Robotic Sentry Using All-Terrain Wheelchair Platform

**Background:** The need for active security around facilities such as prisons, high value storage, missile silos, hazardous waste storage and political borders has created a demand for robots that can respond to breaches, alarms, or general inspection to reduce the workload on humans. A new generation of wheelchairs from Action Trackchair is designed for use in all terrains and offers a starting point to address a robust, robotic monitoring and response capability for these situations.

**A New Design Concept: The Robotic Sentinel**

Using the Action Trackchair (provided by the manufacturer) as a platform, develop a robotic sentinel that meets the security requirements of secure facilities, as indicated by the design scenario below. Design sensors, communications, control systems, programming, and systems management (power, maintenance, control) approaches that can be tested on the Trackchair as part of the project.

**Scenario:**

You’ve been asked to provide 24/7 security coverage of remote fenced in areas around an underground storage facility. The facility has two perimeter fences with a 10ft gap between them. Most of the surface between the fences is a 3ft sidewalk but there are areas that have gravel, grass and in some cases puddles up to 1ft deep. During winter months, snow drifts up to 1ft deep may be encountered. These facilities are square, 2 acre compounds which means you have a 1200ft perimeter to monitor.

There are dozens of these facilities so it is impossible to provide 24/7 human coverage of each site. You have stationary sensors and closed circuit TV so you know when there is a disturbance at each site. However, when there is an alarm you must quickly investigate the reason and if possible send a sentry to the breach within 2 minutes of an alarm to collect and provide more detailed information. The design goal is to design and build a robot that can do the job.

The robot shall be able to be stored in a standby condition in a small shelter that provides it with power, communication and shelter from the elements. Upon deployment, the sentry shall disconnect from the electrical connections, leave the shelter, proceed to a point designated before leaving the shelter via the shortest route, and position itself facing the area of interest to standby for further instruction. The approach to calculation and response to these requirements (i.e., real time onboard calculation vs. preprogrammed routes, obstacle avoidance, and location determination) will be part of the design process.

**Skills Needed for This Work:** (1) Basic understanding of robotics. (2) Control system theory for closed loop navigation. (3) Mechanical and Electrical design skills for mounting and constructing components. (4) Understanding of wireless audio/video data transmission and communications. (4) Test planning and testing skills to ensure capability and durability of a finished design.

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