

ECE 445 Team 12 Contract

Spring 2026

Project Information

Project No. 12: Two-Wheel Differential Drive Ant-Weight Battlebot

Team Members:

- Haoru Li, haorul2
- Ziheng Qi, zihengq2
- Ziyi Wang, zw67

This contract outlines the expectations, responsibilities, and collaboration principles agreed upon by the team to ensure the successful completion of the project. It defines how tasks will be distributed, how decisions will be made, and how potential issues will be addressed throughout the semester.

Project Description

This project designs and builds a two-wheel differential drive ant-weight (under 2 lbs) combat robot featuring a horizontal drum spinner weapon and dual front wedge system. The robot prioritizes maneuverability, structural robustness, and electrical reliability under high-impact combat conditions. An ESP32-based control system enables wireless operation, motor control, and safety fail-safes. The design also includes an experimental investigation into gyroscopic stabilization using IMU feedback to explore flip recovery at the ant-weight scale.

Project Goals

If successful, the team will demonstrate a fully functional ant-weight combat robot that meets competition requirements and performance targets. The robot will achieve reliable differential drive mobility with rapid in-place turning, a horizontal drum weapon capable of reaching competitive tip speed, and stable operation under high-impact conditions.

The system will integrate a custom PCB centered around an ESP32 microcontroller for wireless control, motor driving, safety monitoring, and IMU-based telemetry. Additionally, the project aims to experimentally evaluate gyroscopic stabilization using real-time IMU feedback to determine its practical effectiveness at the ant-weight scale.

Member Expectations (Ground Rules)

1. Each member is expected to attend scheduled meetings and actively participate in discussions and technical work.
2. Members must complete assigned tasks on time or communicate in advance if delays are anticipated.
3. Open and respectful communication will be maintained at all times, especially when technical disagreements arise.

4. Each member is responsible for staying informed about overall project progress, not only their individual subsystem.
5. Major design decisions and changes must be discussed with the team before implementation.
6. If unforeseen academic, personal, or technical challenges arise, members must inform the team promptly to avoid impacting project milestones.

Roles and Responsibilities

Although all team members share equal responsibility for the overall success of the project, primary responsibilities are distributed to ensure efficient progress across subsystems.

- **Haoru Li – Mechanical Modeling and Stability:** Responsible for physical modeling, torque and acceleration calculations, rollover analysis, gyroscopic effect modeling, and experimental data analysis. Contributes to structural design decisions and validation of performance requirements.
- **Ziheng Qi – Embedded Systems and Control:** Responsible for firmware development, wireless communication implementation, motor control logic, IMU integration, and system-level debugging. Supports integration across mechanical and electrical subsystems.
- **Ziyi Wang – Electrical and Power Systems:** Responsible for power distribution design, voltage regulation, ESC interfacing, and PCB implementation. Oversees electrical reliability, safety mechanisms, and integration of weapon and drive systems.

All members will collaborate on design reviews, testing, subsystem integration, and final validation to ensure balanced contribution and shared accountability.

Project Meeting Times

TA Meeting: The team will meet weekly with the TA on Tuesday as scheduled.

Internal Team Meeting: The team will hold a fixed internal meeting every Friday at 3:00 PM to review weekly progress, discuss technical challenges, and assign tasks for the following week. We plan to use Discord to conduct team meetings.

Agenda and Decision Process

- Meeting agendas will be discussed and finalized prior to each meeting through team communication.
- The team will aim to reach decisions through consensus. If consensus cannot be reached in a timely manner, decisions will be made by majority vote.
- Meeting notes and task assignments will be recorded after each internal meeting, with responsibility rotating among team members.

Process and Penalties for Team Issues

The team adopts a three-step approach to address ground rule violations, with increasing levels of intervention depending on the severity and persistence of the issue. The goal is to resolve conflicts constructively rather than immediately resorting to penalties.

- **Step 1: Internal Discussion.** If a team member does not meet agreed-upon expectations, the issue will first be addressed through open and respectful discussion. The member will be given an opportunity to explain any circumstances and clarify misunderstandings.
- **Step 2: Corrective Action Plan.** If the issue persists, the team will define clear corrective actions and establish reasonable deadlines. Responsibilities may be adjusted to ensure continued project progress.
- **Step 3: Escalation.** If repeated violations occur or the issue significantly impacts project milestones, the matter will be escalated to the TA or course instructor for mediation. Persistent lack of contribution may be reflected in the final peer assessment.

End-of-Term Agreement on Peer Assessment

There will be two formal peer assessments:

- The first provides constructive feedback.
- The second affects final grades.

The team agrees that this contract is binding and enforceable. All members understand that failure to meet the expectations outlined in this document may be reflected in the final peer assessment.

Signatures

Iterate on this document until all members are comfortable signing.

I affirm that I participated in generating this team charter and will abide by its contents to the best of my ability. I understand that failure to meet expectations may lead to the stated consequences.

netID: haorul2
Date: February 20, 2026

Digital Signature: Haoru Li

netID: zihengq2
Date: February 20, 2026

Digital Signature: Ziheng Qi

netID: zw67
Date: February 20, 2026

Digital Signature: Ziyi Wang