Robotics in Construction Automation
Final Project

Due Dates: June 5 (Milestone I) June 12 (Final Presentation)

Project Goal

You will develop a robotic crane which can be operated remotely, controlled by voices and also perform autonomous actions. This robotic crane is capable of operating in a predefined working area, picking up and lowering down an object freely. To achieve the goal, you have to design the robot hardware (at least two degree of freedom) and also a software planner that can control the robot to perform the tasks smoothly. Three major functions need to be achieved:

1. **Tele-Operation**: The user can control the robotic crane by using joystick, mouse or keyboard to pick and lower the object.
2. **Voice Control**: The user use voice commands to control the robotic crane to pick and lower the object.
3. **Autonomous Erection**: The robotic crane is capable of using vision information and autonomously picking and lowering the object.

Environment Setting

As shown in the figure, a circle black blanket (approx. radius = 32cm) will be distributed to each group. It presents the working area of the robotic crane. In the center of working area, a square area (width=20cm) is preserved as the foundation of the robotic crane. The blue ball in Lego box serves as the target object to be hoisted. The red ball serves as the target location to be lower. You are able to attached a magnetic mental in the end of the crane (like a hook) and the blue ball. You are allowed to select whatever type of magnetic mental. The number of magnetic mental or their arrangement is not limited either. During the presentation, I will arrange the blue ball and red ball freely to test the performance of the crane.
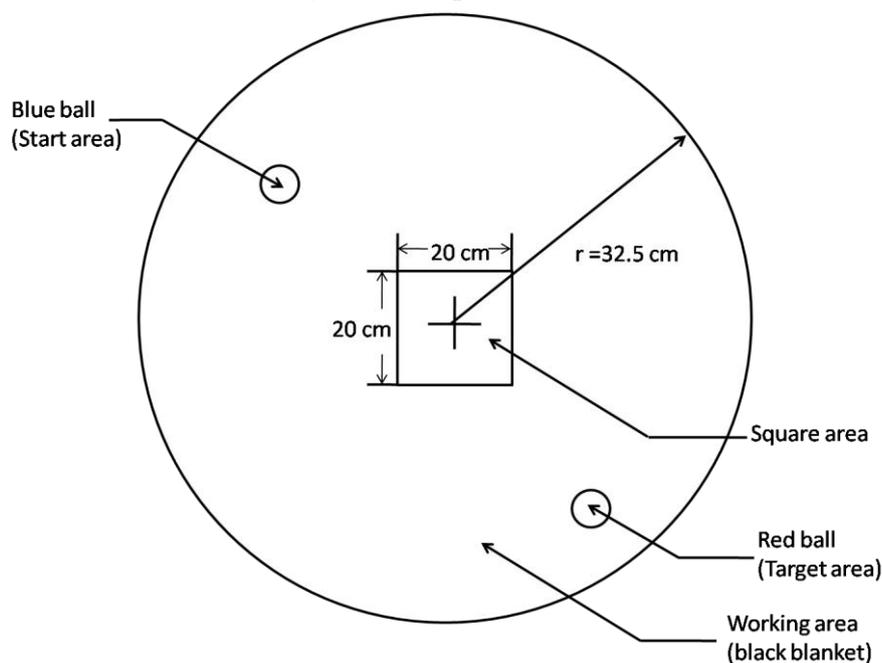
Grading

Both hardware and software designs will be evaluated in terms of effectiveness, performance and creativity. The grading will be separated into two parts. One is a report, in which we will review robot designs in both hardware and software components, and the other one is a field performance, in which we mainly evaluate the robot performance when it perform road inspections. Detailed grading items and weights are listed as follows:

1. **Milestone 1**(20%): Demonstrate the first task, tele-operation task.

2. **Field Presentation** (40%): Demonstration the tree tasks listed above. They are weighted as (1) tele-operation (10%), (2) voice control (15%),(3) autonomous motion (15%),

3. **Report** (40%): You need to develop a detailed report to describe your robot. You are encouraged to include many figures, flowchart diagrams, sketches, photos and snapshops from computer screen to help you explain the designs. Three sections need to be included: (1) *hardware design* (20%) including the conceptual design and methods to implement the design and (2) *software design* (20%) including the mechanism of the planner and the VPL diagram that realizes the design.