



“The Inspector” - Remote Inspection Device ASME Design Challenge

Kevin Gidley, Karl Nix, Travis Williams, Jacob Wirtz
Advisor - Dr. Chuen Hsu

PROJECT OVERVIEW

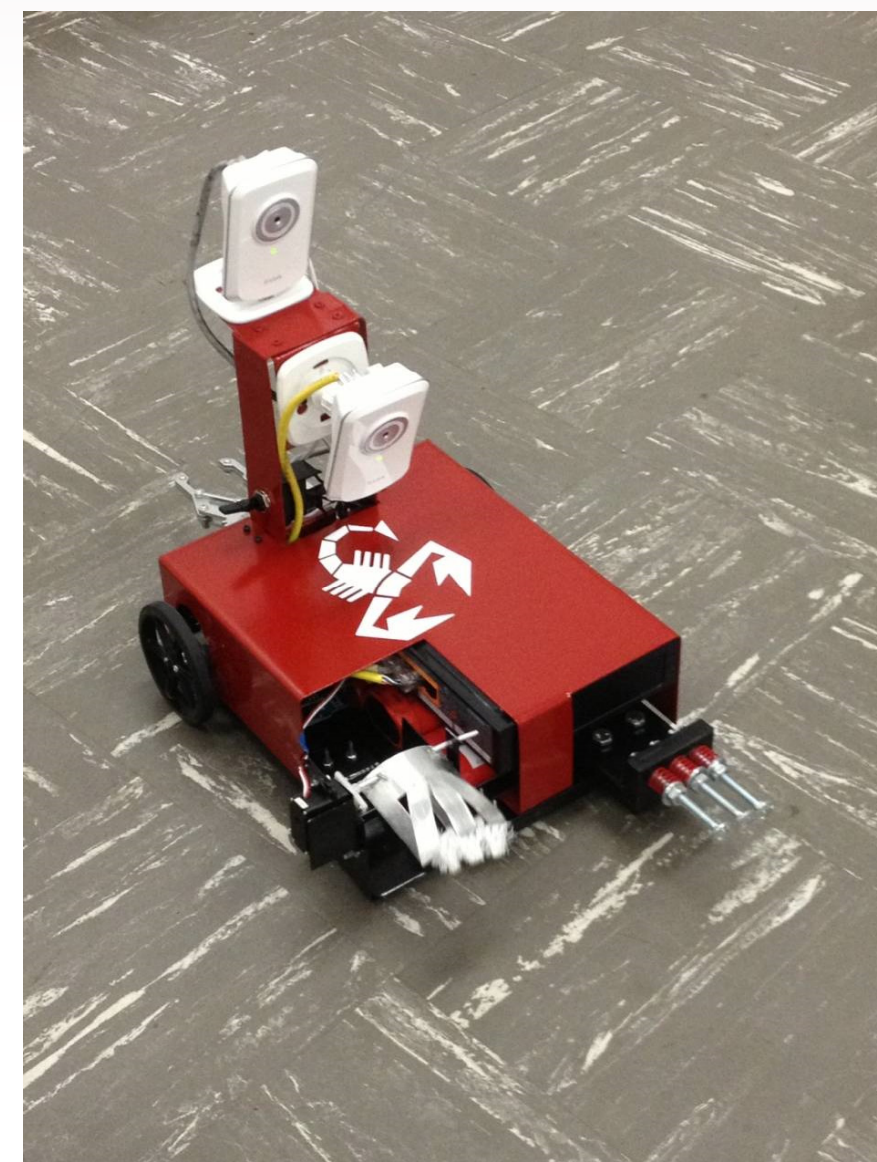
The purpose of this project was to develop a device capable of inspecting nuclear facilities after disasters similar to the Fukushima incident of 2011. The goal is for the device to perform several inspection tasks while eliminating the radiation exposure to facility workers.

The constraints of the project included:

- Powered by rechargeable batteries.
- Controlled via wireless transmitter/receiver link.
- Must have a clearly marked master shut off switch.

The competition tasks include:

- Navigating obstacles.
- Reading of a simulated gage positioned in plane with the floor.
- Pushing a simulated button orientated perpendicular to the floor.
- Depositing a simulated sensor in a designated area.
- Collecting a simulated sensor and returning to home position.

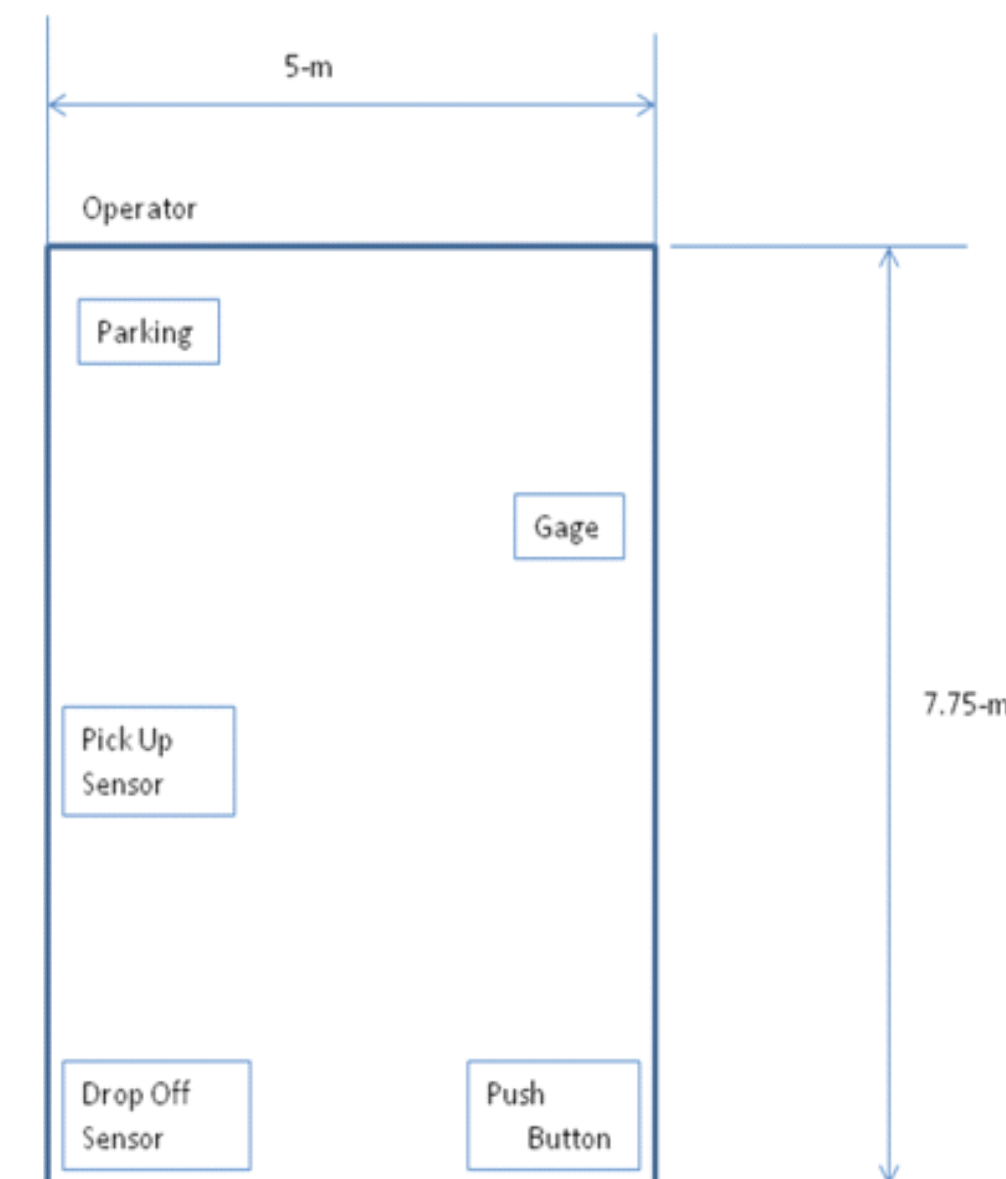


HOW IT WORKS

The final design solution for the remote nuclear inspection device can be seen to the left. To complete each task a separate sub-system was created. The power supply system consists of three rechargeable 7.2 Volt nickel-metal hydride 6-cell batteries. The communications are handled by a NETGEAR wireless-N router, located inside the lid. This provides the user with the camera feeds and also connects with the Arduino. Dual cameras are utilized to allow for both a close view of the scoop and bumper, and also a clear outlook for navigation. The operator uses an XBOX 360 controller via laptop to drive the device, giving commands to the two independent rear mounted drive motors and servos. To allow for high maneuverability two ball casters were used to support the front of the device.

COMPETITION SCORING AND COURSE

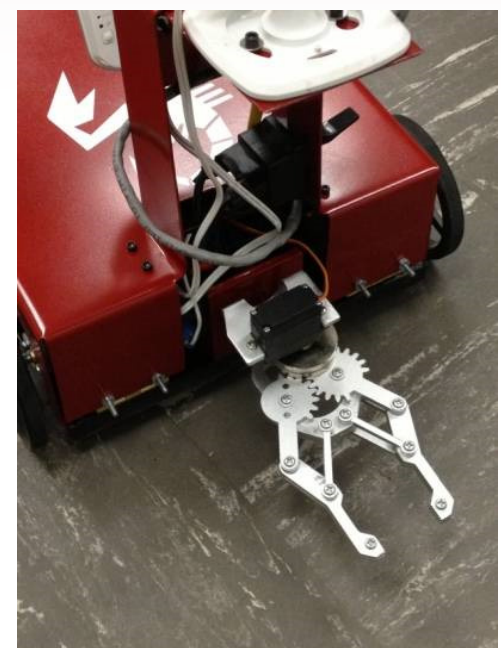
- Correctly reporting the gage reading is worth 1000-points
 - The sensors are worth 2000-points each (if one is placed in the designated drop area and the second sensor is returned to the starting point)
 - Pushing the button is worth 3000-points.
- The winning device will have the highest score S where:
- $$S = (R) - 10 * s - 200 * T$$
- R = task score
 T = Times device touches border tape
 s = seconds to complete task, maximum 300



Button pressing Bumper



Sensor Pick-Up Scoop



Sensor Release Claw

CONCEPTUAL DESIGN

Initial design called for front and rear facing cameras and router mounted to the top case, front mounted bumper and sensor scoop, rear mounted sensor depositing claw, and two independent drive motors mounted to the rear with front mounted ball casters as shown above.

Through construction and testing several design changes were made, including camera orientation and mounting, and mounting layout within the case to include the router.

