College of Engineering
Department of Mechanical & Industrial Engineering

College of Engineering
School of Electrical Engineering & Computer Science

To Predict ▶ To Design ▶ To Perform

ME, ECE Capstone Design Programs

Team 72: IEEE Region 5 Robotics Competition

Chris Chuang — ME
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John Kennedy — EE
Wes Madere — EE
William Spencer — EE

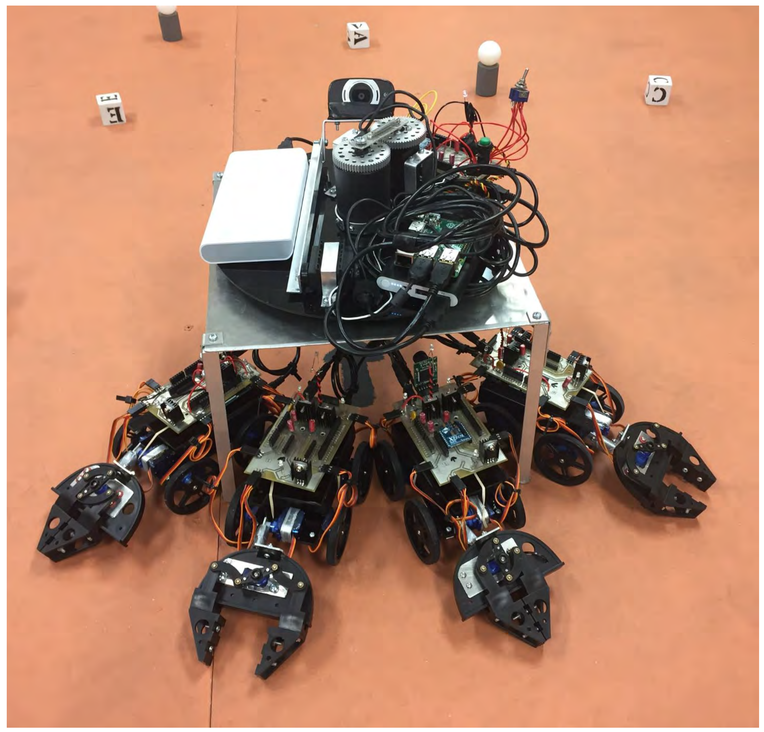
Objective Statement:

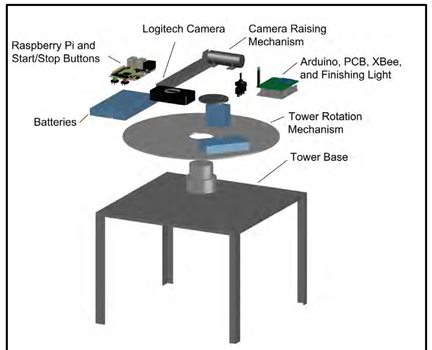
Design and build an autonomous robot(s) to identify and transport labeled blocks to matching labeled slots in a “mothership” receptacle while avoiding obstacles.

Design Concept:

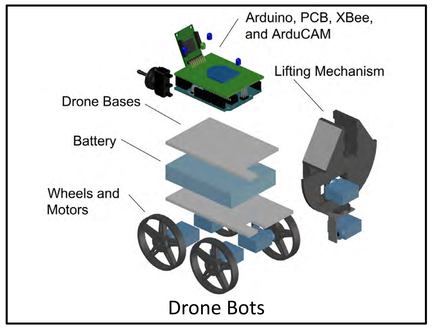
The design is separated into a central "Tower" robot and four "Drone" robots. The Tower robot is equipped with a camera on a rotating disk that can survey the playing field, and from there give orders to the “Drone” robots to complete all tasks in a round.

Constraint	Value
Maximum Weight	40 lbs
Maximum Size	1 cubic ft (before round begins)
Maximum Height	1 ft (2 ft after round begins)
Time limit	6 minutes per round





Tower Bot



Drone Bots

Manufacturing Processes:

- Operating a lathe
- Water jet cutting
- Dremel cutting
- Drilling with drill press and handheld drills
- PCB manufacturing
- Soldering PCB components
- Tower Robot and Drone Robots assembly

Computation and Control Structure

Tower Raspberry Pi		Tower Arduino Mega
Visual object identification for all competition objects Letter identification neural computing Map generation Pathfinding and collision detection Error identification and management Instruction generation and transmission	USB Serial Communication	Tower rotation and camera arm lift servo motor control Communications routing between all components of the network

XBee Wireless Communications

Drone Arduino Uno
Receive, interpret, and manage instructions
Movement and clamp servo motor control

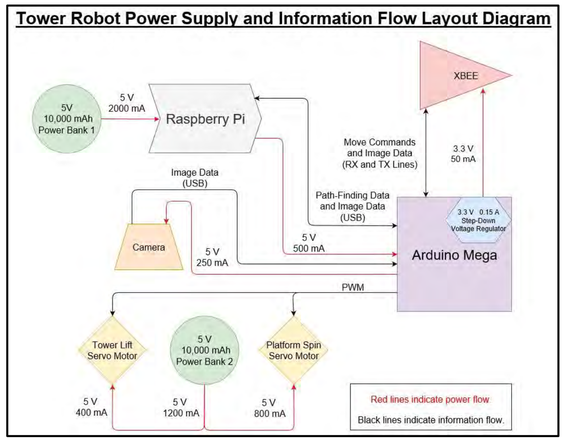
Engineering Analyses:

- Component Testing
- Circuit Testing
- PCB Ground Analysis
- Stability Analysis
- Neural Network Training
- Drift Compensation Analysis

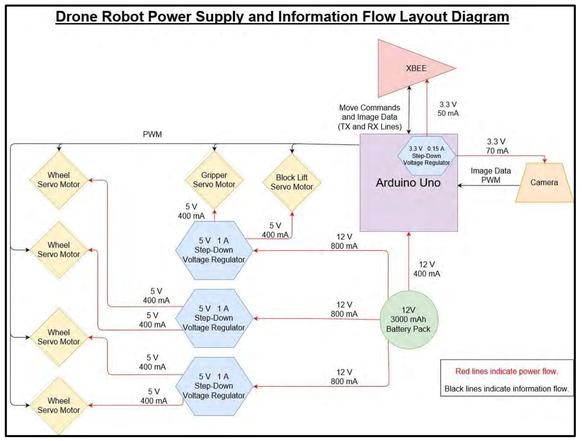
Safety Measures:

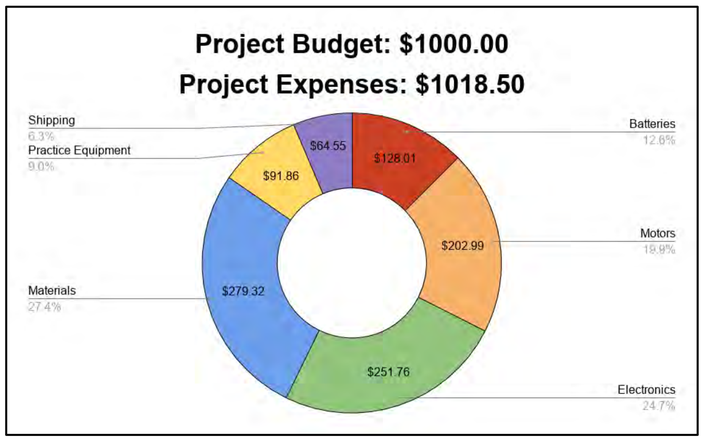
- ON/OFF Switches on Every Robot
- Emergency Stop Button on Tower Robot
- Fuses
- Heatsinks

Tower Robot Power Supply and Information Flow Layout Diagram



Drone Robot Power Supply and Information Flow Layout Diagram





August	September 2018	October 2018	November 2018	December 2018	January 2019	February 2019	March 2019	April 2019
• Preliminary concept generation	•Evaluation of concepts and selection of best concept	•Subsystem research on the various components of the chosen design	•Analysis of the robots' systems to determine areas of improvement	•Completion of the project prototype design	•Acquired Components •Assembly of practice equipment	•Assembly of the physical components of the robots	•Data collection for software development •Fixing any issues with the physical components of the robots	•Testing the robot under competition conditions to improve efficiency •Complete the project

Sponsor: Mr. Gabriel DeSouza

Adviser: Dr. Jerry Trahan