Project Description
Semester Project for SFAS2021[1]

Abstract

The goal of the project is to develop software for a simulated robotic system capable of navigating a predefined environment and identifying existing targets using information coming from QR codes and unveil a secret message.

Figure 1: Project Components

Details

The project will be executed in teams. Each team will have 4 members (already defined). Each team will work a simulation including robot, i.e. an Turtlebot 3(Fig. 1).

The goal of the project is to develop the software (based on ROS) which will instruct it to **AUTONOMOUSLY** locate all N targets in a predefined area, where the targets lie in unknown locations. For 2020, N=5.

QR Codes

Each QR code (Fig. 1) will contain the following attributes:

1. X,Y coordinates of the QR target
2. X,Y coordinates of the next QR target
3. The QR target ID (in the range [1,N])
4. A letter or word associated with this QR target

We have provided a launch file —available on learn.dtu.dk— which can detect and extract the QR info. Here's an example string read from the QR code:

```
data: "X=2.35\r\nY=3.24\r\nX_next=5.3\r\nY_next=5.9\r\nN=3\r\nL=M"
```


[1]The contents of this Document are confidential to the students of Technical University of Denmark following the course Software Frameworks for Autonomous Systems – SFAS - 2021

Evangelos Boukas,
Lazaros Nalpantidis
DTU Electrical Engineering
Department of
Electrical Engineering

Elektrovej
Building 326
2800 Kgs. Lyngby
Denmark

Tel. +45 45 25 35 76

www.elektro.dtu.dk

Additionally, you will use the QR codes to define the relative location of the target to the camera (Fig. 2). The topic "object_position" provides messages of type Geometry_msgs::PoseStamped.

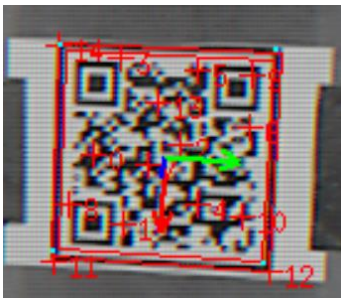

Figure 2: QR Pose

Operational Space

In Figure 3 you can see the simulated area in which the robot will operate in.

Figure 3: Example Working Area

Operation Pipeline

To understand the project goal of the project we present here an example pipeline for solving the problem. The robot could:

1. “Manually” map the area (you can teleoperate ONLY for this step).

2. Start exploring the area until a QR target is found

3. Find a second QR target,

4. Use the “hidden” frame of reference to locate the rest of the target’s frame of reference.

5. Construct the “secret message” sentence by concatenating the strings from all detected targets in the correct order (from 1 to 5)

Deliverable

The students should provide:

- a concise and descriptive report
- The source code, as well any additional info (eg: videos of operation)

Deadlines

The following deadlines must be respected:

Subject	**Date**
One Report per team (on learn.inside.dtu.dk)	30 / Novc / 2020

Questions

Any question can be directed to either the Teaching assistants of the course or the course coordinator.