An automatic food delivery robot based on ROS

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ABSTRACT

With various companies of every discipline trying to reduce their human work force in order to maximise profit, scientists and engineers are progressively considering concepts like utilising robots in order to perform simple tasks, such as hotel room service. In this paper we present a automatic restaurant delivery robot, as our final project. The project was conducted with the pioneer robot, model 3-AT, and the Robot Operating System (ROS). The robot is able to perform tasks in sequence, namely, pick up an order, plan a path to the corresponding table, while avoiding collision with walls and obstacles and identify the appropriate customer by using face recognition. The robot is expected to consider two alternative options: display a success message and return to the kitchen if the order was picked up by the customer, or return to the kitchen with the order, if no match was found within the time limit of one minute. The robot comes with a digital touch sensor, which determines whether the order was picked up or not, completely erasing the need for the user to provide input from the keyboard. It is fully capable of accomplishing its task in a realistic environment, since it can avoid moving obstacles, like people, as easily as it avoids static ones. Recovery from being kidnapped is not an issue, since it can easily reset its estimated position on the map and proceed to localise.

I. INTRODUCTION

The purpose of this report is to carefully and minutely describe the steps, design and experiments conducted during the actualisation of this project. The first section introduces the background and key technology implemented, followed by the design and implementation of concepts like autonomous navigation, face recognition and sensor detection, in subsequent subsections.In section 3, the robot model is set up and experiments are conducted in order to prove feasibility. In parallel, some improvements and existing problems are put forward in the discussion part. Finally, final thoughts and further work are included in the last section.

II. ROBOT SOFTWARE DESIGN

The purpose of the this project is to create a delivery robot that can be used in restaurants, delivering food from kitchen to aimed tables. The purpose basically requires the robot to own the capability of localization and navigation. In addition, some other functions which can make the robot more intelligent are better to be integrated in the robot, such as face recognition, voice broadcast and sensor detection for food. The main functions are shown in Fig.2 and each part will be discussed separately.

Fig. 1. line-tracking delivery robot

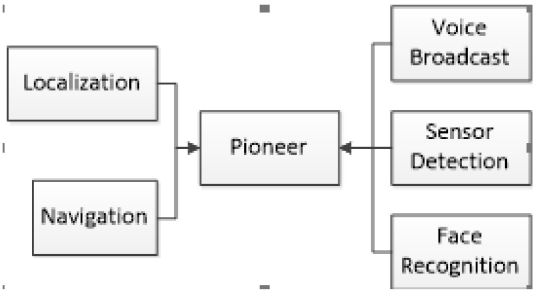

Fig. 2. Pioneer's functions

A. Navigation stack configuration

ROS provides the navigation stack (NavStack) for motion control, which contains ROS packages in path planning, localization, mapping, abnormal behaviour recovery and other aspects. Move_base is the core package and we can run this node for navigation. The input topics for move_base are /tf, /odom, /scan or /pointclouds, /map and /move_base_simple/goal, and the output topic is /cmd_vel, which is the planned velocity.

When the aforementioned move_base package is used, some if its parameters have to be configured. During the configuration process, the importance of some parameters became very clear. Before the move_base can be used, four files need to be created beforehand. Those files are base_local_planner_params.yaml, costmap_common_params.yaml, global_costmap_params.yaml and local_costmap_params.yaml.

In the base_local_planner_params.yaml file, 'pdist_scale' and 'gdist_scale' are extremely important, since those are