Roboy-made Lighthouse Sensor
60Hz, 1mm accuracy,
external object tracking

MODULAR FULL-BODY TRACKING SUITE

BACHELOR THESIS

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MOTIVATION

- Record Human Movements
- Using SteamVR Tracking 2.0 (Lighthouse 2)

THEORETICAL BACKGROUND

Linear Feedback Shift Register

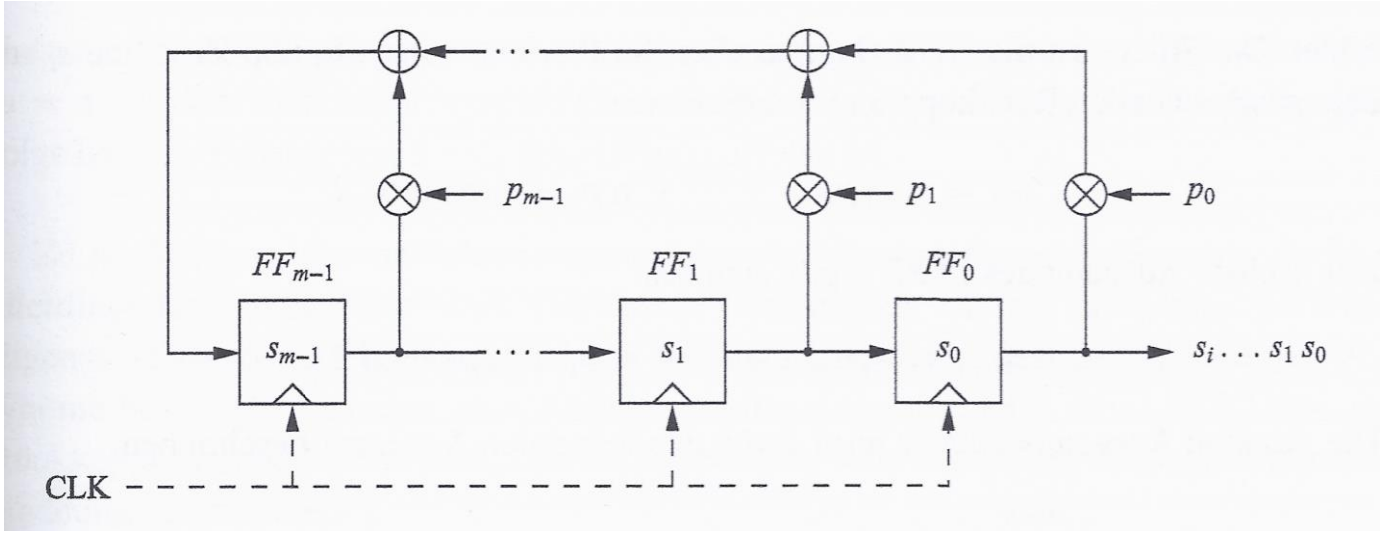

Figure 1: Schematic of Linear Feedback Shift Register [PP16]

THEORETICAL BACKGROUND

Linear Feedback Shift Register

$$s_{m+i} = \sum_{j=0}^{m-1} p_j \times s_{i+j} mod 2$$

$$P(x) = x^m \times p_{m-1}x^{m-1} \times \cdots \times p_1 x \times p_0$$

THEORETICAL BACKGROUND

Telecommunication Channel

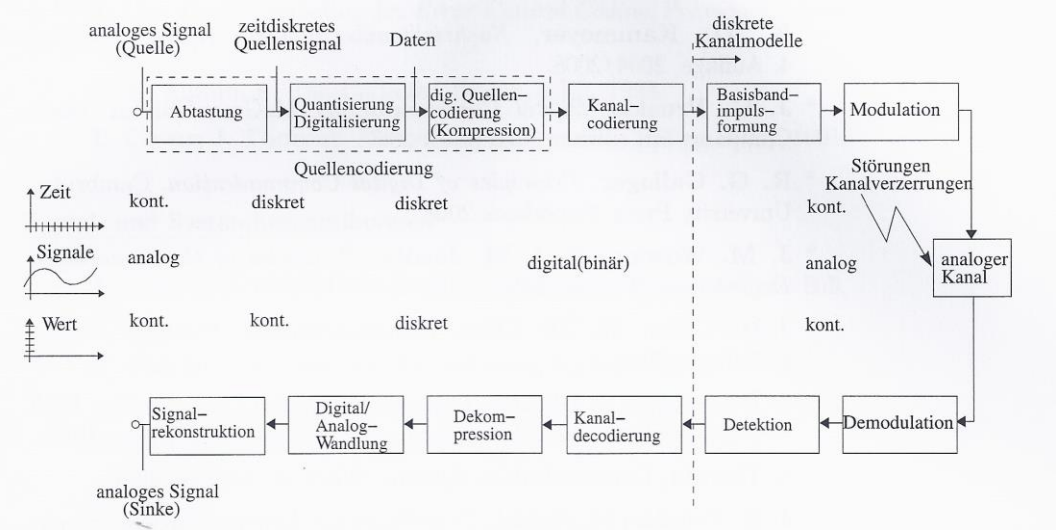

Figure 2: Communication Link [HKSK20]

THEORETICAL BACKGROUND

Telecommunication Channel

- Cryptography: Message is Encrypted
- Source Coding: Message is Comprossed
- Channel Coding: Increase Tolerance against Errors

THEORETICAL BACKGROUND

Triad Semiconductor TS4231

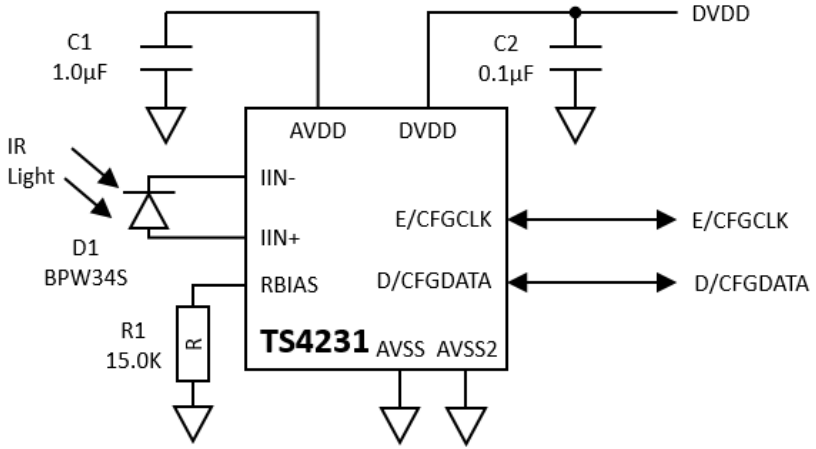

Figure 3: Simplified Circuit Schematic [Tri16b]

SYSTEM DESIGN

GitHub Discussion

- Uses Linear Feedback Shift Register with Length 20 bit
- 2 Feedback Coefficients per Lighthouse 2
- Fast Bitstream with $0.0833\mu sec$
- Slow Bitstream for Information

SYSTEM DESIGN

Photodiode

- PIN Diode
- Good High Frequency Characteristics

SYSTEM DESIGN

Arduino MKR Vidor 4000

- FPGA: Intel Cyclone 10CL016
- Microchip ATSAMD21

IMPLEMENTATION
Measurement of Laser Signals

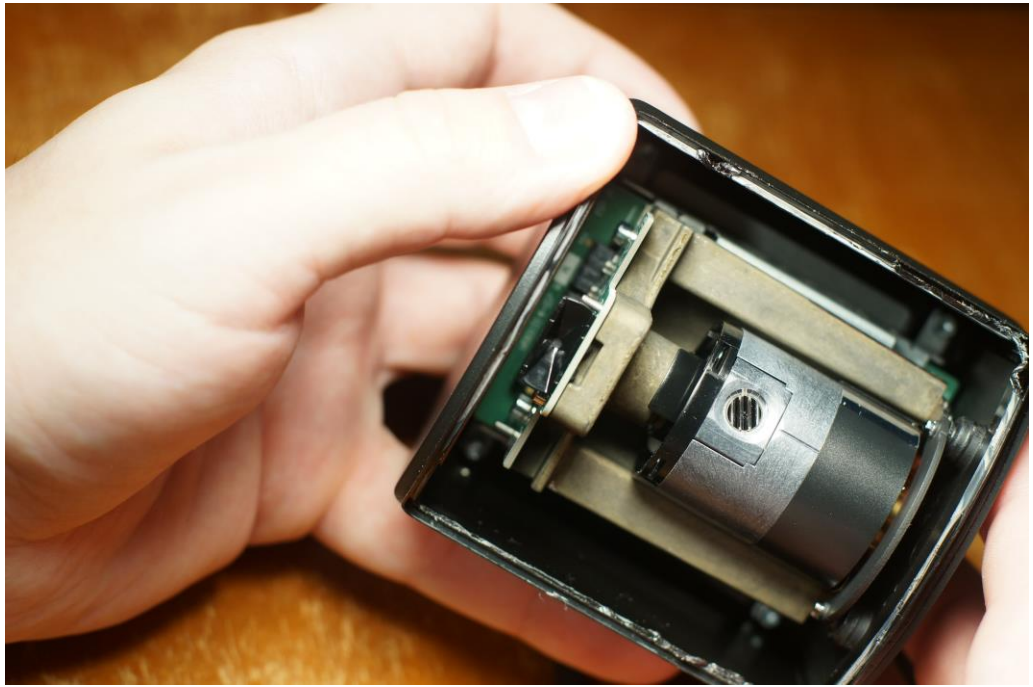

Figure 4: Inside Lighthouse 2 after Destruction [.b]

IMPLEMENTATION

Measurement of Laser Signals

- 6 Different Positions
- Recording DAT-Files on Oscilloscop
- Evaluation in Matlab

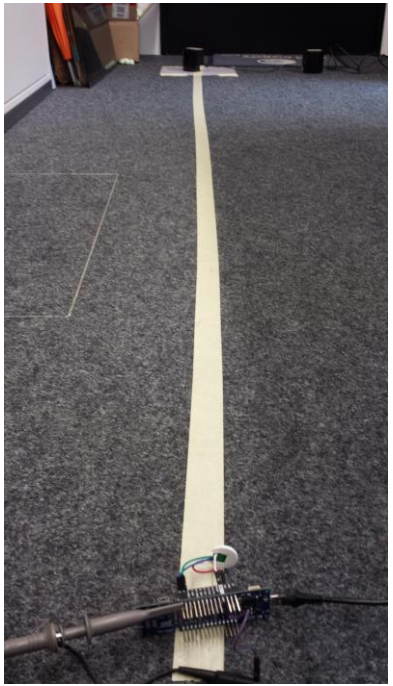

Figure 5: Test Arrangement

IMPLEMENTATION

Real-Time FPGA Detection

$$t = 0.0833\mu sec \times 1.048.575$$
$$= 87.34\mu sec$$

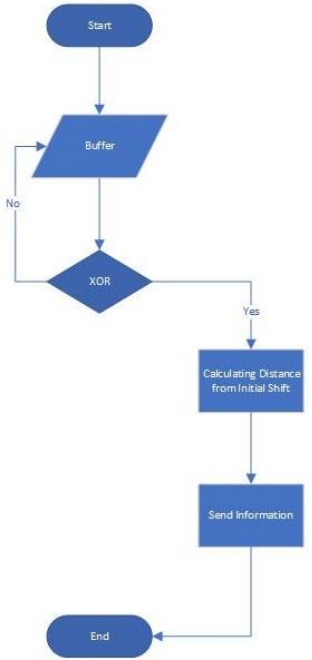

Figure 6: Algorithm for Position Determination

RESULTS

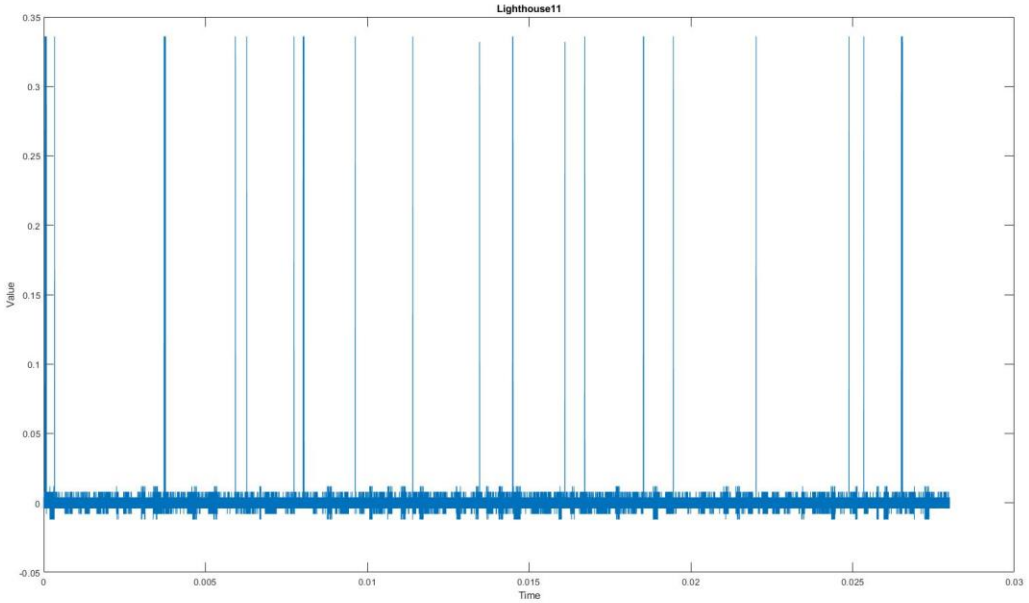

Figure 7: Lighthouse 1 in Position 1 – Plot of DAT-File in Matlab

RESULTS

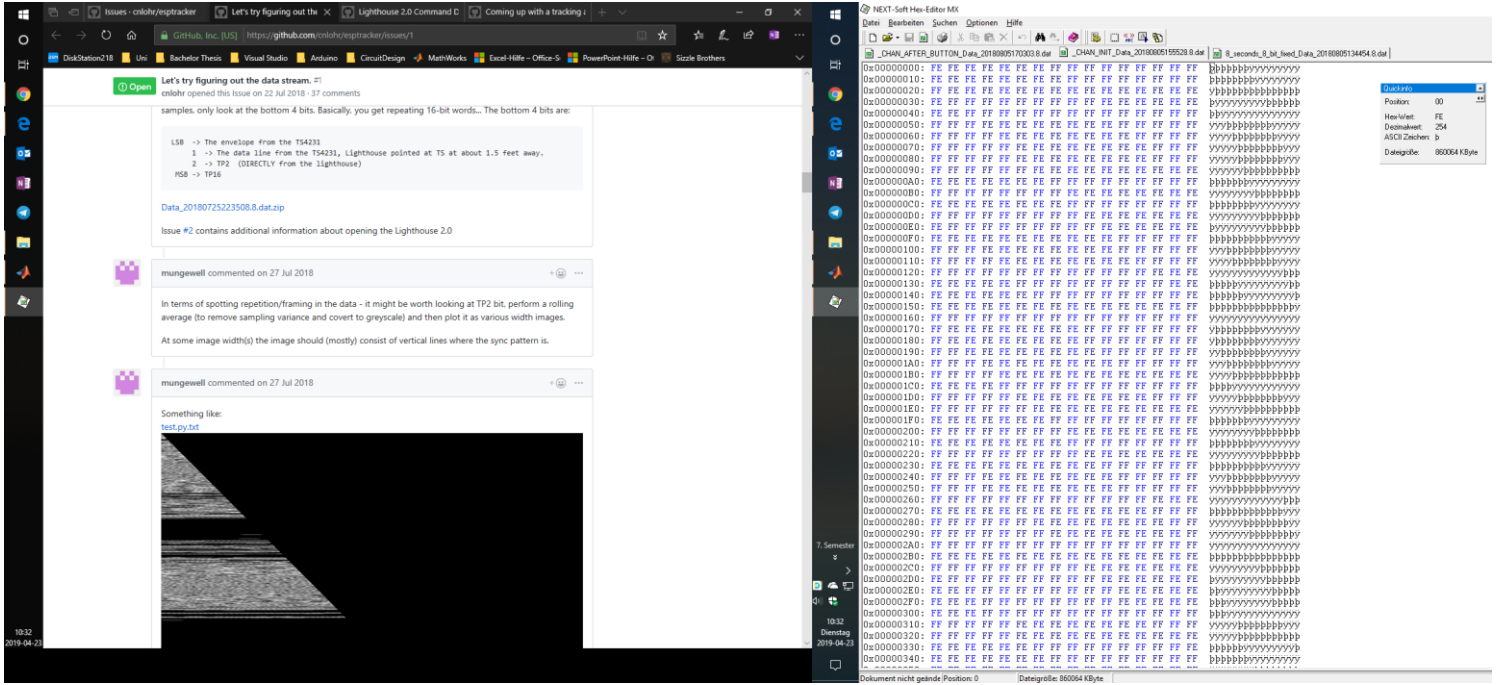

Figure 8: Evaluation DAT-File from GitHub Discussion [.b]

ROBOY.ORG

DISCUSSION

- Adopting already Used System
- Upcoming Software Updates causing Problems

SUMMARY

- Not Able to Decode Laser Signals

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