Self-Driving And Driver Relaxing Vehicle

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Abstract: *In the modern era, the vehicles are focused to be automated to give human driver relaxed driving. In the field of automobile various aspects have been considered which makes a vehicle automated. Google, the biggest network has started working on the self-driving cars since 2010 and still developing new changes to give a whole new level to the automated vehicles. The two applications of an automated car, one in which two vehicles have same destination and one knows the route, where other don't. The following vehicle will follow the target (i.e. Front) vehicle automatically. The other application is automated driving during the heavy traffic jam, hence relaxing driver from continuously pushing brake, accelerator or clutch. The idea has been taken from the Google car, defining the one aspect here under consideration is making the destination dynamic. This can be done by a vehicle automatically following the destination of another vehicle. Since taking intelligent decisions in the traffic is also an issue for the automated vehicle.*

I. Introduction

Autonomous Driving Has Been A Hot Topic With Companies Like Google, Uber, And Tesla. Automated Vehicles Are Technological Development In The Field Of Automobiles. Experiments Have Been Conducted On Autonomous Cars Since At Least The 1920s And Promising Trials Took Place In The 1950s And Work Has Proceeded Since Then. On May 1, 2012, A 22 Km (14 Mi) Driving Test Was Administered To A Google Self-Driving Car By Nevada Motor Vehicle Examiners In A Test Route In The City Of Las Vegas, Nevada. The Autonomous Car Passed The Test, But Was Not Tested At Roundabouts, No-Signal Railroad Crossings, Or School Zones. 2012 In May 2014, Google Presented A New Concept For Their Driverless Car That Had Neither A Steering Wheel Nor Pedals. On May 27, 2014, Google Announced Plans To Unveil 100 Autonomous Car Prototypes Built From Scratch Inside Google's Secret X Lab, As A Result Of Years Of Work That Began By Modifying Existing Vehicles. They Also Unveiled A Fully Functioning Prototype In December Of That Year That They Planned To Test On San Francisco Bay Area Roads Beginning in 2015.The main purpose of making the Google Self-Driving Car was so that everyone could get around easily and safely, regardless of their ability to drive. Aging or visually impaired loved ones wouldn't have to give up their independence. Time spent commuting could be time spent doing what you want to do. Deaths from traffic accidents—over 1.2 million worldwide every year—could be reduced dramatically, especially since 94% of accidents in the U.S. as well as in most other countries involve human error. Purpose What is Google Self-Driving Car? The Google self-driving car is a range of autonomous cars, developed by Google X as part of its project to develop technology for mainly electric cars. The software installed in Google's cars is named Google Chauffeur. The Google self-driving cars are designed to navigate safely through city streets. They have sensors designed to detect objects as far as two football fields away in all directions, including pedestrians, cyclists and vehicles—or even fluttering plastic shopping bags and rogue birds. The software processes all the information to help the car safely navigate the road without getting tired or distracted. How it works Pros · The lack of human error whilst driving, will result in a much safer journey · Due to the sensors on the Autonomous car, they will be able to pack closer together, allowing more cars on the road and therefore shorting traffic times. Disabilities would no longer be a factor in driving, meaning anyone could drive · You would need less space for parking as well as the car would be able to drop you off and then find a parking space further away. The average worker spend 200 hours a year commuting, an autonomous car would allow workers to spend the time on other things.There would be no need to pass a driving test or gain a driving license as everyone would be able to drive. There will always be the worry of the malfunctioning, resulting in a major collision. The lack of need for drivers would be catastrophic for the economy; in 2011 there were 73,000 taxi drivers in England, who would

all become unemployed. This would be common for all driving professions, including lorry drivers, bus drivers etc. When they are first released, they are likely to be extremely expensive, and therefore most people won't be able to afford them. Driving enthusiasts may not find the concept of self-driving car appealing, and therefore will most likely want to keep normal cars. Although the automated vehicles are for ease of humankind yet they are the most expensive vehicles. Considering the different features and the cost, on a small scale a three wheel Vehicular Robotic prototype has been designed that will automatically reach the destination of another vehicle to which it is supposed to follow. We have focused on two applications of an Automated Vehicles here and designed a prototype vehicle for that. The one major issue is during heavy traffic a driver has to continuously push brake, accelerator and clutch to move to destination slowly. We have proposed a solution to relax the driver in that situation by making vehicle smart enough to make decisions automatically and move by maintaining a specified distance from vehicles and obstacles around. The second issue is when two vehicles have the same destination but one of the drivers doesn't know its route. The driver can make his vehicle follow the front vehicle if they are known and share their location to reach the same destination. A three-wheeled Mobile Robot is used for research is given. The Mobile Robot consists of multiple sensors, which helps it to communicate with Google Maps API (Application Program Interface) and makes it determine obstacles in order to follow the route and move smoothly. The Mobile Robot connects directly to Google Maps API using GPRS Module, gets route and moves in that direction. While the ultrasonic sensors, which have been used for prototype design, helps to avoid obstacles on run time. The traffic situation in Pakistan leads to design this project prototype, which aims at relaxing driver and creating an automated vehicle whose destination out is dynamic unlike Google car, whose destination is static and fixed. This research has been a need for Pakistan if implemented in real time.

II.   Literature Review

Qudsia Memon, Muzamil Ahmed, Shahzeb Ali, Azam Rafique Memon, Wajiha Shah, After the development of the autopilot airplanes . This is an advanced step for autonomous driving vehicles.With the help of this algorithm, vehicles can be set to automatically navigate to the destination location by continuously receiving the direction from another vehicle moving ahead tothe same destination.

M.Frutiger and C. Kim, selfdriven sailboats and ships; the deceptively modest dream that Has rarely ventured beyond the pages of science fiction since Our grandparent's youth is the self-driving car. But due to technological Advancement in the roads and the increasing population has Made difficult for this dream to becoming true. In the pre-computer days of the 1930s, the driverless cars Were only the science fiction things. But the development of the digital computer made possible to dream of self-driven Vehicles outside the fiction. By the 1960s the self-driven cars Have been dreamed to navigate on ordinary streets on their Own. German pioneer Ernst Dickmanns, in the 1980s, got a Mercedes van to drive hundreds of miles autonomously on Highways, a tremendous feat especially with the computing Power of the time.

Marc Weber D. Helbing, When Robert Whitehead invented the self-propelled torpedo in the 1860s, the early guidance system for maintaining depth was so new and essential he called it " The Secret." Airplanes got autopilots just a decade after the Wright brothers. These days, your breakfast cereal was probably gathered by a driverless harvester. Sailboats have auto-tillers. Semi-autonomous military drones kill from the air, and robot vacuum cleaners confuse our pets. Yet one deceptively modest dream has rarely ventured beyond the pages of science fiction since our grandparent's youth: the self-driving family car. Unlike Mars rovers or sailboats, cars need to navigate the complex world of city streets, passing inches away from fragile, litigious human beings. This article explores both the history of autonomous vehicles in general, and that elusive goal of a car that drives itself.

Paul. Rau, In the mid-2000s, the Defense Advanced Research Projects Agency (DARPA) sorted out the Grand Challenges where groups assembled to contend with selfdriving Vehicles. In 2009, Google began the self-driving car Venture, including colleagues who had effectively devoted Years to the innovation. By 2012 the Google car hits the Road for testing. By the passing years, the car is developed And equipped with multiple sensors, radars, lasers, Global Positioning System (GPS), it uses heavily detailed maps, and many other things to safely drive and navigate itself with no human interaction. The car can not only drive itself but it can be parked on its own, it can go on freeways, cameras are used to find and detect objects that are then processed by the computer within the car .

James Menden In may 2014, Google presented a new concept for their driverless car that had neither a steering wheel nor pedals and unveiled a fully functioning prototype in December of that year that they planned to test in 2015. The car is equipped with multiple sensors, radars, lasers, it uses GPS, it uses heavily detailed maps, and many other things to safely drive and navigate itself with no human interaction. The car sends out

thousands of signals and lasers every second and it uses these radar and lasers to analyze road conditions including the road, pedestrians or any obstructions. The car can react to construction, a rapid slow down of cars, and it can avoid obstructions in the road. The car can not only drive itself, it can park, it can go on freeways, and it can drive better than a human!

Adam Fisher, Google is betting that established car manufacturers, working with low-cost radar and camera components, will never adequately bridge that gap. It's chosen a different technical path, one that uses lidar to leap frog level two altogether. It believes its level-three system will make cars safe enough for people to day dream while they're being driven to work. And it's not stopping there. NHTSA's former deputy director, Ron Medford, has just signed on as Google's director of safety for the self-driving-car project. "Google's main focus and vision," says Medford, "is for a level-four vehicle."In summer 2015, Google launched and tested some different features where each prototypes speed is capped at a neighborhood-friendly 25mph, and during this phase safety drivers aboard with a removable steering wheel, accelerator pedal, and brake pedal that allow them to take over driving If needed .

K. R. Memon, S. Memon, B. Memon, A. R. Memon, and M. Z. A. S. Syed, E. Frink, D. Flippo, and A. Sharda After many successful roads testing of Google Car has made to believe in some years roads will be safely Occupied with self-driven cars. Determination of a suitable path for a robot that is collision free between the initial and end positions through a workspace in the presence of obstacles is challenging for Autonomous Robot design. Autonomous Mobile Robot that finds the optimal path using Google navigation to navigate in a realtime environment. However, Google Maps or Google Navigation do not provide realtime obstacles at the current time, so it is also important to know about the obstacles in realtime and to avoid them.

III.   General Concept

Travelling by car is currently one of the most deadly forms of transportation, with over a million deaths annually worldwide. As nearly all car crashes are caused by human driver error, driverless cars would effectively eliminate nearly all hazards associated with driving as well as driver fatalities and injuries.
The top 4 causes of accidents are:
3.1 Distraction
Self-driving cars are dedicated to driving and can notice more, from all angles, and react more quickly. No amount of text messages or hamburgers will have any effect on the car's ability to stay focused on the road.
3.2 Speeding
Self-driving cars don't care about your appointments, frustrations or stop-and-go traffic. They can be set to obey the law, respect road signs, and they will never lose track of how fast they are and should be going.
3.3 Drunk Driving
Some self-driving cars do drink a lot of alcohol, but they're quickly being replaced with cars who drink responsibly and cars that run only on energy drinks.
3.4 Recklessness
Self-driving cars have no ego and no interests in taking risks.

3.1 RELATED WORK

After the development of the autopilot airplanes, self-driven sail boats and ships; the deceptively modest dream that has rarely ventured beyond the pages of science fiction since our grandparent's youth is the self-driving car . much work has been carried out in the area to make cars self-driven . but due to technological advancement in the roads and the increasing population has made difficult for this dream to becoming true. In the pre-computer days of the 1930s, the driverless cars were only the science fiction things. But the development of the digital computer made possible to dream of self-driven vehicles outside the fiction. By the 1960s the self-driven cars have been dreamed to navigate on ordinary streets on their own. German pioneer Ernst Dickmanns, in the 1980s, got a Mercedes van to drive hundreds of miles autonomously on highways, a tremendous feat especially with the computing power of the time.

In the mid-2000s, the Defense Advanced Research Projects Agency (DARPA) sorted out the Grand Challenges where groups assembled to contend with self driving vehicles. In 2009, Google began the self-driving car venture, including colleagues who had effectively devoted years to the innovation. By 2012 the Google car hits the road for testing. By the passing years, the car is developed and equipped with multiple sensors, radars, lasers, Global Positioning System (GPS), it uses heavily detailed maps, and many other things to safely drive and navigate itself with no human interaction. The car can not only drive itself but it can be parked on its own, it can go on freeways, Cameras are used to find and detect objects that are then processed by the computer within the car . In May 2014, Google presented a new concept for their driverless car that had neither a steering wheel nor pedals and unveiled a fully functioning prototype in December of that year that they planned to test in 2015. In summer 2015, Google launched and tested some different features where each

prototypes speed is capped at a neighborhood-friendly 25mph, and during this phase safety drivers aboard with a removable steering wheel, accelerator pedal, and brake pedal that allow them to take over driving if needed.

After many successful roads testing of Google car has made to believe in some years roads will be safely occupied with self-driven cars. The authors in have developed unmanned vehicle prototypes in which they have worked on the obstacle avoidance and path planning . In this paper, we have designed two applications of an autonomous vehicle, which can help the driver to relax for the certain duration of time. This paper presents a concept in which the modified concept of Google car is focused, the Google car has to reach the static destination automatically; in our prototype, we have made the destination dynamic. Here our destination is also a vehicle which is moving on a certain route. Our prototype will follow that vehicle. Another application that we have implemented here was to tackle heavy traffic congestion and allow the vehicle to move automatically during that traffic congestion.

3.2 PROBLEM STATEMENT

Driving customs and road conditions are dramatically different across the globe, with narrow, congested lanes in European cities, and anarchy in Beijing's giant traffic jams. In India's capital, New Delhi, luxury cars share poorly marked and congested lanes with bicycles, scooters, trucks, and even an occasional cow or elephant.Then there is the problem of aggressive humans who make dangerous moves such as cutting cars off on freeways or turning left in front of oncoming traffic. In India, for example, even when lanes are marked, drivers swing from lane to lane without hesitation.

According to the Centers for Disease Control, fatalities from traffic incidents happen on an annual basis upwards of 33,000 people. Many of these accidents are preventable, and an alarming number of them are a result of distracted driving.Drivers At-Fault for Most Accidents. While surely some faulty mechanics can be cited as the cause for certain accidents, more often than not drivers themselves are the most dangerous things about hitting the open road. The reality is that there are so many factors at play when a driver gets behind the wheel and a safe road experience relies on a driver that is 100 percent focused on the road.Speeding, being distracted by happenings inside the car or outside, failing to follow road laws, or driving while tired, drunk, or under the influence of drugs can all be extremely dangerous. Adding just one of these factors to the mix dramatically increases the chances that an accident will happen. While all of these factors are unlikely to be controlled every time a driver turns the ignition key.

IV.   Working

Our prototype model shows some work on both the application. In our prototype model following components are required.

4.1 Components
i.   **Global Positioning System[GPS]**
   The Global Positioning System (GPS), originally Navstar GPS, is a space-based radio navigation system. It is a global navigation satellite system that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

ii. **Arduino**
   Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

iii. **Global System for Mobile Communication[GSM]**
   The Global System for Mobile Communications (GSM) is a second generation (2G) standard for mobile networks. GSM stands for Global System for Mobile Communication. It is a digital cellular technology used for transmitting mobile voice and data services.

iv. **Ultrasonic Sensor**
   An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.

v. Compass

A compass is an instrument used for navigation and orientation that shows direction relative to the geographic cardinal directions.

Our main focus is on Following Vehicle, which detects and avoids obstacles, coordinate with Google Maps API, get route and follow the route. For another application, it checks vehicles around and automatically moves slowly behind the traffic until it gets out of traffic jam situation. The function of the Target vehicle is just to provide the coordinates to Following Vehicle, which are also not static as the Target vehicle is moving towards its destination. Figure shows application in which vehicle automatically follow the front vehicle and maintains specified distance from vehicles around.
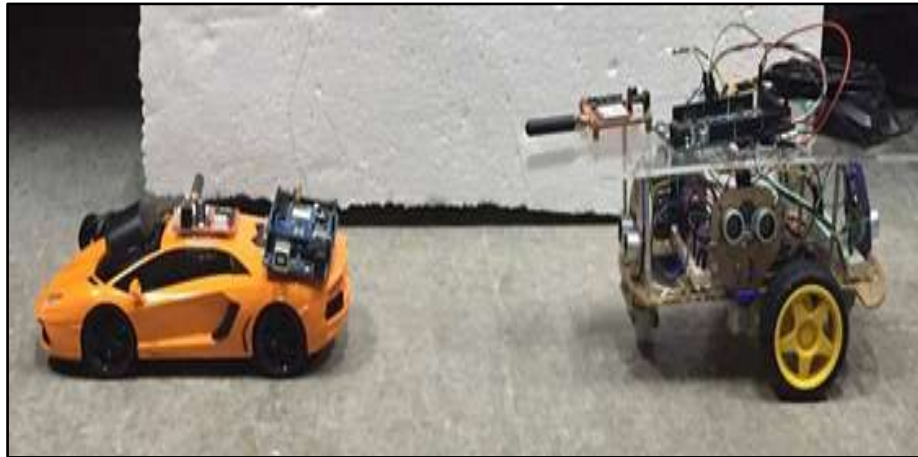
Fig 4.1 : Designed Robotic Vehicle

The vehicle automatically moves and hence relaxes the Driver. The above figure shows the hardware implementation. This whole project involves the two vehicles first defined as the Target Vehicle and second as Following vehicle. The Target vehicle fetches its existing location coordinates through GPSand sends to Arduino then these coordinates in the form of the message has been sent to Following vehicle after every certain time of interval.

The Following vehicle whenever receives a message through GSM, the message is sent to Arduino. Arduino then decodes the message and fetches the coordinates of Target vehicle. Since Arduino already has its own coordinates (at following vehicle side). Through GPRS arduino then connects to the Google Maps and compares the existing location coordinates of Target vehicle received through the message with existing location coordinates of the Following vehicle; thus tries to find the smallest possible route to reach the Target vehicle. Arduino after all the processing gets the direction from Google API. This direction is then compared with Robot's current direction and after rotating vehicle in that direction, the vehicle starts moving forward. Thus vehicle will continue fetching the current location received from the Target vehicle after every certain time span and will continue move in that direction and this process continues until the vehicle reaches the destination vehicle's location. The Following vehicle in the middle of following the Target vehicle will keep on looking for the obstacle that might come. To look for the obstacle, ultrasonic sensors have been used. Ultrasonic Sensors have been fixed all around the vehicle so that the vehicle detect the obstacle and get away from it. For instance if there is a wall or a pedestrian in front of the vehicle, the ultrasonic sensors at the front side of the vehicle will detect and the vehicle will turn to the safe side, another possible scenario might come in which there are three obstacles; in front, at the right side and at the left side of the vehicle, the ultrasonic sensors will again detect the obstacles and the vehicle will then moves backward even if there is an obstacle behind, it will stop for a moment and thus again looks for the obstacles from the beginning thus deciding the route on the basis of circumstances.

Fig 4.2 : Experimenting Self Driving Mechanism

Fig 4.2 shows the route taken by the front vehicle while the red colored line shows the route taken by the Following vehicle after getting instructions from Google Maps. By testing the vehicle in real time, we have also observed that even if the target vehicle takes the wrong route, the following vehicle will follow the right route because it is connected to Google Maps. As it is a prototype and vehicle is very small, hence it is very slow but if the system is implemented in real vehicles then this could help in solving the discussed issues in real time.
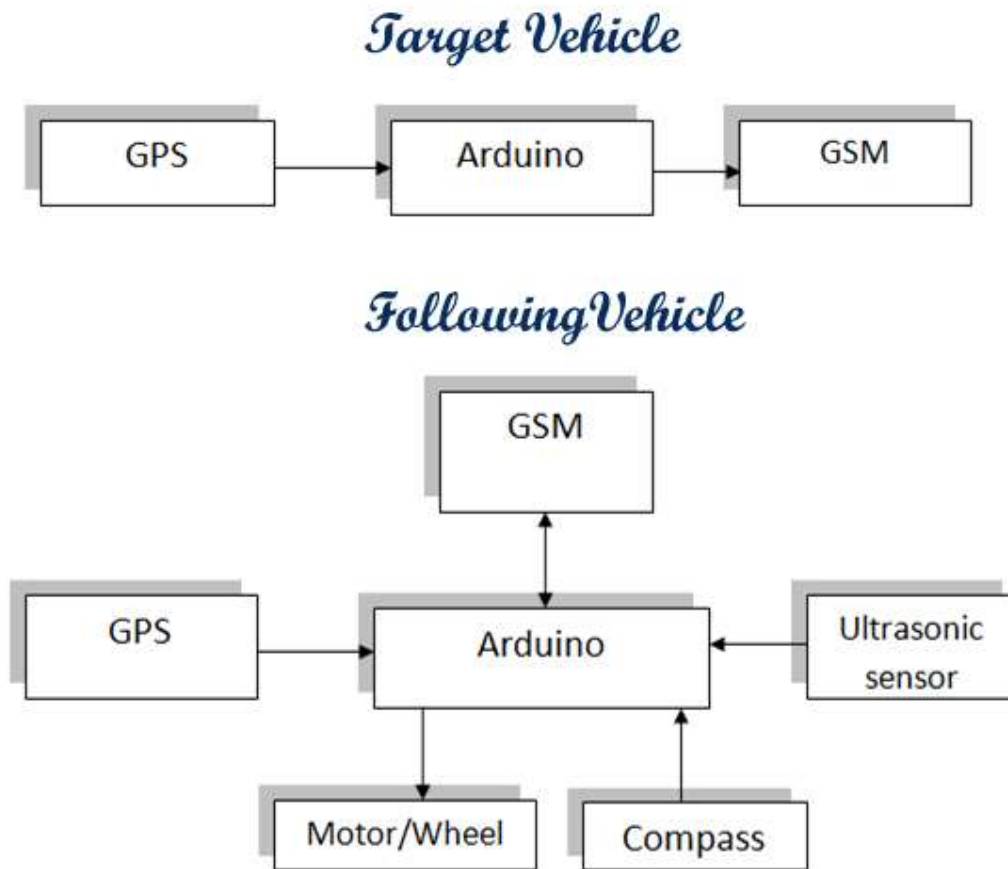
4.2 Block Diagram

Fig 4.3 : Block Diagram of Prototype Model

The Block diagram shows the different components used in the self driving prototype model.We are using two vehicles target vehicle & following vehicle.The target vehicle is using GPS,Arduino & GSM. The following vehicle is using GPS, GSM, Arduino, Ultrasonic Sensor,Motor or Wheel & Compass.
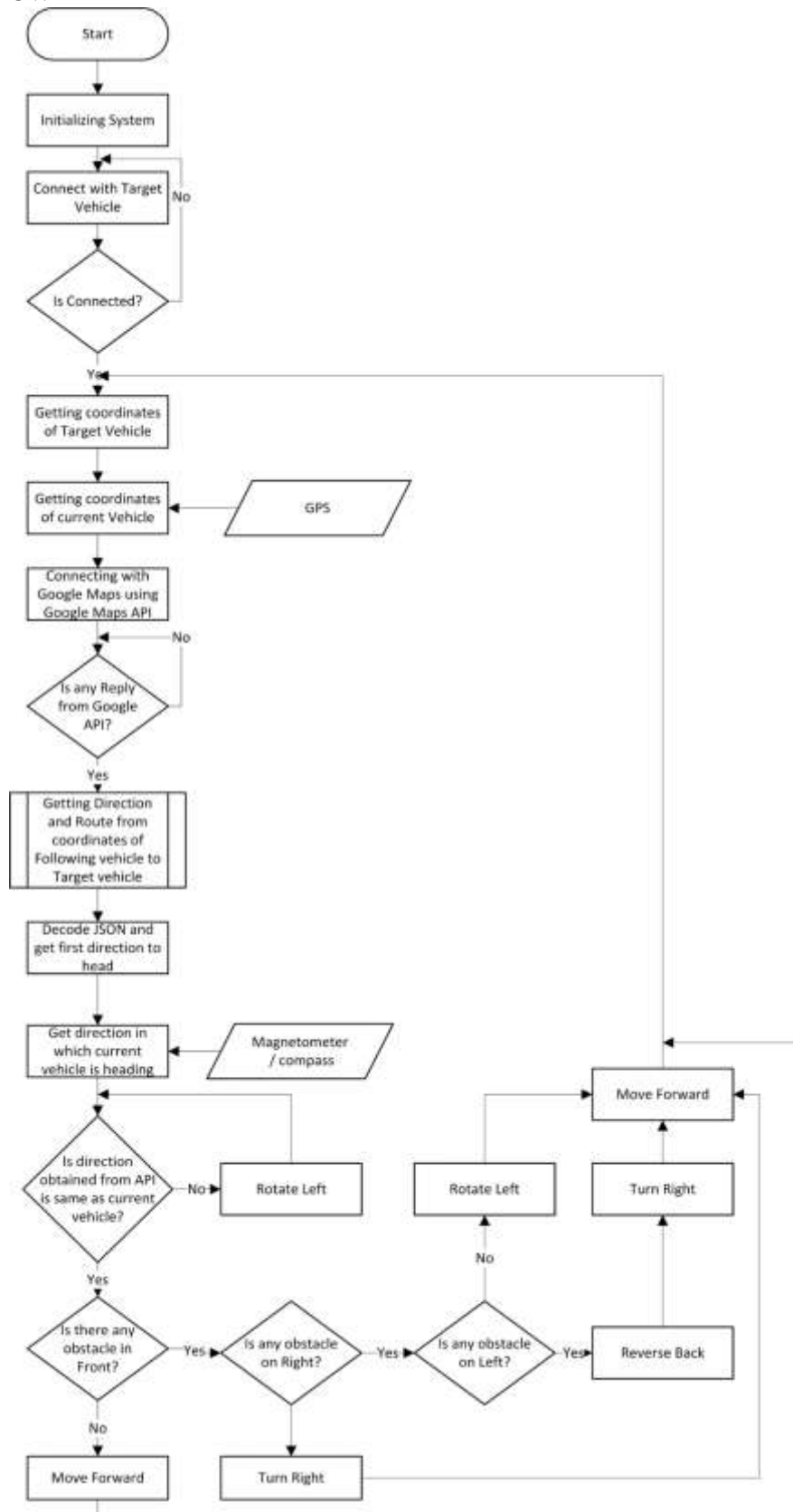
3.5 WORKING FLOW

Fig 4.4: Working Flow Process

V.   Advantages

- Reduce the number of road accidents.
- Passengers can carry on with other things.
- Mobility for disabled individuals.
- Maximize utilization of driving time.
- Reduce Traffic Congestion

VI.   Limitations

- Driverless cars struggle going over bridges.
- Driverless cars struggle on roads without clear lane markings.
- Driving in cities is much harder for autonomous cars than cruising on the highway.
- Driverless cars can also have trouble in high speed driving situations

VII.   Applications

- Autonomous Driving
- Autonomous Flying
- In Civil engineering for pipes inspection.
- For developing automated components for farming vehicles such as irrigators, tractors and buggies, mining vehciles such as drilling rigs.
- For industrial vehicles like forklifts and car crash testing vehicles.

VIII.   Results And Conclusion

The project has been tested at university and found working smoothly as shown in following figures. The front vehicle is moving on its way to some destination, while the following vehicle (at back) is getting GPS location of the front vehicle and moving towards it by getting directions and instructions from Google Maps using Google Maps API. Blue line routeshows the route taken by the Front vehicle while the Red colored line shows the route taken by the Following vehicle after getting instructions from Google Maps. By testing the vehicle in real time, we have also observed that even if the target vehicle takes the wrong route, the following vehicle will follow the right route because it is connected to Google Maps. As it is a prototype and vehicle is very small, hence it is very slow but if the system is implemented in real vehicles then this could help in solving the discussed issues in real time.
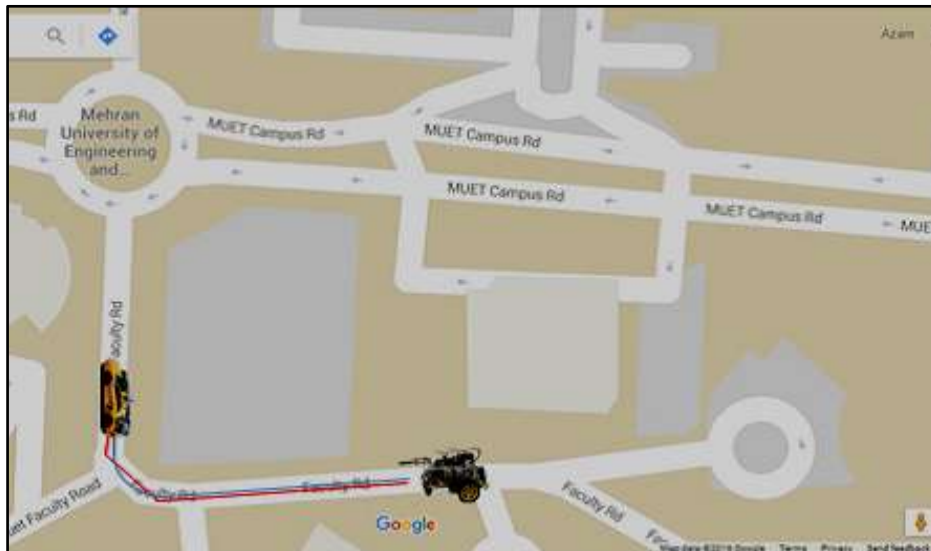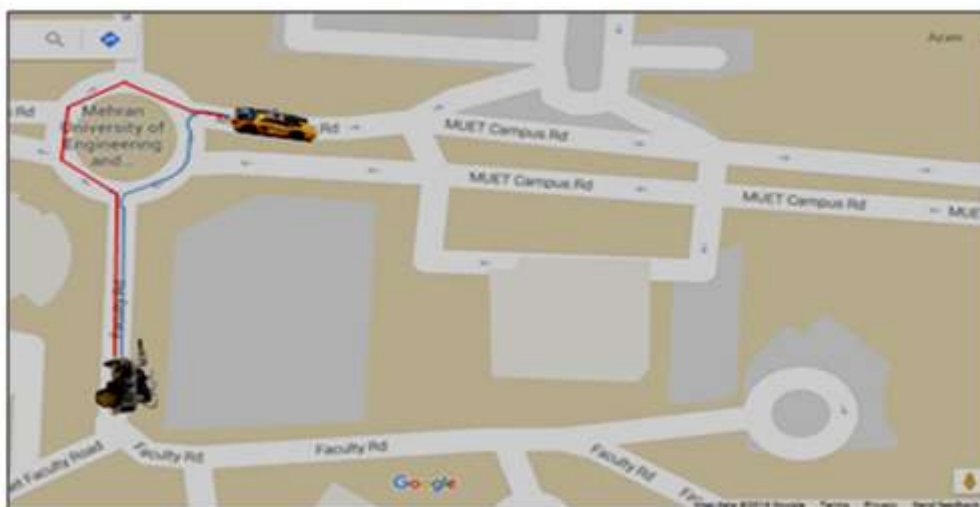

Fig 8.1 : Experiment while taking turn

Fig : 8.2 Experiment while taking wrong turn

This is an advanced step for autonomous driving vehicles .With the help of this algorithm, vehicles can be set to automatically navigate to the destination location by continuously receiving the direction from another vehicle moving ahead to the same destination .The robotic vehicle routes itself with the guidance of another vehicle moving ahead to the same destination, therefore, deviations in time can occur.

The goal of navigation process for a robotic vehicle is to move the robot to a known destination in an unknown environment. The navigation planning is one of the vital aspects of autonomous systems. When the robotic vehicle actually starts to move towards the planned route it may find unknown obstacles from the existing location to the destined location, hence the robotic vehicle must avoid the obstacles and follow an optimal route to reach the destined position. The potential applications of this robotic vehicle are to use these types of autonomous vehicle on highways or heavy traffic roads. These types of autonomous vehicles can also be used when a driver travels to the new areas. It is an improved navigation system for autonomous vehicles.

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