

Background

Most maintenance and construction activities related to utilities will take place in the footpath outside the family home. Activities will often involve heavy equipment which can be dangerous to a civilian who may have entered the work site unnoticed by the pedestrian management team. The current methodology used where pedestrian management is deployed is to place pedestrian managers at both ends of the construction zone to assist the public either through or around the work site. This method is not only costly but sometimes ineffective at stopping unauthorized entries and alerting the workers that a pedestrian has entered the worksite.

Purpose

In order to eliminate unauthorized entries into construction sites, a digital surveillance system is proposed. Using LIDAR-Lite sensors from Garmin, the system will detect unauthorized entries to the worksite and alert both the pedestrian and workers. The goal of the project is to provide a safer construction site for both pedestrians and workers, as well as reducing the number of people necessary on a given worksite.

Proposal

Develop a surveillance system that uses Garmin's LIDAR-Lite sensors to create a virtual fence which would sound an alarm when an unauthorized breach has occurred. The fence would be made up of several bollards, each pointed at the next, to create a fully enclosed work area. In the event of a breach, visible and audible alarms on each bollard are activated, alerting the pedestrian they have entered a hazardous area. Each worker in the site will also be wearing a Garmin fitness band which will alert the worker and allow them to interact with the system such as disabling the alarm.



Figure 1. Concept sketch of a secured site using the proposed solution.



Figure 2. Garmin fitness band (Vivoactive HR).



Figure 3. Example test area.

Final Design

Bollard

- 4-inch diameter PVC pipe that houses all necessary electrical components
- Bollard mounted on tripod for quick and easy adjustments to terrain
- LIDAR sensors mounted at 24 and 48 inches from the ground
- Lithium-Ion battery able to last a typical work week
- Ultra bright LED strobe light
- Piezo buzzer alarm
- Button for user interaction
- Power switch

Internal mounting

- Wood frame to hold all components (battery, sensors, PCB)
- Easy disassembly for modifications or component replacement

PCB

- Power distribution board with 24 volts, 12 volts, and 3.3 volts regulator
- Connects LIDAR sensor, alarm speaker, buzzer, and wireless antenna to the microcontroller
- Monitors battery level

Microcontroller

- Accelerometer to monitor disturbances
- Monitors the operation of the device and alerts
- Communicates with the fitness bands via ANT communication

Fitness bands

- Alerts users of a breach in the perimeter
- Provides user interaction with system

Features

- Waterproof
- Sensor max distance of 25m
- Easy access to charging port on top of bollard
- Fully charged in under 3 hours



Figure 4. Finished bollards.

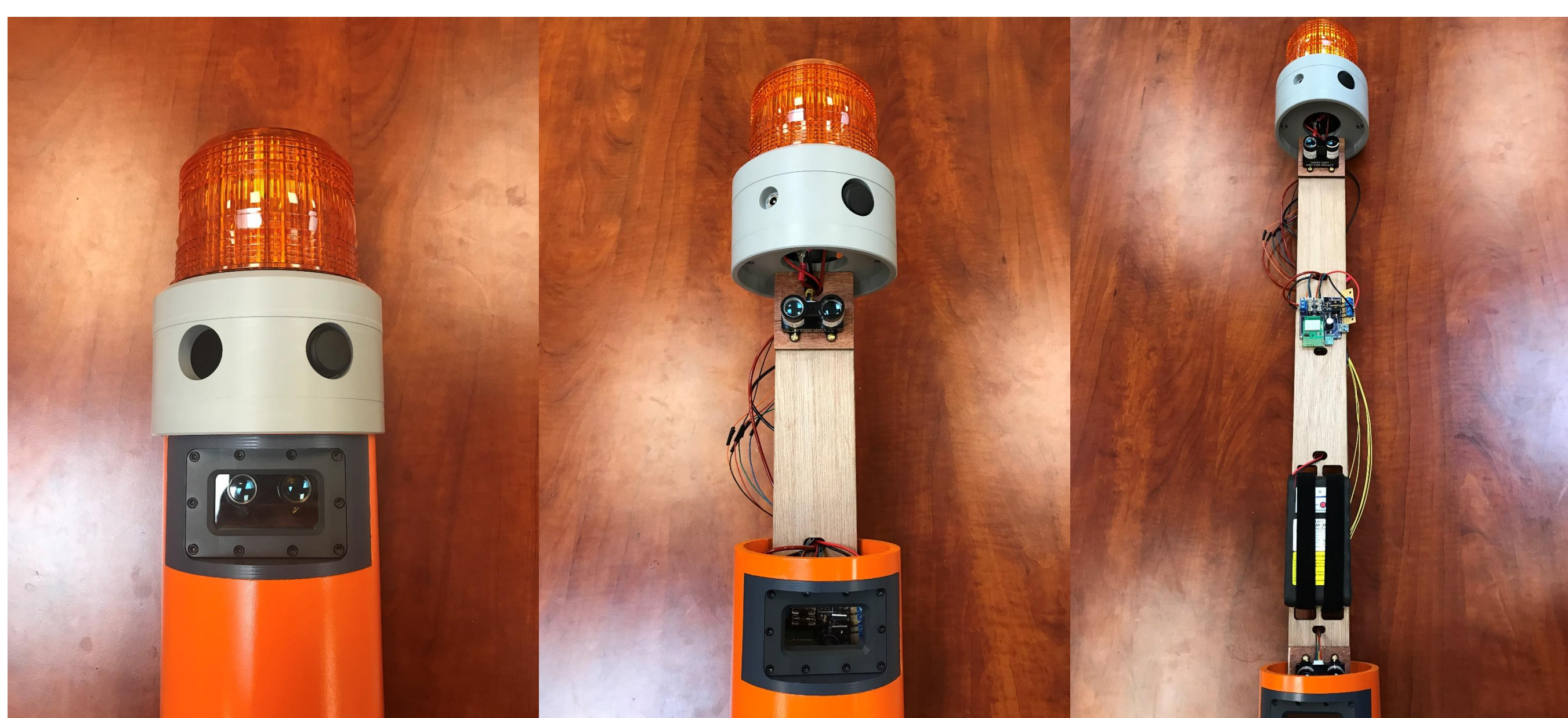


Figure 5. Bollard displaying the removable feature of the inside components.

Operation

On start-up the user will be prompted to enter training mode in order to align each bollard and establish the perimeter.

After all bollards have been properly aligned, the user can then activate the site and the worksite will be active and show the site secured screen.

In the event of a breach, each fitness band that is connected to the system will receive an alert that there has been a breach. Once the situation has been resolved any user can clear the site alert and go back to the site secured screen.



Figure 6. Application view on the fitness bands.

Future Expansions

- Live GPS map
- Internet
- Live camera recording on breach

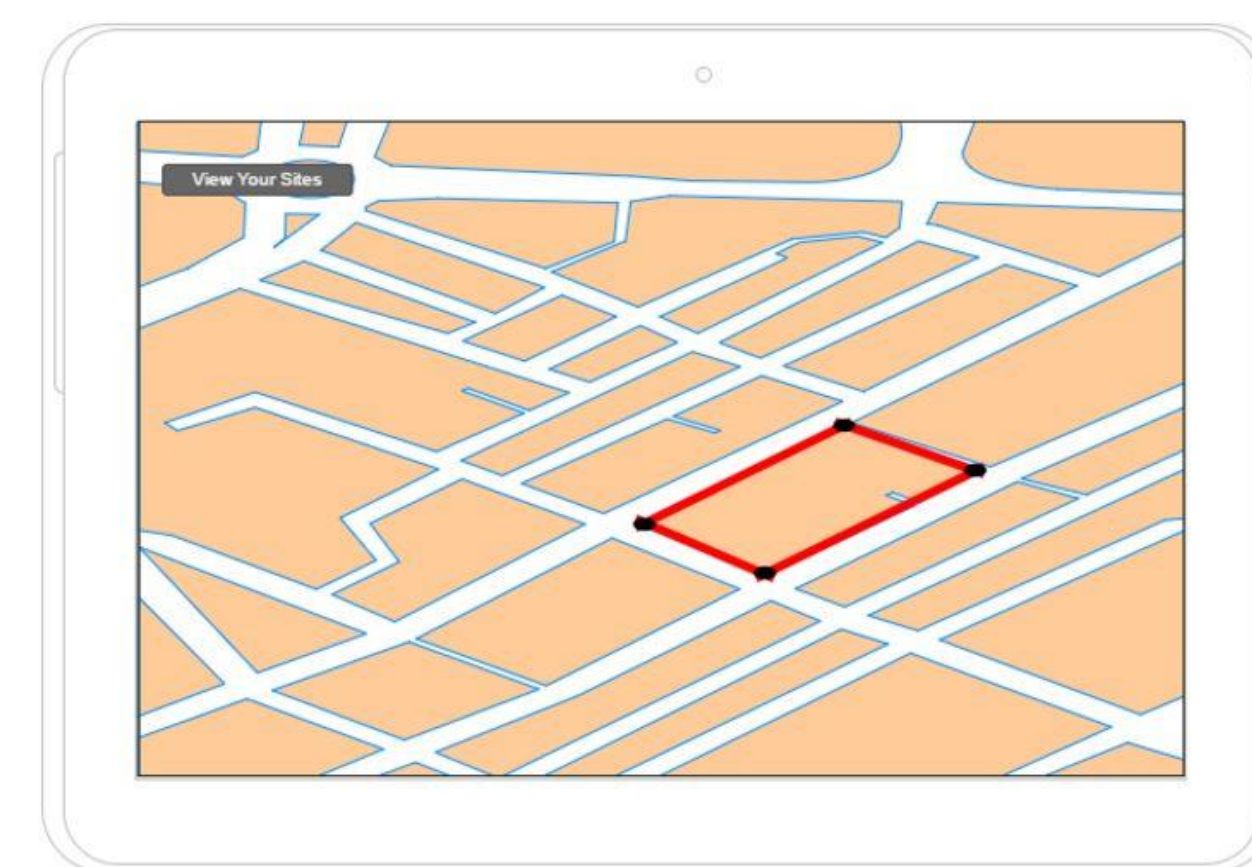


Figure 7. Live GPS map showing where each bollard is located in the worksite.

Deliverables

- 5 completed bollards
- BOM for building 20 more bollards
- Instruction and assembly manuals



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