M3: MVP

GTA Project

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Percentage of final system : 40-50%

Abstract: Making a car autonomous can be a very difficult task, but it's based on two main factors: sensors (like RADAR or LiDAR)that will collect data information and the processor, that will define a set of actions to take (like turn right or left or increase speed) based on that data. Artificial Intelligence is used by the processor to learn the best actions to take with those cases. But how? Let's give an example: when we stop on a red light or speed down because of untypical meteorological conditions, we use our memory to take that quick actions. Our driving experience habituate us and our brain to look for that little pieces of information that encounter on the road. To make a car autonomous, we need that cognitive intelligence implemented on car's processor so the car can learn and execute those actions that a human would do on determinized cases. The problem is the collection of massive data quantities (also called big data) that forces to have a vehicle fleet with top gear sensors. This slow and expensive approach don't cover all the cases like accidents, to collect data.

A more efficient and less expensive way to collect big data is to use a drive simulator, like the GTA V. The cost is very low due to it is a virtual simulation and also have the possibility to all data types like accidents.

Overall goals: Our goal is to collect data from GTA V with different scenarios (like climate conditions) and use that to generate a dataset. An advantage of collect data from a virtual simulation it is the possibility to collect ideal data without noise and the range is infinite because we can put the camera and also the LIDAR on the same position and the 3D Print cloud will perfectly coincide with the views from the camera. But the point is to be realistic, so we will handle the data to make it real as possible. We will also use different real LIDARs specifications within the virtual LIDAR to generate more realistic data collection. With the dataset successfully generated, we will be able to identify objects on the game based on our generated dataset with help from 3D object detection algorithms. This is a important task to compare different types of LIDARS and see if the LIDAR SENSOR itself is a good source of data collection for autonomous driving. That's our main objective.

MVP Mission: FUSE LIDAR with Camera to give us a colored point cloud. The camera is essential for collect color data and the LIDAR Sensor for 3D space and perception. This is a important step for the project due to it is essential for the car as an autonomous thing distinguish between objects, cars, persons, et cetera.

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Features: Client can see that the point cloud taken correspond to the screenshot of a moment that both (point cloud and camera image) was taken by overlapping both sources of data.
At this stage, the objective is to fuse only lidar with camera and not to start comparing different types of lidars or without.

Scenarios: At this stage we don't have any scenariou to the clients achieve their goals, although this is the most difficult and important one. But one possible scenario is the client check if the fusion correspond precisely with the shape and color of a car, for example.

Setup: for this MVP, we made a script with matlab that will generate a colored point cloud from a screenshot and point cloud already taken (script name: teste.m). Basically, the script open the point cloud, and screen shot, and start the algorithm of coloring point cloud saving the colored point cloud.

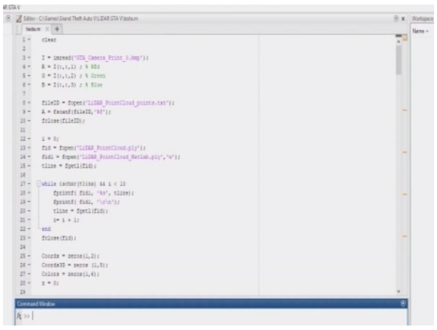
Steps:

1. Open GTA V
2. take ScreenShot
3. Take Point Cloud LIDAR
4. run the script
5. See resulting Point Cloud (colored).

Script/Rationale:

LiDAR Point Cloud written to file.

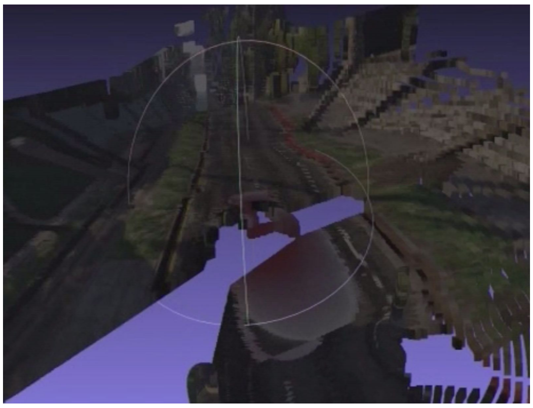
1. open GTA and take screen shot and LIDAR



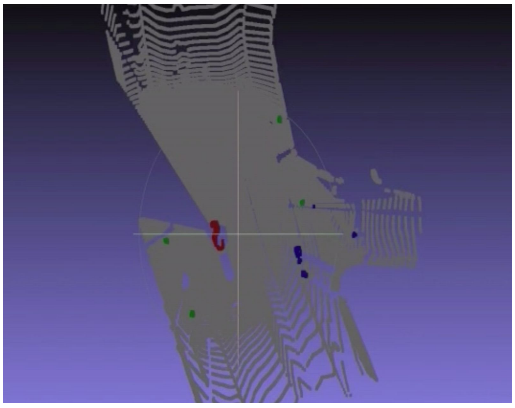
```
clear

I = imread('GTA_Camera_Print_0.bmp');
R = I(:,:,1) ; % RED
G = I(:,:,2) ; % Green
B = I(:,:,3) ; % Blue

fileID = fopen('LiDAR_PointCloud_points.txt');
A = fscanf(fileID,'%f');
fclose(fileID);

i = 0;
fid = fopen('LiDAR_PointCloud.ply');
fid1 = fopen('LiDAR_PointCloud_Matlab.ply','w');
tline = fgetl(fid);

while ischar(tline) && i < 10
    fprintf( fid1, '%s', tline);
    fprintf( fid1, '\r\n');
    tline = fgetl(fid);
    i= i + 1;
end
fclose(fid);

Coords = zeros(1,2);
Coords3D = zeros (1,3);
Colors = zeros(1,4);
z = 0;
```

```
>> |
```

3. Run the script



4. See the colored point cloud



2. See the colored point cloud.