Eagleye: Personnel Tracking in an Augmented Reality Environment

Senior Design
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Optical Operations

Project Goal

- System for tracking construction workers in real time
- Microsoft HoloLens application showing personnel location at any given time
- Small token, which is attached to toolbelt
- Communicates with a distributed tracking system that relays data to the HoloLens
- Allows supervisors and general contractors to prevent safety incidents
- Ensures workers are held accountable for where they are and their job

What is Optical Operations?

- Provides site management on an industrial scale
- Customer: Construction general contractors
- Use real-time 3D AR to ensure that the right assets and people are at the right place, at the right time, in a safe way

Design Requirements

Functional Requirements

- 3-part system: token, services, and HoloLens
- System will utilize construction sites' wifi
- Worker will keep token on belt and it will use wireless signal strength data for localization
- Admin website
- Must store data for future playback

Non-Functional Requirements

- Tracking accuracy within 6 meters
- Real time tracking
- Battery life of token is 10 hours
- Token is no larger than iPhone 8
- Token will relay readable data to HoloLens
- Must be able to track outdoors
- Delay must be no longer than 1 second

Engineering Constraints

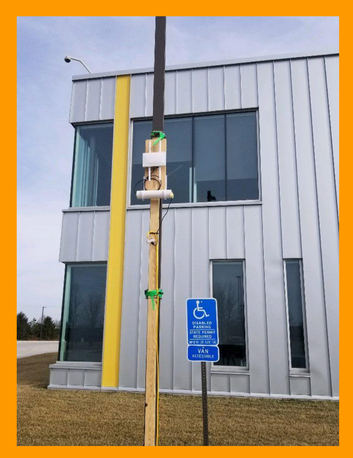
- Budgetary constraint: $5,000
- Time constraint: 9 months
- Design requirements

Engineering Standards

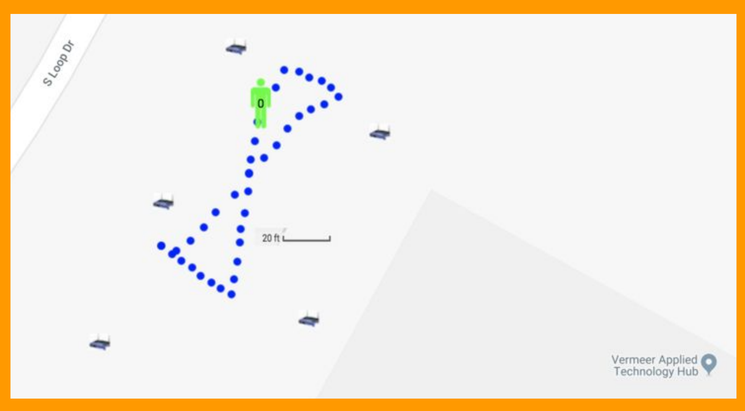
- IEEE 802.11: Specification for implementing wireless local area network (WLAN) computer communication
- ISO 21500: Guidance on Project Management

Eagleye on the HoloLens

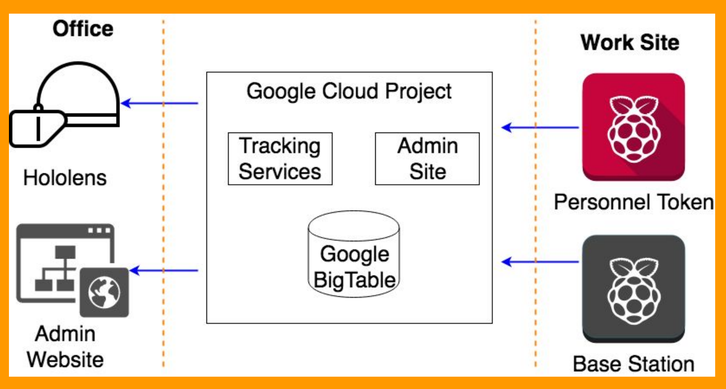
The system's token: a Raspberry Pi Zero



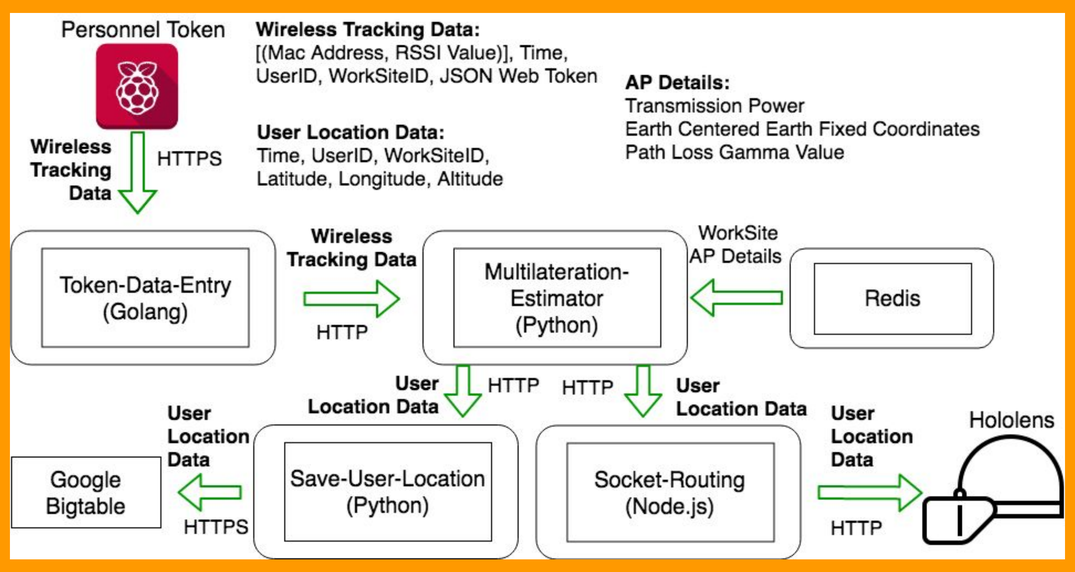
Test setup at the ISU Startup Factory



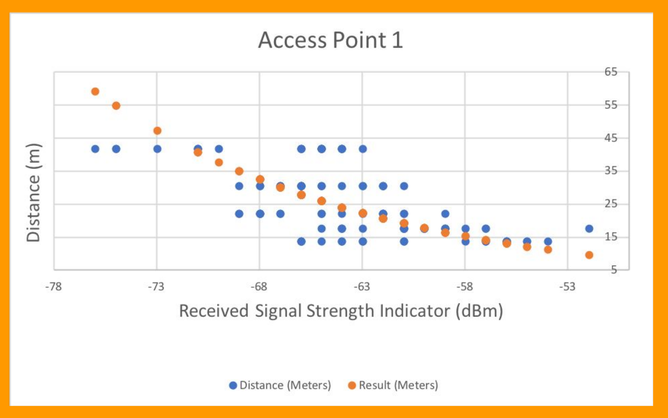
Simulation Test



System overview diagram



Tracking Services diagram



Results of RSSI to distance test

System Users and Uses

Users

- Those who want to ensure that outdoor worksites are running efficiently and safely
- Personnel who enter an active construction site
- Supervisors monitoring locations

Uses

- Monitoring the location of personnel
- Ensuring the safety of all employees on site
- Aid in location tracking in emergency situations

Technical Approach

Tokens (Data Gather)

- Raspberry Pi Zero
- Raspbian Lite (Linux)
- Ansible
- GPSD

HoloLens (Frontend)

- Unity
- C#
- MessageWebSockets

Services (Backend)

- Google Cloud Project
- Kubernetes Engine (Container Manager)
- Docker Containers
- NGINX (HTTPS Proxy)
- Golang, Python, Node.js, Shell Scripts
- MongoDB
- Redis
- Google Bigtable (Big Data Storage)

System Testing Procedure

1. Set up access points outside
2. Pick multiple points to measure in the test area
3. Measure distance between points and APs
4. Gather RSSI values from all points
5. Set up backend services
6. Plug into multilateration service to get longitude and latitude
7. Compare with known GPS location
8. Send information to HoloLens
9. Compare avatar location with GPS location

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