

# Multi-robot Patrolling with Duckiebots

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## I. INTRODUCTION & MOTIVATION

Multi-robot patrolling is an potential idea, I can apply this project to surveillance, security, production line, etc. I realize that robot can help us with something routine and cycling, such as patrolling, which I should patrol lots of nodes again and again. As a result, I come up with this idea, trying to build a multi-robot patrolling system in ROS, and also combine this system with duckietown.

## II. SYSTEM ARCHITECTURE & EQUIPMENTS

### A. SYSTEM ARCHITECTURE

We will have lots of robots(duckiebots) and one master robot(Raspberry Pi3). The all robots and master are all connected to the same router, so that the master can communicate with each robot.

Each robot will follow the yellow line, and when they arrive at the patrolling node, they will stop and wait for the order from the master. The master will tell the robot to keep go forward or turn back as each robot arrived at the patrol node.

### B. EQUIPMENTS

The robot I use is Moified from duckiebot, I replace the dagu motor with JGB37-520 motor which have an encoder in it Fig. 1. In addition, I use yellow lines and black background as our patrol map, and I use apriltags as the patrol nodes Fig. 2. In software part, I use ROS kinetic and ubuntu 16.04 LTS as my develop enviromnet.



Fig. 1. JGB37-520 encoder motor

\*This work was supported by the Robotics Master Program in National Chiao Tung University, Taiwan

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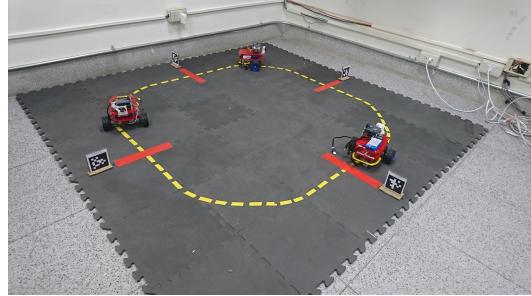


Fig. 2. Multi-robot patrolling map

## III. SPECIFIC AIMS

- Real world patrolling system

I am trying to let multi-robot follow the yellow line and patrol multi-node(apriltags), so that each node will be patrolled in approximately the same idle time. Moreover, those robot will not patol on the same lane at the same time, or they will crash with each other.

- Virtual world patrolling system

I will build a virtual world and models in Gazebo, and try to move all of my patrolling system to Gazebo, so that we can easily show the concept of patrolling robot in virtual world. Moreover, we can connect real world and gazebo, so that it will easily enable us to show the status of each robot and node in gazebo.

## IV. APPROACH

I will modify the lane following in duckietown, to let my robot can patrol along the yellow line. And I will use apriltags with different ID to let the robot know which node they are patrolling now, it's kind of locate the robot.

The algorithm I use is refer to "Distributed On-line Dynamic Task Assignment for Multi-robot Patrolling" [1], we will measure the idleness of each node first, and than the master robot will coordinate every robot to let the nodes with large idleness be patrolled first. If any node is going to be patrolled, the idleness will return to zero, so that no two robots will go to the same node at the same time, and it can avoid collision.

## V. SCHEDULE AND TEAM COLLABORATION

I expect this project can finish real world patrolling before November, and can excute in Gazebo before December. And the experiment video is available in this link: <https://goo.gl/sDwa9j>

## REFERENCES

- [1] A. Farinelli, L. Iocchi, and D. Nardi, “Distributed on-line dynamic task assignment for multi-robot patrolling,” *Auton. Robots*, vol. 41, no. 6, pp. 1321–1345, Aug. 2017.