Automated Temperature Sampler

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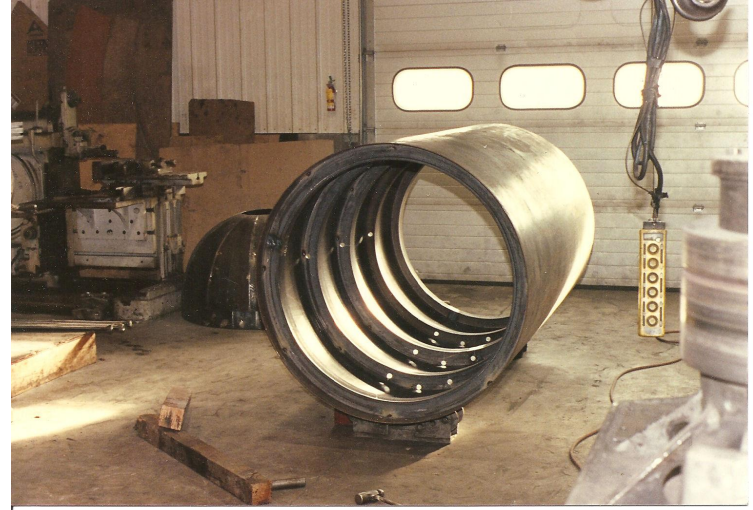
Automated Temperature Sampler

- 4E working in conjunction with EB
- To help the welding technicians

JF

Project Description

- Structure of a submarine
  - Circular ribs are inserted inside the hull
  - The hull is then heated to temperature
  - Ribs are welded into place

- Heating
  - Hull needs to be the right temperature
  - Too hot or too cold and the hull warps
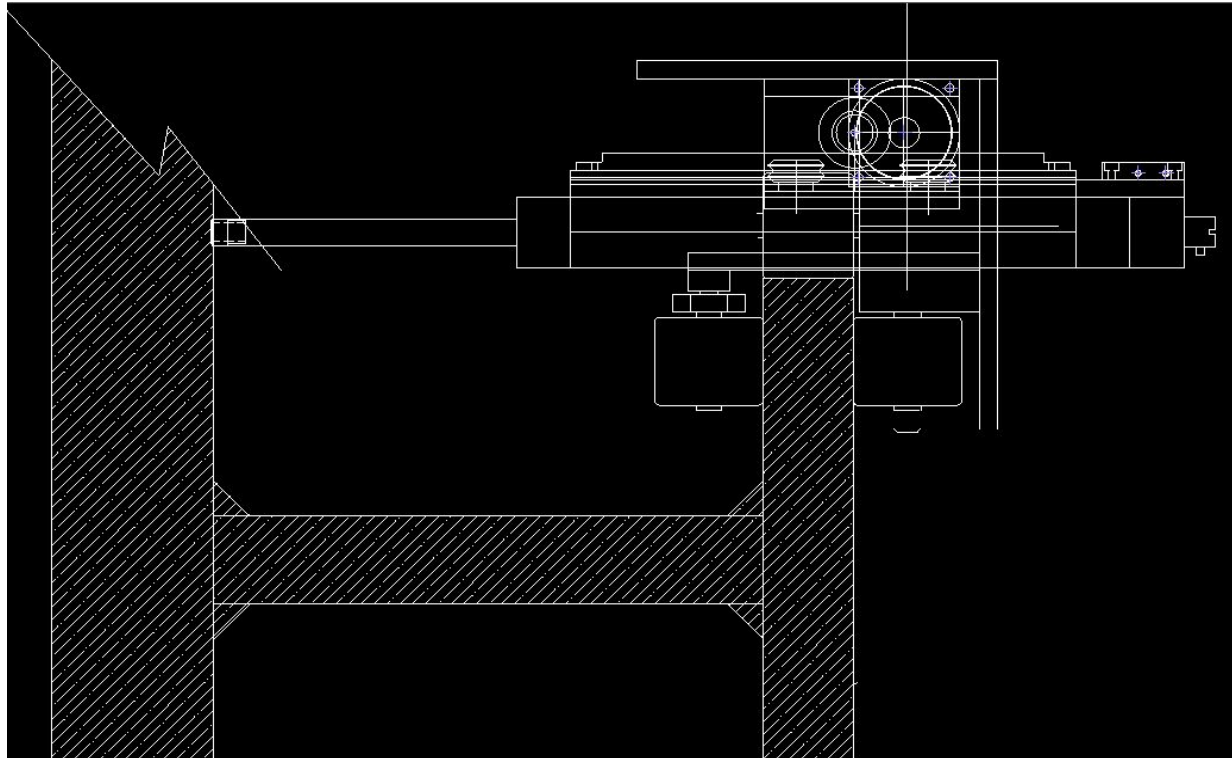

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Project Description

- Old method of monitoring temperature
    - Heating element temperature probes
    - Needed to be retracted

- Older method of monitoring temperature
    - Mark the hull with a crayon and wait for it to melt
    - Could only tell if the hull was above melting point
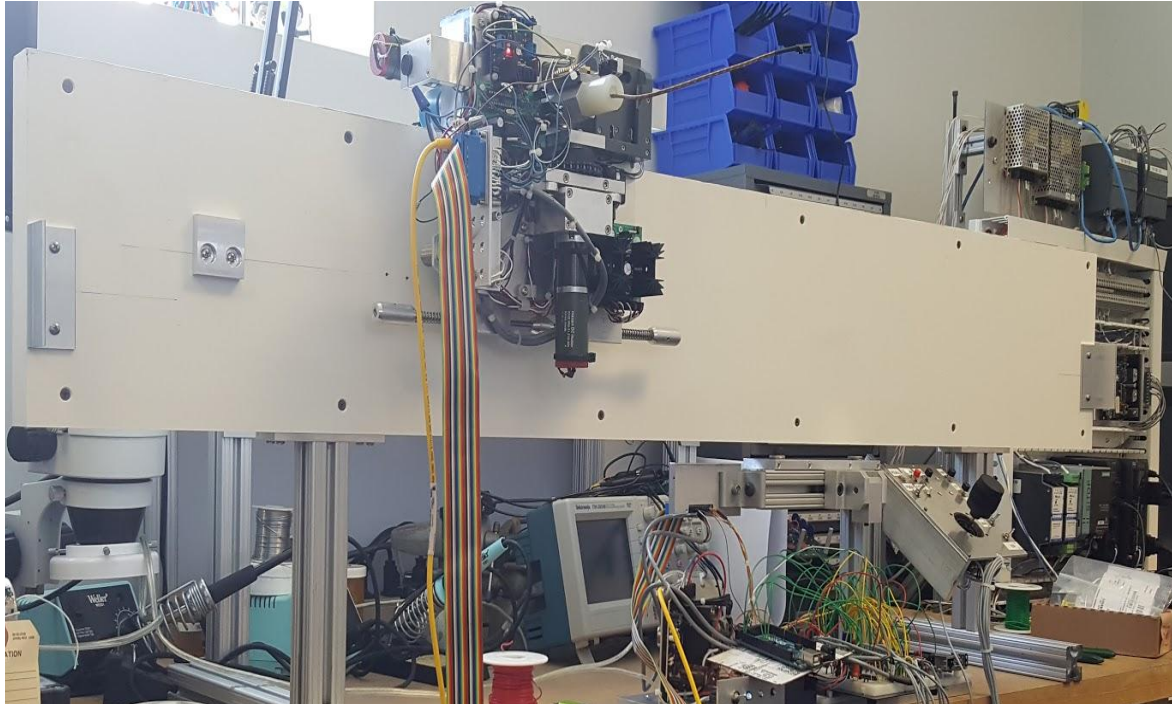   - Couldn't tell if temperature was too hot

RT

Project Description

- Different Designs
  - Drew multiple designs
  - Different mounting strategies

- Different Design Methods
  - Laser temperature probe
    - Optical sensors are unreliable in this environment
    - Not accurate at high temperatures
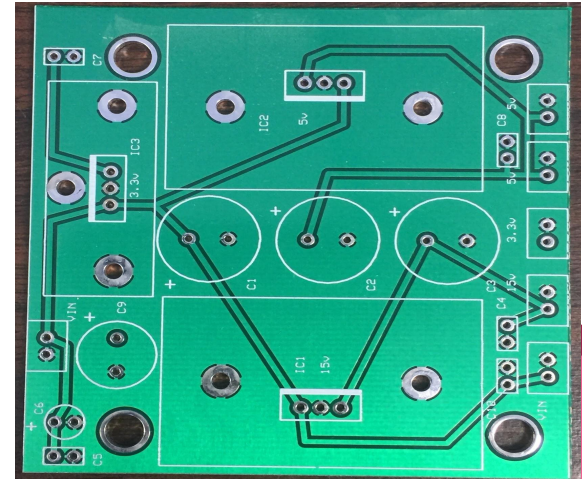
JH

Final Design

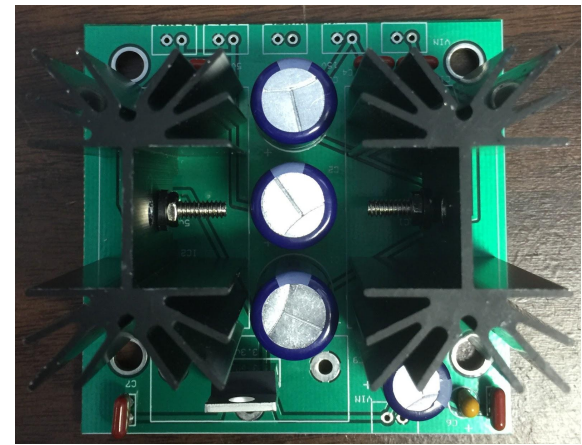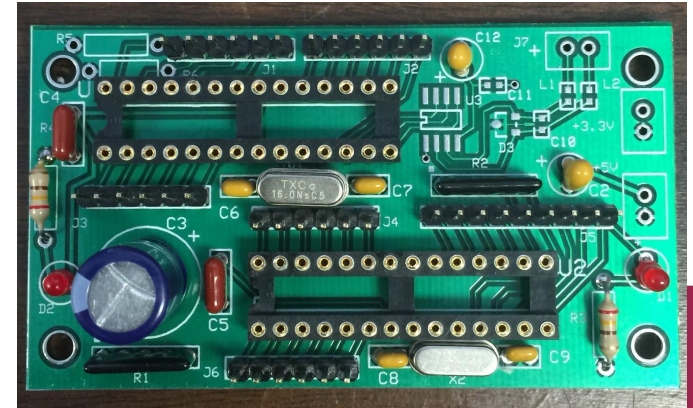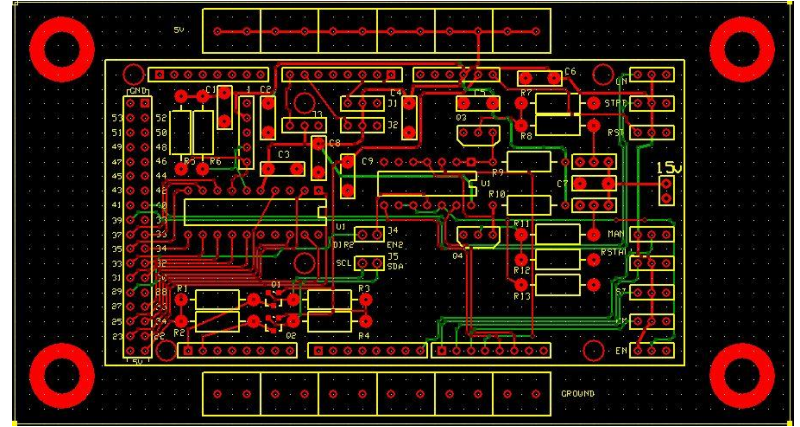# Final Design

JH

Block Diagram

Components (Power)

- Power
  - Decided on 20 volt power supply
    - Yun draws too much current
    - Large amount of power needed:
      - For motors and microprocessors
  - Voltage regulator PCB
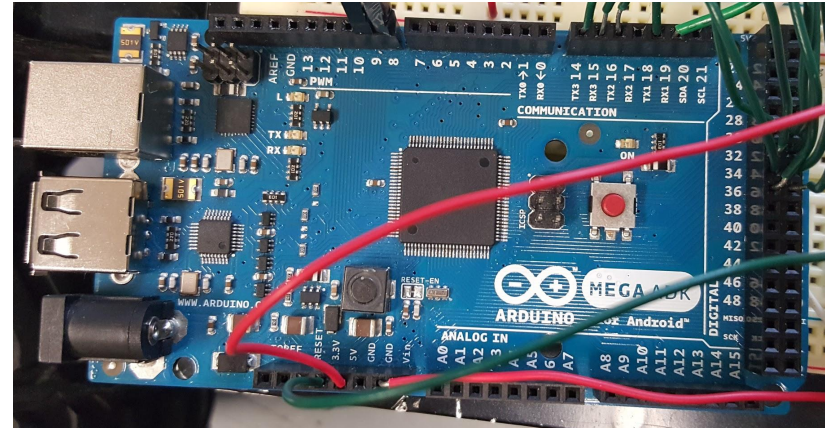   - 3.3v, 5v, and 15v regulators

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Components

- PCB
  - Used ExpressPCB software to design PCB
  - Created to eliminate loose wires on breadboard
  - Minimized component space
- Arduino PCB
  - Contained two ATmega168 chips
    - Used for minimizing space
    - Minimized current use compared to UNO

JF

Components (Microcontrollers)

- Microcontroller (controls)/code
  - Arduino mega
    - Master
  - Arduino Yún
    - Writes a datalog text file to the on board sd card
    - Hosts a webserver on the network and serves the text file
  - Atmega 168 chip
    - Controls the temperature probe
    - Take temperatures in from the Max31855

RT

Components (Sensors)

- HRLV-MaxSonar-EZ-Series
  - Ultrasonic Sensor
  - Sends pings that determine distance of objects
  - Using it to detect objects in samplers path to avoid collisions
- Contact sensor
  - Last resort to detect collisions

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Components (Sensors)

- Dynapar Series E12 (encoder)
  - Pulses as it spins

- LS7166 24-BIT Quadrature Counter
  - Counts encoder pulses
  - Arduino doesn't count fast enough for encoder
  - Counter is capable of handling the count from encoder

  Together used to calculate location

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Components (Sensors)

- Inductive Sensor
  - Sends a signal when sensor is in contact with metal
  - It is used for the homing operations

- Thermocouple
  - Records temperature samples
  - Used to measure temperatures of hull of submarine
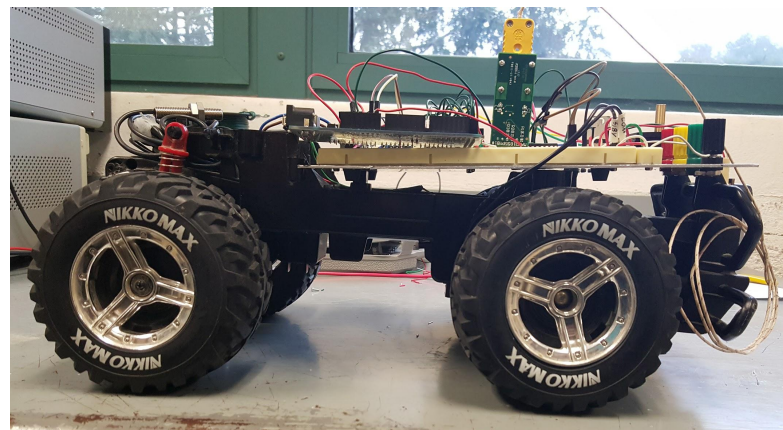 - Temperatures sent wirelessly to tablet

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Estimated Material Cost list

DF-MD 2A Dual Motor Controller	$17.05
Dynapar Series E12 Encoder	$450.00
Arduino Mega 2560	$51.00
Arduino Yun	$50.00
micro sd card 2 gb	$6.49
Atmega 168 chips (slaves)	$3.50
MAX31855 PMB1 Thermocouple-to-Digital converter	$20.35
HRLV-MaxSonar-EZ-Series	$34.95
Pepperl + Fuchs Inductive Sensor NBB5-18GM50-E0	$23.00
DeWalt 20V Max Premium XR 5.0 Ah Lithium Ion Battery	$139.00
PCB Express	$0.00
DF Product Arduino Jumper Cables	$5.00
Power supply PCB and Motor/Temperature PCB	$180.06
Motherboard PCB	$180.06
Gear Motor Probe	$400.00
Gear Motor Main Drive	$400.00
Linear VEE Slide Parts/Probe	$127.24
Encoder Counter Chips	$37.15
Mechanical Drive Components	$1,056.27
Electrical Components	$630.56
Joystick	$217.59
Test Power Supply	$99.00
Thermocouple Device	$18.00
Test Stand Material	$104.00
Total	$4,250.27

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Prototype

- Gave us an idea of how the sampler will run
  - Testing sensors, components, circuits as a whole

- Semester 1 prototype (RC car)

- Semester 2 prototype (Full scale model)
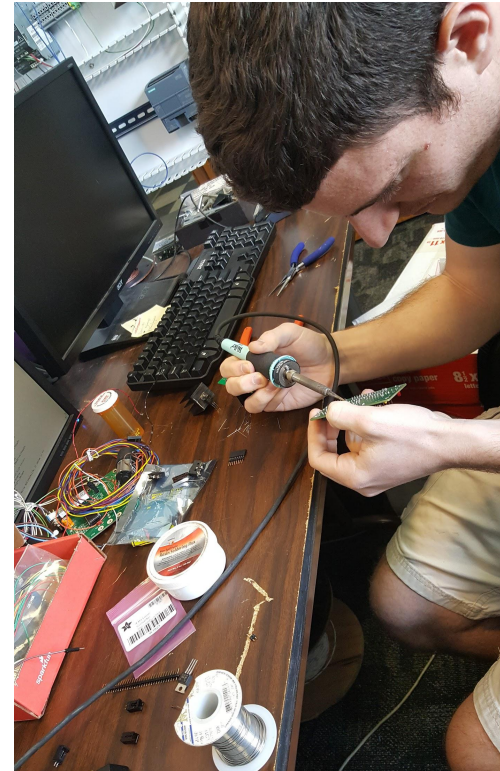
Problems Along the Way

- So numerous. Only honorable mentions from second semester
  - Interrupts with arduinos
  - Connections to hotspots
  - Making and android list out of an array
  - Wiring the prototype

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ABET Outcome C

- Safety constraints
  - Sensors prohibit collisions
  - Functionality was more of a concern
- Economic constraints
  - Extra parts laying around
  - Cost of everything was not too much of a concern

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Project Continuation

- Electrical Engineers Work
  - Make the sampler portable
    - Add battery to power components
  - Improve on movement protocols
    - Needs to be less of a demo type movement
  - Protocols/circuits need to be more robust
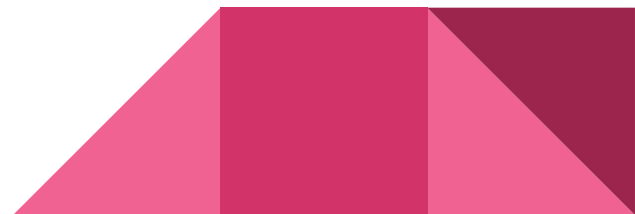   - Lots of accidental resets or resets are incorrect

Project Continuation

- Wireless infrastructure that we use could be improved upon
  - Use another Yun as the connection point
  - Figure out how to use a P2P connection

- App needs lots of work
  - Needs to be more visual
- 2 way communication between Tablet and Sampler
  - Start commands
  - Some settings

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Demo

Acknowledgments

- David Grande
- Professor Sunak

Questions?