PHOTO: Robot Shop, Inc.

Autonomous Photo Booth Robot

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Overview

In this project we will create an autonomous robot that can provide photo booth service to customers. Customers will sit on the chair after making a payment and choosing the background image at cashier/service desk. Then, robot starts moving to the customer by navigating room environment and avoiding obstacles. The robots detect customers' faces when it reaches to destination. A few moments later, the robot will take a picture of the client and send it to a computer at service desk. Finally, customer will be able to pick up the photo at the desk.

Background & Motivation

Currently in the market, Autonomous Mobile Robots (AMR) are being used as tools for providing services such as food delivery systems, similar to Automated Guided Vehicles (AGV), which follow markers or wires in a storage facility or warehouse. Rather than using humans as employees to complete mundane tasks, these AMRs would give employers access to cheap, and reliable workforce.

Several companies have already integrated AMR technologies into their workforce to complete tasks which would be considered simple - such as catering food or information delivery systems. As the minimum wages increase over the country, employers look for alternatives to cut down costs. A need exists for efficient, cheap, lightweight robots capable of completing the simple task of taking pictures of clients. These AMRs can provide companies who take passport photographs a flexible alternative.

Goals

1. Develop an autonomous mobile robot that can take a photo of customer.
2. Collision-free navigation within the given environment along with returning to the docking station
3. Sending photos to the service desk whenever process is completed with the image in the desired dimensions.

Specifications

- The robot can navigate between docking station and user-defined goal location
- Once user specifies what kind of photo the client desires, the robot starts to move to a predefined position within the area.
- When robot reaches at the goal position and detects the face of the customer, it takes the customer's picture and sends it to the service desk

Deliverables

- **Demonstration of the successful procedure of the autonomous photo booth robot (video)** which shows delivering service of taking picture based on customer's need
- **Project Report** that has fully documentation of project including code repository.

Project Timeline

1. Navigation Software Implementation April 5, 2018
   Create a map of potential environment, and have the turtlebot navigate around the given environment to key points consistently. The turtlebot carries an open laptop which runs the navigation software.

2. Facial Recognition Software April 8, 2018
   Create software which detects human faces and takes a photograph of their face, and process the image into the official dimensions of government passport identification photographs.

3. Video demo of photograph robot taking orders from clients April 12, 2018
   Create a video demonstration of the autonomous photograph robot receiving the client's location and navigate to his or her location. The robot will then confirm that it has arrived at the desired location, give the client an audible signal, and then finally take the photograph. After the photograph has been sent to the operator, the robot is to acknowledge the client that the photo has been sent. Finally, the robot returns to its docking station maintain its battery's charge.

Resources

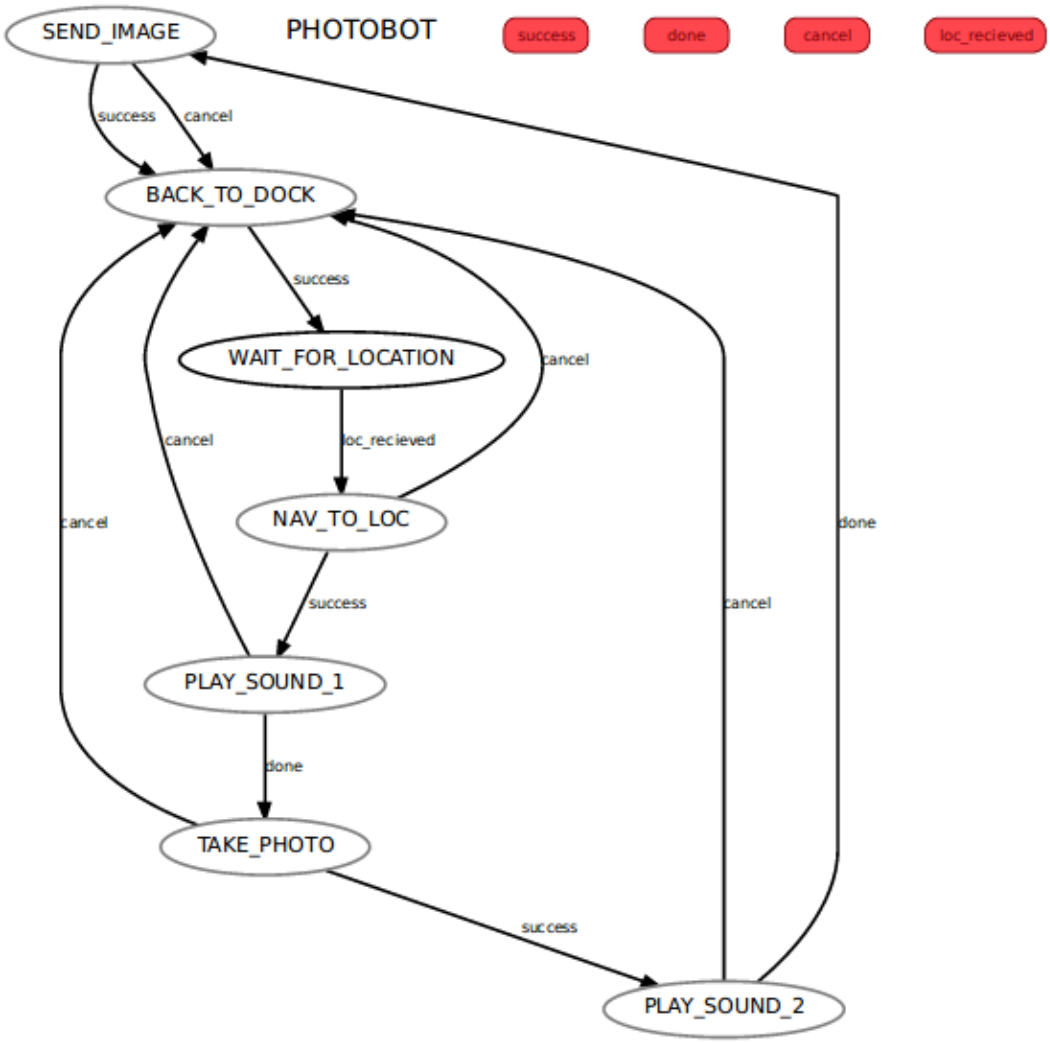
Hardware

- Kobuki-based Turtlebot 2 mobile robot base
- Asus Xtion Pro Live RGB-D Camera
- External USB Camera
- Laptop running Ubuntu 14.04 & ROS Indigo

ROS Packages

- ROS slam_gmapping package http://wiki.ros.org/slam_gmapping?distro=indigo
- ROS smach package http://wiki.ros.org/executive_smach?distro=indigo
- Autonomous navigation with a known map with turtlebot http://wiki.ros.org/turtlebot_navigation/Tutorials/Autonomously%20navigate%20in%20a%20known%20map
- ROS Navigation stack http://wiki.ros.org/navigation/Tutorials
- ROS vision_opencv http://wiki.ros.org/vision_opencv
- ROS Usb_cam http://wiki.ros.org/usb_cam

Finite State Machine



Risks and Issues

- This will be the first time we have used OpenCV to detect faces and taking picture in a python program. Testing necessary OpenCV libraries/packages should to alleviate all possible problems.
- The time to complete project may have been underestimated, so parts of the project will be added in an incremental trend to be able to demonstrate by the Competition date April 12, 2018.

Budget

- Estimated time to complete designing and testing the autonomous photo booth robot is 20-25 hours including complete documentation.

Evaluation

An autonomous robot will be evaluated in four parts and having at least 80% score will be accepted as a successful prototype. The following four tests:

- **Test 1 Building map of environment:** The robot will build a map of studio for adequate navigation, which is Test 4, repeatedly for 15 trials.
- **Test 2 Navigation :** The robot will navigate the environment between goal position and docking station and avoid the obstacles on the way repeatedly for 15 trials
- **Test 3 Face Detection:** The robot will successfully detect face of customer when it reaches predefined goal position at map.
- **Test 4 Taking the Picture:** The robot will take picture of customer after 3 seconds later when it detects the face.