RUSTY RAILWAYS

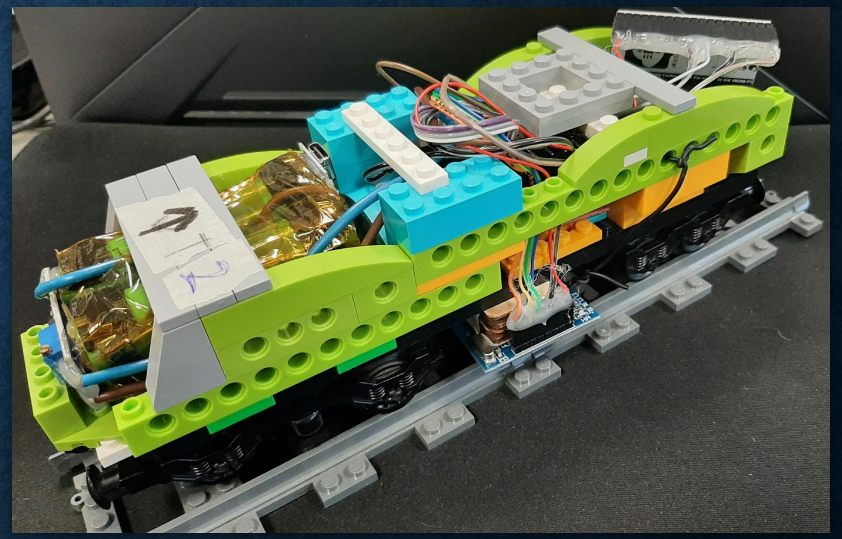
Project: embedded software for IoT

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)**

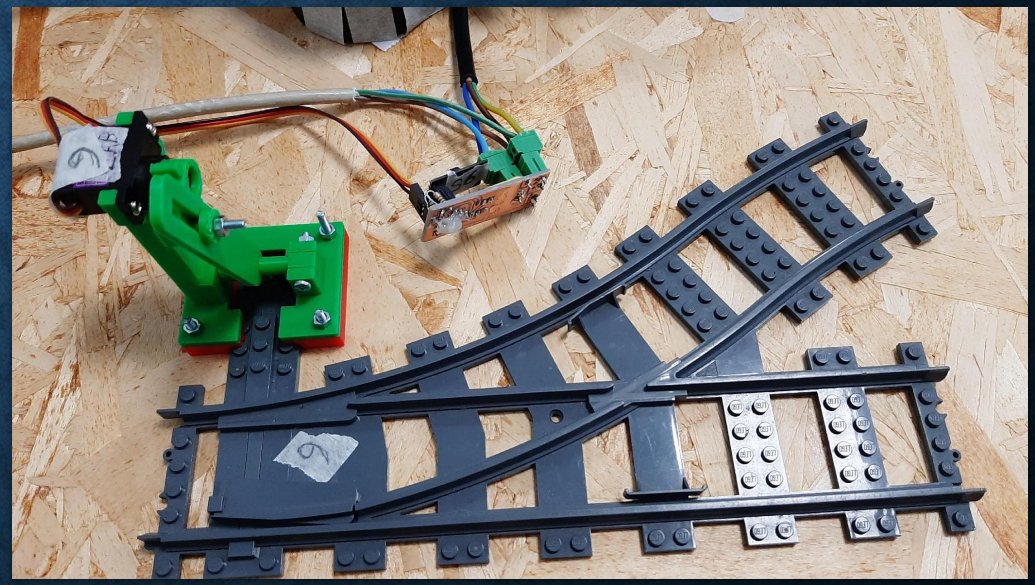
TRAIN

- 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



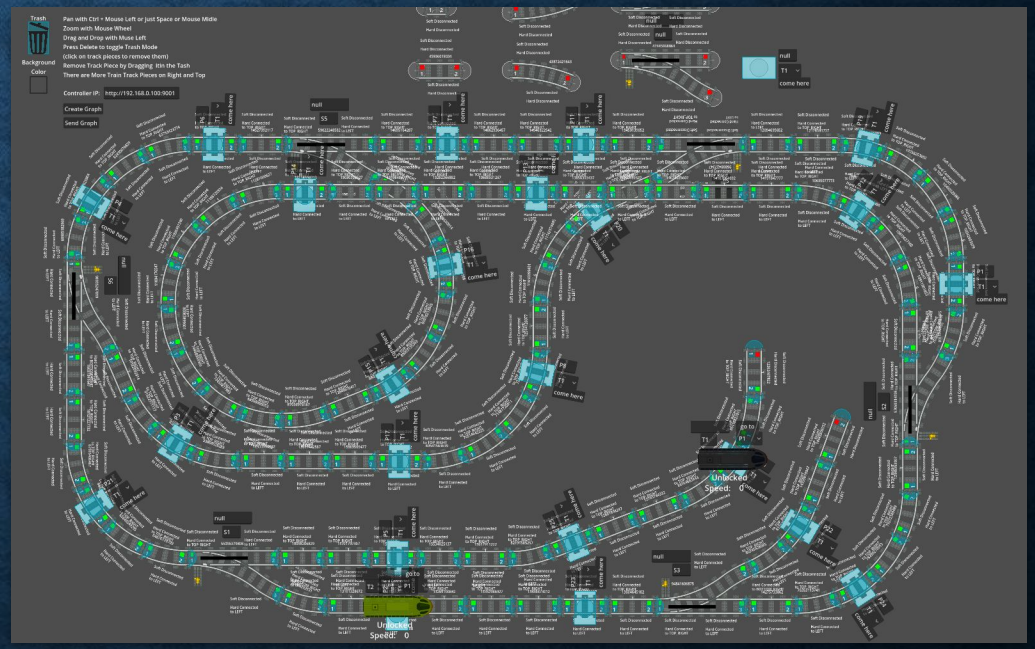
RAILWAY SWITCHES

- 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

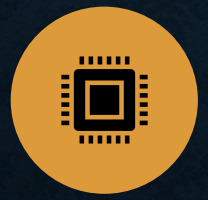
FUTURE IMPLEMENTATIONS

Adding an encoder to the motors to allow for 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!

FAB LAB UNITRENTO