

Gyroscope Data Handling (GDH)

About the project

Hi, this is the project given by Mr. Lieu from GAM.AIS as a training assignment for new juniors. This project will simulate the process of

1. Read data from a gyroscope sensor
2. Push those data into a queue
3. Pop the queue
4. Write to a predefined region in FLASH

Team members

Our team have 5 members, each do a different task

1. LongNDT5 (me): create three separate threads and integrate all modules
2. VinhDD1: program a Flash simulation
3. LongH9: program a gyroscope sensor simulation as well as the driver to read the data

4. TungBT23: package the data read from the sensor
5. HungDH14: create a FIFO buffer to push and pop data
6. TuanPA41: check valid package, find the address in FLASH to log

Build with

Programming Languages

- C (MinGW-64 version 13.1.0)

Editor

- VSCode
- Dev-C++

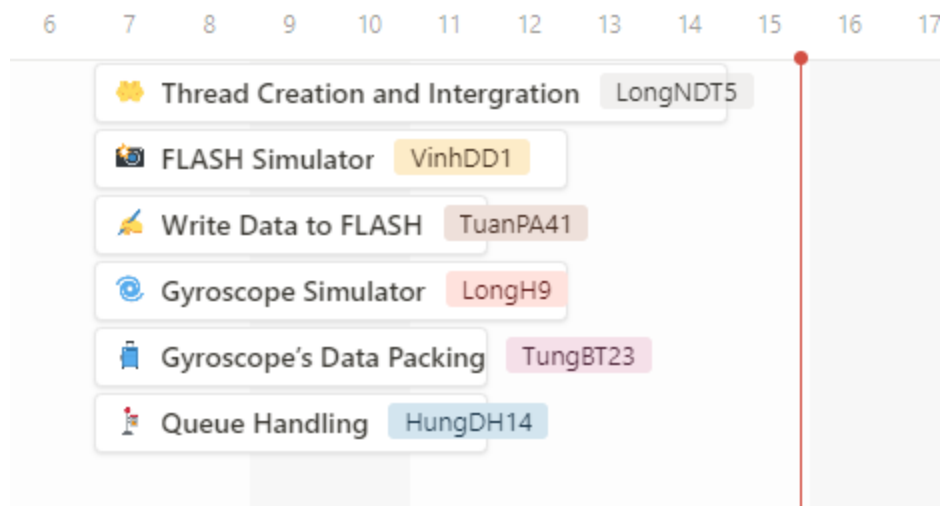
Version control

- Git and Github

Project Management

- Notion

Deadlines and Meeting Schedules



Meeting Schedules

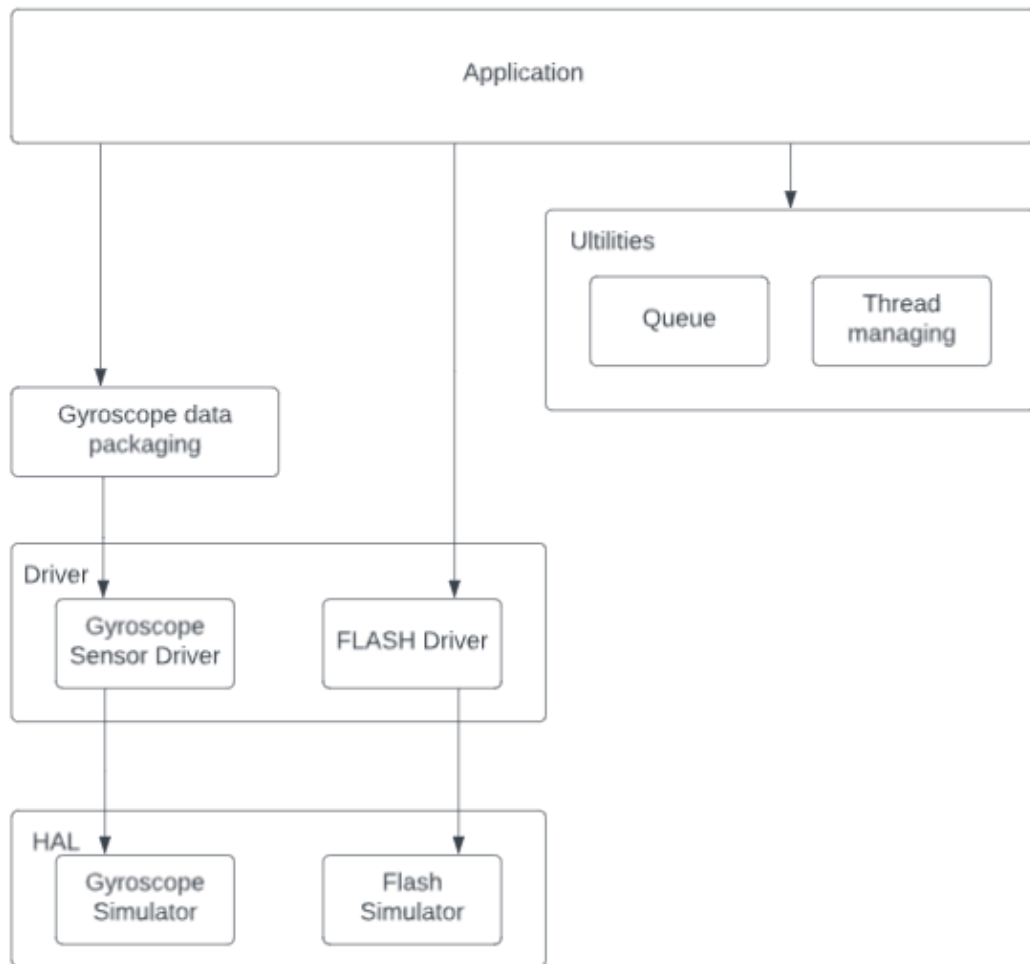
September 2023

< Today >

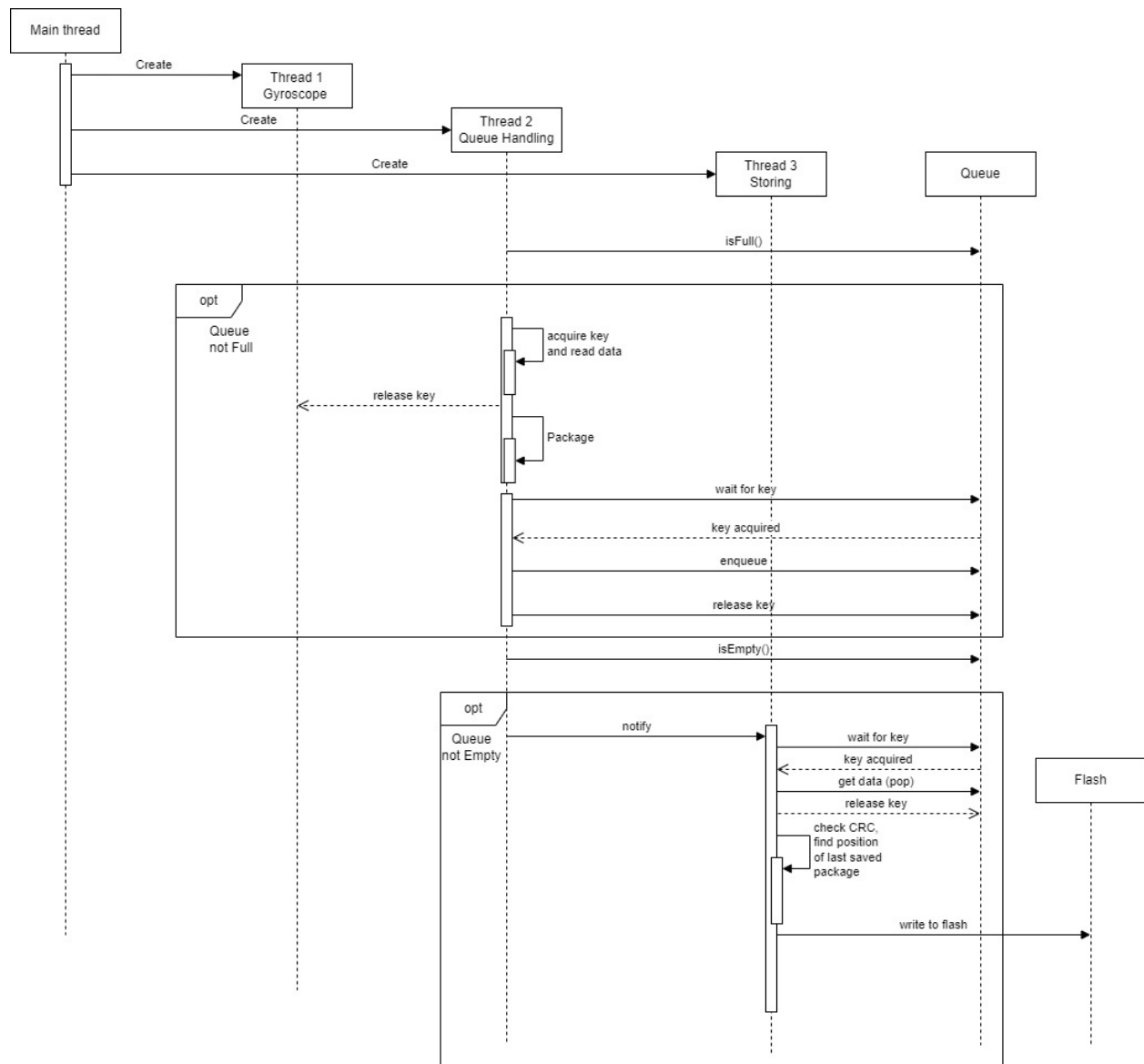
| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---------------------|-----|---------------------|-----|--------------------|---------------------|-----|
| 27 | 28 | 29 | 30 | 31 | Sep 1 | 2 |
| 3 | 4 | 5 | 6 | 7 First meeting | 8 Second Meeting | 9 |
| 10 Third Meeting | 11 | 12 Final Meeting | 13 | 14 Conclusion | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |

UML Diagram

Layered Diagram



Sequence Diagram



Getting Started

You will see some test option at the beginning of the main.c files. That's right, you can choose which testing option you want to do by uncomment it, then build the project.

```

/* ***** Tesing Selection ***** */
/**
 * * @brief Uncomment the line below to include the testing code
 * */
// #define TESTING

#ifdef TESTING
// #define TEST_GYROSCOPE_READ_DATA
// #define TEST_GYROSCOPE_PACKAGE
// #define TEST_GYROSCOPE_PACKAGE_HEX
// #define TEST_QUEUE_PUSH_AND_POP
// #define TEST_CHECK_CRC
#define TEST_FLASH_WRITE
#endif

```

Test the data read from gyroscope

| Preamble | Version | Timestamp | Gyro X | Gyro Y | Gyro Z | Acce X | Acce Y | Acce Z | Temp | Reserved | Used | CRC | Testing | Index |
|----------|---------|-----------|--------|--------|--------|--------|--------|--------|------|----------|------|-----|---------|-------|
| | | | 8.39 | 4.63 | 7.73 | -5.15 | 1.68 | 8.17 | 53 | | | | Read | |
| | | | -7.10 | 8.62 | -9.39 | -0.71 | 2.55 | 9.44 | 57 | | | | Read | |
| | | | 0.81 | -4.23 | 3.29 | -0.96 | 3.02 | 9.27 | 61 | | | | Read | |
| | | | -1.21 | 2.41 | 9.46 | -1.74 | 3.55 | 8.97 | 66 | | | | Read | |
| | | | -3.90 | 9.91 | 4.07 | -2.77 | 3.98 | 8.52 | 70 | | | | Read | |
| | | | -5.39 | 7.12 | -5.91 | 2.50 | 4.53 | 8.32 | 74 | | | | Read | |
| | | | -4.94 | 3.44 | 4.22 | -1.45 | 5.12 | 8.23 | 78 | | | | Read | |
| | | | -0.56 | 5.58 | 1.93 | 3.10 | 5.40 | 7.57 | 82 | | | | Read | |
| | | | -6.45 | -0.36 | -2.31 | 0.54 | 6.16 | 7.60 | 86 | | | | Read | |
| | | | -3.10 | 6.72 | 1.95 | 0.50 | 6.59 | 7.23 | 89 | | | | Read | |
| | | | 6.00 | -6.47 | -8.88 | 8.57 | 3.38 | 3.33 | 92 | | | | Read | |
| | | | -9.93 | 5.43 | -5.28 | 4.73 | 6.43 | 5.68 | 95 | | | | Read | |
| | | | -8.92 | 8.54 | -5.35 | -5.40 | 6.41 | 5.07 | 98 | | | | Read | |
| | | | -0.53 | 9.84 | 6.36 | 7.35 | 5.33 | 3.69 | 101 | | | | Read | |
| | | | -4.67 | 6.27 | 6.69 | -7.19 | 5.73 | 3.40 | 104 | | | | Read | |
| | | | -2.04 | 9.27 | 3.51 | 9.11 | 3.21 | 1.68 | 106 | | | | Read | |
| | | | -6.87 | -6.62 | 8.29 | 5.59 | 7.33 | 3.33 | 108 | | | | Read | |
| | | | 2.92 | -8.41 | 2.22 | 4.23 | 8.31 | 3.02 | 110 | | | | Read | |
| | | | -2.91 | 4.26 | 0.65 | -6.28 | 7.23 | 2.10 | 111 | | | | Read | |
| | | | -5.29 | -1.12 | 1.35 | -2.80 | 9.15 | 2.11 | 113 | | | | Read | |
| | | | -4.78 | 9.17 | -2.32 | -1.78 | 9.51 | 1.54 | 114 | | | | Read | |
| | | | 5.07 | 3.79 | 7.99 | 4.58 | 8.63 | 0.80 | 114 | | | | Read | |
| | | | -2.74 | 1.21 | -1.81 | -6.24 | 7.56 | 0.22 | 114 | | | | Read | |
| | | | 2.09 | 4.95 | 4.32 | 6.79 | 7.06 | -0.29 | 114 | | | | Read | |
| | | | -1.97 | -4.76 | 7.89 | 6.66 | 7.15 | -0.75 | 114 | | | | Read | |
| | | | -6.77 | -6.63 | 7.16 | -6.40 | 7.31 | -1.29 | 113 | | | | Read | |
| | | | 5.67 | 4.45 | -3.74 | -3.56 | 8.86 | -2.22 | 112 | | | | Read | |
| | | | -0.50 | 8.28 | 6.29 | 9.06 | 3.56 | -1.12 | 111 | | | | Read | |
| | | | -8.09 | 3.96 | -4.36 | 6.55 | 6.83 | -2.55 | 110 | | | | Read | |
| | | | -6.88 | 8.88 | -1.12 | -7.64 | 5.55 | -2.61 | 107 | | | | Read | |
| | | | -3.01 | -1.50 | 8.31 | 2.90 | 8.18 | -4.56 | 105 | | | | Read | |
| | | | 6.74 | 1.13 | 7.78 | -6.43 | 6.24 | -3.97 | 102 | | | | Read | |
| | | | 8.21 | -2.80 | -1.20 | 0.76 | 7.88 | -5.77 | 100 | | | | Read | |
| | | | 0.11 | 2.14 | 3.46 | 3.95 | 6.88 | -5.75 | 96 | | | | Read | |
| | | | 6.70 | 2.39 | 6.54 | -7.96 | 4.12 | -3.96 | 93 | | | | Read | |
| | | | 0.93 | -2.94 | 3.76 | -3.69 | 6.16 | -6.66 | 90 | | | | Read | |
| | | | -6.88 | 8.00 | 9.40 | 1.26 | 6.14 | -7.53 | 86 | | | | Read | |
| | | | -1.27 | 4.27 | -4.96 | -0.24 | 5.70 | -7.97 | 82 | | | | Read | |
| | | | 5.56 | 1.68 | 3.40 | 3.46 | 5.80 | 8.45 | 73 | | | | Read | |

Test the packaging of gyroscope data

| Preamble | Version | Timestamp | | Gyro X | Gyro Y | Gyro Z | Acce X | Acce Y | Acce Z | Temp | Reserved | Used | CRC | Testing | Index |
|----------|---------|-----------|------------|--------|--------|--------|--------|--------|--------|------|----------|------|------|---------|-------|
| ABCD | 01 | 21:46:43 | 15/08/2023 | 3.36 | -3.98 | -1.07 | 2.35 | 1.95 | 9.31 | 53 | 0000 | 00 | 008D | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 0.50 | -6.34 | 0.11 | -7.13 | 1.83 | 6.47 | 58 | 0000 | 00 | 294D | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 2.83 | -1.48 | 5.59 | 9.13 | 1.17 | 3.35 | 63 | 0000 | 00 | 73F4 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -3.58 | 4.51 | -5.90 | 3.87 | 3.38 | 8.34 | 66 | 0000 | 00 | A133 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -9.39 | -1.08 | 3.23 | 9.43 | 1.16 | 2.42 | 70 | 0000 | 00 | 2617 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -3.96 | 5.86 | 9.04 | 3.38 | 4.37 | 8.09 | 74 | 0000 | 00 | B86B | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 5.02 | 1.24 | 7.42 | 0.13 | 5.05 | 8.40 | 77 | 0000 | 00 | 81D6 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 7.44 | -9.52 | 7.44 | 4.98 | 4.70 | 7.02 | 80 | 0000 | 00 | 7294 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 9.92 | 0.82 | -3.06 | -6.33 | 4.53 | 5.95 | 84 | 0000 | 00 | B4E7 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 2.32 | 6.72 | 4.48 | -8.21 | 3.49 | 4.06 | 87 | 0000 | 00 | 8931 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 7.89 | -3.25 | 9.22 | 7.62 | 4.21 | 4.50 | 90 | 0000 | 00 | A321 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 3.16 | -7.03 | 4.43 | 0.49 | 7.10 | 6.74 | 93 | 0000 | 00 | A0A7 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 9.61 | -3.11 | -0.02 | 0.76 | 7.49 | 6.28 | 96 | 0000 | 00 | F8CE | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -0.79 | 3.83 | -8.02 | 6.11 | 6.20 | 4.50 | 100 | 0000 | 00 | 08B0 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -0.70 | 9.01 | -9.09 | -6.19 | 6.39 | 4.11 | 102 | 0000 | 00 | D8AA | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 2.65 | -9.53 | 9.12 | -0.32 | 8.58 | 4.72 | 105 | 0000 | 00 | 33A0 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 6.42 | 4.78 | 1.68 | -1.59 | 8.79 | 4.02 | 107 | 0000 | 00 | 8E39 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 0.34 | -5.02 | 3.85 | 7.77 | 5.59 | 2.11 | 109 | 0000 | 00 | B9E1 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 0.86 | 6.43 | -3.33 | 9.12 | 3.45 | 1.04 | 111 | 0000 | 00 | 92DE | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 9.01 | 9.46 | 7.73 | 7.66 | 5.93 | 1.47 | 112 | 0000 | 00 | 2003 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 2.23 | 2.48 | -3.21 | -2.24 | 9.37 | 1.80 | 113 | 0000 | 00 | 3FA7 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 1.89 | 6.00 | 8.54 | 6.03 | 7.66 | 0.94 | 114 | 0000 | 00 | C5F7 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -6.56 | -8.54 | 6.34 | 6.63 | 7.21 | 0.41 | 114 | 0000 | 00 | E64A | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 7.16 | 3.73 | 8.37 | 6.61 | 7.23 | 0.02 | 114 | 0000 | 00 | CE15 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -1.59 | -1.30 | 6.80 | -7.17 | 6.68 | -0.34 | 114 | 0000 | 00 | 493D | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 8.16 | 4.25 | -6.13 | -3.72 | 9.01 | -1.02 | 114 | 0000 | 00 | A48B | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -8.34 | 4.25 | -9.33 | -9.23 | 3.24 | -0.56 | 113 | 0000 | 00 | 4C4A | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 3.55 | 9.85 | -9.32 | -1.87 | 9.35 | -2.24 | 112 | 0000 | 00 | C202 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -2.03 | -1.84 | 0.28 | -1.80 | 9.26 | -2.66 | 111 | 0000 | 00 | 5047 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 1.67 | -8.82 | 3.85 | -5.42 | 7.70 | -2.71 | 110 | 0000 | 00 | 65A9 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 1.60 | 3.43 | 7.28 | -5.21 | 7.67 | -3.17 | 109 | 0000 | 00 | 7D2A | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 6.69 | 4.43 | -2.84 | 1.41 | 8.74 | -4.20 | 107 | 0000 | 00 | 21DD | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 7.69 | 2.64 | 9.71 | 9.46 | 2.23 | -1.23 | 105 | 0000 | 00 | 5E9F | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -8.96 | -9.51 | -2.81 | -0.03 | 8.28 | -5.24 | 103 | 0000 | 00 | 7023 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -0.05 | -2.33 | 8.04 | 7.95 | 4.66 | -3.34 | 100 | 0000 | 00 | 1583 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -9.33 | -1.96 | 8.28 | 6.08 | 5.97 | -4.85 | 97 | 0000 | 00 | D8C8 | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | 3.84 | -9.09 | 7.30 | -7.79 | 4.33 | -4.08 | 93 | 0000 | 00 | 91CD | Package | |
| ABCD | 01 | 21:46:43 | 15/08/2023 | -9.32 | -1.88 | -3.33 | 8.27 | 3.62 | -3.81 | 90 | 0000 | 00 | A879 | Package | |

Test the data validity after each queue operations

| Preamble | Version | Timestamp | | Gyro X | Gyro Y | Gyro Z | Acce X | Acce Y | Acce Z | Temp | Reserved | Used | CRC | Testing | Index |
|----------|---------|-----------|------------|--------|--------|--------|--------|--------|--------|------|----------|------|------|---------|-------|
| ABCD | 01 | 21:47:26 | 15/08/2023 | -4.75 | 3.62 | -9.37 | -9.05 | 0.71 | 3.69 | 52 | 0000 | 00 | 75CD | Push | 1 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -5.03 | -2.38 | 5.63 | 5.08 | 2.23 | 8.08 | 58 | 0000 | 00 | A515 | Push | 2 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -4.75 | 3.62 | -9.37 | -9.05 | 0.71 | 3.69 | 52 | 0000 | 00 | 75CD | Pop | 1 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -5.03 | -2.38 | 5.63 | 5.08 | 2.23 | 8.08 | 58 | 0000 | 00 | A515 | Pop | 2 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -2.48 | 0.12 | 6.14 | 4.41 | 2.91 | 8.25 | 63 | 0000 | 00 | 9CA2 | Push | 3 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -2.48 | 0.12 | 6.14 | 4.41 | 2.91 | 8.25 | 63 | 0000 | 00 | 9CA2 | Pop | 3 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -5.83 | -1.06 | -9.62 | 8.39 | 2.64 | 4.32 | 77 | 0000 | 00 | 0B41 | Push | 4 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 4.08 | -2.75 | -2.14 | -0.56 | 6.24 | 7.54 | 86 | 0000 | 00 | 867E | Push | 5 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 9.44 | 9.72 | -0.92 | 6.72 | 4.94 | 5.15 | 91 | 0000 | 00 | BD1F | Push | 6 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -5.83 | -1.06 | -9.62 | 8.39 | 2.64 | 4.32 | 77 | 0000 | 00 | 0B41 | Pop | 4 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 4.08 | -2.75 | -2.14 | -0.56 | 6.24 | 7.54 | 86 | 0000 | 00 | 867E | Pop | 5 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 9.44 | 9.72 | -0.92 | 6.72 | 4.94 | 5.15 | 91 | 0000 | 00 | BD1F | Pop | 6 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 7.00 | 5.37 | 9.92 | -7.07 | 5.03 | 4.55 | 94 | 0000 | 00 | 31A7 | Push | 7 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 7.00 | 5.37 | 9.92 | -7.07 | 5.03 | 4.55 | 94 | 0000 | 00 | 31A7 | Pop | 7 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 7.47 | 2.71 | -5.29 | 8.67 | 4.14 | 1.93 | 107 | 0000 | 00 | 028D | Push | 8 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -8.90 | -3.07 | 4.63 | -2.51 | 9.12 | 2.58 | 112 | 0000 | 00 | 8956 | Push | 9 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -0.23 | -8.85 | 6.89 | -0.75 | 9.58 | 1.90 | 113 | 0000 | 00 | E4AF | Push | 10 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 7.47 | 2.71 | -5.29 | 8.67 | 4.14 | 1.93 | 107 | 0000 | 00 | 028D | Pop | 8 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -8.90 | -3.07 | 4.63 | -2.51 | 9.12 | 2.58 | 112 | 0000 | 00 | 8956 | Pop | 9 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -0.23 | -8.85 | 6.89 | -0.75 | 9.58 | 1.90 | 113 | 0000 | 00 | E4AF | Pop | 10 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 6.43 | -3.76 | 3.30 | -5.68 | 7.93 | 0.96 | 114 | 0000 | 00 | E8BD | Push | 11 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 8.41 | 6.13 | -2.82 | 8.65 | 4.54 | -0.76 | 113 | 0000 | 00 | B52C | Push | 12 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 6.43 | -3.76 | 3.30 | -5.68 | 7.93 | 0.96 | 114 | 0000 | 00 | E8BD | Pop | 11 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 8.41 | 6.13 | -2.82 | 8.65 | 4.54 | -0.76 | 113 | 0000 | 00 | B52C | Pop | 12 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -3.25 | 8.12 | -7.70 | -5.89 | 7.59 | -1.92 | 112 | 0000 | 00 | 7C98 | Push | 13 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -3.25 | 8.12 | -7.70 | -5.89 | 7.59 | -1.92 | 112 | 0000 | 00 | 7C98 | Pop | 13 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 1.10 | 5.79 | 3.97 | -5.60 | 7.15 | -3.70 | 106 | 0000 | 00 | 6789 | Push | 14 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -0.46 | -3.71 | -8.37 | 3.92 | 7.27 | -5.27 | 100 | 0000 | 00 | F3DE | Push | 15 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 1.10 | 5.79 | 3.97 | -5.60 | 7.15 | -3.70 | 106 | 0000 | 00 | 6789 | Pop | 14 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -0.46 | -3.71 | -8.37 | 3.92 | 7.27 | -5.27 | 100 | 0000 | 00 | F3DE | Pop | 15 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 4.14 | -4.01 | 4.40 | -6.92 | 5.29 | -4.48 | 96 | 0000 | 00 | 5A71 | Push | 16 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 8.62 | 7.44 | -3.03 | 9.57 | 1.28 | -1.68 | 84 | 0000 | 00 | 08A0 | Push | 17 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 4.14 | -4.01 | 4.40 | -6.92 | 5.29 | -4.48 | 96 | 0000 | 00 | 5A71 | Pop | 16 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | 8.62 | 7.44 | -3.03 | 9.57 | 1.28 | -1.68 | 84 | 0000 | 00 | 08A0 | Pop | 17 |
| ABCD | 01 | 21:47:26 | 15/08/2023 | -9.03 | -2.59 | -0.43 | -6.22 | 4.16 | -6.33 | 80 | 0000 | 00 | F346 | Push | 18 |

Test the writing to Flash

| | | | | | | | | | | | | | | | |
|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Package 1, Write at 0, Package position 0.0 | | | | | | | | | | | | | | | |
| AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | F0 | 72 | 79 | B9 | BC | 5C | EE |
| 3F | 28 | 3E | 13 | 9F | 89 | CF | 1C | 40 | 7C | C1 | BD | E0 | 5E | 70 | 0F |
| C0 | 1F | D1 | F5 | 4E | E1 | 0D | 21 | C0 | A6 | 89 | 46 | 8A | D3 | 40 | EC |
| 3F | F3 | 45 | 8A | B9 | 87 | FE | 12 | 40 | 33 | 00 | 00 | 00 | 00 | D9 | 26 |
| Package 2, Write at 64, Package position 1.0 | | | | | | | | | | | | | | | |
| AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | A8 | 67 | D7 | B3 | EB | D9 | F5 |
| 3F | 6E | 32 | 36 | 19 | 9B | 8C | 0D | C0 | 80 | FB | C0 | 7D | E0 | 3E | F0 |
| 3F | BC | 15 | 11 | BE | 3B | 12 | 23 | 40 | C4 | 21 | BF | B1 | 65 | F6 | DA |
| 3F | 5A | 7C | 05 | 6E | 6D | C5 | 01 | 40 | 33 | 00 | 00 | 00 | 00 | 14 | 4F |
| Package 3, Write at 128, Package position 2.0 | | | | | | | | | | | | | | | |
| AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | F0 | F5 | F8 | 7A | 7C | 3D | FE |
| 3F | 7C | E4 | 3D | F2 | 1E | 79 | 0F | C0 | F0 | BA | 77 | DD | BB | EE | ED |
| BF | 00 | BA | 2E | 90 | 4A | 7B | D8 | BF | 46 | 1D | 3B | 19 | 6F | 32 | FD |
| 3F | BE | 97 | 2C | 55 | F4 | 3D | 23 | 40 | 33 | 00 | 00 | 00 | 00 | 15 | 55 |
| Package 4, Write at 192, Package position 3.0 | | | | | | | | | | | | | | | |
| AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | F3 | 60 | 79 | B0 | 3C | 58 | 22 |
| C0 | 58 | D3 | AB | E9 | D5 | F4 | 0A | C0 | D0 | 49 | E6 | 24 | 73 | 92 | F9 |
| BF | 70 | 7C | 6B | F1 | E8 | AB | 21 | 40 | ED | 25 | 29 | E8 | B8 | 47 | E9 |
| 3F | 1A | 7C | 70 | 50 | B6 | A8 | 10 | 40 | 33 | 00 | 00 | 00 | 00 | 02 | 95 |
| Package 5, Write at 256, Package position 4.0 | | | | | | | | | | | | | | | |
| AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | 3E | 03 | 9F | 81 | CF | C0 | 07 |
| C0 | 40 | DE | 1F | EF | 8F | F7 | 23 | C0 | 18 | A4 | 0A | 52 | 05 | A9 | 02 |
| 40 | A6 | C6 | 86 | 96 | 76 | 7E | 12 | 40 | 91 | EB | 2B | C0 | 9B | C4 | F9 |
| 3F | 2E | DC | 3D | CB | 8F | FA | 20 | 40 | 33 | 00 | 00 | 00 | 00 | 9B | 6B |
| Package 6, Write at 320, Package position 5.0 | | | | | | | | | | | | | | | |
| AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | 6C | 1A | 35 | 8D | 9A | 46 | 0D |
| C0 | D4 | 16 | 6A | 0B | B5 | 85 | 12 | 40 | 80 | 4C | 45 | A6 | 22 | 53 | D1 |
| BF | 6E | 75 | 50 | D4 | C1 | 83 | 1E | C0 | DC | 14 | 36 | 49 | 3C | 23 | 00 |
| 40 | 11 | CB | 58 | 01 | 0B | 3F | 17 | 40 | 3E | 00 | 00 | 00 | 00 | 6D | 3D |
| Package 7, Write at 384, Package position 6.0 | | | | | | | | | | | | | | | |
| AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | 60 | 1C | 30 | 0E | 18 | 07 | 20 |
| C0 | 40 | 26 | 1F | 93 | 8F | C9 | 07 | 40 | 62 | 48 | 31 | A4 | 18 | 52 | 20 |
| 40 | 28 | 82 | 14 | 41 | 8A | 20 | F5 | BF | A6 | 2D | 38 | FF | A0 | 44 | 12 |
| 40 | 52 | 92 | F5 | 04 | A8 | 23 | 21 | 40 | 49 | 00 | 00 | 00 | 00 | A6 | F5 |
| Package 8, Write at 448, Package position 7.0 | | | | | | | | | | | | | | | |
| AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | C0 | FF | DF | FF | EF | FF | F7 |
| 3F | 54 | 32 | 2A | 19 | 95 | 8C | 12 | 40 | AE | 1B | D7 | 8D | EB | C6 | 21 |
| C0 | CF | 97 | 4D | 32 | 8D | FF | 22 | C0 | C6 | 8A | 24 | 18 | 10 | 65 | F7 |
| 3F | 23 | 97 | E2 | F1 | 67 | A5 | FE | 3F | 54 | 00 | 00 | 00 | 00 | ED | 7C |

| Offset | 01 | 02 | 03 | 04 | 05 | 06 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | | |
|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Sector 0 | | | | | | | | | | | | | | | | |
| 00000000 | AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | F0 | 72 | 79 | B9 | BC | 5C | EE |
| 00000016 | 3F | 28 | 3E | 13 | 9F | 89 | CF | 1C | 40 | 7C | C1 | BD | E0 | 5E | 70 | 0F |
| 00000032 | C0 | 1F | D1 | F5 | 4E | E1 | 0D | 21 | C0 | A6 | 89 | 46 | 8A | D3 | 40 | EC |
| 00000048 | 3F | F3 | 45 | 8A | B9 | 87 | FE | 12 | 40 | 33 | 00 | 00 | 00 | 00 | D9 | 26 |
| 00000064 | AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | A8 | 67 | D7 | B3 | EB | D9 | F5 |
| 00000080 | 3F | 6E | 32 | 36 | 19 | 9B | 8C | 0D | C0 | 80 | FB | C0 | 7D | E0 | 3E | F0 |
| 00000096 | 3F | BC | 15 | 11 | BE | 3B | 12 | 23 | 40 | C4 | 21 | BF | B1 | 65 | F6 | DA |
| 00000112 | 3F | 5A | 7C | 05 | 6E | 6D | C5 | 01 | 40 | 33 | 00 | 00 | 00 | 00 | 14 | 4F |
| 00000128 | AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | F0 | F5 | F8 | 7A | 7C | 3D | FE |
| 00000144 | 3F | 7C | E4 | 3D | F2 | 1E | 79 | 0F | C0 | F0 | BA | 77 | DD | BB | EE | ED |
| 00000160 | BF | 00 | BA | 2E | 90 | 4A | 7B | D8 | BF | 46 | 1D | 3B | 19 | 6F | 32 | FD |
| 00000176 | 3F | BE | 97 | 2C | 55 | F4 | 3D | 23 | 40 | 33 | 00 | 00 | 00 | 00 | 15 | 55 |
| 00000192 | AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | F3 | 60 | 79 | B0 | 3C | 58 | 22 |
| 00000208 | C0 | 58 | D3 | AB | E9 | D5 | F4 | 0A | C0 | D0 | 49 | E6 | 24 | 73 | 92 | F9 |
| 00000224 | BF | 70 | 7C | 6B | F1 | E8 | AB | 21 | 40 | ED | 25 | 29 | E8 | B8 | 47 | E9 |
| 00000240 | 3F | 1A | 7C | 70 | 50 | B6 | A8 | 10 | 40 | 33 | 00 | 00 | 00 | 00 | 02 | 95 |
| 00000256 | AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | 3E | 03 | 9F | 81 | CF | C0 | 07 |
| 00000272 | C0 | 40 | DE | 1F | EF | 8F | F7 | 23 | C0 | 18 | A4 | 0A | 52 | 05 | A9 | 02 |
| 00000288 | 40 | A6 | C6 | 86 | 96 | 76 | 7E | 12 | 40 | 91 | EB | 2B | C0 | 9B | C4 | F9 |
| 00000304 | 3F | 2E | DC | 3D | CB | 8F | FA | 20 | 40 | 33 | 00 | 00 | 00 | 00 | 9B | 6B |
| 00000320 | AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | 6C | 1A | 35 | 8D | 9A | 46 | 0D |
| 00000336 | C0 | D4 | 16 | 6A | 0B | B5 | 85 | 12 | 40 | 80 | 4C | 45 | A6 | 22 | 53 | D1 |
| 00000352 | BF | 6E | 75 | 50 | D4 | C1 | 83 | 1E | C0 | DC | 14 | 36 | 49 | 3C | 23 | 00 |
| 00000368 | 40 | 11 | CB | 58 | 01 | 0B | 3F | 17 | 40 | 3E | 00 | 00 | 00 | 00 | 6D | 3D |
| 00000384 | AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | 60 | 1C | 30 | 0E | 18 | 07 | 20 |
| 00000400 | C0 | 40 | 26 | 1F | 93 | 8F | C9 | 07 | 40 | 62 | 48 | 31 | A4 | 18 | 52 | 20 |
| 00000416 | 40 | 28 | 82 | 14 | 41 | 8A | 20 | F5 | BF | A6 | 2D | 38 | FF | A0 | 44 | 12 |
| 00000432 | 40 | 52 | 92 | F5 | 04 | A8 | 23 | 21 | 40 | 49 | 00 | 00 | 00 | 00 | A6 | F5 |
| 00000448 | AB | CD | 01 | 01 | 30 | 15 | 0F | 08 | 7B | C0 | FF | DF | FF | EF | FF | F7 |
| 00000464 | 3F | 54 | 32 | 2A | 19 | 95 | 8C | 12 | 40 | AE | 1B | D7 | 8D | EB | C6 | 21 |
| 00000480 | C0 | CF | 97 | 4D | 32 | 8D | FF | 22 | C0 | C6 | 8A | 24 | 18 | 10 | 65 | F7 |
| 00000496 | 3F | 23 | 97 | E2 | F1 | 67 | A5 | FE | 3F | 54 | 00 | 00 | 00 | 00 | ED | 7C |

Acknowledgements

LieuND

For his dedication in guiding us. It's not an easy project but he tried to explain everything as straightforward as he could

DangLH

For emotional support. Sometimes we were too drown in the project but Mr. Dang hyped us up with his weird stories.