GR24 Capstone Design Review

Team Overview

| 54 | 264 | Univ of Calif - Santa Barbara | | -10 | 38.3 | 56.7 | 20 | | | | | | 105.0 |

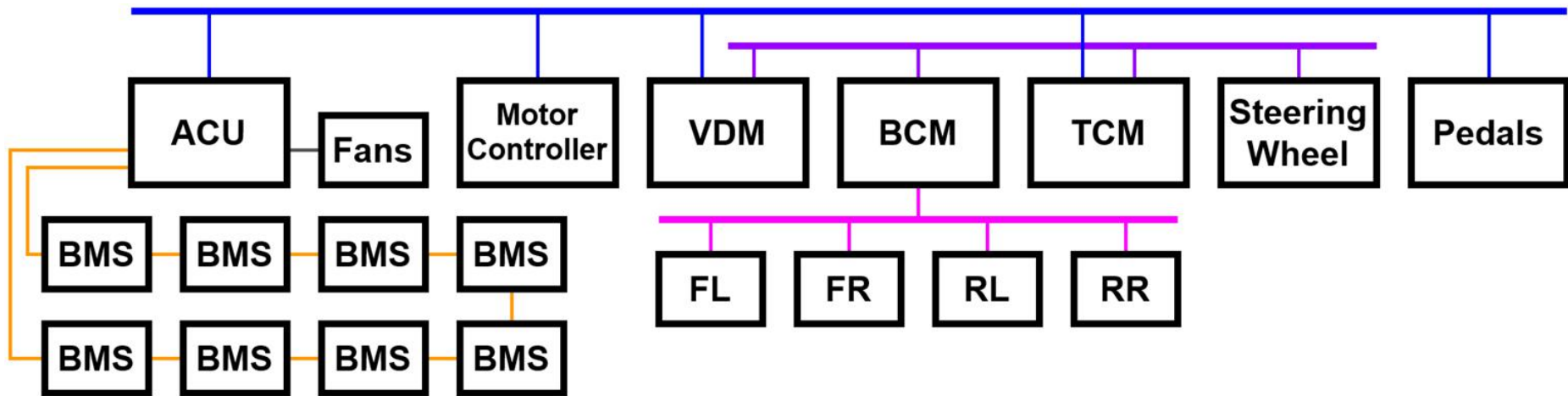Gaucho Racing at FSAE Electric
Michigan 2023

Team Goals

- Pass Technical Inspection at FSAE Michigan 2024
- Positively impact educations and careers of UCSB students
- Establish lasting organizational structure to support iterative vehicle improvement

Control Architecture

Primary CAN
Data CAN
BCM CAN
isoSPI
Analog
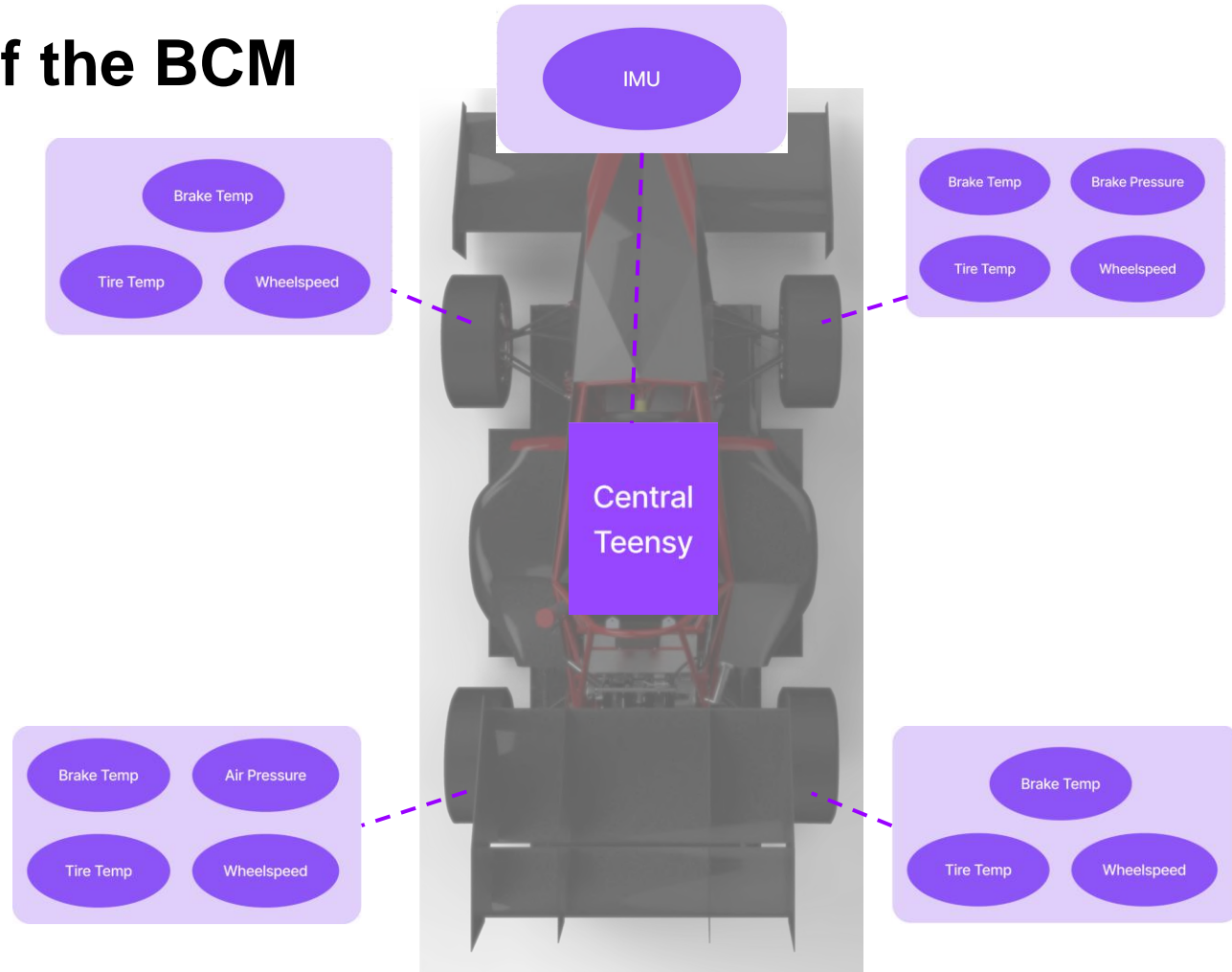
VDM - Vehicle Dynamics Module
BCM - Body Control Module
TCM - Telecommunications Module
**ACU - Accumulator Control Unit**

Block Diagram of the BCM

- Comprised of 5 Teensy 4.1 Microcontrollers

- 4 Teensy devices on the wheel handle sensors near it.

- Center Teensy for sending master packet.

- All the Microcontroller are connected via BCM CAN

IMU

Brake Temp

Tire Temp   Wheelspeed

Brake Temp   Brake Pressure

Tire Temp   Wheelspeed

Central Teensy

Brake Temp   Air Pressure

Tire Temp   Wheelspeed

Brake Temp

Tire Temp   Wheelspeed

Hall Effect Sensor

- Track RPM of each wheel
- Reading on a separate thread
- Uses interrupts to measure RPM
- RPM Derivation:
  - Number of the valid edges sampled at / teeth on the gear
  - Formula to be tested and verified on a test rig
- Operated VIA Analog Voltage
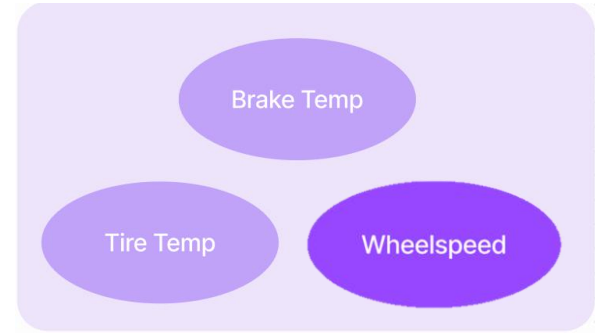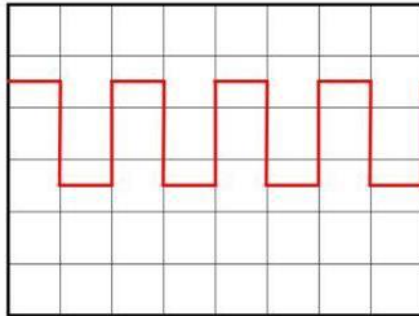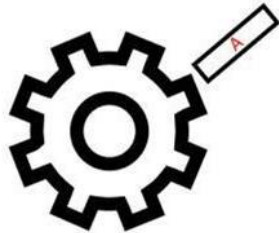
Single Pixel IR Sensor

- Part Number MLX90614
- Used for sensing brake temperature
- Mounted on Suspension A-arm
- Dual Mode
- Temp range: -70°C to 380°C
- Data Binning Protocol:
  - 00 - Cold
  - 01 - Warm
  - 10 - Overheat
  - 11 - Error
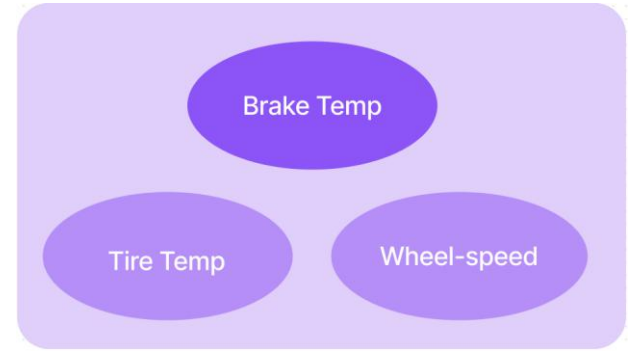

```
Loop Running...

ChipID:17169      gyr_x:2         gyr_y:-19        gyr_z:9
Reading Message: 1
Received message with ID: 124
Message contents:
Temp: 22.99
Ambient: 22.13

  Loop Running...

Reading Message: 1
Received message with ID: 124
Message contents:
Temp: 22.92
Ambient: 22.13

  Loop Running...
```
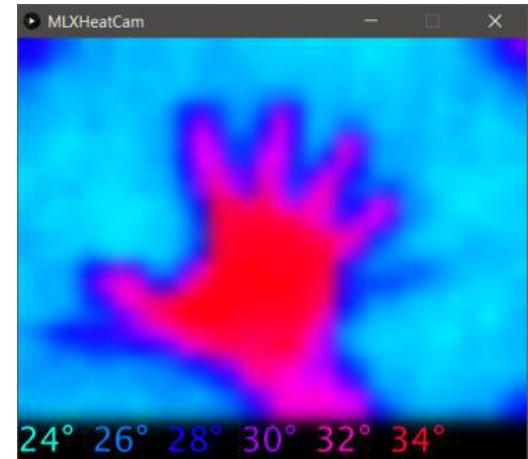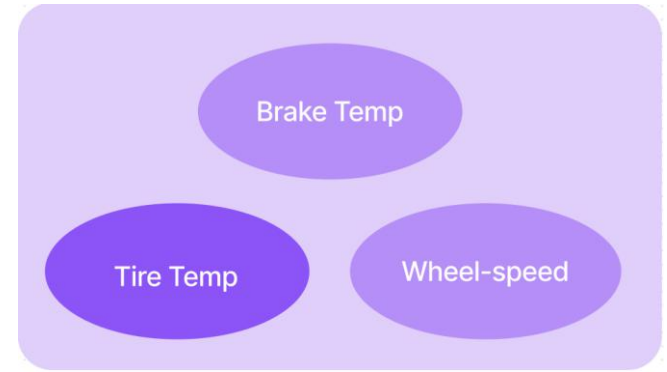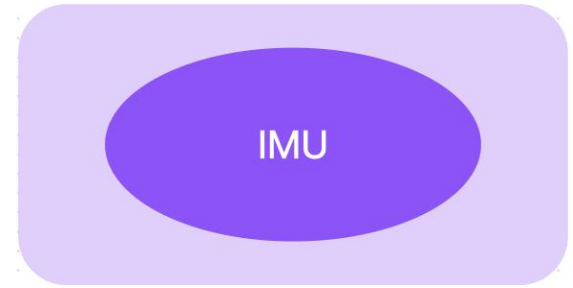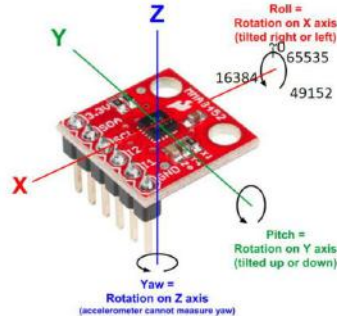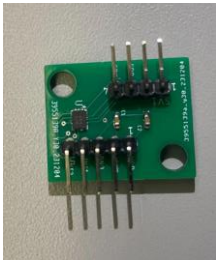
Multi Pixel IR Sensor

- Part Number MLX90640
- Used for sensing tire temperature
- Communicate through I2C
- Comprised of 768 pixel sensors
- Data Binning Protocol:
  - 00 - Cold
  - 01 - Warm
  - 10 - Overheat
  - 11 - Error

IMU

IMU

- 3 - axis Gyroscope
- Used to record car turning condition
- I2C communication protocol used
- Raw data in 2's Complement
- Unit in °/s
- Mounted at nose cone
- Run by main thread

Roll =
Rotation on X axis
(tilted right or left)

Pitch =
Rotation on Y axis
(tilted up or down)

Yaw =
Rotation on Z axis
(accelerometer cannot measure yaw)

```
Loop Running...

Reading Message: 1
Received message with ID: 124
Message contents:
Temp: 23.17
Ambient: 22.13

 Loop Running...

ChipID:17169     gyr_x:0          gyr_y:0          gyr_z:0
Reading Message: 1
Received message with ID: 124
Message contents:
Temp: 23.08
Ambient: 22.17

 Loop Running...

ChipID:17169     gyr_x:9          gyr_y:-15        gyr_z:20
```

What's Next?

This quarter (Winter 2023):

- Finish Brake Pressure Sensor (M3021)
- Finish Linear Potentiometers
- Full Network Integration

Next quarter (Spring 2024):

- Run Full System Test
- Begin Harnessing
- Final assembly