Techno-Mech-Katticus

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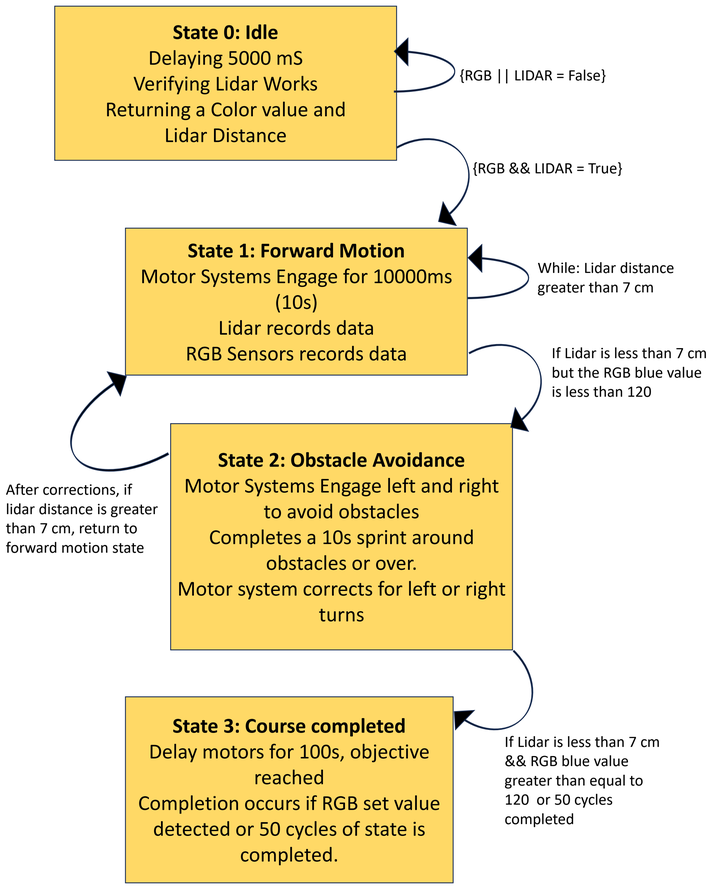
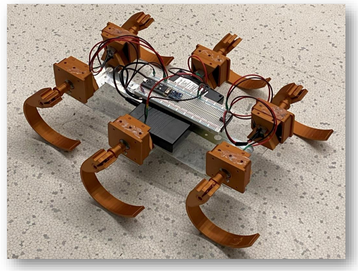
Problem Statement

The design was specific for the Colorado Space Grant Consortium (COSGC), to compete in the 2024 Robotics Challenge. This team explored autonomous movement using legs, time of flight and RGB sensing. The design focused on autonomous movement capable of navigating and traversing mars like terrain and utilizing embedded systems libraries and hardware to communicate and initiate decision making at the robotic level.

State Machine



Design Iterations and Testing

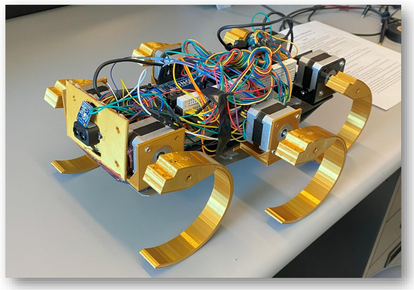


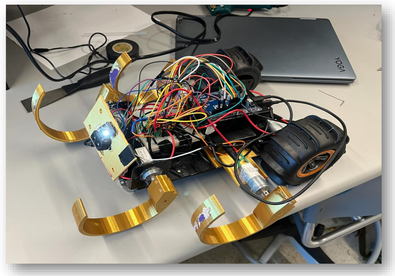
Iteration 1

- Acrylic chassis.
- 3D printed PLA legs and brackets.
- Six DC motors, and driver chip.
- One 12V battery pack powering motors and ESP32.
- TEST: 3D printer motor shafts are easily stripped by the motor.

Iteration 2

- Chassis made from plastic
- Six stepper motors on PLA brackets, connected to new driver chips.
- 3D printed PLA golden legs and front plate to hold Lidar and RGB.
- Strong metal couplings hold the legs.
- TEST: Stepper motors aren't strong enough, sensors work fine.



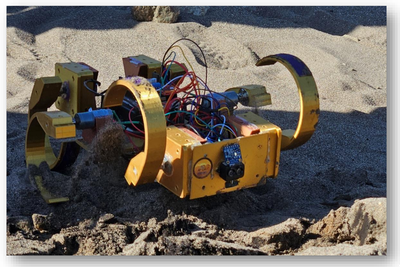


Iteration 3

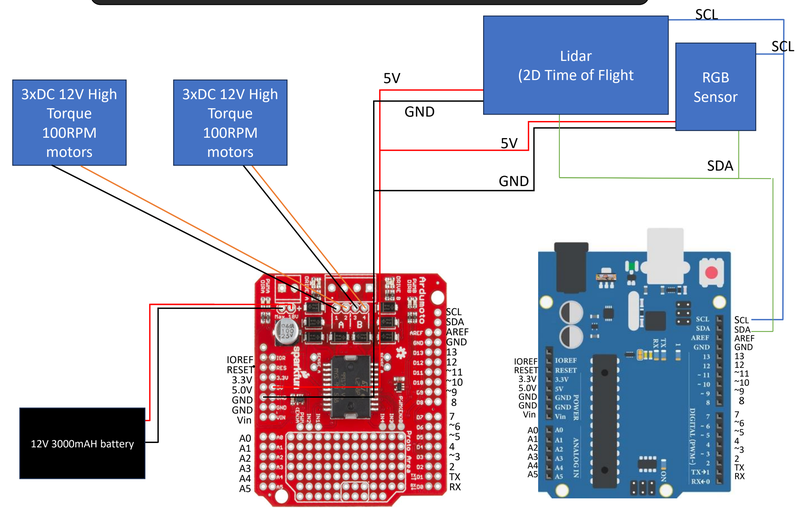
- Reinstalled original DC motors.
- Replaced back legs with tires for added strength.
- TEST: Finished one obstacle course on the tile floor in the lab.
- SAND TEST: Still can't walk in the sand, there could be a weight issue.

Final Iteration

- Plastic sheet chassis, with added middle plate for center motors.
- No tires, all six legs are installed.
- New motor driver chip distributes power evenly to DC motors.
- Lidar and RGB still working.
- TEST: Successful traversing terrain.



Wiring Diagram



*Connections Annotated by Numbering and Lettering.
*Ardumoto board is seated into Arduino Uno Rev 3.

Results

COSGC Challenge

- Successfully navigated through all courses.
- Some sand got into the breadboard.
- Side panels and top are needed to protect electronics.
- Sunlight interfered with the lidar sometimes, may have to switch to ultrasonic sensor.
- Stronger motors will help the robot to walk better, less "Seal" motion.
- Total cost: $301.38

Conclusions

- Next iterations will involve less hot glue and stronger DC motors (with encoders).
- Future designs will have more structural integrity, featuring side panels and a top piece.
- Slight sensor placement changes are needed for the code to operate efficiently.
- Very successful design, considering all the rapid prototyping and time constraints.

Acknowledgements

Funding provided by Colorado Space Grant Consortium | Acknowledgments: Professors Mellenthin and Castleton, COSGC