CISCOR

CENTER FOR INTELLIGENT SYSTEMS, CONTROL, AND ROBOTICS

Team 10
GOLIATH Autonomous ATV

Group Members:

Michael Brazeau Marc Akbar Jeremy Hammond
Omesh Dalchand Lester Kendrick Merrick Salisbury

Advisors:

Dr. Chiang Shih Dr. Kamal Amin Dr. Michael Frank
Dr. Oscar Chuy Dr. Emmanuel Collins

Instructor:

Dr. Kamal Amin

Background

- CISCOR focuses on mobile robotic path-planning
- Requires a more robust autonomous off-road platform
- Previous work included remote control
- Actuators installed

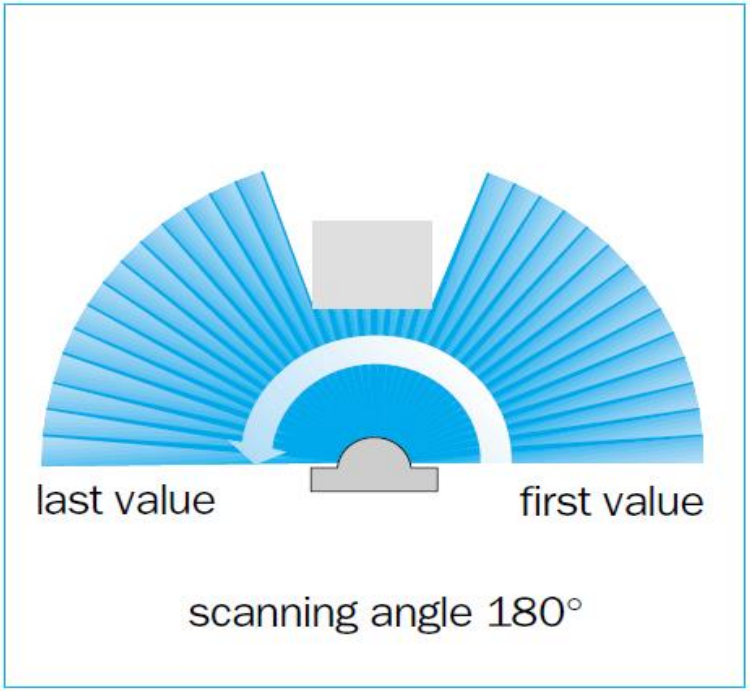
Objectives

- To integrate a sensory system that will scan the surrounding environment
- Use data to compute a trajectory to perform waypoint navigation and road following autonomously
- Will be used as a future research platform for CISCOR

SICK Laser

- SICK LMS-200 Laser Measurement System
- 180 degree scan profile
- Angular resolution

  = 0.25°
- Two lasers

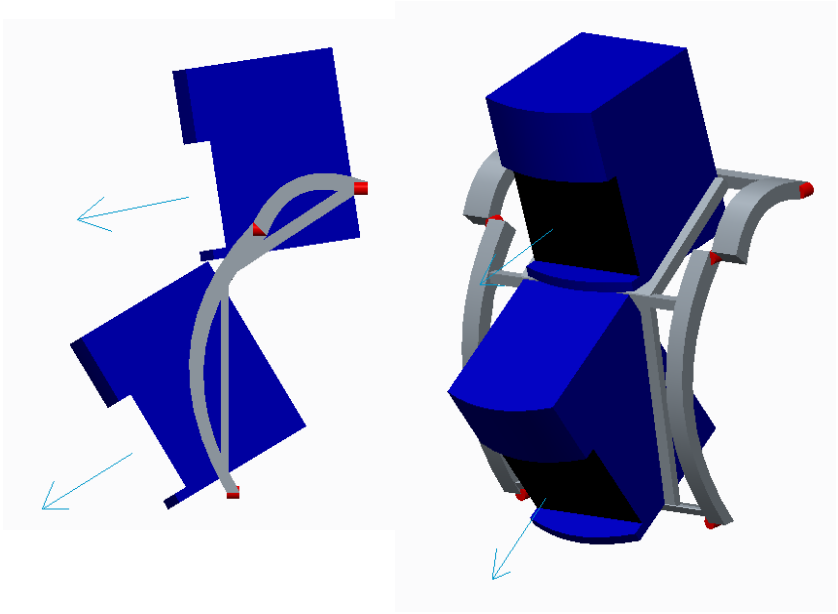


Design Concept 1

- Side-by-Side configuration
- Pros
  - Uniform weight distribution
  - Simple
- Cons
  - Complicated calculation
  - Possible laser interference

Design Concept 2

- Stacked configuration
- Pros
  - Centerline allows ease of calculation
  - No interference
- Cons
  - Susceptible to environment damage
  - Additional mounting components required

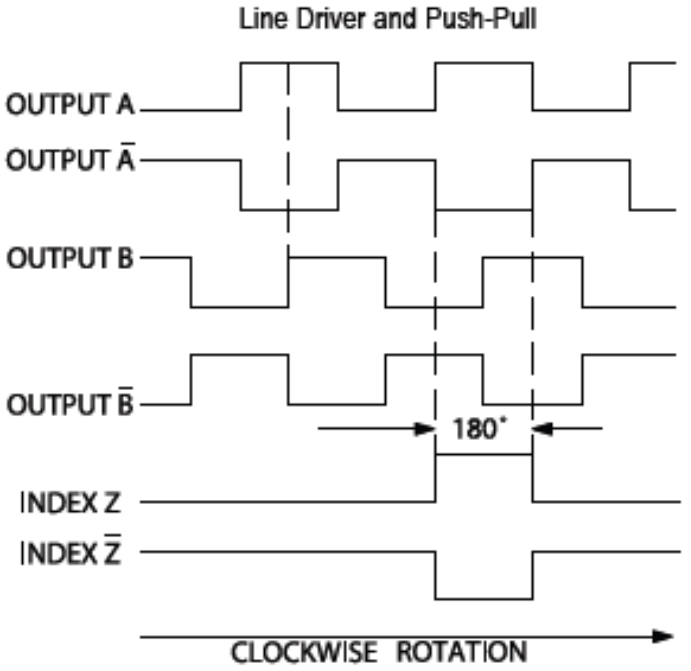


Design Concept 3

- Front-Back configuration
- Pros
  - Both lasers on centerline
- Cons
  - Rear laser requires additional components
  - Rear laser susceptible to impact

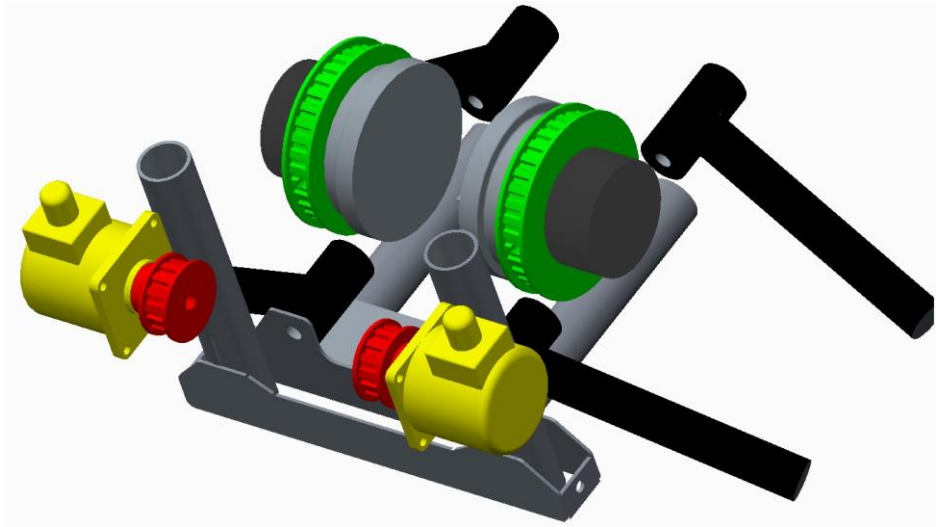
Encoder

- Accu-Coder 725 Encoder
- 30,000 counts per revolution
- Quadrature encoding



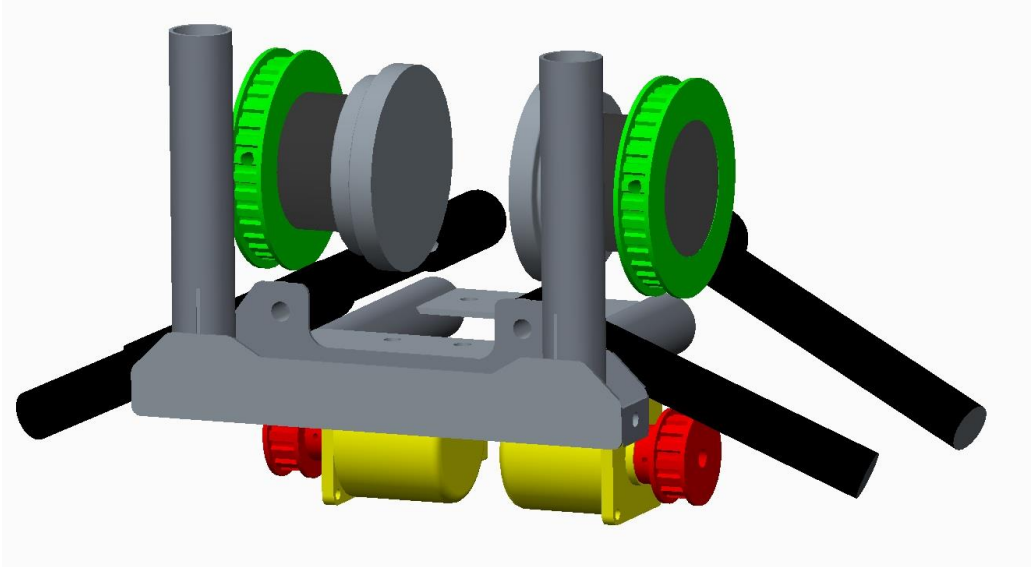
Design Concept 1

- Front-Front configuration
- Pros
  - Safe location
  - Simple mount
- Cons
  - Encoder belt close to ATV frame



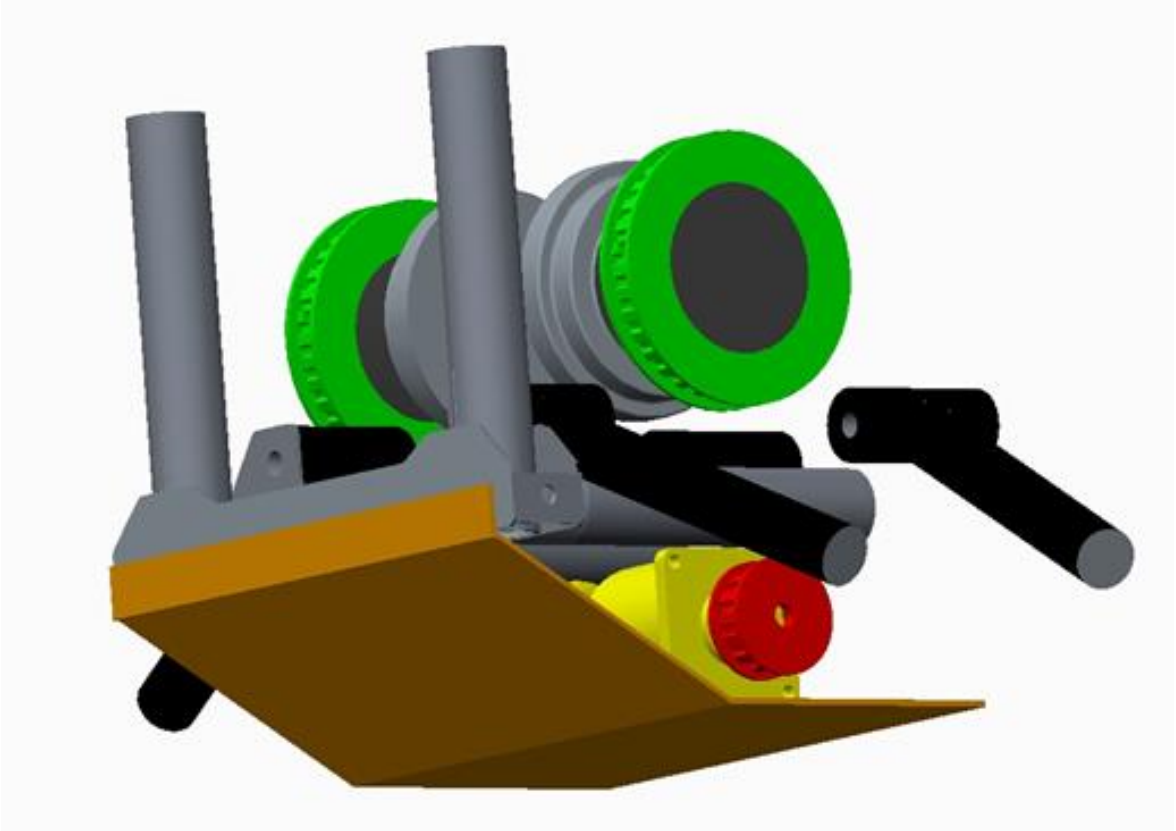
Design Concept 2

- Front-Under configuration
- Pros
  - Belt and pulley clearance
  - Simple bracket manufacture
- Cons
  - Reduces ground clearance
  - Skid plate required



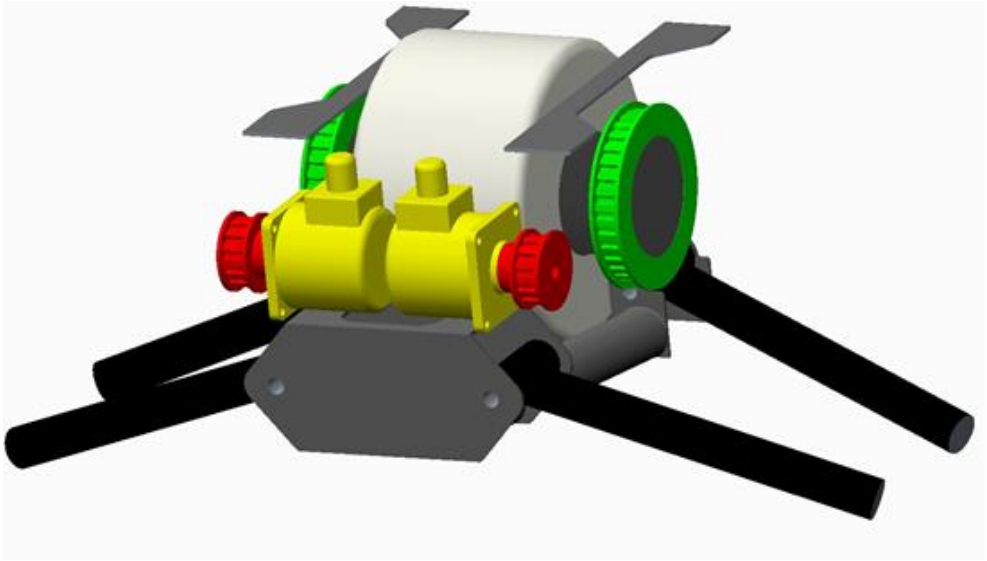
Design Concept 2

Skid Plate



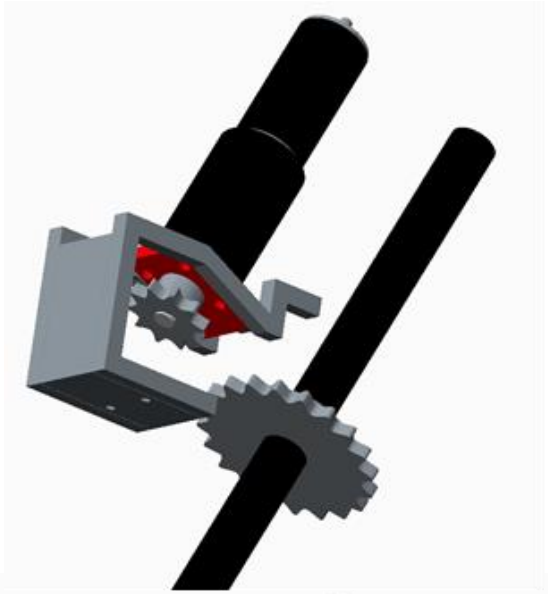
Design Concept 3

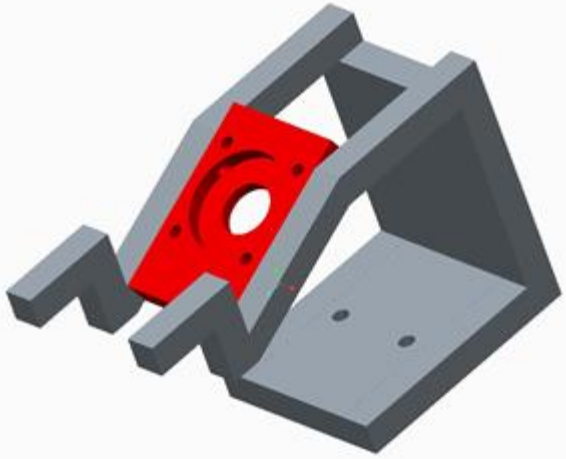
- Rear-Rear Configuration
- Pros
  - Component clearance
  - Simple mounting and adjustment
- Cons
  - Belt damage due to debris



Steering Motor Design Concept

- Brushed 24 VDC Motor
- Mounted in same location
- Pros
  - Simple modification
  - Utilize existing mounts/wires
- Cons
  - Larger bending moment



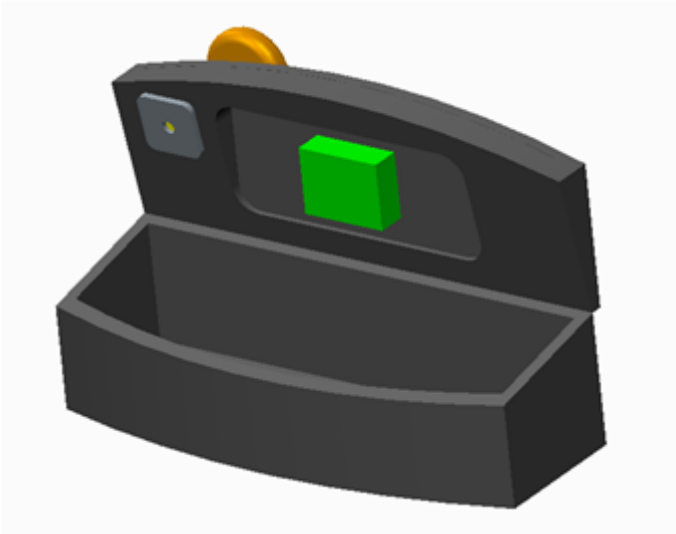


GPS Design Concept 1

- Pro-Pack G2 plus GPS
- Front configuration
- Pros
  - Simple installation
  - Ease of access
- Cons
  - Low antenna stability
  - Close proximity to emergency cut-off

GPS Design Concept 2

- Rear-Trunk configuration
- Pros
  - Protects GPS unit
  - Stable antenna
- Cons
  - Aluminum plate required for antenna
  - Adds heat source to trunk

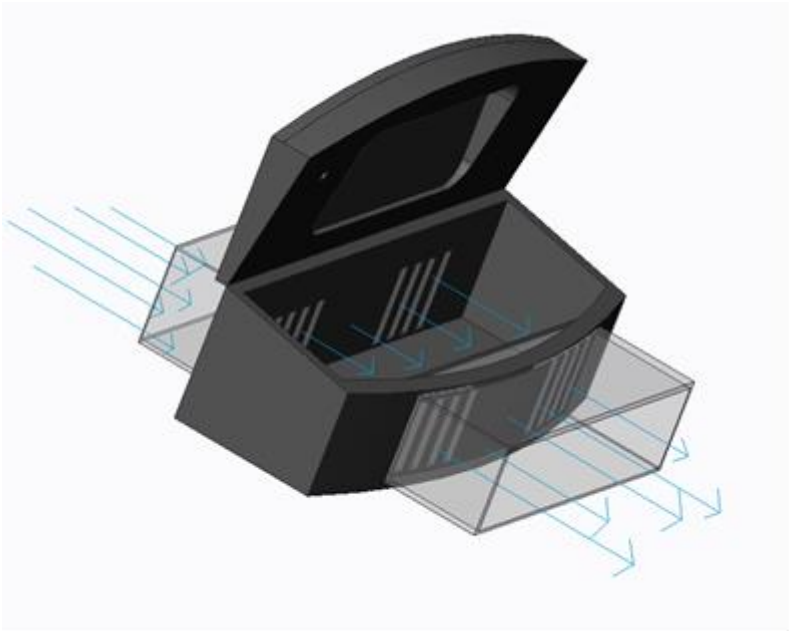


Heat Dissipation

- Previous overheating issue with trunk
- Approximately 250-300 Watts
- Require design to disperse heat
- Design must maintain weatherproof feature

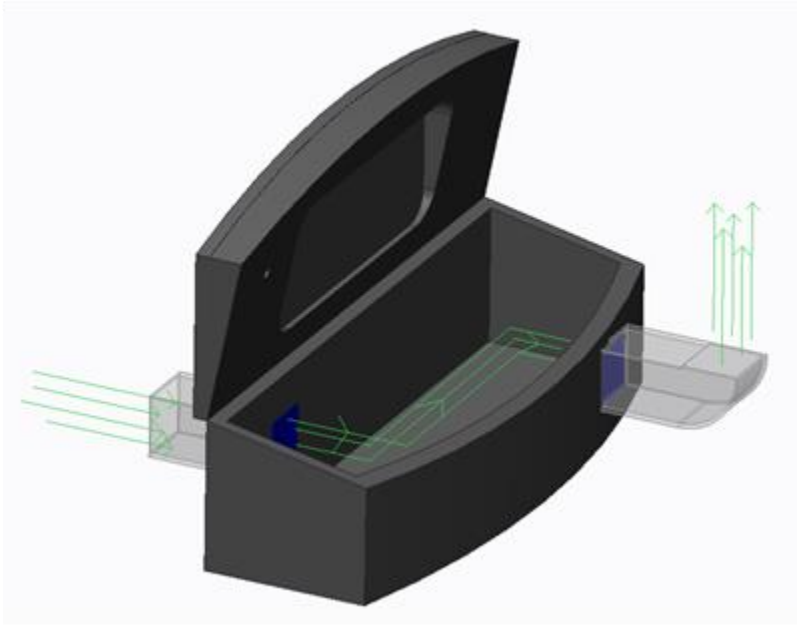
Design Concept 1

- Forced convection due to vehicle motion
- Baffle system to weatherproof
- Pros
  - Inexpensive
  - Consumes no power
- Cons
  - May not remove enough heat
  - Large number of slits could let debris in



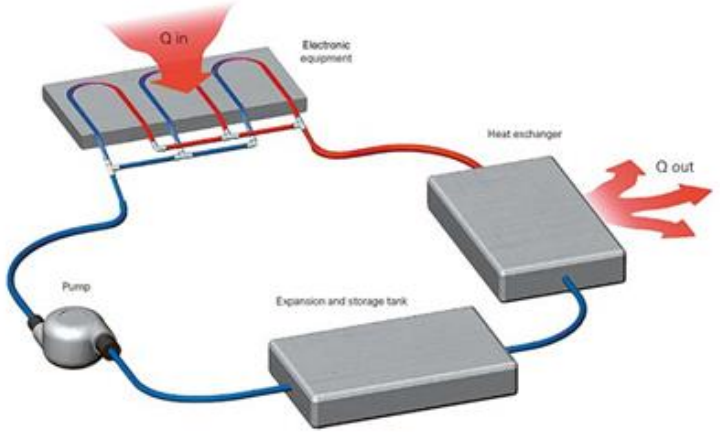
Design Concept 2

- Forced convection
- Pros
  - Relatively inexpensive
  - Large cooling capacity
- Cons
  - Uses extra power to run fans
  - Still susceptible to debris



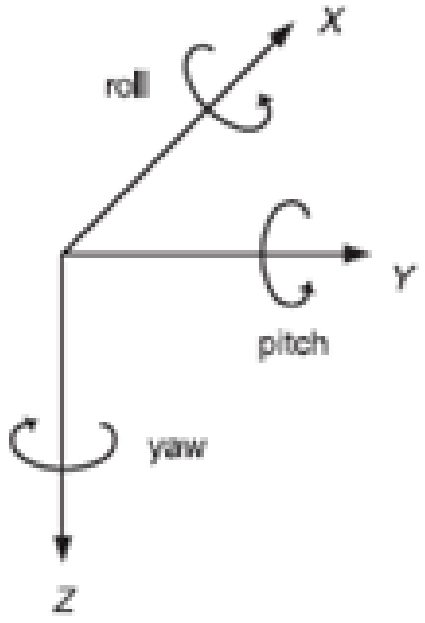
Design Concept 3

- Liquid-Cooling configuration
- Pros
  - Maintains waterproofing
  - High cooling capability
- Cons
  - Expensive
  - Extra power required to run pump
  - Complex



IMU

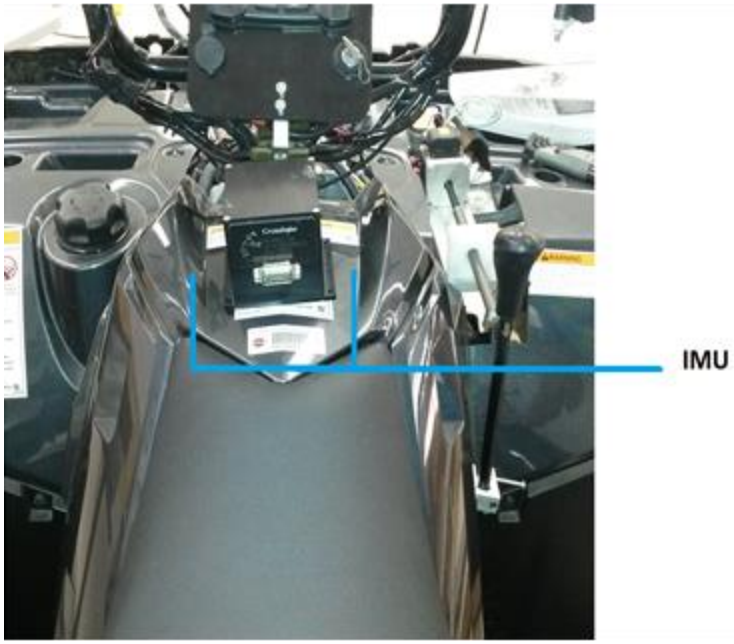
- Crossbow Inertial Measurement Unit
- Six degrees of freedom
- Linear acceleration
- Rotational velocity



IMU Design Concepts

Design 1

Design 2

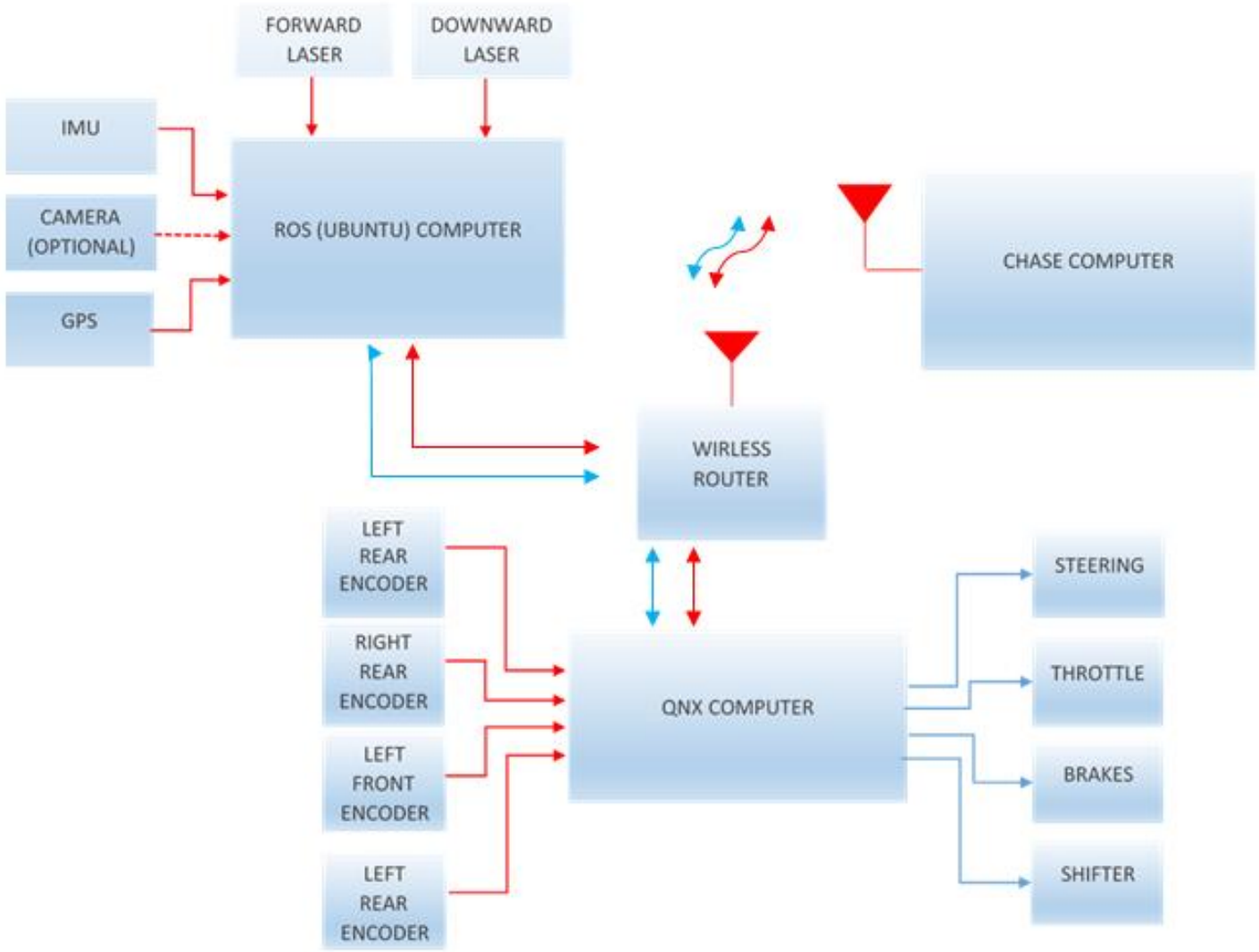


Design 3

Computer needs and control

- Three computers
  - Ubuntu running ROS
  - QNX
  - Chase computer with Ubuntu running ROS
- Wireless router
- Sensors

Computer needs and control



ROS (Ubuntu) Computer

- Sensors
  - Laser
  - GPS
  - IMU
  - Camera (optional)
- Code
  - Waypoint following
  - Road following

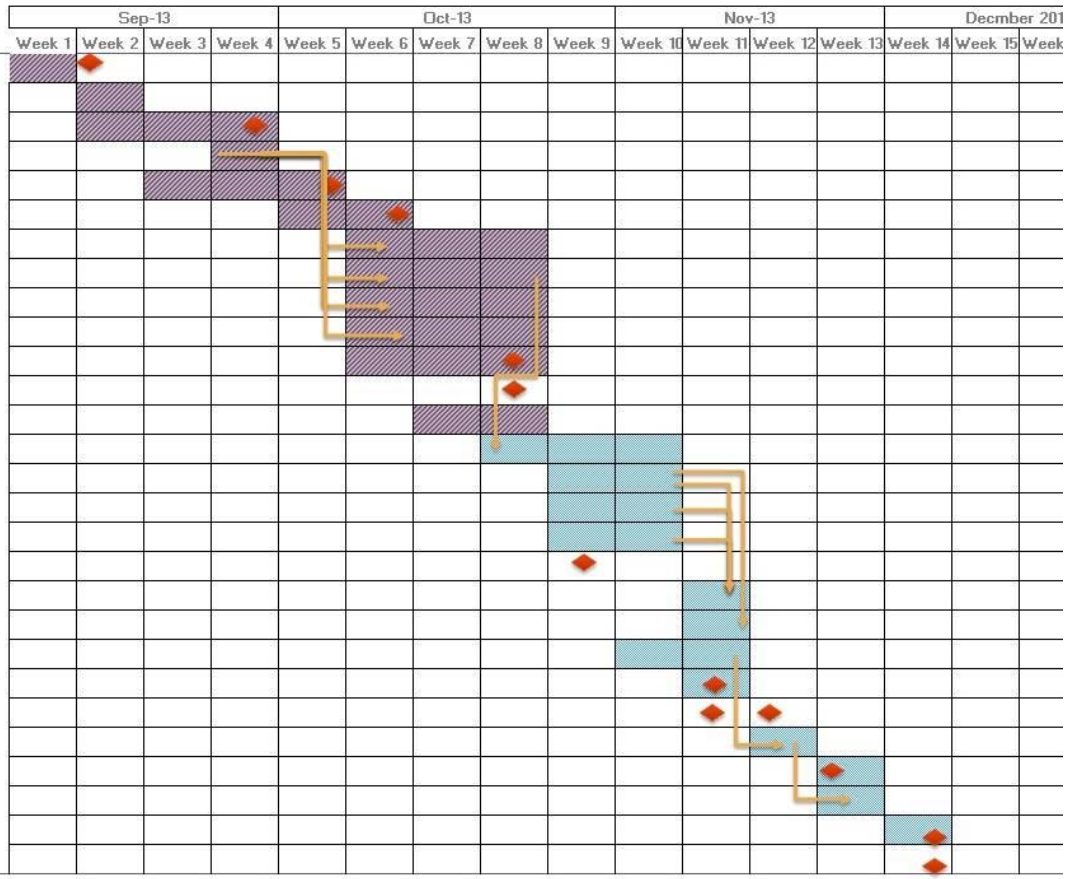
Conclusion / Future Plans

- Large number of conceptual designs gives us many options for our final design
- Confident our designs will meet the requirements
- Further analysis will be done for final design decisions
- Autonomous algorithm development and testing

Gantt Chart

Team 10 Autonomous ATV (GOLIATH)

ACTIVITY	Start date	End date	complete
Ice breaking	30-Aug	10-Sep	100%
Sponsor Meeting		10-Sep	100%
Needs Assessment	10-Sep	27-Sep	100%
Obtain sensors		27-Sep	100%
Code of Conduct	16-Sep	4-Oct	100%
Product Specs	4-Oct	11-Oct	100%
Sensor/ROS/QNX Research	11-Oct	24-Oct	50%
Sensor mount Concepts/CAD	11-Oct	24-Oct	75%
Heat Removal Concepts	11-Oct	24-Oct	100%
Sensor Interface Concepts	11-Oct	24-Oct	50%
Midterm Concept Design	11-Oct	24-Oct	100%
Midterm Presentation		24-Oct	100%
Install Linux,ROS,QNX			50%
Concept Decision/Analysis			0%
SICK Laser Coding			0%
GPS Coding			0%
IMU Coding			0%
Peer evaluation 1		29-Oct	0%
Sensory Data Testing			0%
Computer/Sensor com test			0%
Refine Designs			0%
Midterm 2 Intermin Design		13-Nov	0%
Midterm 2 Presentation	12-Nov	19-Nov	0%
Finalize Designs			0%
Peer evaluation 2		26-Nov	0%
Order Parts			0%
Final Report		6-Dec	0%
Final Presentation		6-Dec	0%



Sources

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Questions?

Comments?