**Object Detection and Retrieval**

**Using Low-Cost Autonomous Robotic Vehicle**

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**Introduction:** In our project, we aimed to design an autonomous rover similar to that of the popular Mars rovers such as Curiosity. Our rover employs a differential drive system with two continuous rotation servo motors that are controlled with the popular ROS robotic programming library in C++ and Python. A navigation algorithm employs the known position of the robot gathered from a magnetic encoder on the motors and the multiple optical range finders placed around the vehicle to avoid obstacles on route to its destination. A camera is employed to detect target objects for simple pick-and-place tasks using its DC motorized gripper placed at the front of the vehicle. We have successfully built this vehicle and have demonstrated its capabilities at the 2019 IEEE RS robotics competition in Lafayette, Louisiana as well as at the SRS presentation day.

**Inspiration:**

- We were inspired to compete in the annual IEEE RS Robotics Competition, where the task was to make an autonomous robotic vehicle to pick and place blocks into a “mothership”.
- The Mars Curiosity Rover served as inspiration for our design mechanically.

**Mechanical Design:**

The structure was designed with Autodesk Inventor to assemble and stabilize all components while simultaneously considering their dimensions and functions. This was achieved by laser cutting and 3D printing fabrication.

3-Layer Chassis

- Front of the 1st layer was designed with corner edges at 45 degrees to fit an optical range finders mount
- 2nd and 3rd layers designed to house battery components, an Open CR, ODROID, a camera, and gripper

**DOF Gripper with Servo Motor**

- 180 degree Servo Gearbox was implemented to rotate the Gripper to a clearance state
- Length of the extension arm was calculated to grab a 1.5” cube midway from the ground
- Servo motor varied the distance between Gripper arms accordingly

**Object Detection and Retrieval:**

- OpenCV was used to detect text in natural scene images using the EAST text detector. OpenCV’s EAST text detector is a deep learning model, based on a novel architecture and training pattern.

**Final Design:**

- Participated in the competition (knocked out in first rounds)
- Was able to pick up a few blocks

**Summary:**

- Made autonomous robotic vehicle capable of detecting, picking up, and placing marked objects.
- Plan to compete in competition again next year.

**Acknowledgements:**

- TCU IEEE, RAIC, IEEE RS and Dr. Morgan Kiani for advising, inspiring and assisting with this research.