Misr University of Science and Technology

College of Engineering and Technology

Department of Mechatronics Engineering

B. Eng. Final Year Project

Autonomous Vehicle for Blind Human Movement Guidance

By:

GROUP (G4)

NAME	ID
Abdelhamid Mohamed Ali Ibrahim	81087
Bishoy Makram Youssef Tawadrous	91629
Fahad Nazih Ahmed Mohamed Ali	86357
Youhana Morcos Elkes Hana	91615
Youssef Ahmed Hamed Abdeltwab	95829
David Maged Yousef	91489

Supervised By:

Supervisor(s)

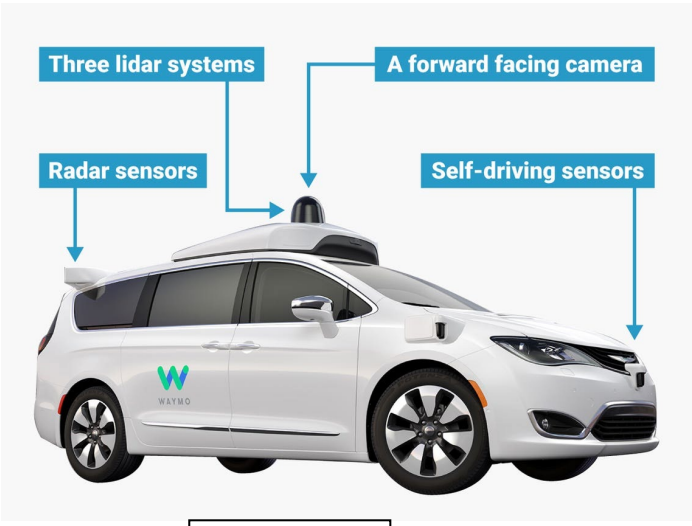
DR.	Bahaa Eldin Mohamed Naser
DR.	Bikheet Mohamed
DR.	Alaaeldin Zakaria Khafagy

Autonomous Vehicle for Blind Human Movement Guidance

Self-drive car:

A car capable of sensing its surroundings and moving on its own through traffic and other obstacles with minimum or no human input. This is the current upcoming technology in the automobile industry and even though it was successfully manufactured by TESLA. In recent years, these cars began to roll out in foreign markets as private and public vehicles (taxis etc.). Many companies like Waymo, UBER, Nissan, Nvidia are involved in this product development. With this type of car, the whole automotive the human errors can be eradicated whilst the drive is made to its best. This project has infused the idea of traffic signal responding which is absent in the current models and the above-mentioned advantages can be achieved with much more ease and at a low cost. This type of system can bring a revolution in transportation for differently abled people and help blind people travel independently.

TESLA



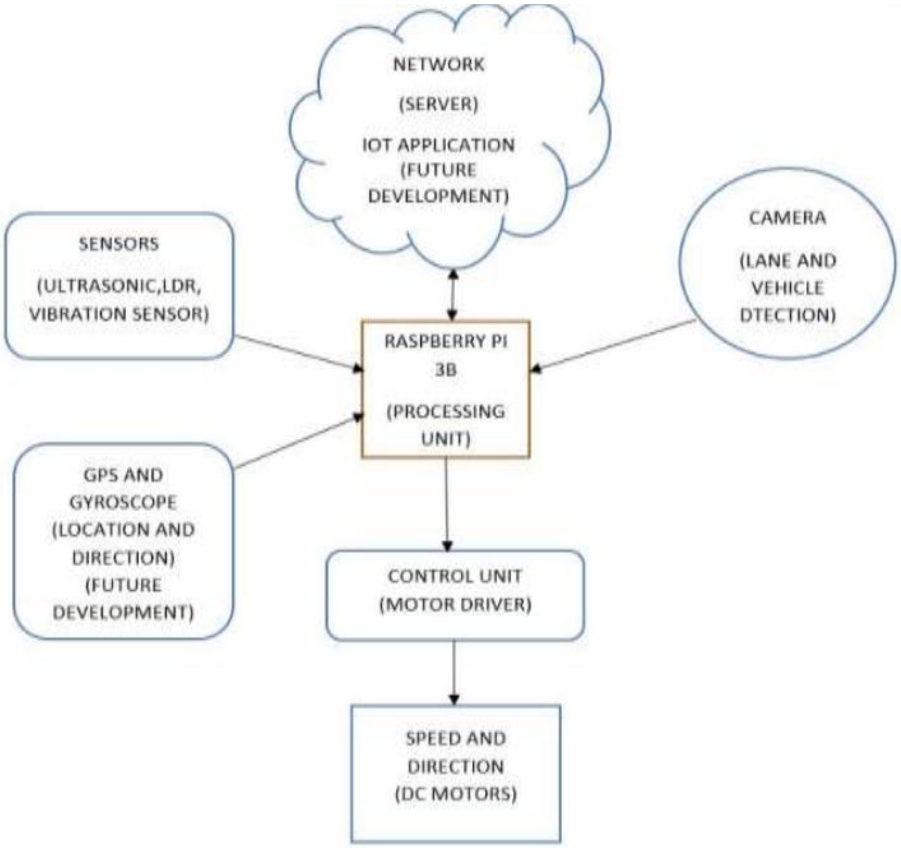
Waymo

We survey research on self-driving cars published in the literature focusing on autonomous cars developed since the DARPA challenges, which are equipped with an autonomy system that can be categorized as SAE level 3 or higher. The architecture of the autonomy system of self-driving cars is typically organized into the perception system and the decision-making system. The perception system is generally divided into many subsystems responsible for tasks such as self-driving-car localization, static obstacles mapping, moving obstacles detection and tracking, road mapping, traffic signalization detection and recognition, among others. The decision-making system is commonly partitioned as well into many subsystems responsible for tasks such as route planning, path planning, behavior selection, motion planning, and control. In this survey, we present the typical architecture of the autonomy system of self-driving cars. We also review research on relevant methods for perception and decision making.

The DARPA Grand Challenge (Buehler et al., 2007) was repeated in 2005 and required self-driving cars to navigate a 132 miles long route through flats, dry lake beds, and mountain passes, including three narrow tunnels and more than 100 sharp left and right turns. This competition had 23 finalists and 4 cars completed the route within the allotted time limit. The Stanford University's car, Stanley (Thrun et al., 2006), claimed first place, and the Carnegie Mellon University's cars, Sandstorm and H1ghlander, finished in second and third places, respectively.

Proposed System:

This project plans to provide a self-driving car with a system that can navigate between two places.
on the map, detect any obstacles, lane detection ,accident avoidance and emergency services. And our project's uniqueness is we are implementing traffic signal responding which is not present in Tesla and other companies' car.



Working of Automated Vehicle:

1) For any intelligent vehicle, first step is always to know where they are currently in the world. For that very basic things need to know local coordinates, road boundaries and intersections, it is local map. Two type of map may be used real time map or stored map. In real time mapmaking, lots of components are use like rndf, gps, camera, lidar, radar etc.

2) Sensor, short range proximity radar, ultrasonic sensors may be used to identify the objects near to vehicle for collision avoidance.

3) For tracking nearby traffic light, some school lane signal or any other signal, track other vehicle can be done by video cameras.

4) To measure distances, detect roadedges,identify lane marking, Lidar (light detection and ranging) can be used.

5) Finally the software part of the automated vehicle system[8]take all this sensory inputs and analyze all that data and provide usable information to vehicle's actuators and send controlled instruction to it.

Levels of Automated Vehicles:

Level	Level Name	Description
0	No Automation	At this level, there is no meaning of automation, complete dependency is on human driver for handling all kind of dynamic tasks
1	Driver Assistance	Specific tasks like steering or accelerator is done by the driver assisted programmed with the assistance of driver
2	Partial Automation	Driver assisted program do both steering and accelerator task and human driver do remaining dynamic tasks
3	Conditional Automation	At this level, all dynamic tasks are done by automated driving system with driving mode specific performance. Human driver respond to system as per its request.
4	High Automation	In this type of system, there is no need of human intervention, all dynamic tasks are done by automated driving system but it work in some driving modes.
5	Full Automation	This kind of system work at all roadways and all kind of environmental conditions. There is no need of any kind of human intervention.

The advantages of self-drive car:

1. More Safety 

Accidents are often caused by driver fatigue, lack of attention or incorrect behavior. This means that almost 99% of all accidents are due to human error. With the elimination of the driver as a source of error and increasing sophistication of systems (sensors, cameras, and AI system), driving can be made more efficient and the accident rate can be reduced. In addition, autonomous vehicles have a lower reaction time and thus shorten braking and starting times.

2. More Time and Comfort 

Depending on the level of the autonomous vehicle, drivers can sit back and relax, take short breaks and devote their time to other things. **In the best case, with a level 5 vehicle, you are just a passenger, while the means of transport reliably takes you to your destination.**

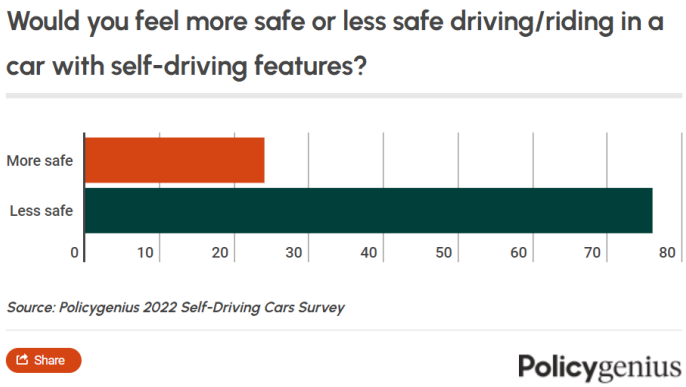
3. More Efficiency in Traffic 

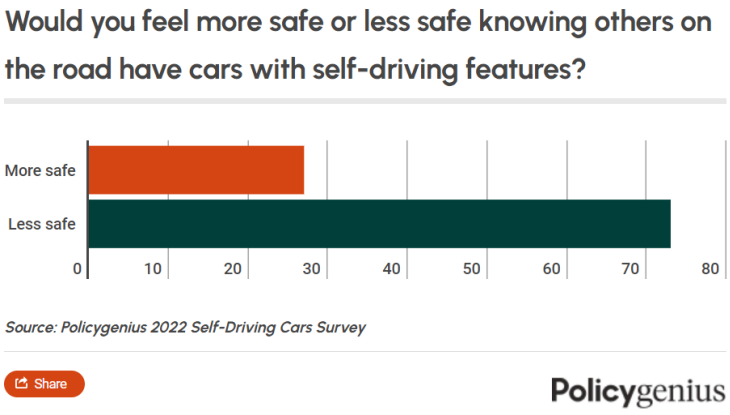
Autonomous vehicles can communicate and coordinate with each other (Car2x communication). They can thus improve traffic flow **and increase road capacity. This reduces annoying and time-consuming traffic jams, allows** shorter routes **to be taken, and makes driving** more efficient and energy-saving **overall. This also offers major advantages in logistics**.

The disadvantages of self-drive car:

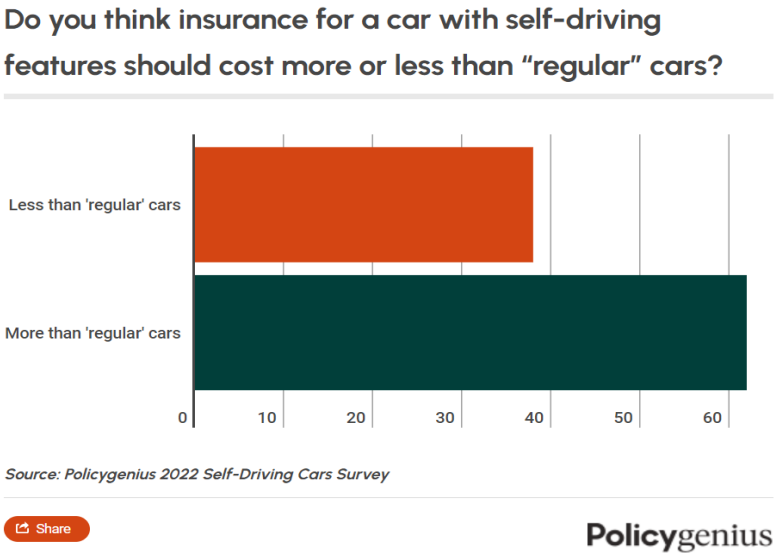
1. self-drive car makes people feel less safe on the road

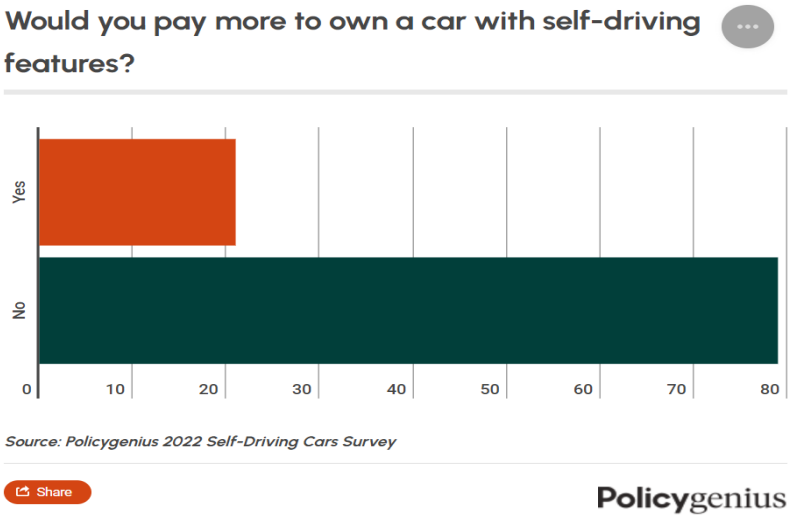
The survey found most of Americans (76%) say they would feel less safe driving or riding in cars with self-driving features. Similarly, 73% of people would feel less safe knowing others on the road are traveling in cars with self-driving features.





Americans are also skeptical about the potential of this technology, with one third (33%) saying that even a car with "full self-driving capability" would require constant attention. Nearly 80% of people say they would not pay more to own a car with self-driving features.





Literature Review for similar projects:

1. Building an Autonomous Car

The main objective of this project is to build an autonomous car that can navigate properly. It is using GPS, LIDAR, and other sensors to navigate to GPS waypoints, avoid obstacles, and return to the start position. This is four-part series on building a miniature self-driving car from scratch, all the hardware and software part of the project is described step by step.

2. Tesla Model RC Self-driving RC Car

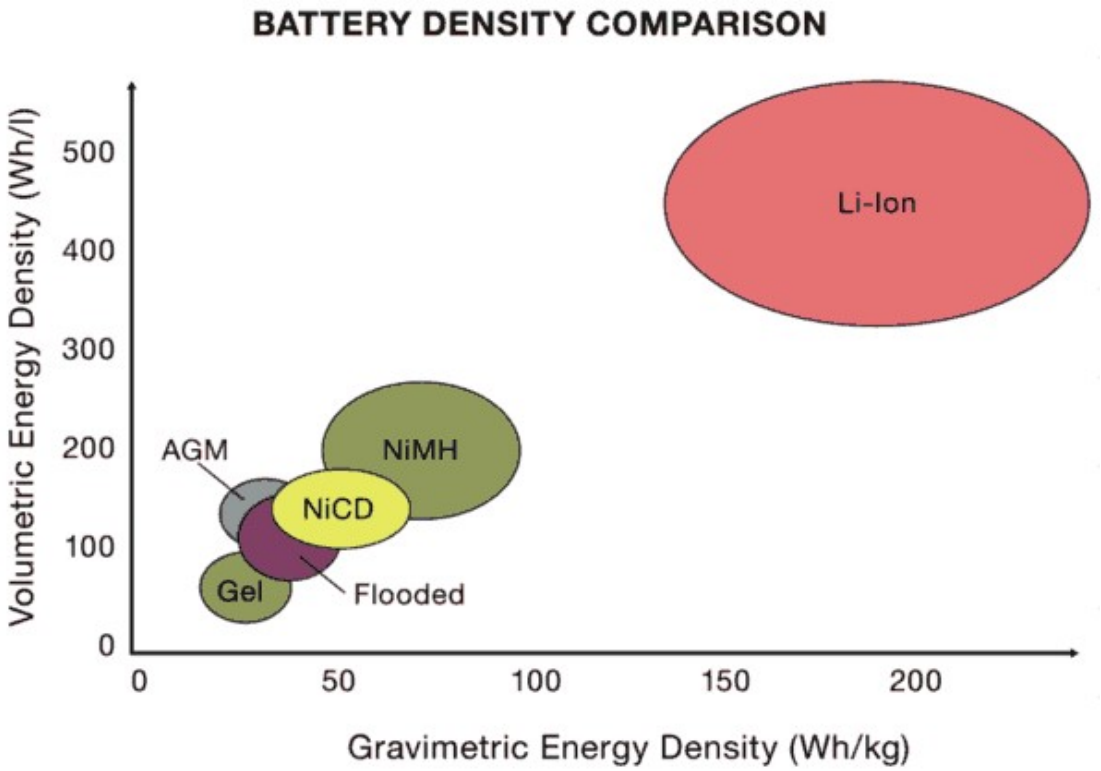
Tesla Model RC is a self-navigating, electric, battery-powered RC car. The goal is to use GPS navigation to get to the location specified on a self Android application While navigating, the vehicle integrates data from various sensors to understand its environment and avoid impediments in its route.

- **battery capacity**

Lithium batteries are the best option. Contactless charging technology reaches near 95% efficiency and needs batteries able to receive a big amount of energy in fast charging cycles.

More energy available in a given volume. In other words, the same power and less weight or the same weight and more power.

We can consider that the energy density in Lithium batteries is three times higher than in the lead batteries.



Why ROS?

Modern robotic systems leverage the ecosystem and modularity of the Robot Operating System (ROS) to enhance the development environment and enable realistic simulations. ROS provides a flexible and robust framework that allows developers to create complex robotic systems with ease. This framework provides a wide range of tools and libraries that can be used to develop various robot applications.

ROS has a large and active community consisting of researchers, developers, and enthusiasts. It benefits from a wide range of packages and libraries created by the community, making it simpler to use existing solutions for different robotics tasks. Additionally, ROS supports simulation software like Gazebo, which expands its features.

Conclusion:

Since Self Driving Car is the major upgradation in automatable industry in future, this project focuses on bring changes in road safety and commuting and significantly reduce accidents and human errors through continuous learning by the system. This project will be a revolution in transporting differently abled people and blind people can drive independently. With our product as base mobile applications can be developed where owner summon the vehicle via the app and produce a fully autonomous car on passing the law (Fully autonomous cars are still illegal, but will be the future mode of transport).

Reference:

https://www.researchgate.net/publication/341132361_Self-driving_car

https://www.prnewswire.com/news-releases/more-than-3-in-4-americans-feel-less-safe-in-self-driving-cars-survey-finds-301623530.html

https://www.policygenius.com/auto-insurance/self-driving-cars-survey-2022/

https://www.swarco.com/mobility-future/autonomous-driving/autonomous-driving-pros-cons

https://www.academia.edu/78729673/Survey_on_Self_Driving_Vehicle

https://www.mathworks.com/help/autosar/ug/what-is-autosar.html

https://www.aionlinecourse.com/blog/self-driving-car-final-year-project-ideas-and-guidelines