

MIET2565 | MIET2566

Systems Engineering Principles

Introduction to Systems Engineering – Tutorial – Driverless Car

Google Self-driving Car System

<https://waymo.com/>



Principles of systems engineering



Systems are created for specified purposes	Run on existing urban road system without driver
Systems have users	Multiple users
Systems interact with the environment around it	Synchronize with on-going traffic on roads Recognise self location and destination address Develop optimum route according to traffic conditions.
System boundary should be clearly defined	The car and all installations (hardware and software) on board. Telecommunication network.
Systems are made by integrating components	Components: Car, camera, traffic recognition, GPS, telecommunication system, on-board intelligence
Systems are designed by the application of engineering science knowledge	Image recognition (traffic conditions) Distance sensors. Internal combustion engine, acceleration, braking forces
Systems engineering tasks are often not repeating	Some systems engineering design tasks are repeating but there are specific requirement such as location, application, time limits, etc, that requires special design. Different applications will demand special features: goods transport, police patrol, driverless ambulance
Systems development and operations are multi-disciplinary	Disciplines: mechanical, electrical, electronics (telecommunication).

Describe the steps that a user (passenger) operates this driverless car



1. On a phone Apps, user enters desired destination and number of people, press submit.
2. The phone Apps sends entered information and user location data to a central server.
3. The central server commands one driverless car (probably nearest) to the user's location. The driverless car locates the user's phone location and stops in front of the user.
4. User opens the car door and sits in. Multiple users act similarly.
5. Driverless car explains some rules, waits for all passengers to have seat belts tied up.
6. Driverless car starts journey. Users are free to do anything so long as seat belt is kept tied up and not disturbing car movements.
7. Driverless car arrives destination and stops at side of road. Users get off.
8. Driverless car detects all passengers are off, then notifies user that fees are deducted from user's registered account.
9. User's phone receives journey complete confirmation.

Components used on this driverless car



1. Car installed with control computer system.
2. Telecommunication network
3. PA system
4. GPS
5. Communicating computer
6. LIDARR/RADAR/camera system for car to process imitate environment, other cars, pedestrians and hazards
7. GPS for overall positioning
8. Map database for route planning
9. Central control attendant attention system to ensure control attendant takes emergency
10. 4g/5g connection for traffic updates, other online information
11. Standard car components (Engine of some sort, hydraulic brakes(ABS), power steering, SRS Airbags)
12. Stepper motor connected to steering assembly
13. Controllable breaks and throttle.
14. Window tint to avoid upsetting other drivers

Questions?