



# Digital Toy Train

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# Prerequisites

- ▶ Model railroad
- ▶ DCC/NMRA decoders
- ▶ Booster connected to parallel port, amplifying signal for tracks & decoders



# Task

- ▶ Implement software that generates NMRA signal
- ▶ Command different velocities of the engine
- ▶ Implement simple UI

# NMRA Signal

- ▶ Standard for controlling model railroad engines
- ▶ Packetoriented
- ▶ Consists of
  - ▶ Synchronisation (14 1-Bits)
  - ▶ Addressbyte
  - ▶ Commandbyte
  - ▶ Checksum byte
- ▶ 1-Bit: 58us high, 58us low
- ▶ 0-Bit: at least 116us high, 116us low

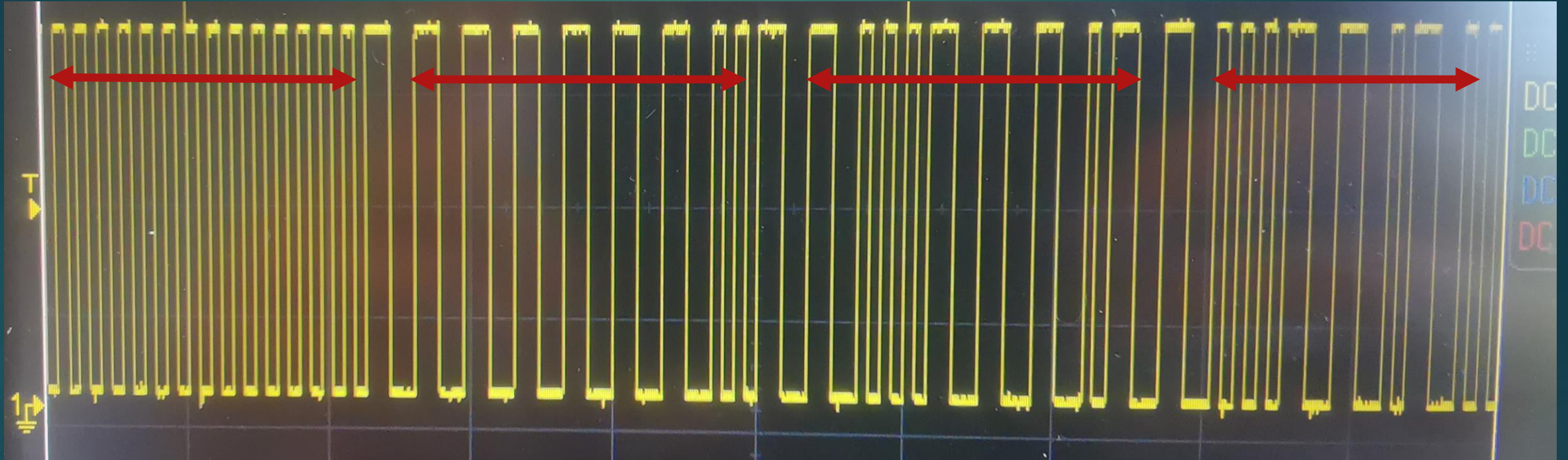
# Packet

Synchronisation

Addressbyte

Commandbyte

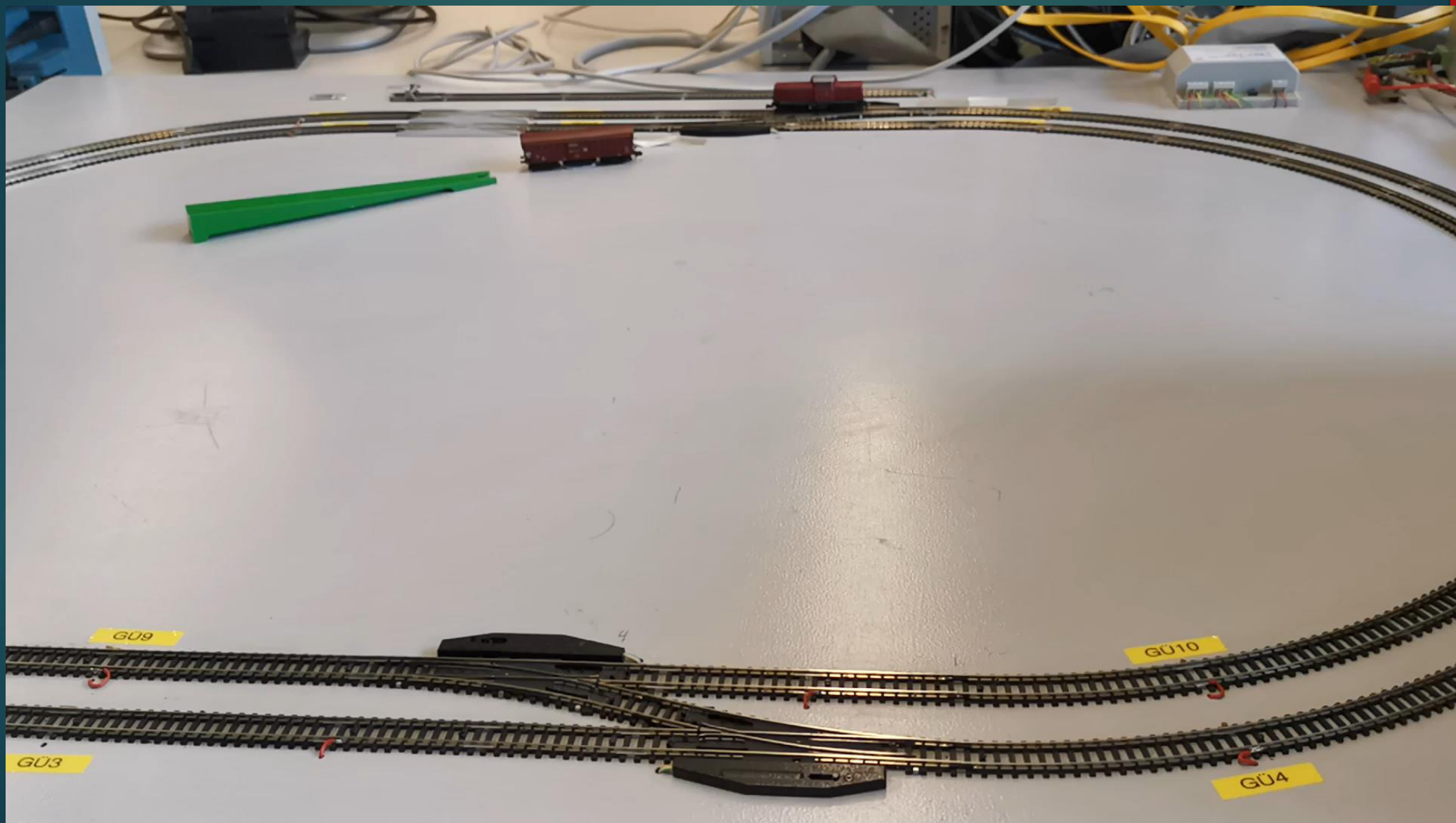
Checksum byte





# Solution

- ▶ Periodic timer
- ▶ Communication to train via serial port
- ▶ Communication to user via FIFO-queue & simple shell script
- ▶ 1 Task which sends in endless loop the packages to the train
  - ▶ Reads command
  - ▶ Calculates checksum
- ▶ FIFO-Handler processes input from UI and sets command
- ▶ Synchronisation by semaphore





Thanks for the attention!

ANY QUESTIONS?