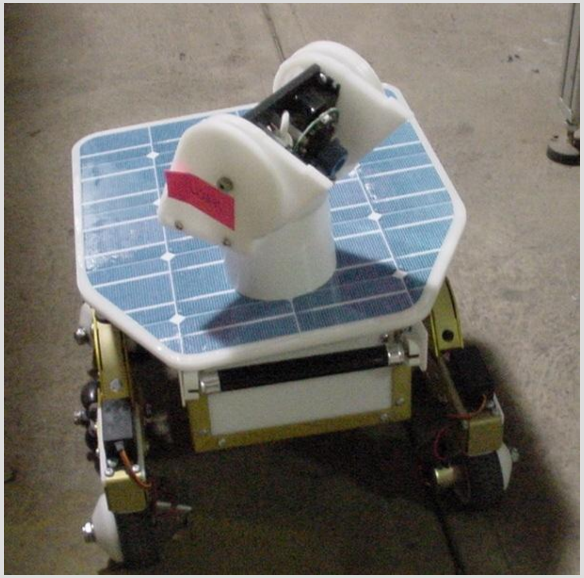
Urban Search and Rescue 2011

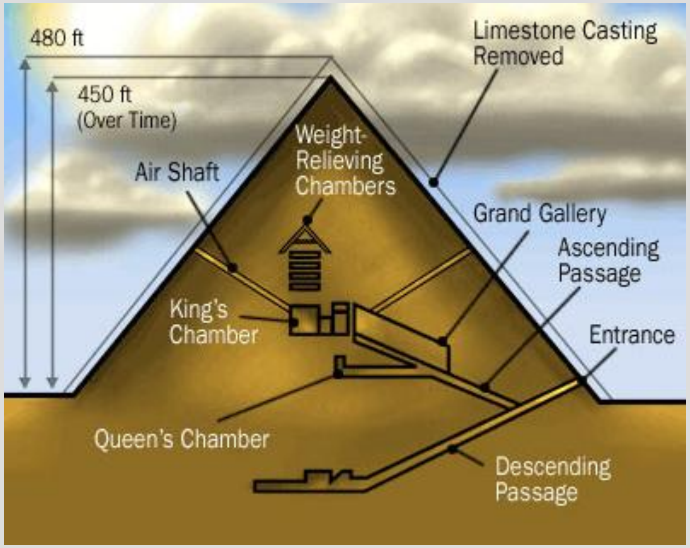
Lead TA's: Victor Marmol and Samantha Tan

Purpose



Carnegie Urban Rescue Force (CURF) has started an initiative with the General Robotics Class of Spring 2011 to develop a fleet of highly compatible robots to help in the rescue effort of:

Howie in Egypt!



- Howie and some of his students were trapped inside of a pyramid in Egypt while they were performing experiments.
- Cause is unknown, information is limited.
- Updates in a few weeks.

Goal

- Design, build, test, and run a robot able to remotely perform urban search and rescue.

Design Criteria

- Size Constraints
  - Width: 7.0 *in*
  - Depth: 8.5 *in*
  - Height: 6.0 *in*
- Tele-Operation
  - Under “Sample Programs” in RobotC
- Vision System
  - Camera supplied (details on the website)
- Parts
  - 3 LEGO motors and $20 spending limit (not funded by the course)
  - All extra parts must be approved by the checkpoint
- Co-Operation
  - Teams of two, your choice of teams

Parts of the Lab & Important Dates

Proposal (March 15)

Design, Extra Parts (prices), meet with TA's

Checkpoint (March 22)

Size constraints, rubble, climbing, vision, drop tests

Reveal this year's world map

USAR Demo (March 29)

Team demos throughout the day

Must vacate REL before March 29 0:00

USAR Finalists (March 30)

Come and watch the final four robots compete SOLO for GLORY!

Note: Only group members present at ALL stages of evaluation will receive grades

Design Proposal

- Write-up:
  - Basic schematics
  - Descriptions
  - Special features & Abilities
  - Metrics for evaluation
  - Sample and rubric on the website

- Following this outline is Highly Recommended.
- Note: You cannot continue on with the prototyping phase if your design proposal does not meet these requirements

Metrics of Design

- Qualitative analysis
  - Mobility, user friendliness, coolness
- Quantitative analysis
  - Top speed, ground clearance, torque
- For the proposal, we would like you to think numerically.

Design Tips

Drive Trains

- Speed vs Torque
- Maneuverability
- Driving in reverse
- Small rubble's effect on system
- Robot may not intentionally damage world

  (NO TACKED WHEELS)

Off Road Examples

- Land Rover
- Jeep
- CMU Boss
- Tanks
- Moon Rover
- Mars Rovers
- ATVs

Center of Gravity

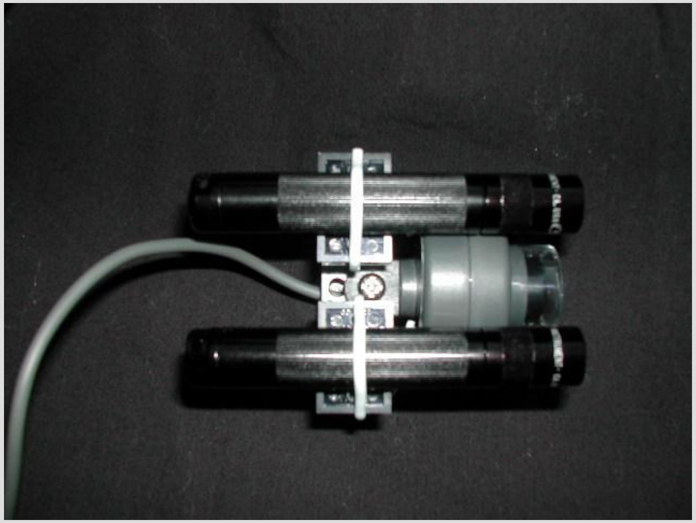
- Masses
  - LEGO motors
  - Added mass (batteries, fishing weights, etc.)
- High center of gravity is bad for climbing
- Traction on front, center, or rear? Depends on the drive train.

Mechanical Robustness

- Weight distribution and support
- Gears and moving components
- Rubble, shocks, drops, high torque situations
- Possible suspension solutions
- No unsecured parts
- Zip Ties

Vision/Lighting

- Blind Spots: Pan and Tilt
- Visibility: Lighting System, Camera Mount
- We recommend a set of ultra-bright LEDs



Control

- Depth and velocity perception are distorted through the camera
- Practice driving through the camera
- Movable camera
- Range of vision vs maneuverability
- Control interface
- Possible intelligent features (self-centering camera, feedback control, tip detection, etc...)

Testing

- Torque and traction
- Robustness of drive mechanics
- Drop test
- Various terrain
- Ground clearance
- Center of Gravity and climbing
- Turning and driving in reverse
- Lighting is very important
- Team communication and strategy

Checkpoint (previous years)

- General Observations from Checkpoints
  - Incline
    - Nearly everyone was able to complete this obstacle
  - Bumps
    - Nearly everyone was able to complete this obstacle
  - Stairs
    - Some teams were not able to complete this obstacle but it is highly recommended that you do.
  - Rubble
    - Some robots got hung up on the rubble
  - Narrow Corridor
    - Nearly everyone was able to complete this obstacle
  - Low Light
    - Only a handful of teams completed this check point

What Didn’t Work

- Low ground clearance
  - Robots getting hung up on rubble and bumps
- Light weight robots
  - Robots don’t weigh enough to produce proper traction
- High center of gravity
  - Robots begin to climb stairs and inclines only to flip over
- High torque wheels/treads
  - Torque is good but so is speed
- Size constraints
  - If your robot changes dimension be sure you can still fit through narrow corridors
- Fragile Designs
  - If you lose any part of your robot during the competition your run is over
  - Grinding and/or clicking noises are never a good thing
  - Two words: Drop Test

Questions?

- E-mail the TAs