Weekly Presentation

Week 40

Luleå University of Technology

September 28, 2020

Group members

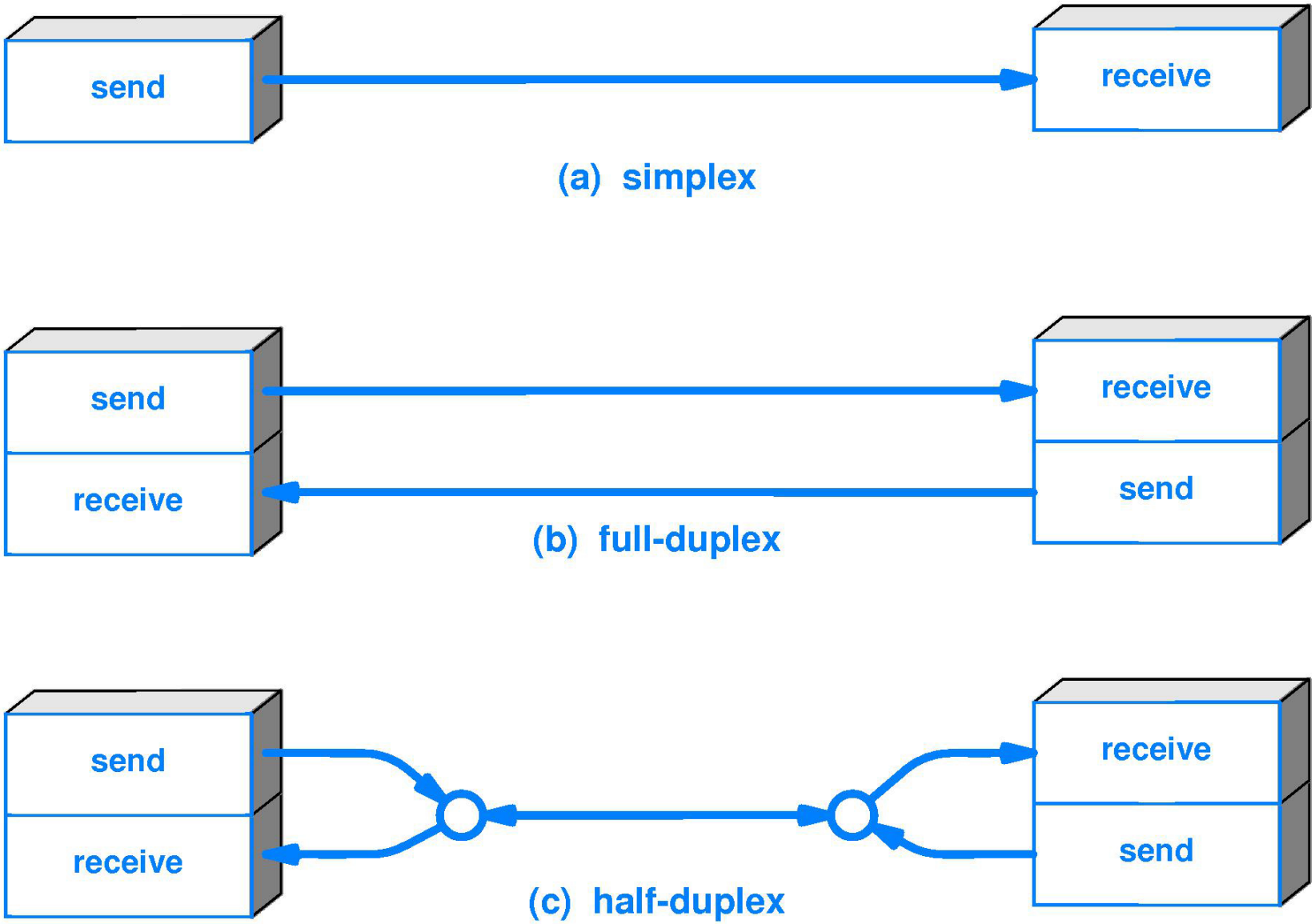
- Y-students
  - Martin Blaszczyk - Project leader and object detection
  - Edward Cedergård -Arm and gripping tool
  - Niklad Dahlqvist - Arm and gripping tool
  - Måns Norell - Movable base
- D-students
  - Edward Källstedt - Object detection
  - Albin Martinsson - Arrowhead and Git

Overview

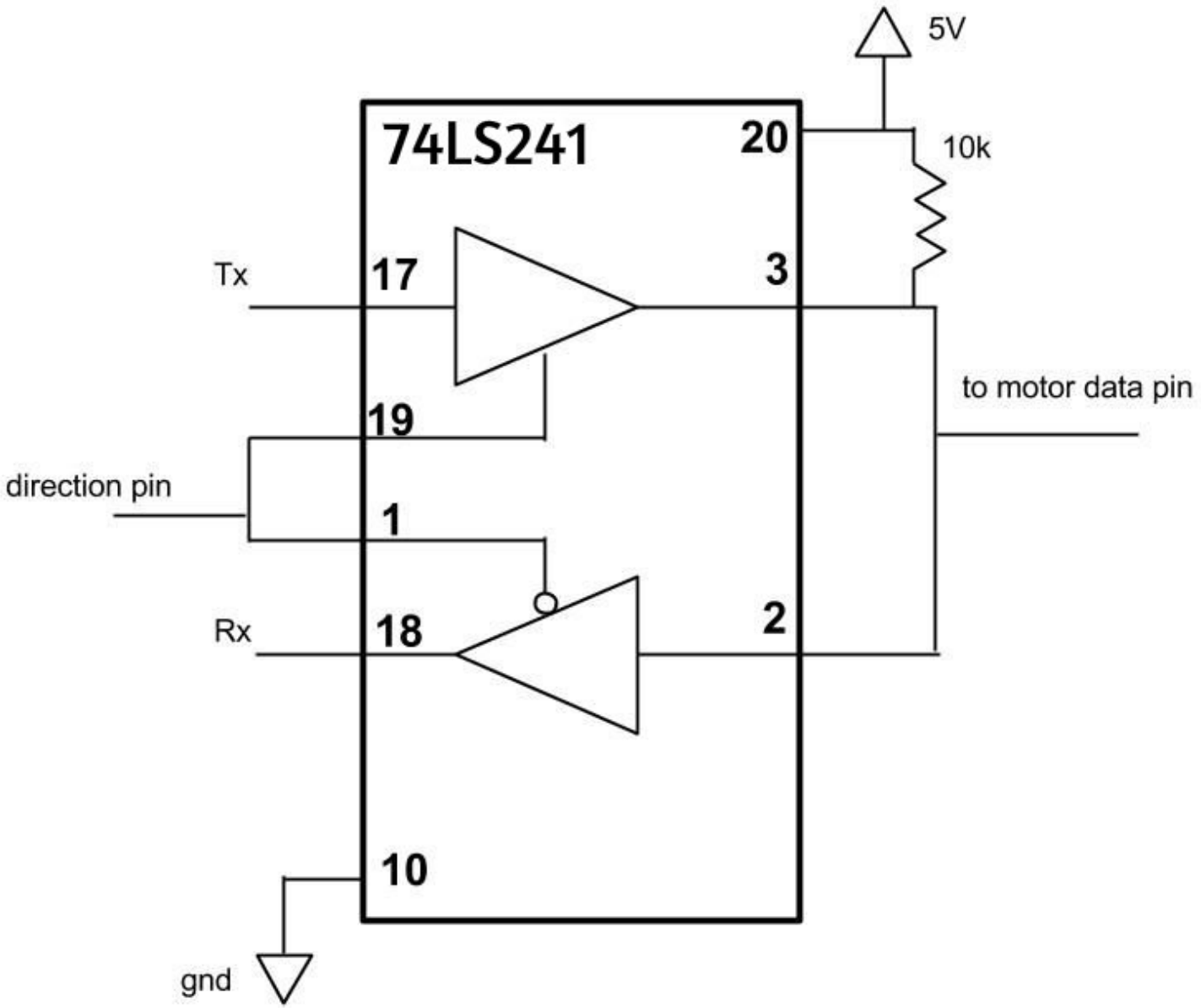
What we have done and what we are working on:

- Full duplex to half duplex serial communication
- Dynamixel data packages

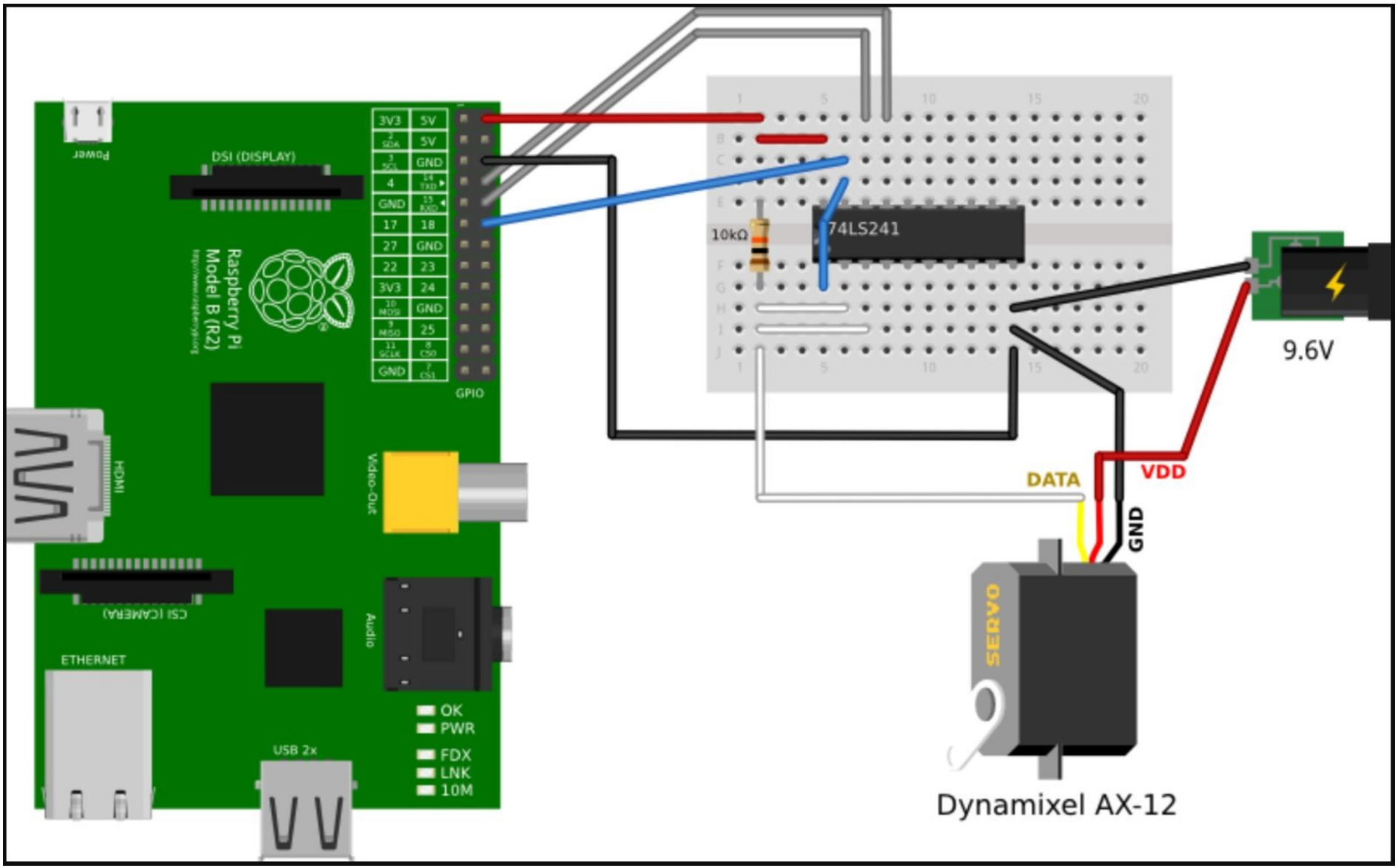
Full-duplex to half-duplex



Dynamixel communication



Curcuit


DSI (DISPLAY)
Raspberry Pi
Model B (R2)
GPIO
HDMI
Video-Out
CSI (CAMERA)
Audio
ETHERNET
USB 2x
OK
PWR
FDX
LNK
10M
10kΩ
74LS241
9.6V
DATA
VDD
GND
SERVO
Dynamixel AX-12

Dynamixel data packages overview

- Data packets structure
- Timing of response
- Example package

Dynamixel data packages

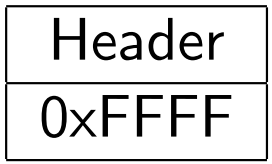
Instruction package - send to the motor

Header	ID	Length	Instruction	Param 1	...	n	Checksum
0xFFFF	ID	Length	Instruction	param 1	...	n	Checksum

Status return package - recieve from the motor

Header	ID	Length	Error	Param 1	...	n	Checksum
0xFFFF	ID	Length	Error	Param 1	...	n	Checksum

Instruction package



Header allways fixed.

Instruction package

Header	ID
0xFFFF	ID

ID is a unique number for each motor connected.

Instruction package

Header	ID	Length
0xFFFF	ID	Length

Length of the message, excluding the header bytes.

Instruction package

Header	ID	Length	Instruction	Param 1	...	Param n
0xFFFF	ID	Length	Instruction	param 1	...	Param n

Parameters, depends on the instruction.

Instruction package

Header	ID	Length	Instruction	Param 1	...	n	Checksum
0xFFFF	ID	Length	Instruction	param 1	...	n	Checksum

The checksum is calculated as
Checksum = (ID + Length + Instruction + Parameter1 + . . .
Parameter N)
where "" is the "not" operation and only the lower byte is used.

Status return package

Header	ID	Length	Error	Param 1	...	Param n	Checksum
0xFFFF	ID	Length	Error	Param 1	...	Param n	Checksum

Similar to instruction package but each bit in the error byte represents one possible error.

Timing of return package

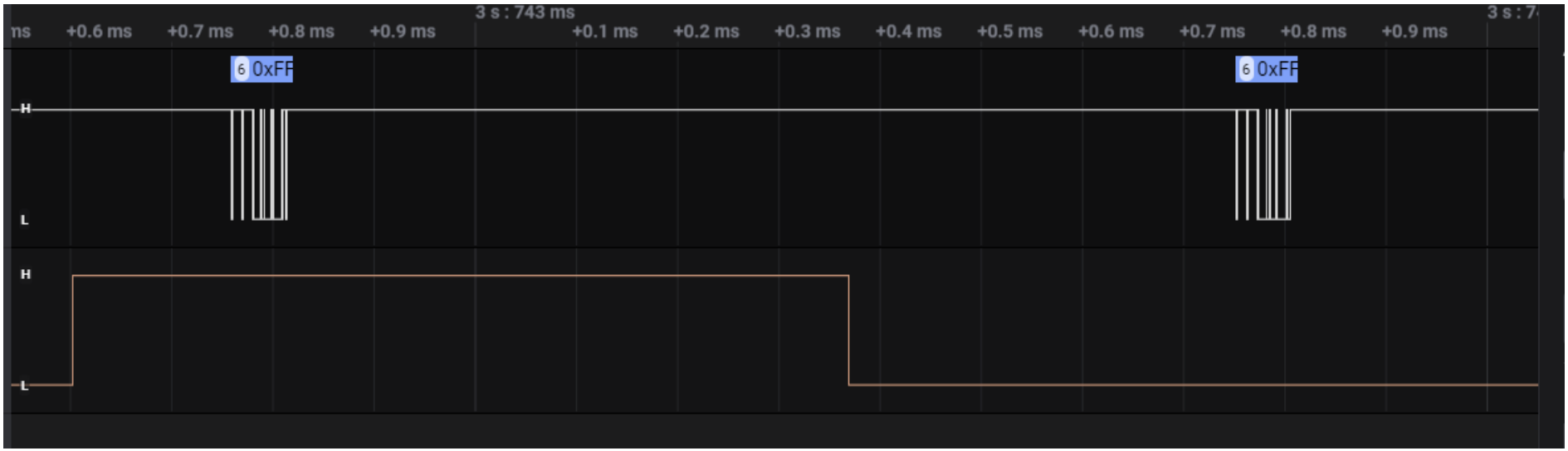
- Return delay can be set for each motor
- Values between 0 - 508 microseconds

Example package

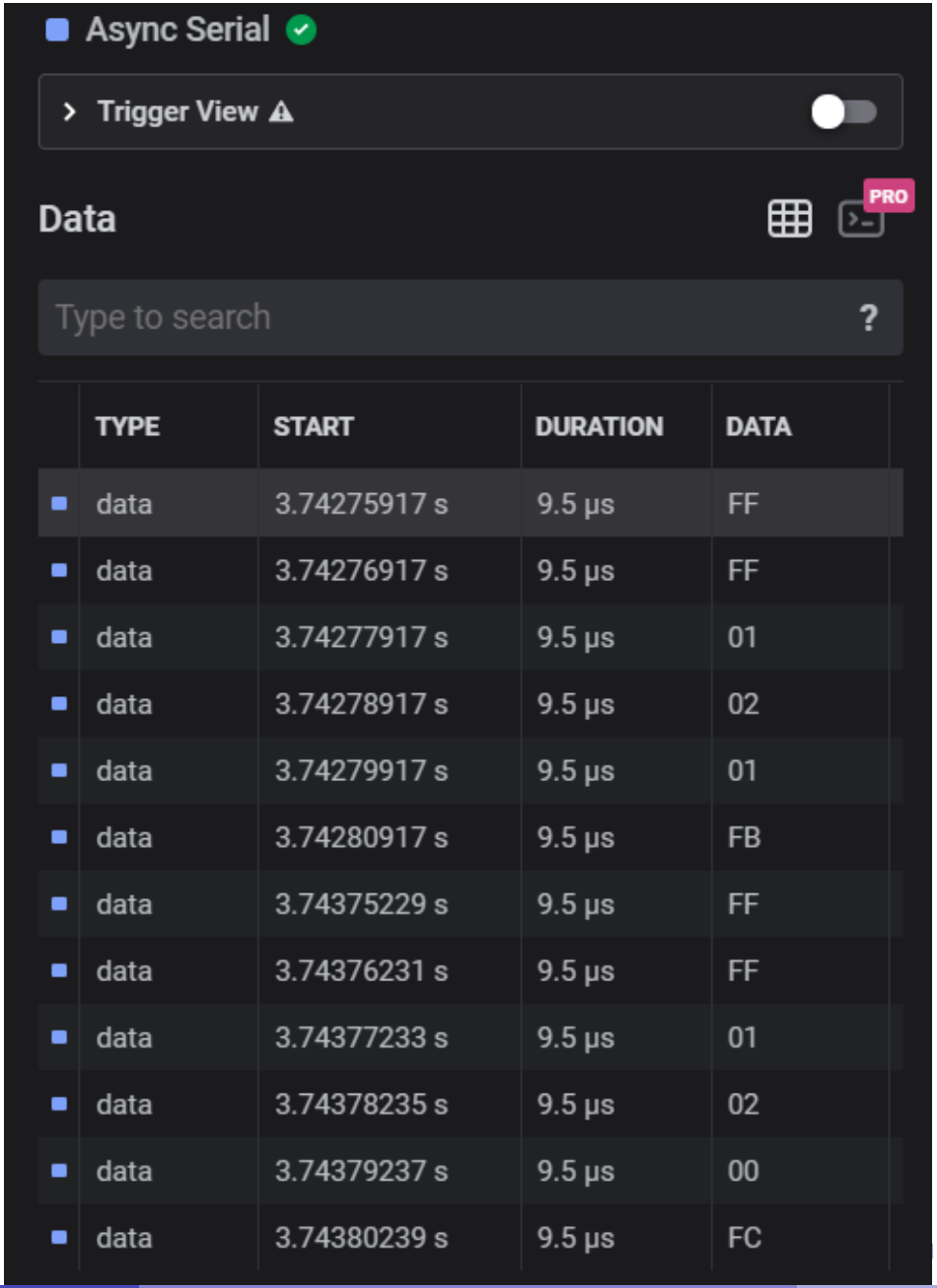
Header	ID	Length	Instr.	P.1	P.2	P.3	Checksum
0xFFFF	0x01	0x04	0x03	0x1E	0x00	0x00	0xD9

Writes the data 0x0000 at memory position 0x1E. (Goal position = 0)

Logic analyzer example



Logic analyzer example



TYPE	START	DURATION	DATA
data	3.74275917 s	9.5 µs	FF
data	3.74276917 s	9.5 µs	FF
data	3.74277917 s	9.5 µs	01
data	3.74278917 s	9.5 µs	02
data	3.74279917 s	9.5 µs	01
data	3.74280917 s	9.5 µs	FB
data	3.74375229 s	9.5 µs	FF
data	3.74376231 s	9.5 µs	FF
data	3.74377233 s	9.5 µs	01
data	3.74378235 s	9.5 µs	02
data	3.74379237 s	9.5 µs	00
data	3.74380239 s	9.5 µs	FC

Demonstration

- https://youtu.be/f_JAT8srcIc

Overall timetable

Sep	Oct	Nov	Dec
Concept generation	Evaluation	Evaluation	
Theory	Prototyping	Evaluation	Finishing up
Simulation	Evaluation	Evaluation	
Prototyping	Final Design	Evaluation	

Time plan for September

Subproject	Week 1	Week 2	Week 3	Week 4
Arrowhead	Reading	Setup	API	Prototyping
Movable base	Reading	Modeling	Simulation	Implementation
Arm and grip	Reading	Kinematics	Simulation	Prototyping
Object detection	Reading	Testing	Prototyping	Evaluation

Questions?