SETTS 2025 course

RoboStar Technology in the Development of a Safe Firefighting Drone

Preparation Material

Introduction

This course will describe and illustrate use of model-driven Software Engineering technology to develop control software for robots whose safety can be demonstrated. In particular, we will describe the RoboStar framework for model-based engineering. After the course, you will be able to:

- write simple models of control software for robots;
- understand how those models can be used to enable several activities of the software engineering lifecycle;
- use the models to automatically generate test specifications;
- describe cutting-edge research being carried out to improve the state of the art on Software Engineering for Robotics.

In the course, you will use the RoboStar modelling tool, called RoboTool.

These notes give pointers to material that describes how to install these tools, and simple tutorials that describe the key steps in their use. The course will give an in-depth overview of the technology that is enabled by these tools, and will help you make more sense of the material in the tutorials. If you succeed in, at the very least, installing the tools, you will save valuable time that will give you a better chance to make the most of the course.

The tools may work with all operating systems. RoboTool, however, has been extensively tested in a particular Linux environment. If you can stick to the recommended configurations as described below, you are less likely to run into problems during the course.

The modelling notation that we will study has some similarity with UML 2 State Machine Diagrams. If you are familiar with these diagrams, you will recognise concepts such as

- state, including initial and final state, and compound state;
- transition, including self transition;
- junction;
- entry and exit actions

If you are not familiar with state machines of any sort, at the end of this material, you will find pointers to some UML 2 tutorials on state-machine diagrams. You will find it useful to look at some of the examples in these tutorials.

Installing RoboTool

RoboTool is available for download from: https://github.com/UoY-RoboStar/robotool/releases. Alternatively, if accessing GitHub is not possible, a mirror for RoboTool is available here: https://robostar.cs.york.ac.uk/robotool/releases/

At the time of writing, the latest version is **v1.1.2025040201**. Choose a zip file according to the operating system and architecture of your machine. For example, choose the archive file named **robotool.product-linux.gtk.x86_64.zip** if you're running **Linux** (we recommend Ubuntu 22.04 LTS) on a machine with an **Intel/AMD x86_64 CPU**. Afterwards, extract the archive into a folder and execute the Eclipse binary.

IMPORTANT: On Linux, you may need to ensure that RoboTool runs under the X11 desktop environment rather than Wayland, which is the default for the latest versions of Ubuntu.

If unsure about this, open a terminal in the location where you extracted RoboTool and run it from the terminal using the following command:

```
GDK_BACKEND=x11 ./eclipse
```

Short RoboChart and RoboTool tutorial

A short tutorial on how to install and use RoboTool to create RoboChart models is available here.

We recommend that you follow Chapter 1, Section 1.4 onwards, of the RoboChart and RoboTool Tutorial, ignoring the installation instructions in Chapter 1 as installation is already covered by the instructions above.

A didactic tutorial on the use of RoboChart is also available from Springer here, that includes an example of a Segway robot modelled in RoboChart.

Short RoboSim and RoboTool tutorial

We also recommend that you follow Chapters 1 to 2 of the RoboSim tutorial, a sister language to RoboChart that allows defining the control software of robots for simulation.

UML2 tutorials on state-machine diagrams [optional reference]

We list below some options of tutorials that cover some of the concepts used in RoboStar models. We note, however, that some of the features of UML2 are not covered in RoboStar as they can be problematic when it comes to providing evidence of safety of the designs. If you have never seen a state-machine diagram, we recommend that you go over at least one of these tutorials, and in particular have a look at some examples.

- https://sparxsystems.com/resources/tutorials/uml2/state-diagram.html
- https://www.visual-paradigm.com/guide/uml-unified-modeling-language/what-is-state-machine-diagram/
- https://nulab.com/learn/software-development/a-simple-guide-to-drawing-your-first-state-diagram-with-examples/

You do not need to install any additional tools, as RoboStar technology is not compatible with these. We will cover the RoboStar concepts in detail in the course.