Mechatronics Lab Autonomous Sumo Competition – Instructions & Requirements

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# Objective

Build an **autonomous robot** on the **Arduino Alvik platform** that:

* Navigates a **2-meter diameter arena.**
* Competes against **4–6 other robots.**
* Uses onboard sensors and actuators to **capture and hold the central hill** (marked red/blue) or remain as the last operational robot within the arena.

Competition Duration: **10 minutes**

# Technical Requirements

1. **Autonomy**
   * No manual control during matches.
   * The robot must start, navigate, and decide actions autonomously.
2. **Sensors -** You must collect and log data from at least:
   * Encoders (for odometry).
   * IMU (orientation).
   * Distance or line sensors (for arena edges).
3. **Data Logging -** During each match, log:
   * Time-stamped sensor data.
   * Actuator commands.
   * State transitions (e.g., searching, attacking, defending).
   * Use wireless logging (using Wi-Fi scripts from Lab 5) to keep the robot untethered.
4. **Arena**
   * Arena floor: 2 meters diameter.
   * Border: marked by black tape or 3D printed tilted surfaces to detect edges.
   * Center hill: small raised area painted red/blue.

# Scoring

* + **Primary goal:** Be on the hill at the match end.
  + **Secondary goal:** Be the last robot operating inside the arena.
  + **Bonus Points:**
    1. High-quality plots and analysis of your sensor data.
    2. Trajectory reconstruction using **wheel odometry and a 2-DOF differential drive kinematic model**

# Report Deliverables

Each team must submit a **concise technical report** containing:

1. **Block Diagram**
   * Show the software architecture and sensor/actuator connections.
2. **Code Overview**
   * **1–2 pages** of commented code snippets demonstrating:
     1. Autonomous state machine logic.
     2. Sensor data acquisition.
     3. Actuator control.
3. **Tactics Explanation**
   * **½ page** describing your robot’s strategy:
     1. How you search for opponents.
     2. How you avoid falling out.
     3. How you attempt to capture the hill.
4. **Data Plots**
   * Time plots of:
     1. Encoder counts / Wheel position.
     2. IMU angles.
     3. Distance sensor readings.
   * **Bonus points**, include a **2D plot of the estimated trajectory** from odometry.
5. **Concluding Experience**
   * **½ page reflection** discussing:
     1. Challenges encountered.
     2. Insights gained.
     3. What you would improve.