



RUSTY RAILWAYS

Project: embedded software for IoT



MASTER



Rust based



Map

Keeps the state of the system



High Level Controller

Communicates the system status with the UI (using HTTP)
Receive move requests



Path Finder and Scheduler

Find the most optimal path
Avoid train crashes
Manage conflicts



Low Level Controller

Controls train and switches (using HTTP)

TRAIN



Rust based



Structured on 2 separate tasks using a FreeRTOS based library



One task Manage Wifi communications



One task manage hardware I/O interfacing



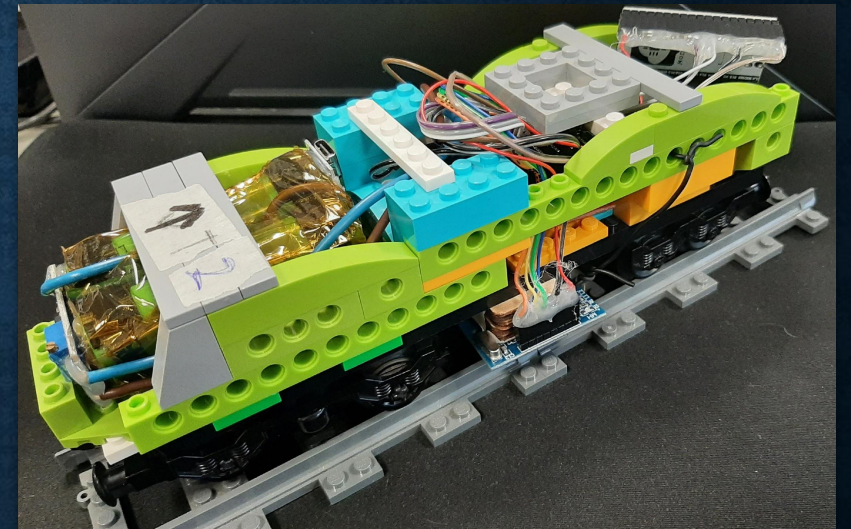
Non blocking Queue to communicate



RFID reader with SPI



H bridge with PWM control motors



RAILWAY SWITCHES



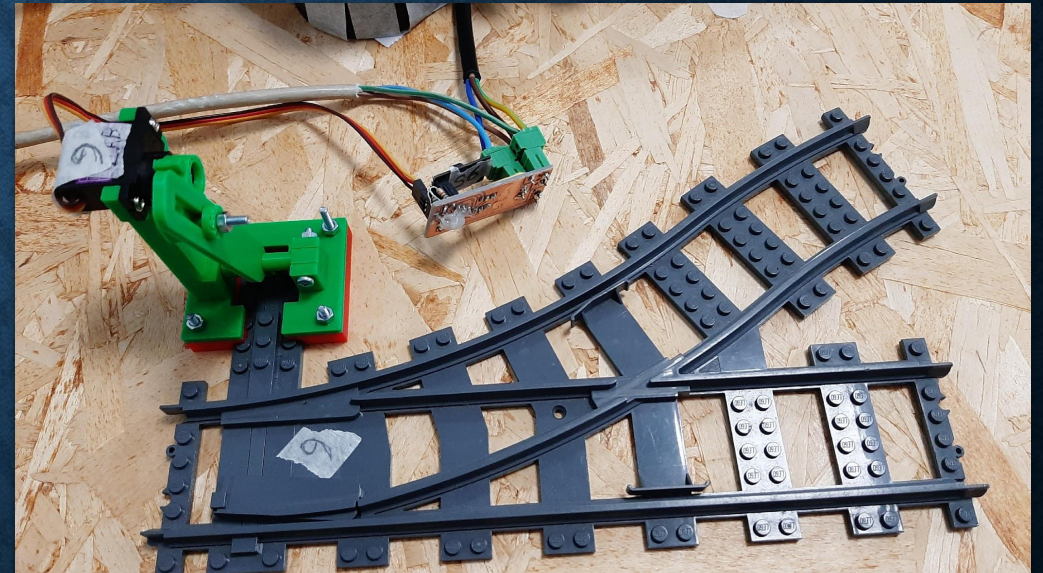
C++ based



PWM servo controller



WiFi communication



CLIENT (GUI)



Godot Based (with GDScript)



Main UI

Create and Edit the
Train Track, set IDs and
Master IP



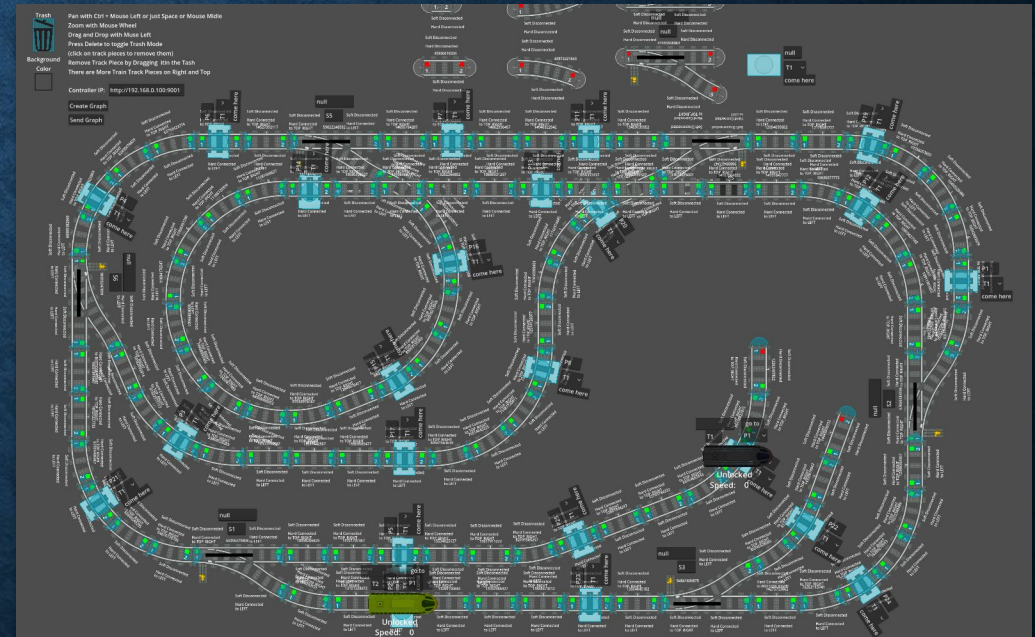
HTTPIO

Send move requests to
Master (using HTTP)



Updaters

Pools Train Positions,
States, Speeds and
Switch States data from
Master (using HTTP)



STRUCTURE AND TESTING

- All Rust components are split into hardware dependent and hardware independent parts using rust's Trait System [Example](#)
- The entire system has been recreated in a [simulation](#) to test all the master's feature without the needs of a physical system
- The master has also 30+ automated unit [test](#)
- All the code is fully covered by [documentation](#) tanks to doxygen and rustdoc



FUTURE IMPLEMENTATIONS



Adding an encoder to the motors to allow a better speed control using PID



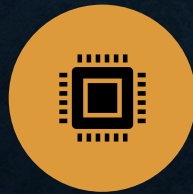
Adding battery level reader using ADC



Add charging station inside the map



OTA: Possibility to update the firmware via internet



Integrate with a loading/unloading system to deliver goods (possibly a coffee delivery machine for our professor Yildirim)

CONTRIBUTIONS



Master:

- Low Level Controller: Federico Peruzzo
- Path Finder And scheduler: Luca Sartore
- High Level Controller: Lorenzo Cattai

Trains: Luca Sartore and Michele Callegari

Switches: Michele Callegari

Graphical user interface: Lorenzo Cattai

Electronic Design, testing and manufacturing: Federico Peruzzo

3D Design: Luca Sartore

Git Repository: https://github.com/MrLakige/rusty_railways

A Special tanks to the **UniTn FabLab Team!**