Georgia Tech Night Rover

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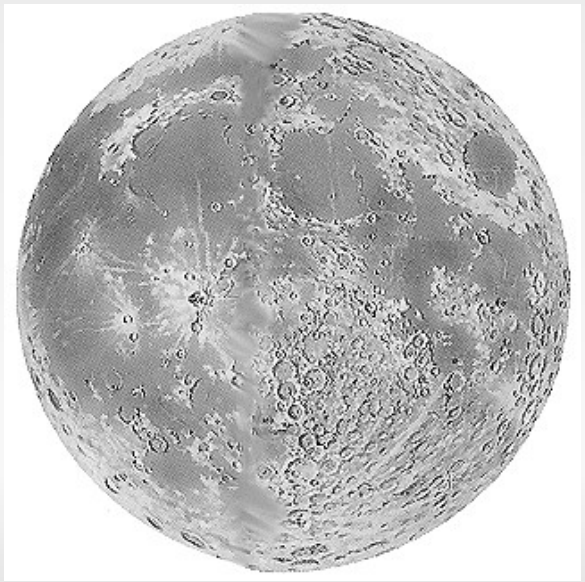
Night Rover Purpose

- NASA sponsored Night Rover Centennial Challenge
  - Moon has a 28 earth-day light/darkness cycle
  - New technologies/techniques for solar energy harvesting
- Clean Tech Open: NASA partner for development of clean technologies

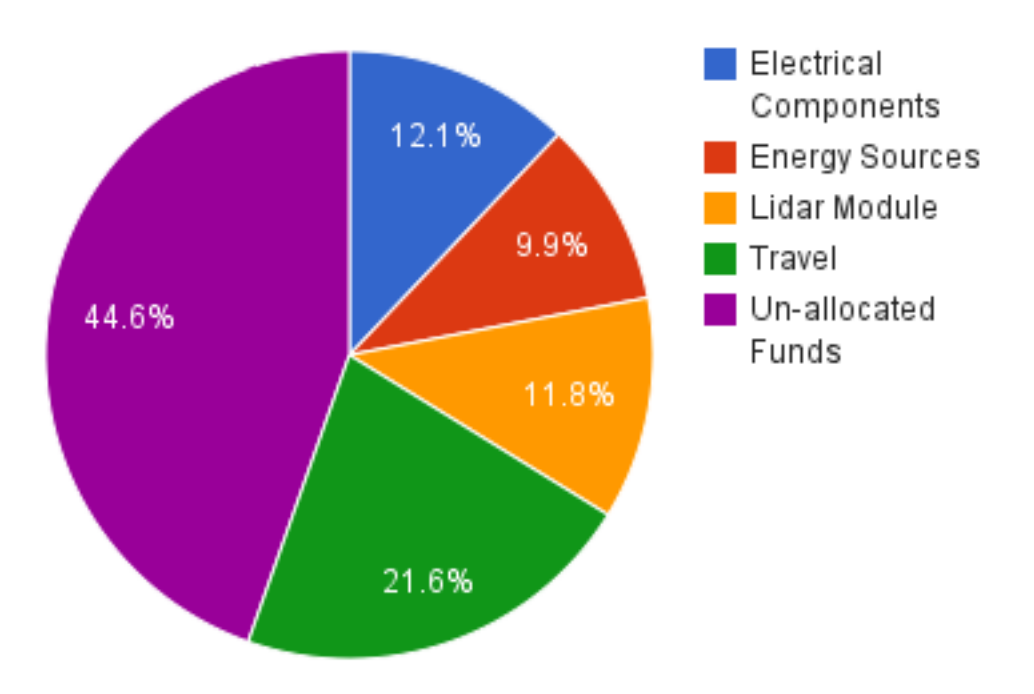


Night Rover Goals

- Defined for Intel Cornell Cup:
  - Travel maximum distance over 24 hours
  - Match scaled (1/5) average velocity of Mars rovers
  - Design electrical system such that:
    INPUT = OUTPUT
- Defined for NASA Challenge:
  - Maximum distance over 72 hours

Rover Progress

- On time with feasible deadlines!
  - www.GtNightRover.com/?q=sched
- Within budget!



Rover Progress

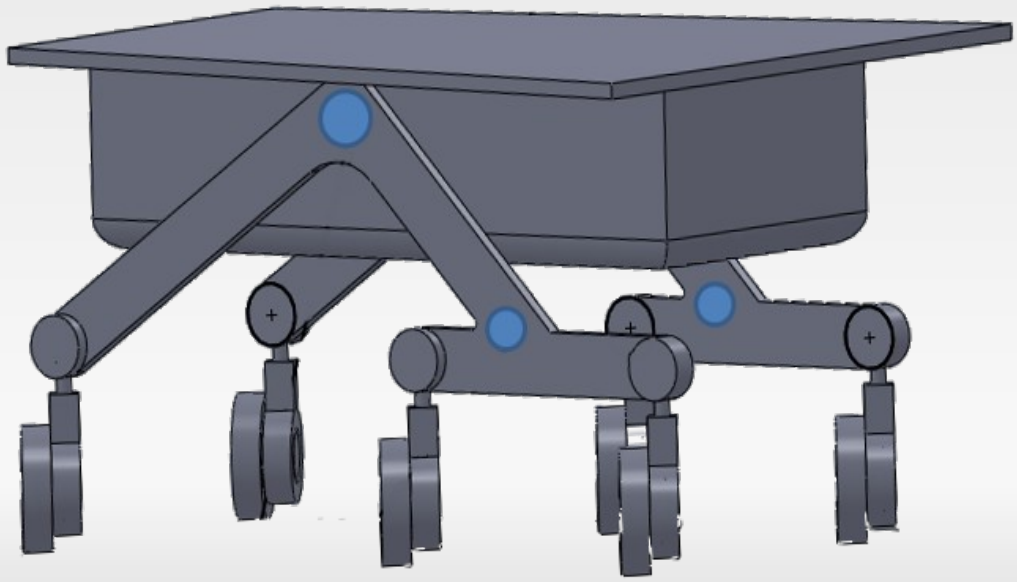
- Eletrical Team
  - Circuits designed and components ordered
- Software Team
  - Adapting/writing code for algorithms to handle input from selected electrical components
- Structural Team
  - CAD and machine parts

Base Locomotive Functionality

- Motor controller
  - Forward, reverse, turning
  - Maintain sufficient average velocity
  - Communication with path planning module
- Real time collision detection
- Basic path planning
  - Compass or random decisions of obstacles

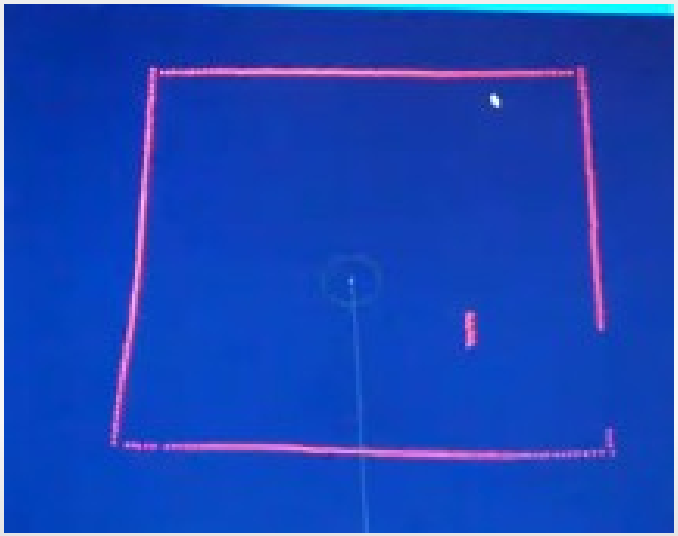
Structural Specifications

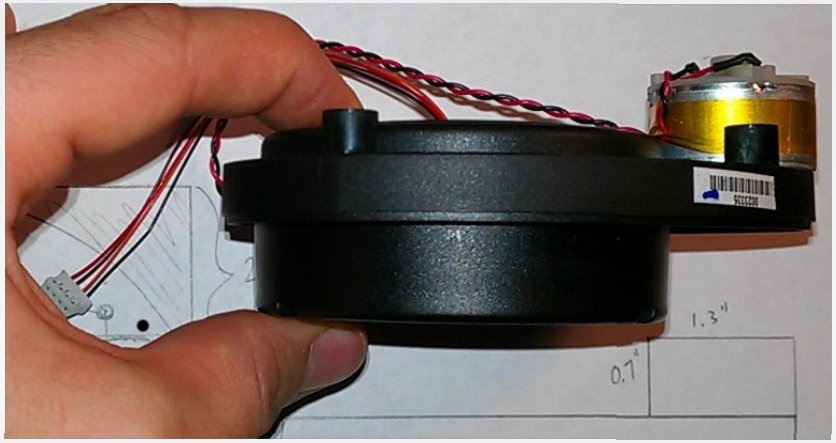
- Rocker-Bogie suspension
- 6 independently driven wheels
- Closed body design
- Bottom mounted Lidar module



Navigation Specification

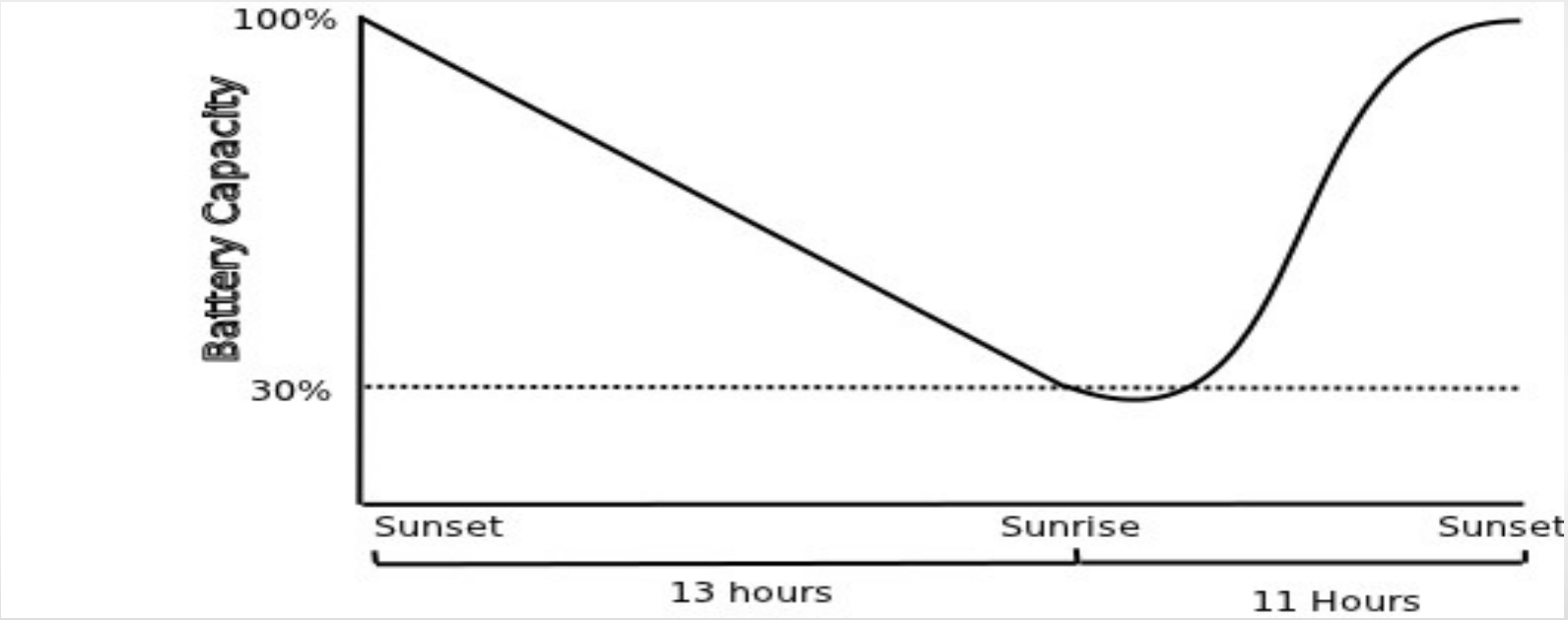
- Path planning/navigation uses 2D Lidar distance readings
- Robust graph search algorithms though 2D plots using OMPL and Boost
- 2D map build from combining sequential graphs





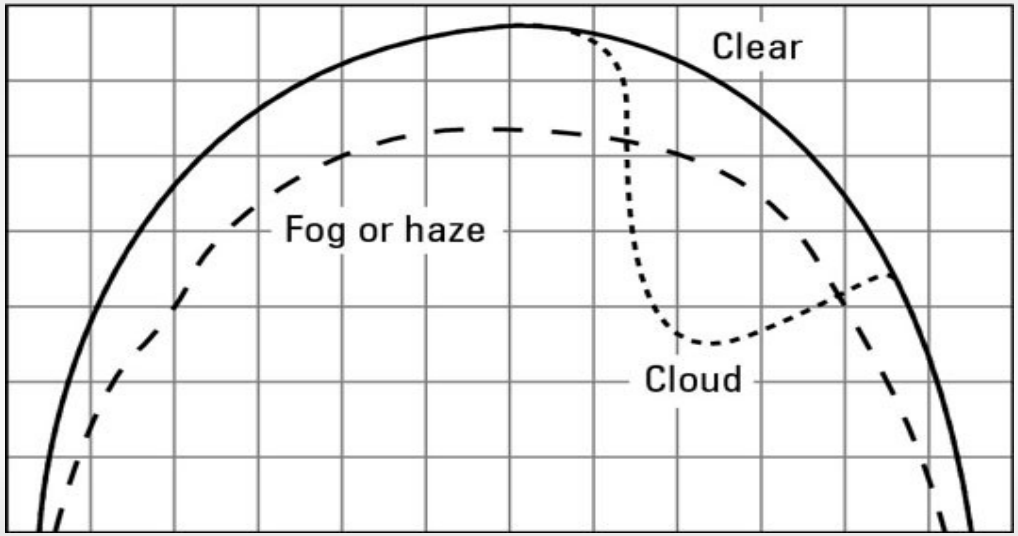
Base Solar Harvesting Functionality

- Solar Harvesting
  - Power controller
    - Enable/disable battery charging
  - Sufficient wattage to return batteries to 95-100% capacity

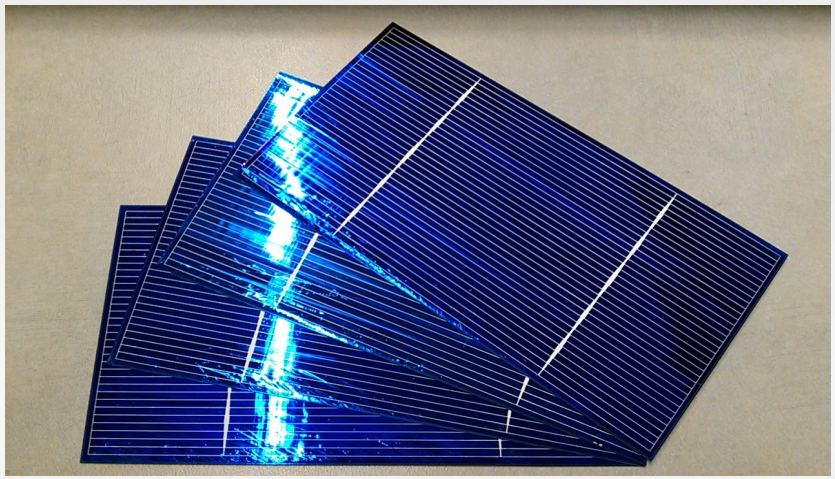


Solar Harvesting Specification

- Custom built flat mounted solar panel
- Sufficient power for electrical systems and recharging batteries during day light
- Requirements calculated for earth's light/darkness cycle

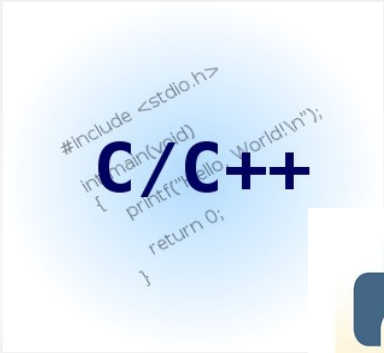


Sun Light Intensity During Daylight



Production Testing Specifications

- Functionality testing in lab setting
  - Mechanical: level carpet or tile
  - Electrical: labs with oscilliscope/multimeter
  - Software: Atom board development environment



Fullscale Testing Specifications

- Full scale tests on a smooth level surface on optimal day
  - Parking deck or parking lot
  - Randomly placed obstacles
  - Clear sunny day

Complications and Concerns

- Scaled size down 1/5th to remain within budget
  - Multiple iterations of design and parts selection
  - More manageable for testing and travel
- Unreliable reporting of electronics power consumption
  - Monte-Carlo simulations for solar panel
  - Experimental readings for actual parts
  - 5-10% over-estimation in power budget to handle uncertainty

Complications and Concerns

- Desired development environment for Atom Board
  - Booting from USB or SD card
  - Linux or embedded OS (Windows XP as fall back)
- Minimize power consumption of Atom Board while maximizing computation power
  - Compute in low power state?
  - Board and OS's responsiveness to sleep/wakeup signals

Complications and Concerns

- Power supply provides single point of failure
  - Careful not to overcharge batteries
  - Rejected two battery design due to complexity
- Time constraints
  - Feasible deadlines
  - Weekly meetings to report progress
  - Each aspect of project completed by team of two for accountability