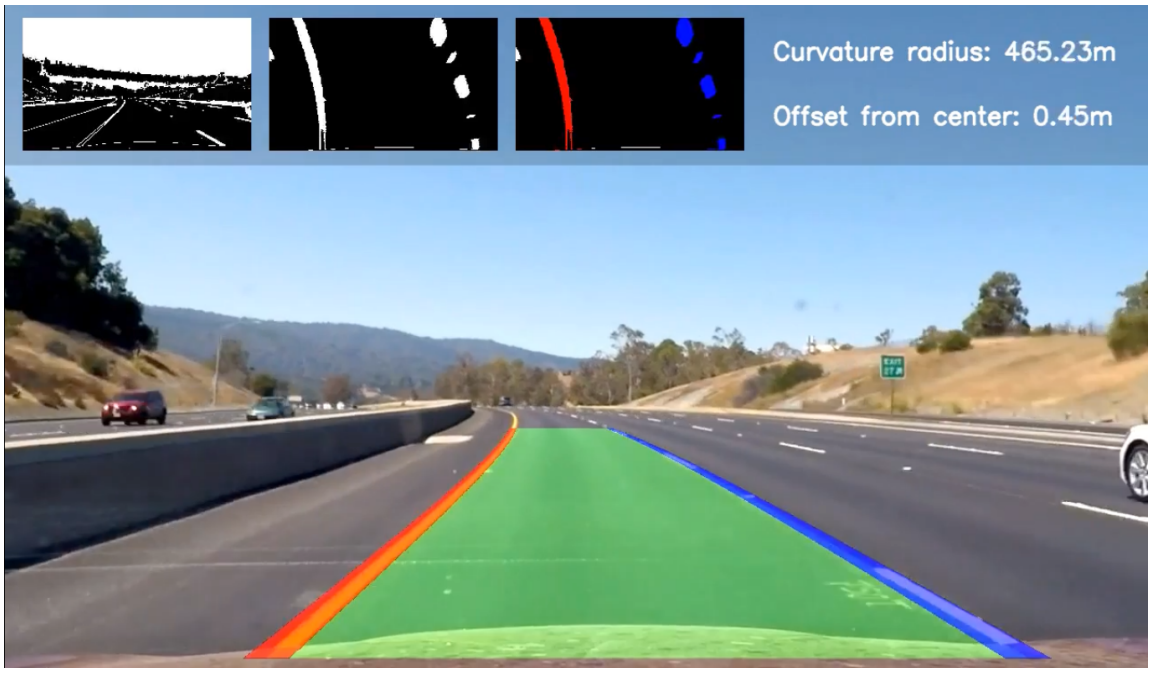
A. For Lane Detection

1. Camera Calibration
2. Image Distortion Removal
3. Binarization
4. Lane Detection
5. De-Wrapping
6. Offset Calculation
7. Radius of Curvature Calculation
8. Steering Angle Calculation

B. For Vehicle Detection

1. Camera Calibration
2. Image Undistortion
3. Binarization
4. Gradient Finding
5. Vehicle Detection

6. Distance Calculation
7. Distance storage in Array
8. Velocity Calculator
9. Velocity data Collection
10. Acceleration Calculation


Curvature radius: 465.23m
Offset from center: 0.45m


steering angle: 0.63
distance to camera 1: 15.00
speed of object 1: 2.69m/s
acceleration 1: 0.45m/s2
distance to camera 2: 0.00m
speed of object 2: 0.00m/s
acceleration 2: 0.00m/s2

4.References

1. how-to-build-a-self-driving-car-in-one-month-Max Deutsch
https://medium.com/@maxdeutsch/how-to-build-a-self-driving-car-in-one-month-d52df48f5b07

2. self driving car datasets - Udacity
https://github.com/udacity/self-driving-car/tree/master/datasets

3. Andrew Ng Machine Learning
https://www.youtube.com/watch?v=PPLop4L2eGk&list=PLLssT5z_DsK-h9vYZkQkYNWcItqhlRJLN

4. Deeplearning.ai
https://www.youtube.com/channel/UCcIXc5mJsHVYTZR1maL5l9w

5. Self Driving Car Engineer | Udacity
https://www.udacity.com/course/self-driving-car-engineer-nanodegree--nd013

6. CYHSM carnd
https://github.com/CYHSM/carnd

7. Jeremy Shannon carnd vehicle detection
https://github.com/jeremy-shannon/CarND-Vehicle-Detection