

# Mechatronics Lab Autonomous Sumo Competition – Instructions & Requirements



## 1. 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**

## 2. Technical Requirements

### a. **Autonomy**

- No manual control during matches.
- The robot must start, navigate, and decide actions autonomously.

### b. **Sensors** - You must collect and log data from at least:

- Encoders (for odometry).
- IMU (orientation).
- Distance or line sensors (for arena edges).

### c. **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.

### d. **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.

### 3. Scoring

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

### 4. Report Deliverables

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

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