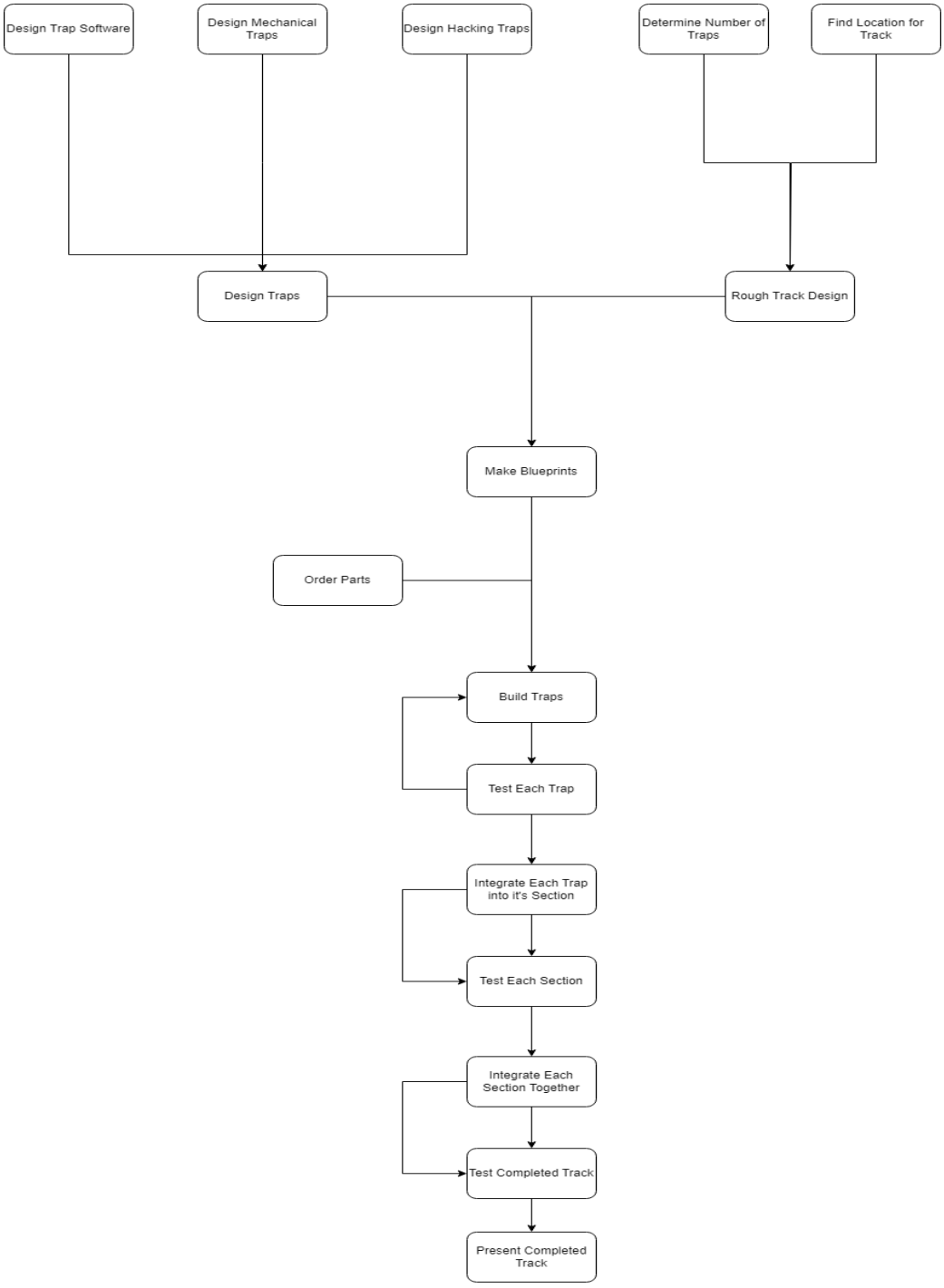
3 Project Plan

3.1 Task Decomposition



Design traps software: The Software we will be using to tell the traps how they should behave will be Arduino programming language, which is a variant of C++. The purpose of designing and creating trap software is to allow the trap's parts to work together and allow all the traps to function predictably.

Design mechanical traps: The mechanical traps will be designed using various components ordered in advance from the ETG. The traps' purpose is to slow or stop cars on the track. The design will be using motors, switches, sensors, and other components.

Design hacking traps: When designing hacking/cybersecurity traps, we took some inspiration from our previous classes. Vincent took a wireless security class last semester and suggested that we should attempt to disrupt the radio signals that were being sent to the car from the controller. We found that the best way to complete this was by using a faraday cage. Another way that this could be completed was by taking over the radio signal that the RC car was using. This can be done by scanning to see which signal is being affected and using our own programmable remote to attempt to hijack the signal with a stronger strength.

Determine number of traps: We decided that we will be using 3 hardware and 3 software traps for our final track design. We have determined the type of traps and the planned general functionality for the final trap designs. We have yet to begin assembling the hardware components because of the lack of parts on hand. Parts are being ordered and we will begin building the traps as the parts come in.

Finding location of track: While finding the location of the final track, we are in the process of exhausting all our options. So far, we have emailed the TLA to see if it would be possible to rent out sections that would allow us to complete this project indoors during the cold winter months. This did not progress as we had found it too costly and will be busy during dead week of the next semester. Our next option is to rent out a room at the memorial union, but we are still awaiting a response email. Lastly, we are looking into renting out a park pavilion. While this will be outside, it will be under some shelter so it will allow for us to complete the race even if it were to rain

Rough track design: When designing the rough draft for our track design, we had to visualize the space of 25x50ft, so we had marked out an area of the TLA to help us visualize it. We also took some inspiration from a classic oval track like those found in Nascar, and found that it would be good to place some traps on the straight aways to prevent them from gaining too much speed, as well as some traps on the curves to see how their cars can handle autonomously turning in rough terrain

Design traps: When we complete the initial brainstorming and final draft of the traps we commit to using for our race, we will need to begin designing the traps, keeping in mind what materials we will need and how easily and compatible they will be with our complete track design.

Make blueprint: We need blueprints to make sure the traps are reproducible by others and to know exactly what needs to be ordered to be able to build the trap.

Order parts: To order the parts for our track a bill of materials was created to show ETG which components were needed and the cost of them. Additional descriptions were provided about each product relating to their function and need.

Build traps: When we receive our parts for our traps construction of them will start. Each trap will be built from our components with a majority of them being some form of moving barrier, elevation change, or a rotating obstacle. Many of these will be controlled by sensors and programmed with microcontrollers to take action when cars approach them.

Test each trap: When we complete the process of building the traps, we will need to start testing. To start testing we can do this in several ways including both the hardware and the software components of each. For the software testing section, we will need to use programs like the Arduino IDE to debug software mistakes and to better tune our traps to be more effective.

Integrate each trap into its section, test the section: Since our track will be broken into separate sections that will make transporting the track easier, we need to make sure that each section of the trap is working before implementing it with another section. This will be done by testing all of the traps within the section, as well as running a test RC car between each trap within the section.

Integrate each trap together, then test: After each trap is tested individually, we will have to make sure that it is possible for a car to complete the traps. This will require us to run the track multiple times from different positions around the track, and make sure that it can be completed by the test car to make sure that the other teams have a fun, but challenging race.

Present completed track: The final track will be presented as part of our second semester senior design project presentation as well as presented to our client in a one-on-one setting as this was what was requested. This one-on-one setting for the final track presentation will allow us to hide some of the trap positions from the other car teams which will provide a unique experience during the race day.

3.2 Project Management/Tracking Procedures

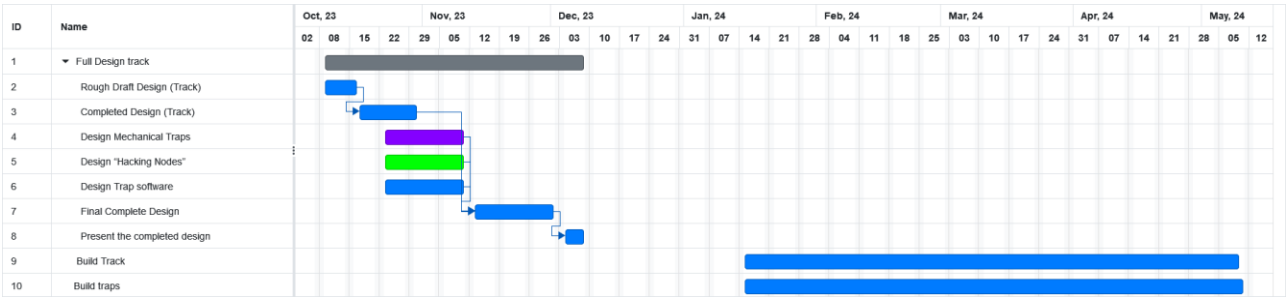
In our agile project workflow, we will be using Gitlab as our central hub for project management and documentation. Gitlab will serve as a comprehensive platform for tracking our project progress

and maintaining a record of our tasks. This will allow us to have seamless collaboration among our team and enable us to contribute to the project and document our work efficiently. Additionally, we will also be using a Trello board to enhance task management. Tasks will be organized on the Trello board, allowing us to easily monitor their status and transition them through different stages of the development process. By combing these two software's, we aim to streamline our agile development process, and ensure efficiency throughout the project lifecycle.

3.3 Project Proposed Milestones, Metrics, and Evaluation Criteria

By setting a milestone and deadline, our team aims to make progression our project. By October 20th we successfully identified and selected traps for our intended purpose. Following this, we will have our rough draft ready and completed by October 27th. Subsequently, our ideas and translating them into a comprehensive blueprint, achieving this milestone by November 16th. With those blueprints, we will have until November 17th to finalize the design details. Our plan is to present the completed design to our faculty advisor on December 7th, ensuring that we stay on track. We seek evaluation based on our comprehensive efforts throughout the project and meticulous attention to the more intricate details. For our metrics, we will have three traps that are software based and three that are hardware based. We also plan to have the timing of the cars be within milliseconds to record a viable time for each of the times.

3.4 Project Timeline/Schedule



There were four important milestones in our project. First was a rough draft of our design completed by October 27th or earlier. About a month later, by November 29th, a blueprint for the track and a completed design of our track were needed. Lastly this design will be presented on December 7th to our faculty advisor, Dr. Bigelow.

3.5 Risks and Risk Management/Mitigation

- One of the largest risks in this project will be running out of materials or damaging them where we would need to procure more.
    - This can be mitigated through good planning, having a small buffer of supplies, continuous monitoring, and having adequate storage for the material
- Potential getting electrocuted by low voltage.
    - Prevent this by making sure everything is grounded properly and is dry and wearing proper protective gear.
- The construction will have an inherited risk because of power tools.

- Follow safety rules of power tool use: do not wear loose clothing; wear eye, hearing, and hand protection.

3.6 Personnel Effort Requirements

	Team Members	Start Date	End Date	Estimated Hours
Rough Draft Design (Track)	Taylor, Chris, Jaxon	10/9	10/16	3
Completed Design (Track)	Taylor, Chris, Jaxon	10/16	10/27	4
List of Traps	All	10/9	10/23	6
Design Mechanical Traps	Taylor, Chris, Jaxon	10/23	11/10	30
Design "Hacking Nodes"	Vince, Zech	10/23	11/10	30
Design Trap software	Simon, Vince	10/23	11/10	30
Final Complete Design	All	11/10	12/3	10

3.7 Other Resource Requirements

Materials:

- Wood
- A large magnet/electromagnet
- PVC pipe
- Pipe covers
- Tarp
- Fasteners
- Hinges
- Metal rods
- Access to wood/metal shop
- RC car for testing
- PLC (like Arduino)
- Wires
- Electric actuator for wall trap
- Motion detector