

ME, ECE, BE Capstone Design Programs



Robotic Tank Cleaner

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Objective

The goal of this project is to create a robotic machine to minimize the amount of time personnel have to spend inside of tanks vacuuming hazardous liquids and small amounts of solid residues from internal tank floors.

Background

- Operators enter tanks in hazmat suits with supplied air in order to push excess chemicals towards vacuum hose and shovel polymers
- Chemicals made in batch processes and tanks cleaned in bulk
- OSHA Safety personnel need to be present during process
- Those chemicals are Divinylbenzene, Vinyl toluene and other monomers

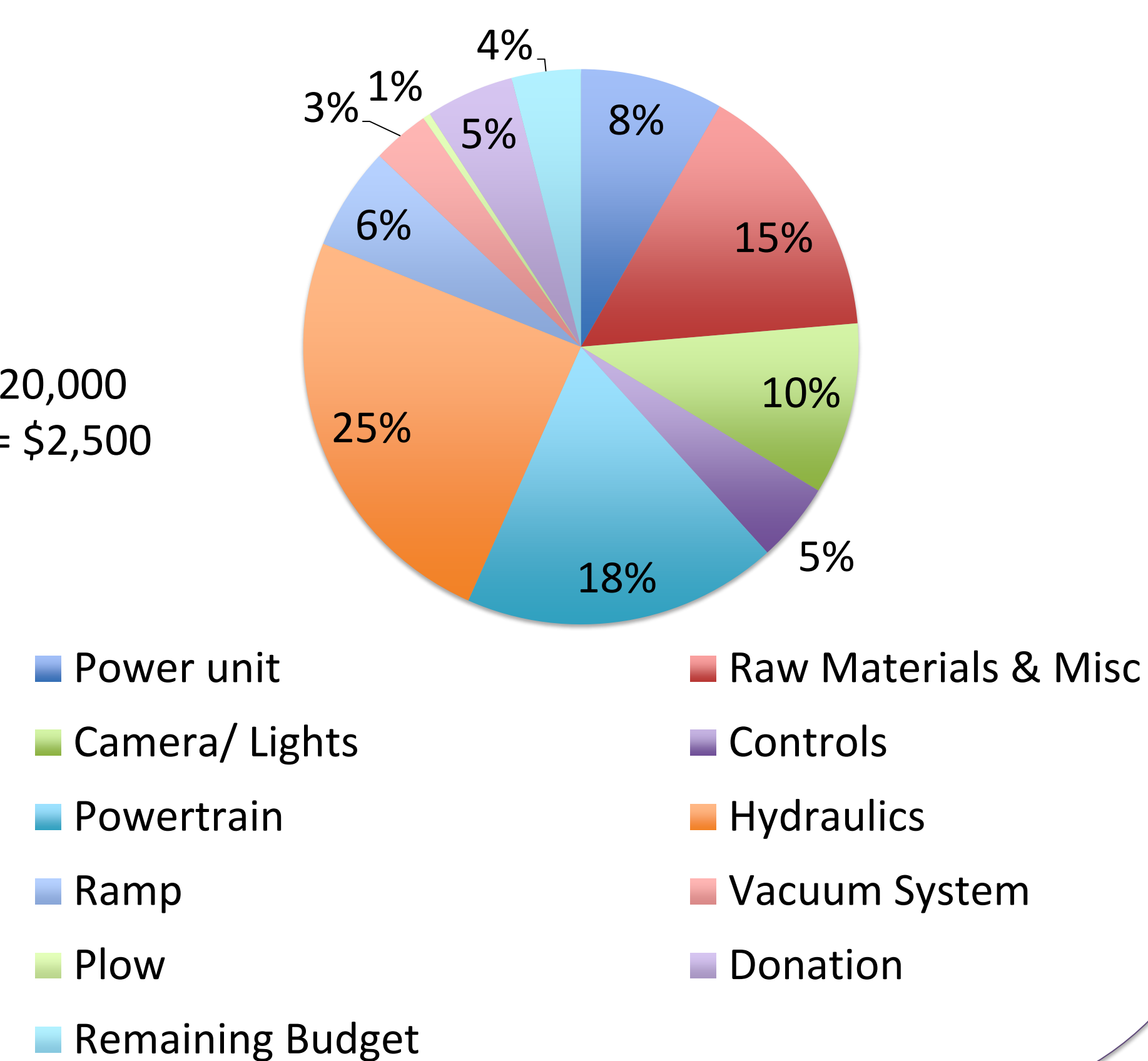


Constraints

- 20-80ft Diameter tanks
- 24" man-way
- Entryway 2.5-3 ft off of the ground
- Intrinsically safe
 - No sparks
 - Low heat
- 2-3 man operation
- Cut working time in half

Budget

Total Given Budget = \$20,000
Total Amount Donated = \$2,500



Features

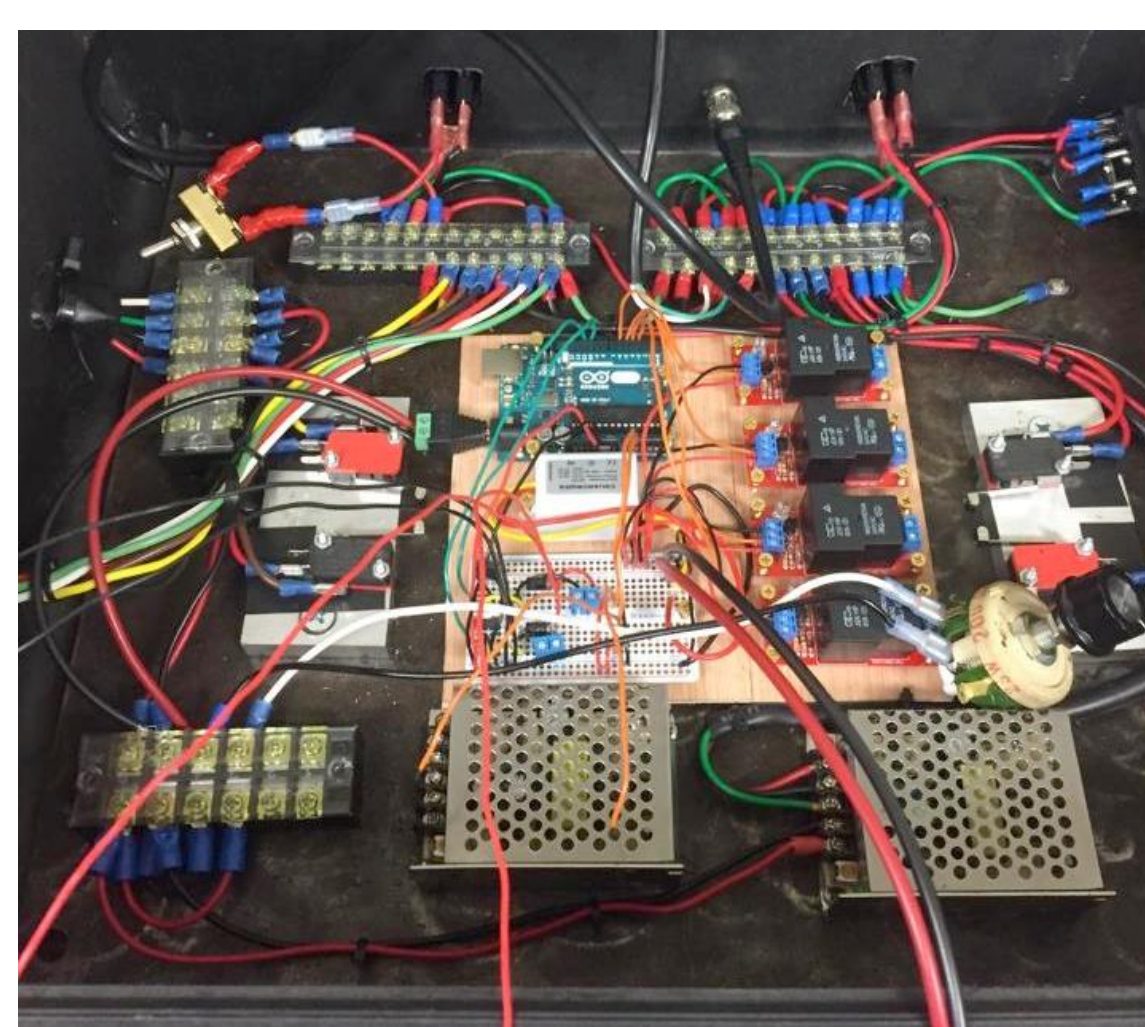


RTC the Tiger System

- Detachable plow
- Rubber Insert Tracks
- Quick Connects to Motors
- 90 degree vacuum connection

The Ramp

- Extendable Legs
- Aluminum Construction
- Expanded Metal for Traction
- Ramp Extension for Entrance



Electronic Controls

- Skid Steer Controls
- Speed and Directional Control
- Intrinsic Camera
- Intrinsic Light

Hydraulic board design

- Open Center Solenoids
- EFC Throttle valves
- Quick connects to motors
- Manual flow Control valve
- Pressure gauge



Testing Results

- **Electrical component testing (Camera)**
 - Visibility of the camera
 - Illumination of the light
 - Controlability
- **Suction Test**
 - Detachable suction head
 - Vacuum 90% or greater of liquid left
 - 5 inches of liquid removed
 - Vacuumed 6,000 gal in 20 minutes.
- **Material push test**
 - Test motors ability to push solids with blade
 - Measure of enough torque
- **Drive Tests**
 - Test that vehicle can drive through the manway and can pull the load of umbilical without slipping



Safety

- OSHA requires Hazmat gear to enter these chemical tanks
- Hearing protection required for noise above 85 dB
- Air mover required to move inert gasses away from open manway
- Safety rescue team require for tank entry
- Air purity must be checked before entry is allowed