Team STS

Sulfur Tungsten Silver

UNIVERSITY OF MARYLAND
A. JAMES CLARK SCHOOL OF ENGINEERING

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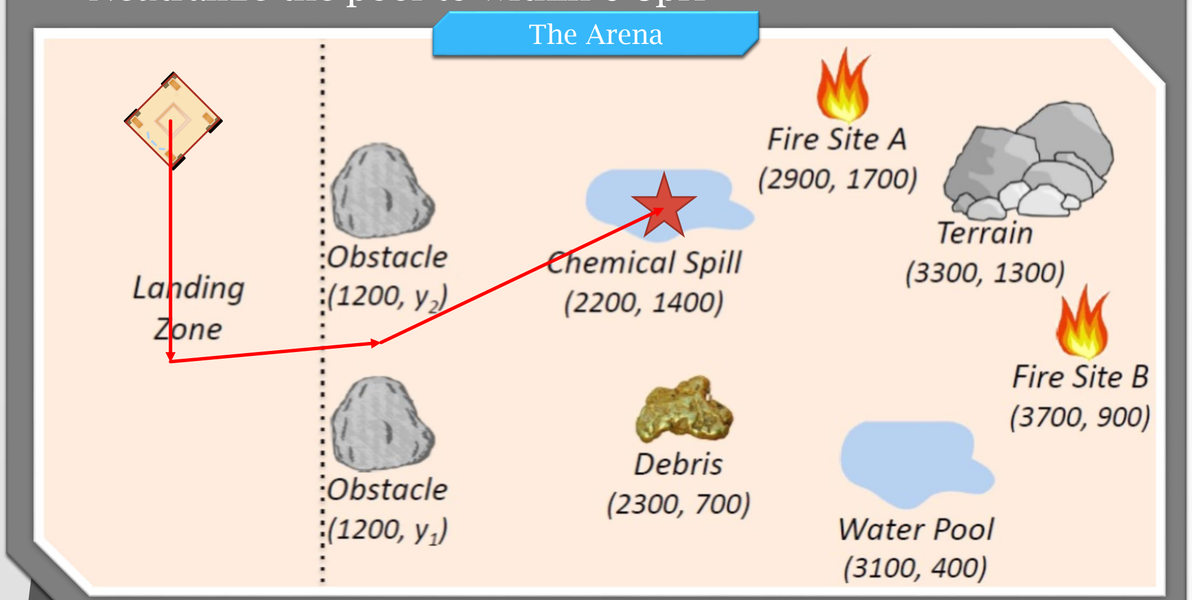
ENES 100 – 0601 | Evandro Valente | Spring 2016

Mission

Design and build an autonomous vehicle which can:
- Navigate to the mission site within 250mm
- Measure and transmit the pH of a pool of water within .3 pH

Advanced Objectives:
- Collect a 10-15mL sample of the polluted water
- Neutralize the pool to within 6-8pH

The Arena



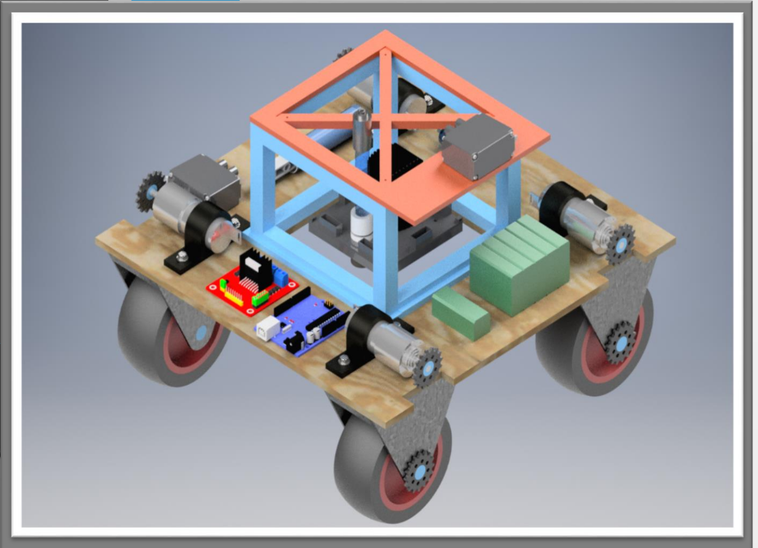
Design

The OSV is designed to accomplish all objectives and it functions around a platform based delivery system. At the middle of the OSV, there is a cutout where a platform with instruments lowers into the pool. The major design implications include:

Locomotion:
- Uses a chain and sprocket system to drive wheels with motors above (so OSV can drive over pool)

Mission:
- The OSV navigates to the pool and centers itself above it
- A platform with the pH meter, submersible pump, and tubes lowers into the pool
- pH meter takes a reading and transmits it, completing all base objectives
- A solenoid triggers, releasing a tensioned syringe which draws a sample from the tube
- To neutralize, a motor pulls off a stopper from a syringe full of basic solution, which dispenses through the tube
- Simultaneously, the submersible pump mixes the pool

Initial CAD



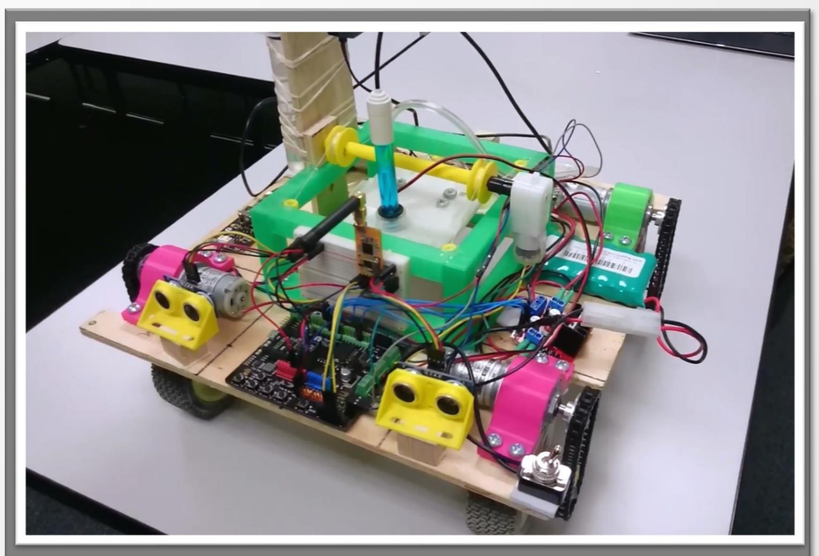
Preliminary systems design without advanced objective capability

Design process

Adapted to physical limitations of components:
- Created a mechanism to securely attach the sprockets to the axles
- Consolidated power system to make room for components
- Added relay switches to activate system mechanisms

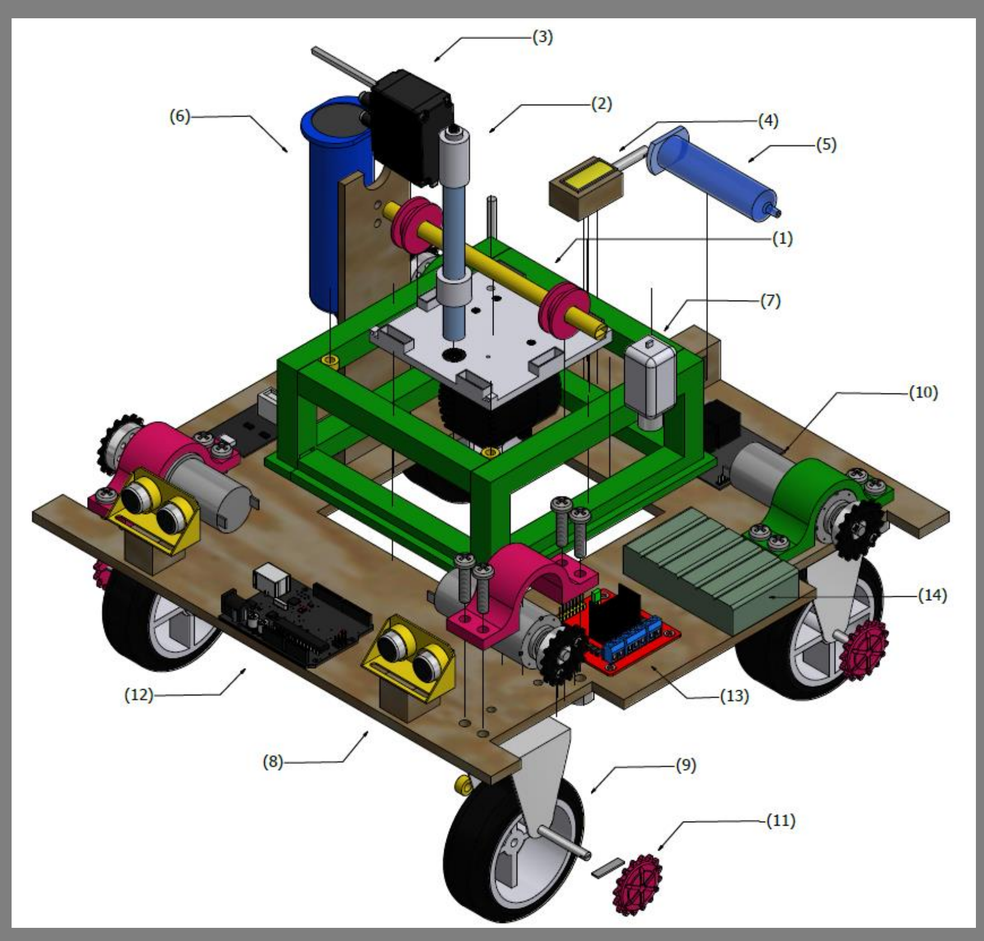
Redesigned layout to accommodate test results:
- Changed how base solution is dispensed after determining accuracy was irrelevant
- Shortened tubes to help drain base solution

Final Product



Completed functioning OSV with all components and objective capability

Diagram



#	Part Description
1	Lifting platform
2	pH Meter
3	Stopper pull motor
4	Solenoid
5	Sampling syringe
6	Base syringe
7	Platform motor
8	Ultrasonic sensor
9	Wheel
10	Drive motor
11	Sprocket
12	Microcontroller
13	H-Bridge
14	7.2V NiMH battery

Performance

The OSV was the highest scoring OSV for chemical in Spring 2016 with a cumulative score of 135.

Scoring run 1:
- Accomplished both base objectives

Scoring run 2:
- Accomplished both base objectives
- Neutralized the pool
- Drew a 9mL sample (1mL away from goal)

Lessons learned

The platform design allowed for easy completion of mission objectives, but introduced difficulties for locomotion. Custom parts had to be designed and hand built to accommodate the increased complexity, and only at the end did we have the OSV moving reliably. Main takeaways are:
- Do not make what can be simple, complicated
- Consider all implications when choosing a design
- Ensure basic functionality before focusing on more advanced features