**Project Background**

Robot can be used in a variety of industrial scenarios. For example, A robot taking a camera can patrol around in a plant to check the status of each machine by using object recognition technology and report the machine condition to a server repeatedly.

**Goal**

The purpose of this project is to demonstrate the mobile robot’s mapping and navigation functionality in a plant to collect useful information through image identification for machinery condition monitoring in real time.

**Result summary**

The final delivery of the project consists of 3 parts:

* Use debug tools to enable the robot to construct a 2D map in a plant and patrol around based on the map.
* Build communication between the robot and the server to transmit real-time data and command.
* Build an image identification environment in the server side, and then adopt some specific object recognition algorithms for machine condition monitoring.

In the project, the robot now is ready for task and has the functionality to construct a 2D map in an unknown environment. Then it can navigate within the constructed map. The robot is running on a Linux system with Robot Operating System installed.

The robot is equipped with a lidar and an USB camera with high resolution. It uses NVidia Jetson Nano as its upper computer which runs the master node in ROS network and stm32 as its lower computer which manages its motors and sensors.

The mapping uses a program with cartographer algorithm. The cartographer mapping method is chosen because of its stability to map the large area scenario is best through tests. Use the remote controller to move the robot to let the lidar collect data and construct the map. The navigation uses Dijkstra algorithm to find shortest path and dynamic window approach to generate a best velocity command to move the robot.

The camera is configured with appropriate resolution and its stream is pushed by ffmpeg to the server for further processing. Then the stream is fed to the Yolo object detector to identify target objects. In this case, the target objects are digital displays installed on the machines. Then, the displayed texts are recognized and send to the SQL server database.