

Multi-Purpose Connected Robot

Concentration Project – LTU
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Introduction:

MP-ConBot (Multi-Purpose Connected Robot) is a project that aims to monitor homes for security purposes. It consists of a Robot that can be controlled from a Mobile Application via Wi-Fi from anywhere around the world. The system is a UDP Client/Server System hence why it can be controlled from anywhere as long as both the client and the server are connected to the Wi-Fi. The Mobile Application acts as a client and communicates with the robot which acts as a server. The robot application communicates via Serial Communication with a microcontroller and the later controls the mobility and allows moving in any direction. In addition to the remote mobility control, the system is capable of providing additional features to the user, such as the Robot establishing live video stream with the Mobile Application, as well as the robot detecting and recognizing any shapes and numbers; also, autonomous line following. This system can easily be expanded to perform more tasks. It is used now for home security monitoring but can serve multi-purposes such as grass cutting, snow shoveling and any other service that requires remote monitoring and/or control.

See it working: https://www.youtube.com/watch?v=97OW5__Yb5I

Server(Robot) Repository: <https://github.com/KyleKhalaf/MPConBot-PC>

Client(Mobile) Repository: <https://github.com/KyleKhalaf/MPConBot>

Features:

- Mobility Control

Using the Mobile Device, the system is capable of controlling the robot from anywhere around the world as long as both the robot and the mobile are connected via Wi-Fi; which is, theoretically, available everywhere. The Mobile Application is able to move the remote robot forward, backward, left and right at all times and synchronously with the other features being ran. Once the Mobile Application executes, it would be ready to start sending requests to the connected robot.

- Live Video Stream

The system is capable of establishing live video streams between the mobile device and the robot, using the UDP communication technology via Wi-Fi; Also once the mobile application executes, both the robot and the mobile device will get connected. With a button click, the robot can start streaming frames to the mobile device; And the later manages to display the frames on the screen in a form of a live video. This feature is the main feature of the system and was the challenge of this project. This feature works synchronously with the mobility control and the other features. Therefore, the system provides the user with a mobility control and a live video stream at the same time; And the user can see and move in any direction.

- **Snapshots**

The mobile device provides the user the capability of capturing receiving streams in a form of frames. At all times the stream is active, the user can save any frame with a button click, as much as he desires. Then, there is a Gallery in the application that allows the user to access those saved frames and view them, delete any and/or share any.

- **Line Following**

This feature was implemented to show the capabilities of expanding this system to do autonomous tasks. This feature depends explicitly on intelligence of the software, and the camera of the hardware. With some Image Processing, we can successfully recognize and detect lines on the ground. Once we recognize and detect the line, we can then control the motors to move according to the line, and keep repeating the process, hence following it autonomously.

- **Number Recognition**

Another cool autonomous feature is to detect and recognize numbers. Similar to the line following, this uses the intelligence of the software and the camera of the hardware. The robot has access to the camera at all times. Using Image Processing, the robot can apply repeated algorithm and process each of the retrieved images to check if any part of the image has a number in it, to then apply another algorithmic procedure and recognize what the exact number is, and finally display the detection result.

- **Shape Recognition**

Last feature but not least is shape recognition. It is very similar to the number detection but is different in how it was implemented. The Robot would have a database of all shapes, and then process the frames to detect big shapes in the frame, and then compare it to see if it matches any of the shapes that are in its database, and finally display results of detection.

I thank Prof. CJ Chung for leading me in this development, Prof. Jon Ruzala for his Image Processing lectures and Prof. Godfrey Nolan for his Android Development knowledge. This project could not be completed without your unfailing support over the semesters. I am grateful for your help and assistance and also for considering me for this reward.