Good Samaritan Mini
Urban Search and Rescue Robot

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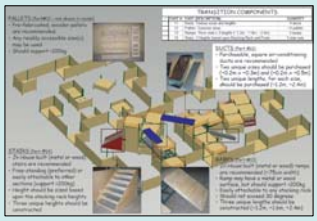
What is the RoboCup Urban Search and Rescue Competition?

The yearly competition is sponsored by **NIST** (National Institute of Standards and Technology).

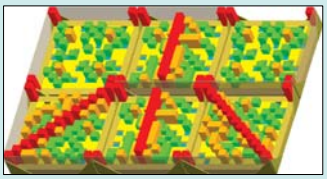
The arena consists of three regions each with progressing difficulty.

The robot starts in the easiest arena and makes it's way to harder areas where more points are earned.



A rough drawing of the competition arena.

Obstacles include: Pallets, Stairs, Ducts, Ramps and Step Fields



Random step fields that the robots must traverse

Step fields are a way of quantitatively representing rubble, such as broken concrete.

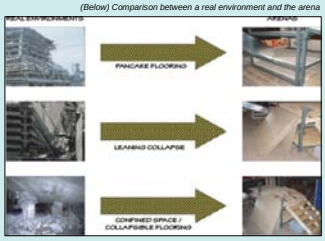
Robots score points by finding "bodies" and identifying which, if any, vital signs are present.

The more bodies that are located and the more vital signs that are correctly identified, the more points a team receives.

Mock "bodies" can: Move limbs, emit CO2 gas, emit heat, make noises

(Above) Mock body with vital signs that the robots must identify

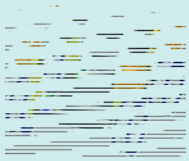
(Below) Comparison between a real environment and the arena



Eventually the technologies developed as a result of the competition will be used in real disaster situations to save lives and protect rescue workers.

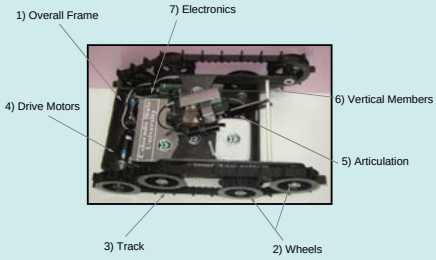
What is the Good Samaritan Mini?

The Good Samaritan Mini is a remote controlled robot designed to compete in the RoboCup Urban Search and Rescue Robot competition and eventually be able to be deployed into collapsed buildings and other hazardous environments.



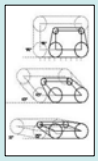
Over the past few years several iterations of the Good Samaritan Platform have been built by CSU engineering students; **Our job is to shrink the 2005/2006 design by roughly 50%.**

There are seven major areas of redesign, these areas are listed below in relation to the 2005/2006 platform.



Why build a Mini Platform?

Changes to the RoboCup rules in 2006 defined three distinct regions to the competition arena. A region designed for large robots, a region designed for mid-size robots, and a region designed for small robots.



Size comparison

While the current Good Samaritan platform performed well, it wasn't possible to fit into some of the smaller confined spaces of the arena and detect victims in these areas. This is where the Good Samaritan Mini platform excels.

Advantages

Can fit into spaces nearly 50% smaller than the current Good Samaritan Platform

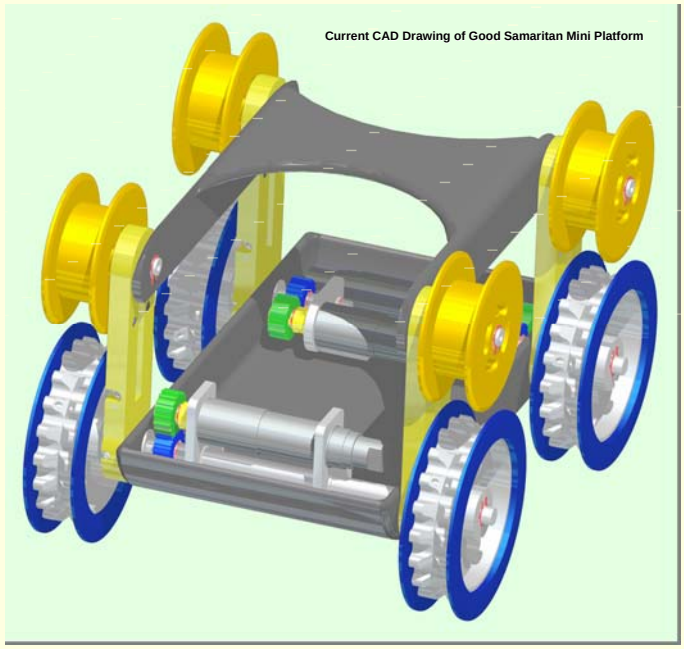
Lighter weight for easier transportation

Disadvantages

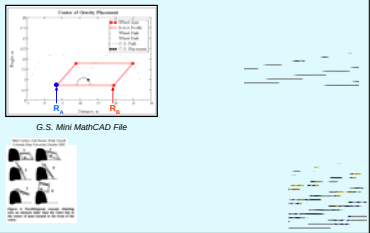
Harder to traverse larger obstacles such as stairs

Smaller size reduces the number of sensors that can be placed on the platform

Current CAD Drawing of Good Samaritan Mini Platform



Design Analysis



G.S. Mini MathCAD File

Shown below is an overview of the electrical system

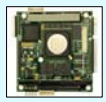
Redesigned motor driver (highlighted-right) provides a compact footprint while implementing a PID closed-loop motor control system.

Highlights include:

Parvus Single Board Computer (lower-right)

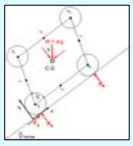
Sensoray PC/104+ Frame Grabber

USB OrcBoard for Analog and Digital IO



Lithium-Polymer batteries, shown left, provide high power and have a light weight

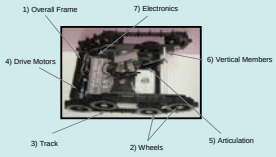
Torque required = 300 ozf*in



FBD – Reaction Forces

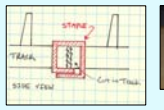
Torque calculations were done to determine motor sizing

A motor manufactured by Port Escap was selected based on calculated requirements

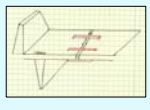


Due to high loads on the vertical members, impact analysis was done in Pro/E

Final member design is shown on the right



Track availability is extremely limited which meant we had to come up with a method of customizing an available product by cutting it to length and stapling it back together



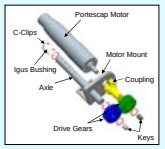
Wheels are custom machined out of Nylon 6 (glass reinforced)

Wheel sizing is very important for both ground clearance and center of gravity placement

We built several physical models to help determine optimal wheel sizes based on the tracks and platform size

Several design iterations were done before we decided on a design consistent with the drive motors. This simplified the complexity and reduced our parts count.

Geared DC motor allows the top member to articulate which allows the robot to climb over larger obstacles



Summary

Goal:

Build a functioning robot to compete in RoboCup: Urban Search and Rescue 2007.

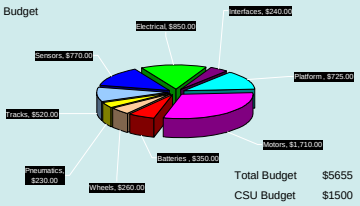
Fall 2006:

Finish design and simulated testing of Good Samaritan Mini Platform. Finalize part selections.

Spring 2007:

Machine, mold, and order parts to assemble a fully functional Good Samaritan Mini Platform in time for testing and RoboCup 2007!

Budget



Total Budget	$5655
CSU Budget	$1500
Donations	$2500
Deficit	$3155

References:

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Parvus Cooperation (http://www.parvus.com/products/OEMSolutions/CPUBoards/CPU-1433/)