Aalto Software Course Topics

Surrogate (Surrogate.tv) is a Finnish start-up company which focuses on creating a whole new gaming experience by allowing players to control real-life robotics, toys, etc. over the internet from anywhere in the world, in real-time. This is possible by utilizing its ultra low latency streaming technology and robot SDK to stream video feeds of games that take place in real-life. Currently the company has a real-life pinball machine, robot battling, racing cars, and claw games available to the public to play as their first steps into this new space. Our goal is to be an open platform where anyone can connect their robotics to offer experiences based on remote robotics.

We are offering 2 different project options for the Aalto's Software Course. Both of the projects have the common end goal of creating technology that could potentially be available to the public on our website Surrogate.tv. These projects can utilize our existing frontend, backend systems,robot control and streaming SDKs, and our hardware expertise.

Technologies used in the projects are a mixture of embedded systems where you will have to work with Python or C++ to interact with sensors or existing SDKs. Web development is done with a modern stack where you preferably work with Typescript and React. The backend infrastructure will be based on a mixture of AWS serverless backend services such as gateways, lambda functions, database and possibly nodejs servers running as docker containers. You will also get familiar with websockets, udp, and REST-APIs. Our team of 19 people can support you with different areas of the technology.

Project 1: GPS geofencing for outdoor robots

In this project the goal is to develop a geofencing system that provides a basis for outdoor robotic experiences on the surrogate platform. As we are allowing users to control robots through the internet and outdoors, different precautions need to be taken into account. Geofencing is a method used in drones and other robotics where the robot is allowed only to operate inside a certain area, defined by gps coordinates. The task is to build a geofencing system which consists of embedded robot code and a web user interface and necessary backend infrastructure.
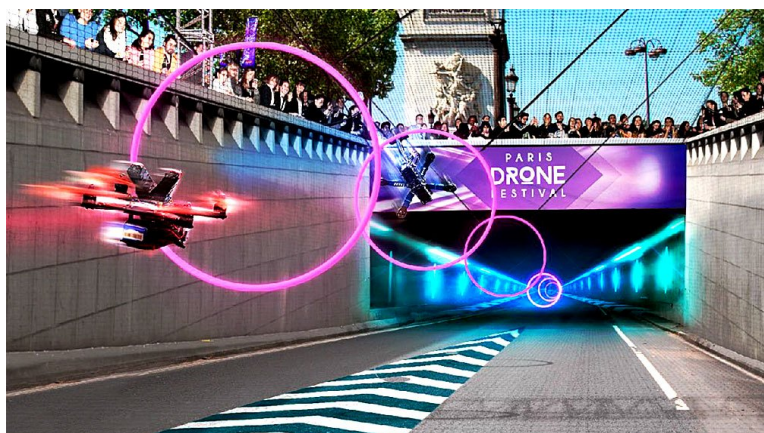
The robot side will be running on raspberry pi on the robot interacting with a gps and compass sensors and doing the actual geofencing based on the configured coordinates and stop the robot from passing the fence. The robot should also provide its live location and heading to the user interface.

The user interface should be a map based tool where the user can determine area, multiple areas or paths to be used with geofencing on the graphical map. These configurations should then be stored for each unique robot to a database from which the robot can fetch them. User interface should also draw on the map the current location and heading of the robot, and also could show additional information such as speed, history path data. The system should also support tracking multiple robots in the same map at concurrently.

If the project scope allows, different recovery methods of returning the robot to the geofenced area, pre-emptive warnings of leaving the geofence area could be added to the system. Also integrating the gps tracking interface to the surrogate platform user interface is possible and hoped.

Surrogate will help you by providing our robot control SDK, low-latency streaming SDK and guide you to using modern AWS serverless stack to complete the project, and of course source the robots and sensors you will need for the work. At the end of the project, you should be able to safely drive the robot remotely outdoors in Espoo while using your geofencing and tracking system!

Project 2: Creating a Drone Based Racing Game

In this project the team will focus on integrating drones to the surrogate platform and robot control sdk. The goal is to have a fully functioning drone game playable online where users can remotely control a drone through the internet and race against each other, or do exploration outdoors.

The team will either (or both if time allows) retrofit a drone with a Raspberry Pi that can be controlled through a network and can stream to the internet for players around the world, wirelessly. Or use a commercial drone from a company such as DJI or Parrot that has camera, wifi functionality and open control SDK available.

In addition to integrating commercial drone or open source flight controllers and raspberry pi together to operate the drone smoothly. The drone should also be able to fly automatically to a certain location before it runs out of the battery, to for example wirelessly recharge through induction or other methods, and the drone software should have safety features (such as fencing) to not be allowed to fly out of a certain area or to hit objects.

The racing track should have hula hoops or similar gates that recognize when a certain drone has passed it - in order to deliver up to date game standings. Surrogate can help with proving the gate sensors hardware, but your job will be integrating the whole system of drones, track and game logic together with the safety features.

There are no specific **requirements** for the students, but as both of our project proposals involve embedded systems, the group will benefit from having interest in robotics, and python, c++ and advanced linux knowledge will be beneficial. On the web development side javascript or typescript experience and working with React will help. These projects are **moderate** but not too difficult.

Legal Issues
- Intellectual Property Rights (IPR):
  - The client gets all IPRs to results as default
  - However, the results that contribute and relate to our open source python robot sdk, will be published with the sdk which will be released as open source during the Fall 2020
- Confidentiality
  - The client will share some confidential information with the students.

Benefits working with us
- We employ many people who have taken this very course, 2 of them are in our original team. You will be in good hands.
- 700sqm office in Espoo with tons of robotics, a lab and cool stuff. You are welcome to work at our premises and there are snacks waiting for you in the fridge.
- Experienced team of 14 engineers to support you with robotics, programming, AWS
- We will set you up with necessary robotics and cloud servers for your development
- You will get to use our core video streaming and robotics technology

Client representative 1
- Product Owner (CTO & Co-founder at Surrogate)

- Severi Tikkala
- Severi (at) surrogate.tv
- +358 50 416 2100
- Niittytaival 13, 02200 Espoo

Client representative 2
- Cloud Architect (Chief Architect & Co-founder at Surrogate)
- Esko Vähämäki
- Esko (at) surrogate.tv
- +358 40 579 4940
- Niittytaival 13, 02200 Espoo