ELEX 7820: Real Time Embedded Systems  
 Lab Project:

2d LiDAR Mapping Device

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Prepared by:

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# Introduction

# Items

This section contains tables of both the mandatory and other items as outlined in the marking guideline.

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| **Mandatory Items** | **Description of Implementation** |
| SYS/BIOS RTOS – meaningful use of all thread types: HWI, SWI, TSK, IDLE | HWI – Used for I2C, UART, SPI, transaction events, GPIO signals from IR photodiode and encoder.  SWI – Used for post processing of received UART data, I2C transactions, and encoder.  TSK – Used for synchronizing lidar sampling with stepper motor, as sharing distance and angle data between several different tsks responsible for updating the OLED, sending data to PC, and parsing received commands from PC.   IDLE – Used to blink a green LED (David’s favorite colour). |
| CPU Utilization | See relevant section (Sect. 4.0) |
| DSP | * Moving average for filtering number of steps per rotation of LiDAR podium. * Exponential moving average filter (EMA IIR filter) used for measured LiDAR distances. |
| Real Time Processing | Taking real time distance samples with 2 lidar sensors, matching them with the current angular position of the stepper shaft, and sending them to a PC to generate **a map of acceptable fidelity with minimal visible lag** to user. |

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| **Optional Items** |  |
| Add-on-Boards | * Python client: Draws a map from LIDAR data received over UART. Note this is not a physical board, but a custom script/program running on a PC. * LiDAR sensors: Two LiDAR sensors interfaced to via I2C. |
| Ports | * I2C |
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