Design and Performance of an Autonomous Rover with Sensing Arm

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Objective
With limitations regarding human activity in inhospitable environments, it is important to have alternatives for navigating different terrains. In many instances, it is important to have adaptable navigation systems that do not require user input to avoid obstacles. For this robotics challenge, the ideal solution is to develop an autonomous rover with various hardware and software aspects that can attempt to complete the tasks given.

Design Overview

Chassis:
- Machined Aluminum body
- 3D printed ABS plastic wheels inspired by the Curiosity rover
- Spring loaded rear suspension

Electronics:
- 2 Arduino Uno Microcontrollers
- 3 Ultrasonic Sensors
- SparkFun 9DOF Compass
- Sparkfun ArduMotor Motor Shield Driver
- 2 DC Rear Drive Motors
- 2 180 Degree Front steering servos
- 2 11 V Li-Po Batteries

Problem Solving

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
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<tr>
<td>Due to constant interference, sensor outputs would be noisy and results weren’t accurate.</td>
<td>Shielding tape was used to block noise interference.</td>
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<td>Stepper motors were difficult to program for steering purposes.</td>
<td>Servo motors were used as an alternative for steering purposes.</td>
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<td>Wheels would detach from servo motor</td>
<td>A temporary solution was used to keep wheels intact which included gluing them with JB Weld</td>
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<td>Arduino board did not have enough pins for all of our electronics</td>
<td>A second Arduino board was integrated with the main one to avoid with issues</td>
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<td>Voltage regulators were heating up</td>
<td>Heatsink was added in order to absorb the unwanted heat in the electronics</td>
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<td>Sand in the wheel and motor areas</td>
<td>Pins were added to the inner wheel in order to scoop out sand as it moves</td>
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<td>Steering servo motors were jittery and were not turning smoothly</td>
<td>Capacitors and ferrite beads were added to the wires to smooth out servo movement</td>
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Logic Flowchart

Conclusions/Lessons Learned
- Due to time constrains, it is best to work on the most essential components first. Our team often found itself working of different systems simultaneously which took more time.
- Order extra parts just in case, its always best to have it and not need it than not have it and need it.
- Use proper adhesive techniques.
- Spend more time on electronics rather than manufacturing, it takes the most time.

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