OPERATION MANUAL

EML 4551C – Senior Design– Spring 2013 Deliverable
Team 10 – CISCOR Autonomous Ground Vehicle
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Functional Analysis

A simple functional analysis was used to lay out and explain the full operation of Goliath. After all systems have been initialized and Goliath is mission ready, the user will be able to input commands through the remote control. The remote control will allow the user to input all commands that would be needed as if they were a rider on the system.

The next process is getting the inputs transmitted to the actuators. The remote control will transmit the user inputs wirelessly to the remote computer. Through a wireless router the remote computer will send the signal to the computer onboard of Goliath. Once received by the onboard computer the commands will be sent out the proper actuators. It is also through this private network that the computer onboard Goliath will be able to send data back to the remote computer to update the user on Goliath's current condition.

Since a DC motor controls the steering column, the commands that are sent to it must pass through a motor driver first. In order to reduce the number of ports required the Schneider M-Drive actuators have been Daisy-Chained (connected in series). Each drive has a corresponding name. This way when the signal is transmitted to the individual actuators it will be preceded with the correct name. The user will be able to check the status of operation from feedback from the onboard computer.

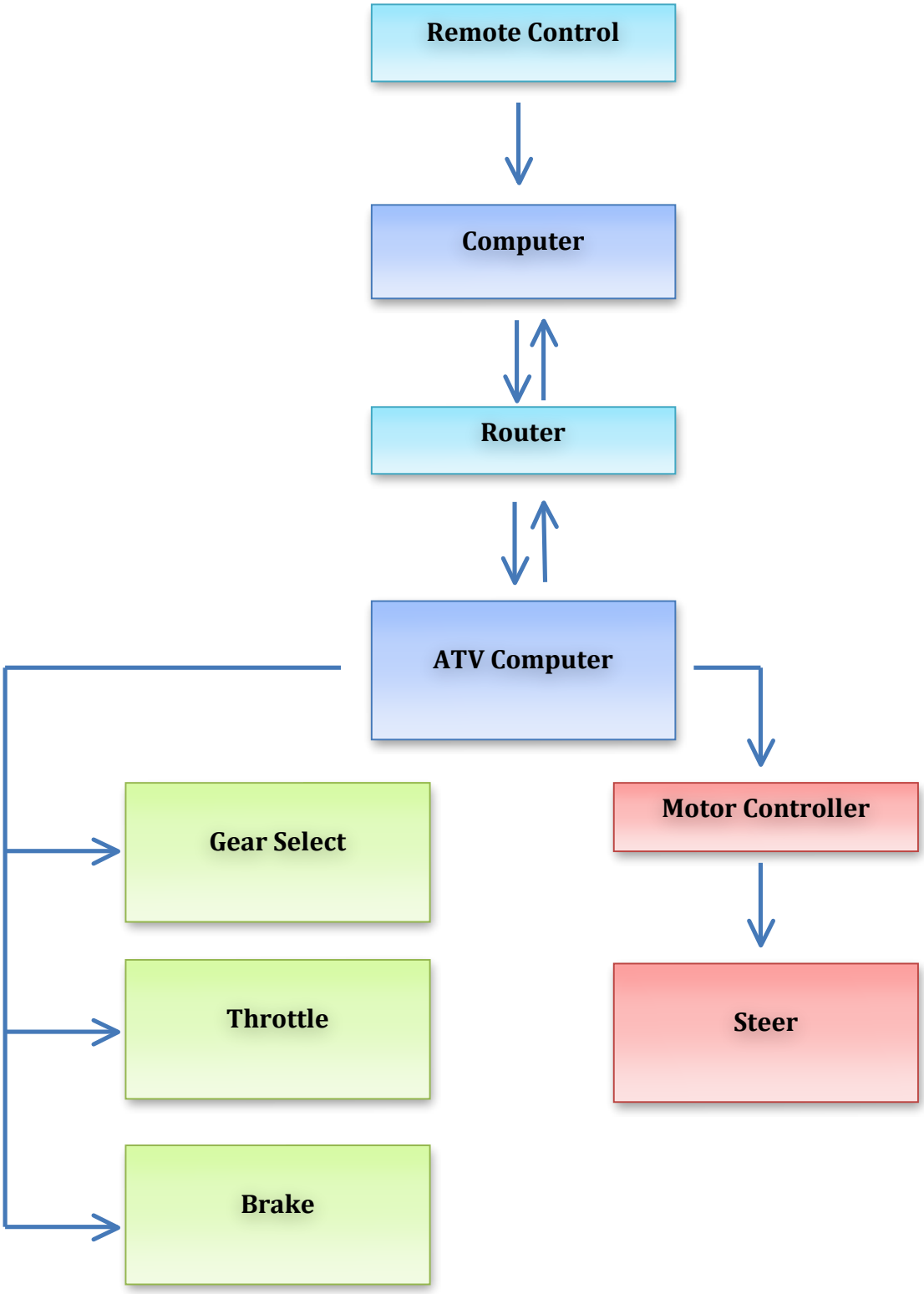

Figure 1: Goliath Flow Chart

Product Specification

2012 Polaris Sportsman 550 All Terrain Vehicle

- 550CC single cylinder fuel injected engine
- 4 stroke
- Single overhead cam
- 87 octane unleaded gasoline
- 4x2, 4x4 high, 4x4 low drive range
- Power steering equipped
- 4 wheel disk brakes
- 53 in. wheelbase
- 722 lb. dry weight
- 5.3 gallon fuel tank

Schneider Electric M-Drive

Actuator operating parameters:

- 24 V
- 2.0 continuous amps

Gear Select Operating Range

The Schneider Electric M-Drive actuator that is equipped for selecting the different gears on GOLIATH has full operating range. This operating range is capable of selecting all gear that includes: Park, Reverse, Neutral, Low, High. The actuator will not exceed the gear extremes of Park and High. Total actuator operating travel: 7.5 inches. Full range response time: under 1.0 second.

Caution: ensure proper alignment with actuator shaft to gear select handle.

Throttle Operating Range

The Schneider Electric M-Drive actuator that is equipped for manipulating the throttle on GOLIATH has full operating range. This operating range is capable of actuating all throttle positions that range from idle to full throttle (roughly 60 mph). Total actuator operating travel: 60 degrees. Full range response time: under 1.0 second.

Caution: ensure that actuator throttle lever is tightly secured to avoid slip.

Brake Operating Range

The Schneider Electric M-Drive actuator that is equipped for manipulating the brake on GOLIATH has full operating range. This operating range is capable of actuating all braking positions that range from no braking to full emergency braking. Total actuator operating travel: .85 inches. Full range response time: under 1.0 second.

Caution: ensure that actuator brake push lever is tightly secured to avoid slip.

Maxon 150W DC Motor

Actuator operating parameters:

- 24 V
- 5.0 continuous amps

Steering Operating Range

The Maxon 150W DC Motor_that is equipped for manipulating the steering on GOLIATH has full operating range. This operating range is capable of turning the vehicle at the tightest turning radius. Total actuator operating travel: 60 degrees left from center, 60 degrees right from center, total of 120 degrees. Full range response time: under 1.0 second.

Operating Procedures

Setup Goliath

- Kill switches in ready (up) position
- Make breaker is not tripped
- Ensure cables are properly connected to batteries

Turning on Goliath

- Power on computers
- Make sure gear select is in the Park position, Throttle and Brake are not depressed
- Turn on Goliath

Initializing Goliath

- Run program on remote computer
- Ensure proper handshake from Goliath computer to verify quality connection

Goliath Ready for Operation

- Control Goliath through Logitech F710 remote control
- Monitor During Operation
    - Throttle: Speed, rpm, absolute position
    - Gear Select: current gear
    - Steer: bearing, position, load on motor
    - Brake: brake activation, absolute position
    - Encoder: encoder values from wheels
    - ATV status: oil temp, fuel level, lights, power steering, 2x4 or 4x4

Shutting Down Goliath

- Return Actuators to initial positions
    - Gear: zero (Park)
    - Throttle: zero
    - Brake: zero
- Turn off Goliath
- Shut down power to computers

Prep for Next Mission

- Connect on-board batteries to battery charger
- Re-fuel Goliath

Future Improvements to Goliath

- Covers for actuators
- Touch screen
- Sensors for autonomous design

In order to ensure that the steering will be able to handle the maximum loads applied from the wheels, a larger motor and gear box may be installed. With minimal changes the current design is compatible with a larger motor. Only the face mount for the motor would need to be re-machined for the new mounting screw locations.

Additionally, a touch screen is recommended to be installed on the front of GOLIATH for diagnostic and control purposes. This touch screen will be able to display vehicle status, speed, and additional sensor information. Furthermore, this screen will be able to control the gear select actuator and communication computers.

Regular maintenance routine

- Charge batteries
- Shift
    - Oil slider
    - Check for misalignment
- Steer
    - Lubricate chain
- ATV
    - Routine service
        - Oil, tire pressure, oil filter, air filter, spark plug, radiator fluid, brake fluid

Spare Parts

- Onboard tools
- Fuses
- Spare tire
- Gas can
- Vehicle fluid (brake, oil, radiator)
- Grease

Troubleshooting

GOLIATH will not turn on.

- Ensure power and ground cables are properly connected
- Check voltage of batteries
- Check fuel level
- Check for loose or unplugged diagnostic sensors on GOLIATH
- Ensure kill switches are in the ready (up) position

Schneider Electric M-Drive will not respond

- Ensure power and ground cables are properly connected
- Check voltage of batteries
- Check “Daisy Chain” communication cable
- Ensure correct name for actuator is used
- Check for actuator misalignment
- Ensure communication port is open on both host and slave computers
- Check Logitech remote control battery level
- Check router for power and broadcast

Maxon Motor will not respond

- Ensure power and ground cables are properly connected
- Check voltage of batteries
- Check for chain misalignment
- Ensure communication port is open on both host and slave computers
- Check Logitech remote control battery level
- Check router for power and broadcast
- Ensure power steering unit is operational

Host/slave communication not responding

- Ensure power and ground cables are properly connected
- Check voltage of batteries
- Ensure GOLIATH is within range of communication broadcast
- Ensure router is operation
- Ensure WiFi is on both host and slave computer