Grand Theft Autonomous 2022C

The game has four robots in two teams (2v2) a red team and a blue team. Robots are controlled wirelessly. The field is split into two, a red side and a blue side for each team. Players cannot view the field. Points are scored by spending autonomous time on the blind side and moving (stealing) objects from the opponent's side to locations on their side of the field. Teams with the most points at the end of two minutes wins.

Rules [subject to change]:

1. Game constraints
    a. Players cannot see the field directly
    b. Matches last 2 minutes
    c. For each packet received, robot must send an ESP-NOW message to staff to determine communication factor. The message will be a single byte with the team number (example code *ESPnow-Game-Sender.ino* is on Canvas).
2. Robot Constraints
    a. Robots must fit in a 12" x 12" x 12" box to start.
    b. Robots are controlled wirelessly via ESP32 microcontrollers.
    c. Robots can have a maximum of 10Kbytes/sec data transmission each way.
    d. Robots should not physically damage other robots or the field.
    e. Robots should not intentionally disrupt sensing or communication of other robots.
    f. Robots must transmit their X-Y location relative to the Vive lighthouse via ESP-NOW message to the staff ESP32 which will echo the info to a UDP broadcast once per second. The protocol for both ESP-NOW message and the UDP broadcast message will be:
        i. Data: Team number, X location, Y location
        ii. 10 digit format: ##:####,####
        iii. UDP broadcast will use port 2510

iv. Police Car object has team number 00

3. Objectives
   a. Score as many points as possible to win game
   b. At the end of the match, location of 5 scoring objects score points. This score is multiplied by a communication factor.
      i. Trophy on your side gives you 1 point
      ii. Fake object on opponent side gives you 1 point
      iii. Police car on the opponent side gives you 1 point
      iv. Double points are scored for each objects in the 2X area.
      v. Objects must be entirely over line to score
   c. Communication multiplication factor determined by the total number of packets received by both robots on a side according to this table:

Total Packets sent to robots	0 – 19	20 – 399	400 – 799	800 – 1199	1200 – 1599	1600 – 1999	2000 – 1399	1400 +
Comm factor	3x	2x	1.8x	1.6x	1.4x	1.2x	1x	0

Rule interpretation - Things explicitly allowed:

1. Robot to robot contact is expected and allowed. Robots should be made robustly with this in mind.
2. Robots may throw objects.
3. Robots may “unfold” or go beyond the initial 12x12x12 size limitation.
4. Robots may separate parts of themselves, but all starting items are considered to be part of the robot.

Rule interpretation - Things explicitly disallowed:

5. No intentional flipping of robots.
6. No dispensing of liquids or flames.
7. No midgame repairs will be allowed. Repairs can happen after games are finished. If a robot is damaged due to intentional action from another robot, a rematch will be called and the offending robot removed from play.
8. No intentional blocking of beacons or emitting of IR frequencies to confuse other robots
9. No intentional blocking of radio signals (generating RF noise) or bright lights to blind opposing cameras

Rule interpretation - Hand of God

10. Any objects knocked over will be returned to the upright position by game judges
11. Any robots that are knocked over will be returned to the upright position by game judges
12. Any objects that end up outside of the field of play will be returned to the field of play by the judges to the nearest point on the field.
13. Each player may request one reset per game. A judge will move their robot from wherever it is to a random position and orientation in the rear of the player’s side. Time will not stop during these actions Any robot deployments or reconfigurations will remain deployed.

Field of Play

The field is 10FT x 5FT plyboard (IR reflective) bounded by 2by4 wooden walls. There are two sides: a red side and blue side. Each team starts on its color side. At no time is the field directly viewable by players. Lines on the field made of black electrical tape delimit zones that affect scoring. Initial positions of robots are shown in the Game Field figure below.

Key Field Features:

- **Vive Lighthouse -**
  - In roughly the planview center of the field will be a HTC Vive LightHouse.
  - Robots can determine their X-Y coordinates from this lighthouse.
  - The coordinates alignment and resolution can be measured by all teams.
  - Police car transmits center XY position (no orientation)
- **Scoring Objects** -
  - One “Trophy” and one “Fake” object sit on each side of the field. These objects transmit IR light, trophy at flashing at 550Hz and fake flashing at 23Hz. They are placed in random locations each game but symmetrically so each team sees the same placement.
  - One “police car” starts in the center of the field.
  - Teams may choose which corner of their side they start on