

***Misr University of Science and Technology***

***College of Engineering and Technology***

***Department of Mechatronics Engineering***

B. Eng. Final Year Project

**3 Proposals for Graduation Projects**

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DECLARATION

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of Bachelor of Science in Mechatronics Engineering is entirely my/our own work, that I/we have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others and to the extent that such work, if any, has been cited and acknowledged within the text of my work.

**Signed:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date:** Day, xx Month Year.

**Signed (repeat for all students):** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Date:** Day, xx Month Year.

ABSTRACT

Autonomous vehicles have been invented to increase the safety of transportation users. These vehicles can sense their environment and make decisions without any external aid to produce an optimal route to reach a destination. This type of system can bring a revolution in transportation for differently abled people and help blind people travel independently.

In our project, we will be working on autonomous vehicles that can use Simultaneous Localization and Mapping (SLAM) and Robot Operating System (ROS) in autonomous vehicles with mapping and path planning. Navigation2 stack autonomous vehicles can navigate via different path planning algorithms using the map Previously built, all of these were achieved using sensors such as lidar and Kinect cameras.

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## Introduction and Literature review

We survey research on This self-driving technology mainly deals with the vehicles that can work and move themselves by sensing the movements and environment without any human presence. These self-driving vehicles are also known as autonomous vehicles. A human driver nor any human passenger is needed compulsorily to operate this vehicle. It totally works on the operations done through sensors, remote controlled operations, artificial intelligence. Thus, making it a product of mechatronics field. A Vehicle that has functionality of autonomous, it means it will aware by itself and has capability to choose by itself. For example, you say “drive me to work”, instead to follow your instruction it will be start to drive at another point, no it will not happen, an autonomous vehicle will follow the driver instructions and will reach the destination as driver want.

## Mechanical design Project Design

### Introduction:

Mechanical design is the process of designing components, parts, products, and systems of mechanical nature. The primary objective of mechanical design is to ensure that the final product or system is safe, reliable, efficient, and cost-effective. We will go to select the material and do calculations.

### Material:

Many different materials are used in the manufacture of autonomous vehicles body and the most used materials nowadays are steel, aluminum, stainless steel, and acrylic. We chose acrylic material for the car body

The Advantages of Acrylic:

• Easy to Fabricate and Shape

• light weight and ideal for precision machining

• Highly impact resistance

• Easy to Maintain

## A table with text on itDifference between Self-Driving Cars and Regular Cars:

# Advantages of Self-Driving Cars:

1. Reduced Costs: In 2021, the U.S. reported 42,915 vehicular fatalities, with 94% of crashes attributed to human error. Autonomous vehicles (AVs) have the potential to significantly reduce human error, which could lower crash rates by up to 90% and potentially save approximately $190 billion per year.

1. Increased Safety: Driver fatigue, inattention, or incorrect behavior are the causes of almost 99% of accidents. With AVs, human error is eliminated. These vehicles, equipped with advanced sensors, cameras, and AI, can make driving more efficient and reduce the accident rate. They also have faster reaction times, leading to shorter braking and starting times.

1. More Time and Comfort: Depending on the level of autonomy, drivers can relax, take breaks, or focus on other activities. In fully autonomous (level 5) vehicles, passengers can fully rely on the vehicle to take them to their destination without needing to drive.

1. Accessibility for Elderly and Disabled: Self-driving cars can offer a safe and timely journey for the elderly or visually impaired individuals who are otherwise unable to drive, helping them maintain independence and mobility.
2. Autonomous vehicle Levels of Autonomous Vehicles:**A diagram of a car driving process

   Description automatically generated with medium confidence**

# Autonomous Vehicle Technologies:

AVs use combinations of technologies and sensors to sense the roadway, other vehicles, and objects on and along the roadway.[2]

**A diagram of a car

Description automatically generated**

# Working of Automated Vehicle:

For an intelligent vehicle, the first step is to determine its current position in the world. This requires understanding local coordinates, road boundaries, and intersections, which is referred to as a local map. Two types of maps can be used: real-time maps or stored maps.

1. Real-time Mapping: In real-time map generation, various components such as RNDF (Route Network Definition File), GPS, cameras, lidar, and radar are employed.
2. Object Detection and Collision Avoidance: Short-range proximity radar and ultrasonic sensors are used to identify objects near the vehicle to prevent collisions.
3. Signal and Vehicle Tracking: Video cameras are used to track traffic signals, school lane signals, and other vehicles.
4. Distance Measurement and Road Identification: Lidar (Light Detection and Ranging) is utilized to measure distances, detect road edges, and identify lane markings.

Development of Autonomous Vehicles**:**

Autonomous vehicle (AV) research began in the 1980s when universities started working on two types of AVs: one that relied on roadway infrastructure and one that did not. The U.S. Defense Advanced Research Projects Agency (DARPA) hosted “grand challenges” to test the performance of AVs on a 150-mile off-road course. Although no vehicles finished the 2004 Grand Challenge, five vehicles completed the course in 2005. In 2007, six teams successfully finished the third DARPA challenge, which involved navigating a 60-mile urban course while obeying traffic laws.

In 2015, the University of Michigan launched Mcity, the first dedicated testing facility for autonomous vehicles. Research at Mcity focuses on the safety, efficiency, accessibility, and commercial viability of AVs. Additionally, unmanned aircraft systems (UAS), or drones, are being deployed for commercial ventures like last-mile package delivery, medical supply transport, and critical infrastructure inspection.