RESTATED SCOPE AND PROJECT PLAN

EML 4551C – Senior Design– Spring 2013 Deliverable
Team 10 – CISCOR Autonomous Ground Vehicle
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Executive Summary

The Center for intelligent Systems, Control and Robotics (CISCOR) does not currently possess an automated vehicle that is sufficiently rugged enough to operate on rough terrain. This project will be focused on producing a research test bed vehicle that will be sufficiently rugged while retaining the versatility to be modified to meet many future research needs. To accomplish this, CISCOR provided the group with a Polaris 550 Sportsman as the base vehicle. To meet the project requirements, this vehicle would need to be modified from its original condition so that it would be capable of autonomous operation and the mounting of various sensors, computers, and other electronics. It was determined that automation of the vehicle could be achieved through ensuring computer control of the throttling, steering, braking, and gear selection of the vehicle. The versatility of the vehicle will be retained by limiting the sensors initially mounted on the vehicle to the smallest feasible volume, leaving space for future mounts. The final goal of this project is to modify the vehicle in the manner described above, without affecting the vehicles range of operation or its ability to operate on rough terrain. The resulting vehicle has been named **G**as **O**perated **L**and **I**ntelligent **A**ll-Terrain Ve**H**icle or G.O.L.I.A.T.H.

GOLIATH underwent minor cosmetic changed in the fall. The plastic protective body paneling was removed and subcomponents were relocated to accommodate the locomotion actuators. Also in the fall, selection and purchasing of all locomotion actuators was accomplished. A brief yet inclusive kinematic model was drafted in the fall semester. In the spring, all actuators have been delivered and are currently undergoing initial quality control/compatibly testing. These actuators are expected to out preform and pass all initial tests. Encoders for all four drive shafts have been purchased. The group expects to have them delivered by the end of this month and mounted by the end of February. All aspects of this project are proceeding on schedule and with minor interruptions.

Revisited Project Scope

Currently there is no off road vehicle platform for autonomous research and design in CISCOR's inventory. Therefore this team was tasked with modify an existing all-terrain vehicle (ATV) to be capable of full autonomous movement by designing, researching and manufacturing components to allow unmanned locomotion control.

Budget

The table below shows the current cost estimate for the completion of this project. The budget for this project is entirely provided by the project sponsor, CISCOR. Our current budget from CISCOR is $5,000. Our final cost estimate is $4,175 which is within our budget. Much of the budget will be used to purchase the components to successfully automate the vehicle. A smaller portion will be used to buy the mounting materials, such as aluminum, and the plastic to protect the locomotion components and improve the aesthetics of the overall vehicle. The rest of the budget will be reserved for unanticipated costs that may arise during construction and mounting of the various components during this spring semester.

Components	Cost	Quantity	Total Cost
Throttle Stepper Motor	450	1	450
Gear Shift Linear Actuator	670	1	670
Braking Linear Actuator	590	1	590
Steering Motor	2,000	1	2,000
Brake Line Pressure Transducer	225	1	225
Aluminum Stock (Plate and Rods)	120	n/a	120
Mounting Hardware (Bolts, Nuts, etc.)	40	n/a	40
Plastic (Aesthetics and Casing)	80	n/a	80
Total Cost of Project			$4,175

Table 1 – Budget breakdown

Gantt Chart

Currently, all phases of this project are proceeding as planned. Please refer to the updated Gantt Chart provided in Appendix A.

Phase I Kinematic Modeling

The basic kinematic model for Phase I has been drafted and is currently undergoing computer simulations.

Phase II Encoder Mounting

Encoders has been selected and the team is waiting for them to be delivered. The mounting design has been finalized and will be manufactured by the end of January.

Phase III Locomotion Manipulation

There are four main locomotion controls on GOLIATH: Steering, Braking, Gear Select, and Throttle. In order to achieve unmanned movement, all four components must be retrofitted with devices to actuate the desired response. Figure 3 illustrates the four locomotion controls on GOLIATH. Each locomotion mechanism is denoted as a subsystem.

1) Steering
2) Braking
3) Gear Selection
4) Throttle

Figure 1 – Illustration of the locomotion controls on GOLIATH

All locomotion mechanisms are proceeding as planned. All locomotion manipulators (actuators) have been delivered and mounts have been manufactured. Miscellaneous parts such as nuts, bolts, and screws are waiting arrive in the coming days.

Phase IV Sensor/Computer Mounting

Phase IV is set to begin within the following month.

Current Vehicle Condition

By the end of the Fall Semester GOLIATH was not in operational running status. The radiator had been removed to make room for analysis and design considerations for the steering actuation. All decorative and protective plastic had also been removed to assess, design and mount different actuators to the body. At the beginning of spring semester, GOLIATH was restored to proper running condition. Currently, it is fully operation and locomotion testing will being in the following weeks. Figures 1 and 2 show the current status of GOLIATH.

Figure 1 – Side profile of GOLIATH

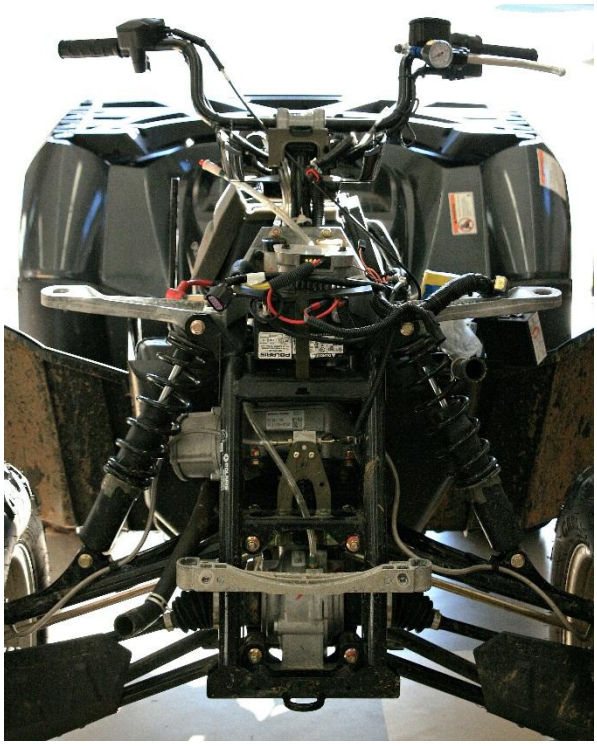

Figure 2 – Front profile of GOLIATH

Conclusion

In conclusion, designs for GOLIATH's locomotion mechanism have been finalized. Motors and supplemental components have been ordered. All aspects of this project are proceeded on time if not ahead of schedule. At the end of spring semester, we are very confident that this project will be finalized and ready for delivery to CISCOR.

Appendix A