

Project Portfolio

TAL ZAITSEV

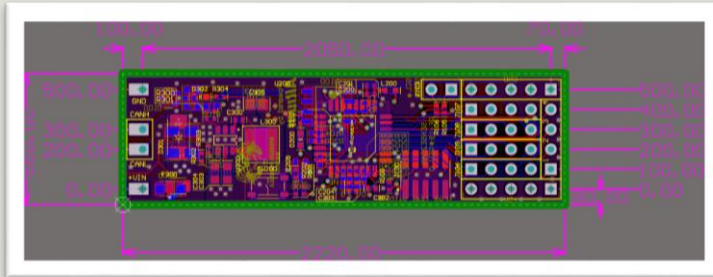
ELECTRICAL ENGINEER

PREVIOUSLY PLATFORM ARCHITECTURE ENGINEER INTERN, AMD

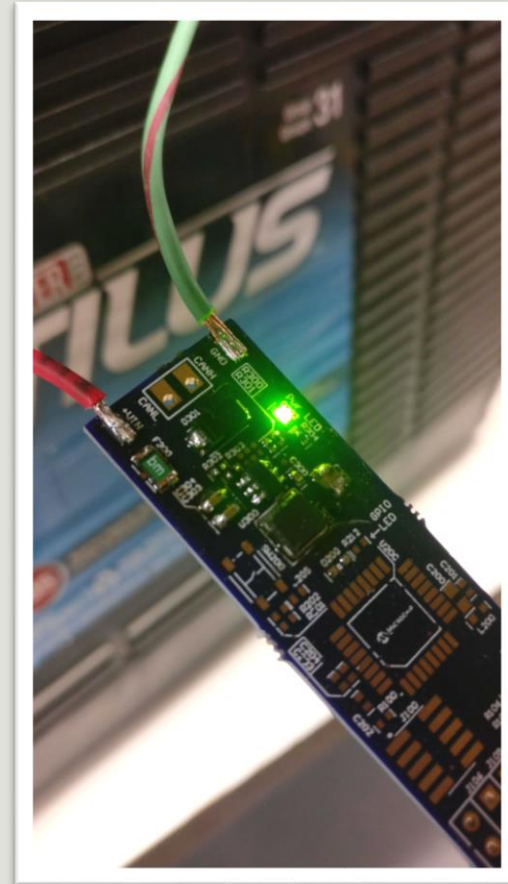
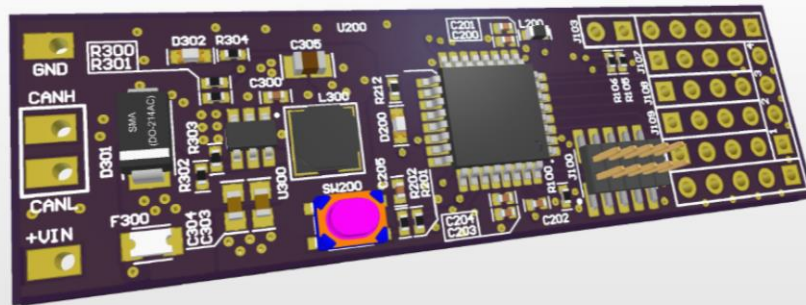
TAL@TALZAITSEV.COM 647 862 7177 TALZAITSEV.COM

Partially assembled board
successfully passing 5V
regulator test

PCB design



PCB render

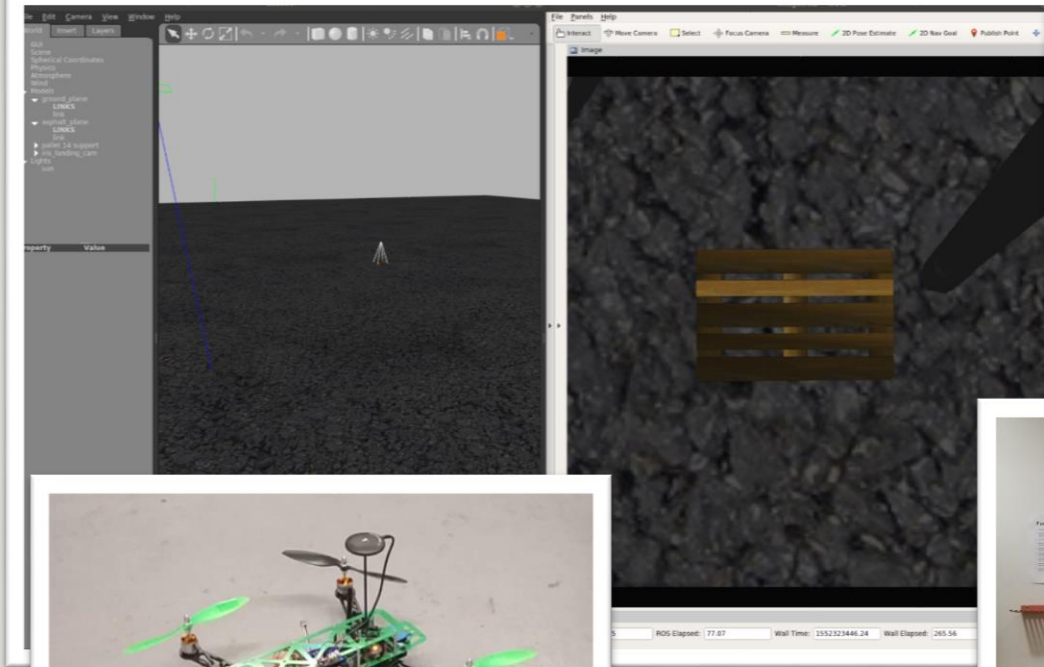


RFR: SENSE2CAN Module (2018-19)

Data acquisition module for Ryerson Formula Racing's 2019 car (RF-19) that streams sensor data back to the ECU over CAN

- Developed a miniaturized PCB design for a harsh automotive environment
- Programmed CAN, I2C, UART, and ADC components of the board

Simulation of autonomous navigation in Gazebo

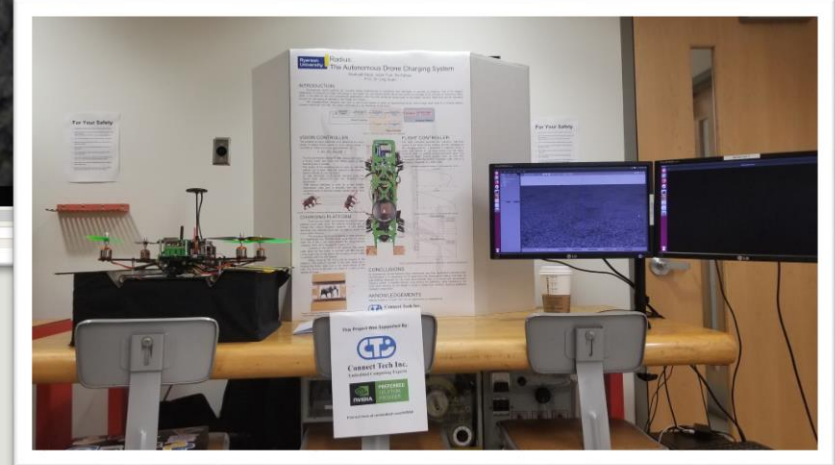


Final demo

Finished drone

Log output of custom ROS node

```
INFO [1552323415.822369411, 359.256000000]: Pos:0.08, 3.23, 4.96, Att:136.66, 179.81, -134.49
INFO [1552323417.012736331, 360.304000000]: Pos:0.23, 9.02, 4.84, Att:161.09, -176.72, -92.87
INFO [1552323418.204584382, 361.356000000]: Pos:0.08, 12.20, 4.76, Att:171.57, -176.65, -88.72
INFO [1552323419.397853996, 362.408000000]: Pos:-0.33, 13.74, 4.72, Att:176.19, 179.63, -89.62
INFO [1552323420.581432726, 363.456000000]: Pos:-0.34, 14.41, 4.75, Att:177.78, 178.03, -89.83
INFO [1552323421.652766352, 364.504000000]: Pos:-0.49, 14.68, 4.79, Att:178.31, 178.25, -89.85
INFO [1552323422.879519859, 365.556000000]: Pos:-0.38, 14.81, 4.85, Att:178.76, 178.57, -89.93
INFO [1552323424.081143631, 366.604000000]: Pos:-0.27, 14.89, 4.91, Att:179.00, 178.96, -89.96
INFO [1552323425.221994180, 367.656000000]: Pos:-0.21, 14.94, 4.94, Att:178.97, 179.02, -89.90
INFO [1552323425.684988207, 368.004000000]: Reached waypoint. Targeting next waypoint
INFO [1552323426.355114674, 368.704000000]: Pos:0.31, 15.09, 4.53, Att:1.07, 46.15, 66.77
INFO [1552323427.530401932, 369.756000000]: Pos:5.29, 15.13, 3.50, Att:0.72, 35.71, 25.51
INFO [1552323428.777107169, 370.804000000]: Pos:10.22, 14.98, 2.45, Att:0.08, 14.40, -1.03
INFO [1552323430.013112091, 371.856000000]: Pos:12.68, 14.91, 2.07, Att:179.87, 173.06, 179.20
INFO [1552323431.138714471, 372.904000000]: Pos:13.94, 14.84, 1.97, Att:179.36, 177.08, 179.59
INFO [1552323432.371281073, 373.956000000]: Pos:14.46, 14.83, 1.96, Att:179.38, 178.43, 179.71
INFO [1552323433.478397709, 375.004000000]: Pos:14.69, 14.85, 1.98, Att:179.40, 178.90, 179.85
INFO [1552323434.657510503, 376.056000000]: Pos:14.80, 14.88, 2.02, Att:179.59, 179.14, 179.89
INFO [1552323435.381989610, 376.656000000]: Reached final waypoint. Entering DNN_LOCK state
INFO [1552323435.878585042, 377.104000000]: Pos:14.85, 14.91, 2.05, Att:179.75, 179.11, 179.95
INFO [1552323437.128989312, 378.156000000]: Pos:14.88, 14.91, 2.07, Att:179.53, 179.17, 179.98
INFO [1552323438.692967126, 379.204000000]: Pos:14.92, 14.92, 2.08, Att:179.66, 179.20, 179.98
INFO [1552323440.035935770, 380.256000000]: Pos:14.96, 14.93, 2.08, Att:179.72, 179.33, 179.98
INFO [1552323440.580179572, 380.600000000]: Achieved DNN_LOCK for 4.000000 seconds. Entering DNN_LOCKING state
```



Capstone: Autonomous Drone (2018-19)

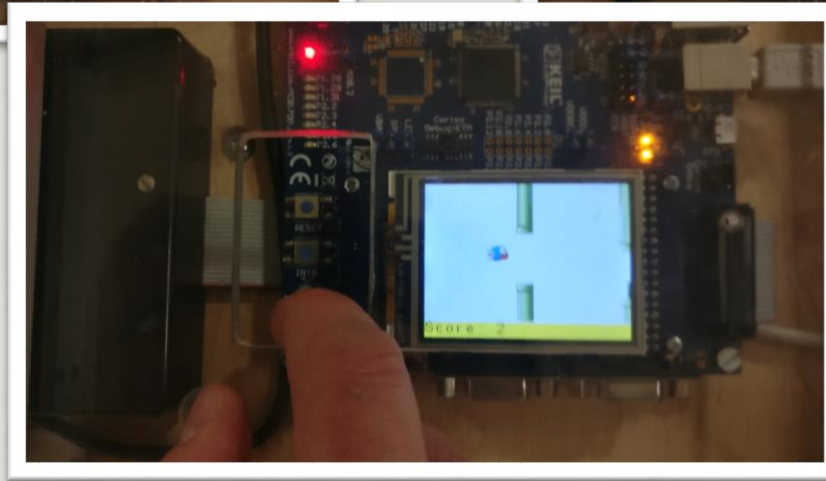
Drone that can autonomously land precisely and recharge on a custom charging platform

- Autonomous controller built on an NVIDIA Jetson TX2 using ROS, interfaced to a PX4 flight controller
- Developed custom node in C++ for navigating to landing platform, and then performing a precision landing sequence
- Project won first place across all Electrical, Computer and Biomedical Capstone projects

Main menu



Image viewer



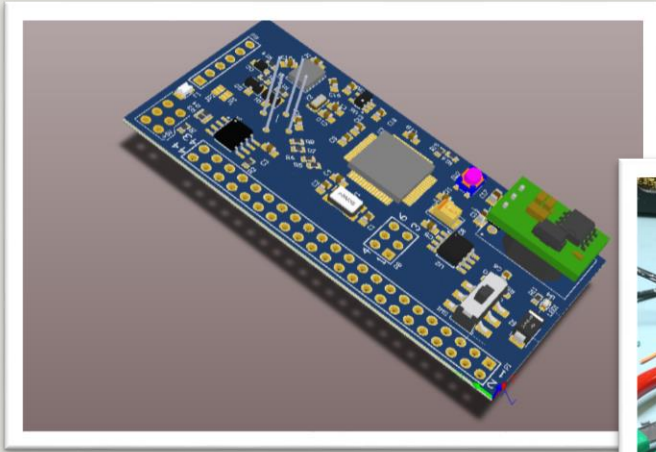
Remake of the infamous
Flappy Bird Game

Embedded Media Player (2018)

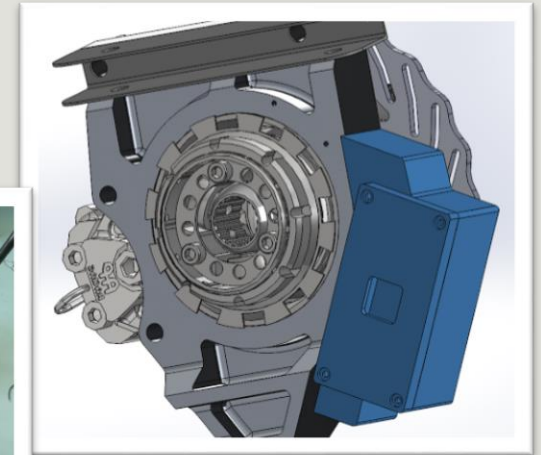
Media player programmed in C for ARM Cortex M3 based development board for Embedded Systems course

- Gained C experience, especially with designing for a resource-limited system
- Code was modular and allowed for easy integration of all media player features
- Featured Windows XP-inspired design with a graphical menu

PCB render



Final assembled modules

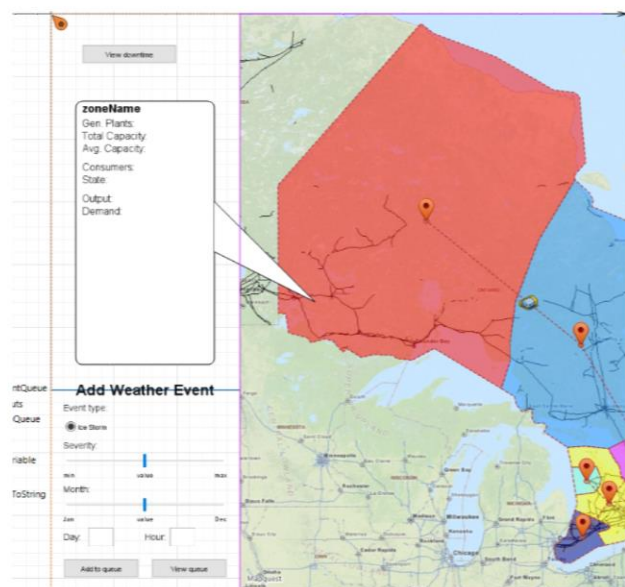


Enclosure in its proposed position on the wheel

RFR: Sensor Module (2016-17)

Data acquisition system (DAQ) that expands the number of analog, PWM and digital inputs available to the ECU

- Using dsPIC33EV Digital Signal Controller for sensor processing and CAN communication
- Variant based design that supports two designs in a single PCB, for minimizing cost



AnyLogic development environment

☒ Just action (returns nothing)
☐ Returns value

Arguments

Name	Type
name	String
zone	int
region	GISRegion
center	GISPoint

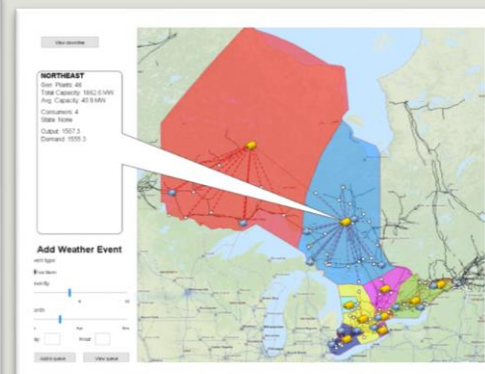
Function body

```

// Network between distributor, pla
GISNetwork network = new GISNetwork

// Generate list of plants inside o
ArrayList<GenerationPlant> containe
for(int i = 0; i < plants.size(); i
  GenerationPlant plant = plants.
  if(region.contains(plant.getLat
    containedPlants.add(plant);
    GISRoute route = map.getRou
    network.add(route);
  }

// Generate list of consumers insid
ArrayList<Consumer> containedConsum
for(int i = 0; i < consumers.size()
  Consumer consumer = consumers.g
  if(region.contains(consumer.get
    containedConsumers.add(cons
    GISRoute route = map.getRou
    network.add(route);
  }
  
```



Running simulation

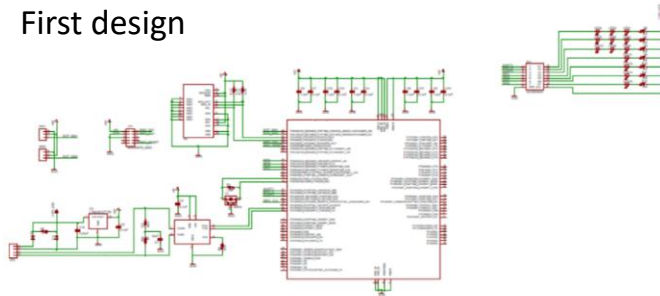


Agent Based Modeling (2016)

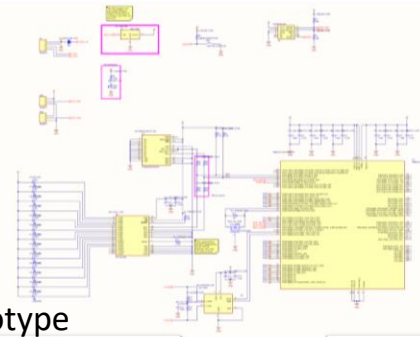
Agent-based model of how adverse weather events affect the power grid in Ontario

- Developed model for graduate student's research using AnyLogic

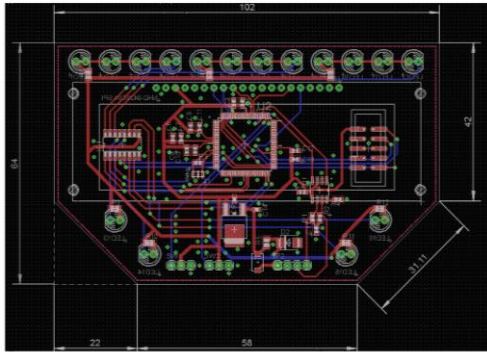
First design



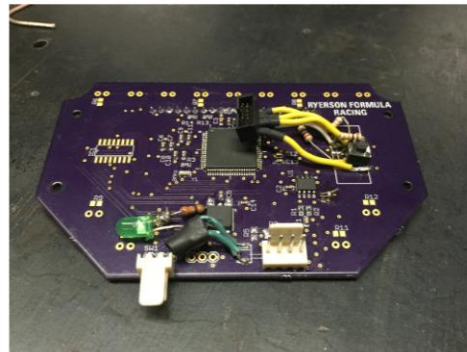
Revised design



First PCB



Revision prototype



Final product



RFR: Dash Module (2014-15)

ARM-based steering wheel display module to provide the driver with information about the car mid-race

- Learned general design process, ARM development, and gained proficiency with Altium Designer

Controller code

```
set pidLastInput[PID_AXES] = (0,0,0);
signed long pidLastTime = 0;
t pidIter[PID_AXES] = (0,0,0);
set pidP[PID_AXES] = { ROLL_P, PITCH_P, YAW_P };
set pidI[PID_AXES] = { ROLL_I, PITCH_I, YAW_I };
set pidD[PID_AXES] = { ROLL_D, PITCH_D, YAW_D };

boolean lockInterrupt = false;

id setup()
// Enable interrupts, set up pins
PCICR |= (1 << PCIE2); // Enables interrupt for pins D0-D7
PCICR |= (1 << PCIE0); // Enables interrupt for pins D8-D13

PCMSK2 = (1 << PCINT22) | (1 << PCINT23);
PCMSK0 = (1 << PCINT0) | (1 << PCINT4); // | (1 << PCINT4);

// Set up receiver input pins
DDRD &= ~(CH1_MSK | CH2_MSK);
DDRB &= ~(CH3_MSK | CH4_MSK); // | CH5_MSK);

// Set up ESC motor output pins
DDRD &= B00100000; // Set pin 5 as output
DDRB &= B00011110; // Set pins 9, 10, 11 as output

pinMode(13, OUTPUT);

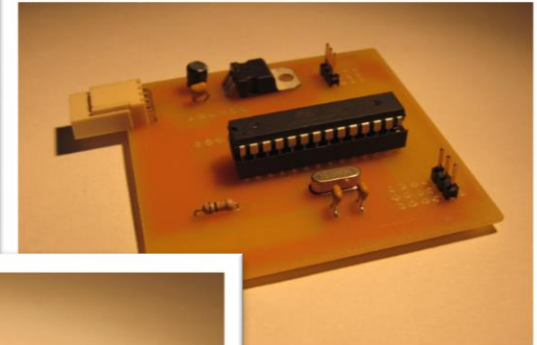
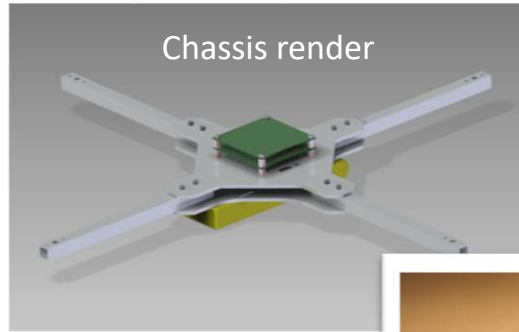
ifdef SERIAL_ENABLED
Serial.begin(115200);
Serial.print("Init\n");
#endif
//Wire.begin();
NPU.init(NPU_UPDATE_RATE, NPU_MAG_MIX_GYRO_AND_MAG, MAG_UPDATE_RATE);

ratioAB = ratioCD = ratioAB_CD = 0;

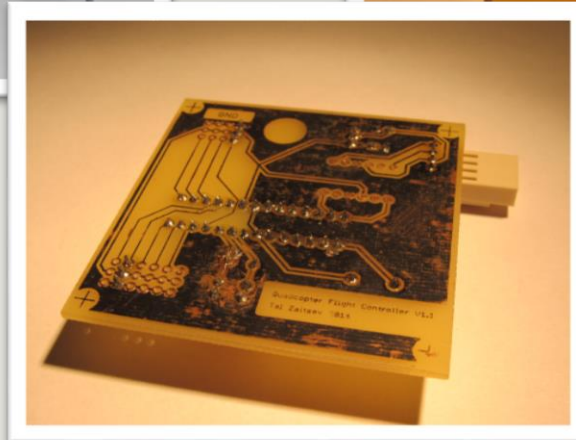
aotA.attach(MA_PIN, CH3_MIN, CH3_MAX);
aotB.attach(MB_PIN, CH3_MIN, CH3_MAX);
aotC.attach(MC_PIN, CH3_MIN, CH3_MAX);
aotD.attach(MD_PIN, CH3_MIN, CH3_MAX);

// aux ESCs
aotA.writeMicroseconds(CH3_MIN);
aotB.writeMicroseconds(CH3_MIN);
```

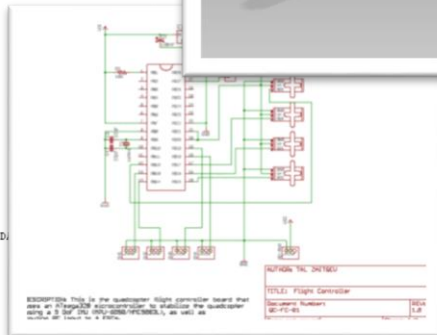
Chassis render



Etched board



Controller schematic



Quadcopter Flight Controller (2014)

Arduino-based quadcopter flight controller board that combines user input with inertial measurements for a smooth, stable flight

- Learned about PID, Kalman filters, and PCB design