**• Project goal (Austin)**

**• Design and engineering decisions that your team made, and how these were**

**informed by user needs, customer requirements, and other constraints**

**Kevin**

Chose OPi5 over equivalent open source computers due to performance, GPIO bus

ODrives because high performance (plenty of room for beefier motors) open hardware open software various encoder support built in control features ROS package CAN daisy chain system

Users requested ROS2 Humble for compatibility and ease of use/popularity

C++ for speed except for where Python for compatibility

**Sam**

Actuator modules and overall dimensions chosen from ODRI project:

* Modules came as a 3D printable pre-designed package with sufficient torque capabilities
* Features 3-Phase brushless motors, 10:1 belt transmission, 5000 count encoder disk for accurate position control

M18 Milwaukee batteries:

* Chosen for sufficient current discharge rate, built in safe charging/discharging, hot swap mounting hardware
* 3D printable mounting sockets matching milwaukee tools

8 fuse power distribution board

* Chosen because it allows each ODrive module to have it’s own 20A fuse

80mm fan

* Chosen because it is the largest size capable of fitting in the robot body
* Runs off 18VDC

Bolt on 3D printable cover

* Features intake and exhaust ports
* Bolt on 3D printable handle for easy carrying and tethering

ODrive and Orange Pi 3D printable mounting brackets

* Due to the tight space, electronics are mounted in brackets with slots for easy removal during testing

Soft 3D printable “shoes”

* Printed from TPU for replaceable high grip contact

**• Your prototype manufacturing process**

**Ben**

Keys parts of the robot to talk about

* Legs
  + What differed from the original leg design to this new and improved design.
    - How that made printing easier and faster (Assuming faster, felt faster)
* Body
  + Specifically how everything is packed away
* Change for PLA to CF-PLA
  + Was it Professor Leang that wanted us to use it?
  + Maybe mention how only one printer in the lab could print this due to needing a specific nozzle.
* Heated Inserts
  + Explain why they were important

**Jordan**

**Results of prototype testing showing that your design performs its required functions.**

For our results, starting with single leg torque, we exceeded the desired threshold of 2.1 Nm, achieving 2.142 Nm, which is in line with the Open Dynamic Robot Initiative values. The total robot weight came in at 9.75 pounds, under our target of 12.64 pounds.

Our battery performance was stable, delivering 18.7 volts and 20 amps. While this didn’t reach the full simultaneous 80 amps we initially aimed for, testing showed that no individual motor exceeded 7 amps. The peak simultaneous draw from all motors was only 18 amps, suggesting good electrical efficiency under load.

Runtime under static conditions was 42 minutes, surpassing our 30 minute goal. For movement, we achieved basic walking, though only while tethered. Full untethered movement and walking through rough terrain are areas for future development. Limitations in our 8-degree-of-freedom design prevented us from achieving a full range of motion.

Overall, while there are areas for improvement, particularly in mobility and power, we successfully met or exceeded many of our critical performance targets.

**Yang**

**• What you learned about the design problem and the design process through your**

**experience working on this project.**

Learned about:

* Adapting existing designs for new purposes by adjusting the physical ODRI design to fit our needs, as well as using ROS2 Humble’s libraries for OOP
* Understanding how data is transmitted over the CAN interface and how to utilize simultaneous data transfer by daisy chaining
* Good documentation and how to write it down can severely affect the continuation of a project
* Communication with an advisor and how to keep in constant, meaningful contact with clients/sponsors
* Knowing when to let go and critically rethink a problem when it becomes overwhelming