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IoT Occupancy Monitoring for Social Distancing Applications

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Scan the QR-code below to see system backend in action!

Background

A major concern for academic institutions in recent times has been providing sufficient and safe resources to their students in order to ensure quality education. Resources are limited and require efficient allocation in order to meet students demands.

Keeping students informed about the status of these resources in real time is the challenge that our project poses to solve, with the assistance of image recognition and real-time streaming of data to people.

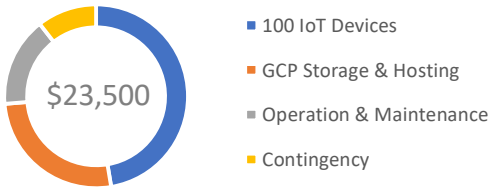
Results

The app can detect and display real time room occupancy to an accuracy of 85% , allowing students to quickly find available study spaces while maintaining social distancing and adhering to building and occupancy rules.

The device transmits real time motion capture and heat map data to the back end (hosted by google cloud) while maintaining an overall cost of less than $100 per unit. The cost is projected to further reduce when purchasing equipment and materials in bulk.

Cost

Total capital cost of the project is $23,500, which includes a 10% contingency, detailed design and implementation of 100 IoT devices covering every shared space in the Albert A. Thornborough building, data storage and hosting of the web application on Google Cloud Platform (based on a 3-year period), and 3 years of operations and maintenance for the physical devices.



Conclusion

This design serves as an important first step towards a more efficient and modern method of allocating shared study spaces uniformly throughout the campus

Design Solution

The design solution utilizes an image processing/open-CV model that predicts whether an individual is walking into or out of a video frame, captured using a raspberry pi camera.

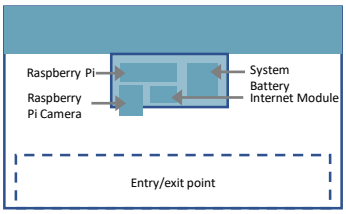
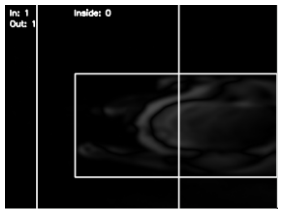


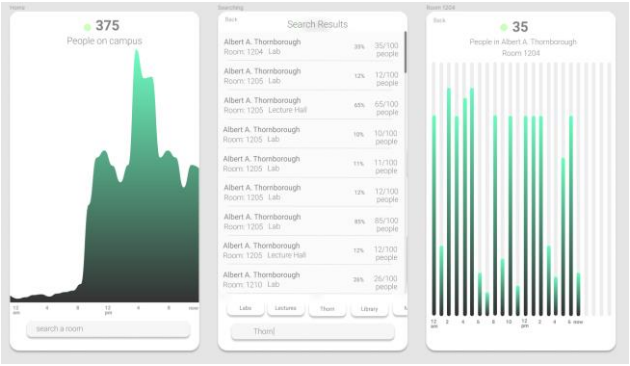
Diagram of ceiling mounted IoT device with raspberry pi camera



Camera output depicting bird's eye view of individual walking below

The raspberry pi captures real time data and sends information to a firebase database where data from all other nodes are collected. This provides accurate information of how many people are in the monitored facility. The designed dashboard utilizes this information to provide useful insight such as occupancy in lab rooms and study rooms.

The designed image processing model saves the original background of the image and compares it to every new frame captured to detect changes in image. If change occurs, the model tracks the changed pixels as the object moves across the frame. The direction of movement determines whether a person is entering or leaving the facility.



Screen capture of the designed dashboard depicting output results of the Albert A. Thornborough building.

The image captured is a filtered image which prevents privacy policy breach and ensures that the subject being tracked is unidentifiable.

SCAN ME

Live Demo

Scan using Google Lens app

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