PROBLEM STATEMENT 10:

Develop a 2D Occupancy Grid Map of a Room using Overhead Cameras

Category: Robotics

Participants: 5th-8th Semester Students

Objective:

The primary objective of this project is to develop a 2D occupancy grid map of a room using overhead cameras, similar to the map created by a ROS2-based SLAM algorithm typically used by autonomous mobile robots (AMRs).

Description:

- In the initial phase, you will need to equip a room or area with four overhead RGB cameras arranged in a 2x2 pattern, ensuring some overlap in their fields of view. The room should contain static objects such as chairs, tables, stools, and boxes. Using the images from these cameras, and by stitching the views together, you will create a 2D occupancy grid map of the room. The goal is to demonstrate that this map can be effectively used by AMRs for path-planning and navigation.

- In the second phase, the room environment will become dynamic, meaning objects like tables and chairs can be moved around. The 2D occupancy grid map should be able to dynamically update itself to reflect these changes, providing a new, accurate map for AMRs to navigate. Additionally, you will add semantic labels to the map (e.g., "table", "chair", "other AMR") to provide further context for the AMRs. This will likely require the implementation of simple object detection.

Outcomes:

Initially, you can model and simulate the room environment, objects, and overhead cameras in the Gazebo simulator. Gazebo will also support the addition of an AMR equipped with an on-board camera or LiDAR for SLAM map generation and navigation using the ROS2 navigation stack. This will allow for a comparison between the map generated from the overhead cameras and the map created by the AMR using SLAM.
