Robotic Replacement of Solar Collector Panels

The final project task is to simulate robots tasked with replacement of solar collector panels on planet with two suns. There will be two types of solar collectors mounted at two different angles (see Figures 1). On each side of the solar farm roof there will be an old solar panel. Teams will be required to have at least two different robots, one with a regular servo-actuated gripper, and one with a continuous rotation servo-actuated gripper. Teams with a third robot that has a different fourbar or a different type of actuator can receive bonus points.

The first robot will need to autonomously remove an old panel and place it on the staging block. The old panel will be replaced with a new panel, which the robot will pick up and place it on the empty spot on the roof. The first robot will then need to move to the other side of the field and start line following as if to pick up the old panel from the other side of the roof. The team will pause the first robot with the IR remote, and replace it with the second robot in the same position. The second robot will proceed to remove the old panel and replace it with a new panel. Robots that can lift and place aluminum plates which have additional weight attached will receive bonus points as specified in the project demo rubric.

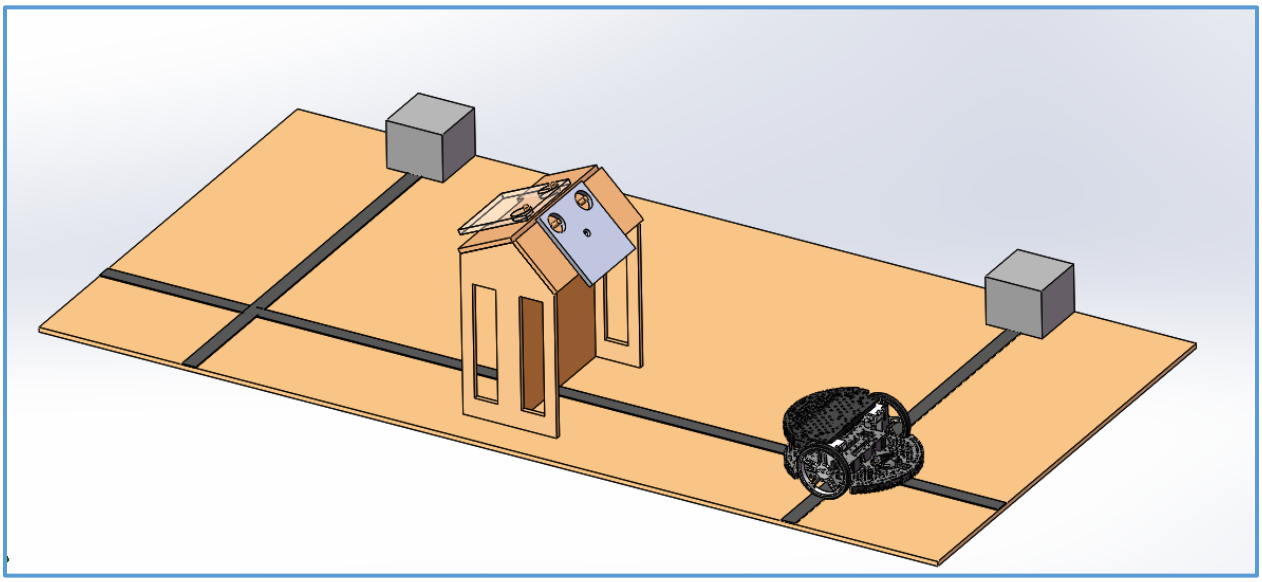

Figure 1: Playing Field Layout

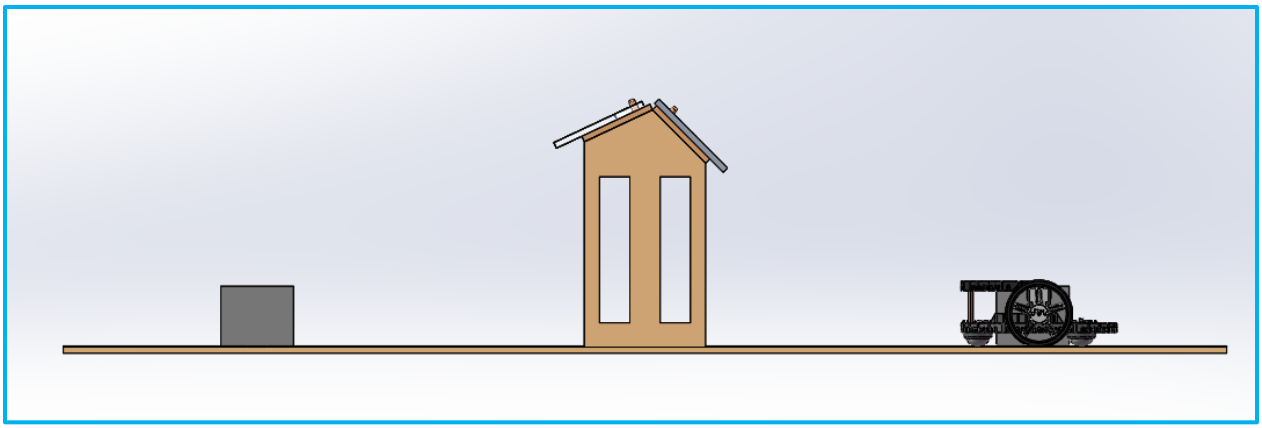

Figure 2: Side View of Playing Field

Briefly, the robots need to:

- Remove an old collector from the roof. Note that the robot should pause when it thinks it has firmly grasped the collector and wait for IR communication from the field (team operator) indicating that it is safe to pick up the collector. The field judges will inform the team which robot will go first and on which side of the field. You can start at any position on the field on the given side.
- Navigate to the staging block and deposit the old collector. Note that the robot should pause when it thinks the collector has been safely placed, and wait for communication from the field indicating that it is safe to release the collector.
- The staging operator will remove the old collector and place a new collector on the staging block. The field will then communicate that the new collector can be picked up.
- The robot will navigate to the empty spot and place the collector on the pins. Note that the robot should pause when it thinks the new collector has been safely placed and wait for communication from the field indicating that it is safe to release the collector.
- The robot should now navigate to the other side of the field and begin to line follow. The team will then pause the robot at the direction of the field judges and replace it with the second robot. The second robot will then proceed to pick up the old collector from the roof. Note that the robot should pause when it thinks it has firmly grasped the old collector and wait for communication from the field indicating that it is safe to remove the collector.
- Navigate back to the staging area and deposit the old collector. Note that the robot should pause when it thinks the collector has been safely placed, and wait for communication from the field indicating that it is safe to release the collector.
- The staging operator will remove the old collector and place a new collector on the staging block. The field will then communicate that the new collector can be picked up.
- The robot will navigate to the empty spot and place the collector on the pins. Note that the robot should pause when it thinks the new collector has been safely placed and wait for communication from the field indicating that it is safe to release the collector.

- The robots also need to be able to receive emergency stop and restart commands at any time.

Additional requirements:

- All robots must use a fourbar mechanism to achieve the three different heights and orientations needed for their gripper mechanism. The lifting assembly can have no more than two actuators on it. The number of actuators and sensors on the rest of the robot is not limited (assuming sufficient I/O pins are available).