Overview

To remain competitive in modern industry, it is becoming increasingly important for businesses to understand customer interests and their habits. The Occu-Fi WiFi-based device tracking system aims to help businesses achieve this goal in a manner that is easy-to-implement and cost-effective.

Using WiFi probe requests that smart devices are configured to periodically transmit, data relating to customer movements and area occupancy can be processed into metrics.

Occu-Fi aims to enable businesses to understand the ebbs and flows of their customers without the need for invasive software, overly complex systems, or managing the responsibilities of ethically collecting and storing customer data.

System Design

The system design is comprised of four layers (see Figure 2):

**Data Collection Layer:** A set of microcontrollers (nodes) which collect WiFi probe requests from nearby devices and relay that data to the data processing layer in Amazon Web Services

**Data Processing Layer:** A set of functions that receive device probes from the data collection layer and determine the locations of respective devices using a multilateration technique; signal strength values measured by nodes at known locations can be used to determine the device location (see Figure 1)

**Data Access Layer:** An API, an SQL database, and a remote filesystem to handle the business logic of the system by providing models for users to easily access and manage their data

**Presentation Layer:** A web application that provides users with a UI to manage their organizations and deployments, as well as analyze metrics and data

Results & Discussion

Each layer of the system has been tested for expected behaviour and meets initial requirements set out for a minimum viable product.

Load and stress testing has yet to be performed on the Occu-Fi system; these are plans for future development. However, most components are horizontally scalable and the system is expected to withstand the maximum foreseeable loads a use case would entail given that the system is deployed on Amazon AWS.

Device locations resulting from the Localization Function’s multilateration calculations are estimated to be accurate within a 4 metre radius.

The resulting system is functional end-to-end. It is an inexpensive, scalable, and efficient solution to tracking the movement of individuals within a space and that space’s total occupancy.

The current front end web application allows for customer movement-related data to be displayed to users in an easy-to-consume way, such as building occupancy heat maps (see Figure 3).

Conclusion

The system as designed will allow businesses to better understand how their customers think and flow through their buildings. It does this by tracking devices as they move through the establishment.

In order to track the devices, Occu-Fi has developed an algorithm utilizing multilateration to locate a device. This technique is accurate within a 4 metre radius, allowing the system to accurately track the devices as they move through the building.

Customer flow data is stored for later presentation to end-users on the Occu-Fi web application.

Presently, no stress nor load testing has been performed on the system. This is due to both physical and time-based constraints on the development of the system.

In the future, both stress and load testing must be completed along with efforts to increase the accuracy of customer flow data. This will allow the system to be viable in more potential use cases.

References
