Chair Availability System For Library

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Observation

- Students have difficulty finding vacancies in the library during peak hours
- Librarians count the number of people and manages the flow control **'manually'**
- Diseases are easily spread through the air in indoor spaces

Motivation

(Object detection)

- Get chair availability in real time
- Avoid indoor virus spreading

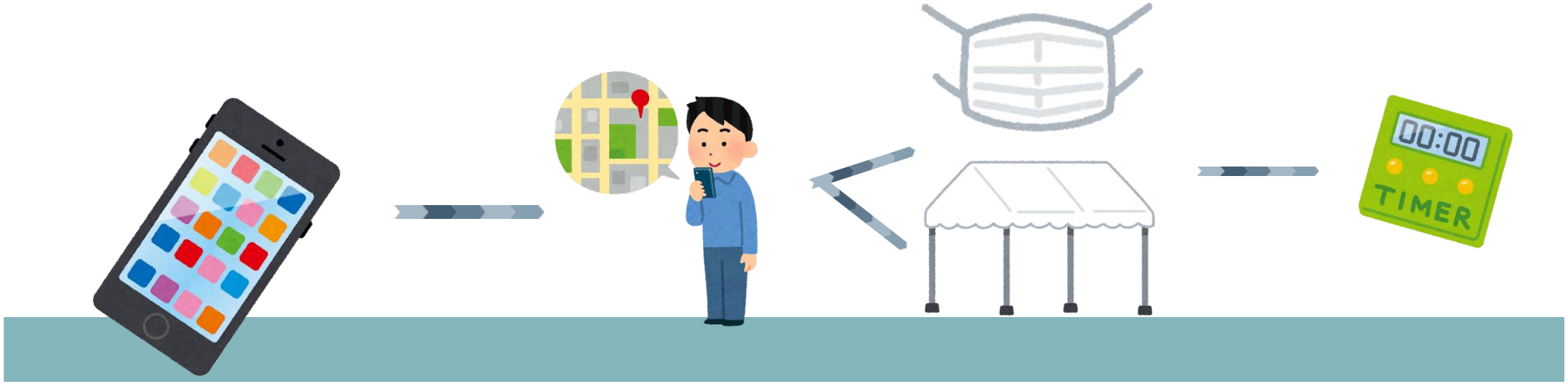
(Data Processing)

- Analyze people's flow

(Data Feedback)

- Suggest a location with more vacancies

System flow for Student



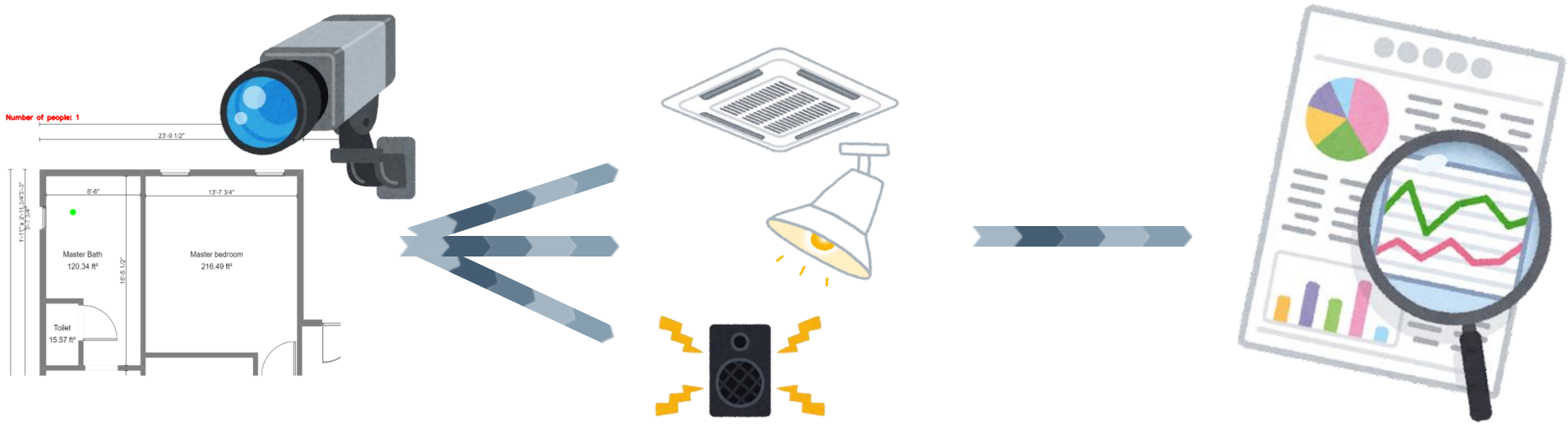
Use mobile application to check the availability

Indoor navigation from the app using IBeacon

Getting information from library using IBeacon

Approximate staying time

System flow for Librarian



Interface for people control with the camera

Connect to smart devices, automatically control according to student flow

Data analysis for improvement

Networking

- Assume the library is covered with Wi-Fi
- The camera using edge computing and connect to Wi-Fi to send processed data to the system and cloud.
- The controller of camera using Wi-Fi to connect to those smart devices
- Students use mobile with the library app to find the IBeacon and no network setup is needed. It should be installed near to the door and without being covered.

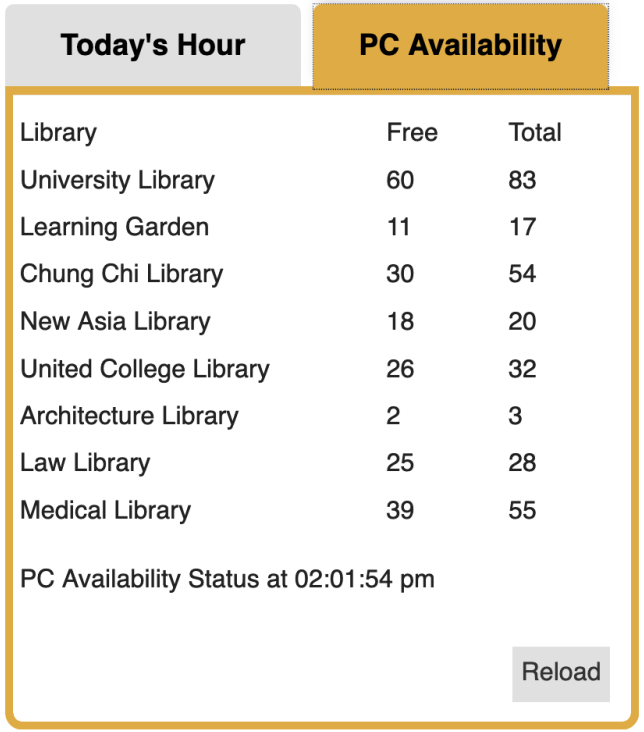
Cost and Benefit

- Each room install an IBeacon device
- Each 1-2 rows install a camera inside the room

- Student more easily to find an empty seat with indoor navigation and get corresponding information of specific room nearby
- Save manpower of utility team with auto control the smart devices including light and air conditioner to avoid virus spreading
- Using camera to detect chair availability can have extensive functions including mask detection and facial recognition in the future

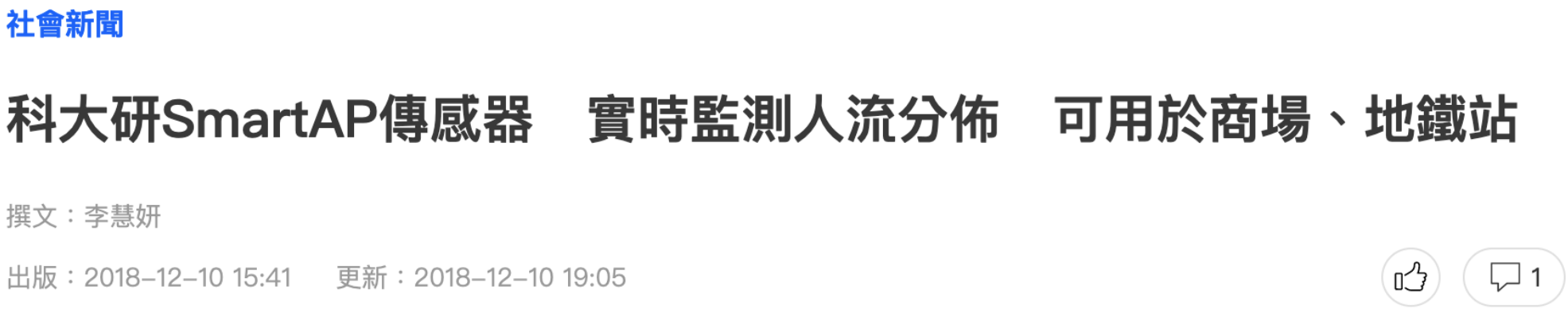
Current Technology 1

- Counting PC availability based on the number of PC logged-in.



Current Technology 2

- Counting people by Wi-Fi connected. (HKUST)
- Relies the **'active'** Wi-Fi connection.



社會新聞

科大研SmartAP傳感器　實時監測人流分佈　可用於商場、地鐵站

撰文：李慧妍

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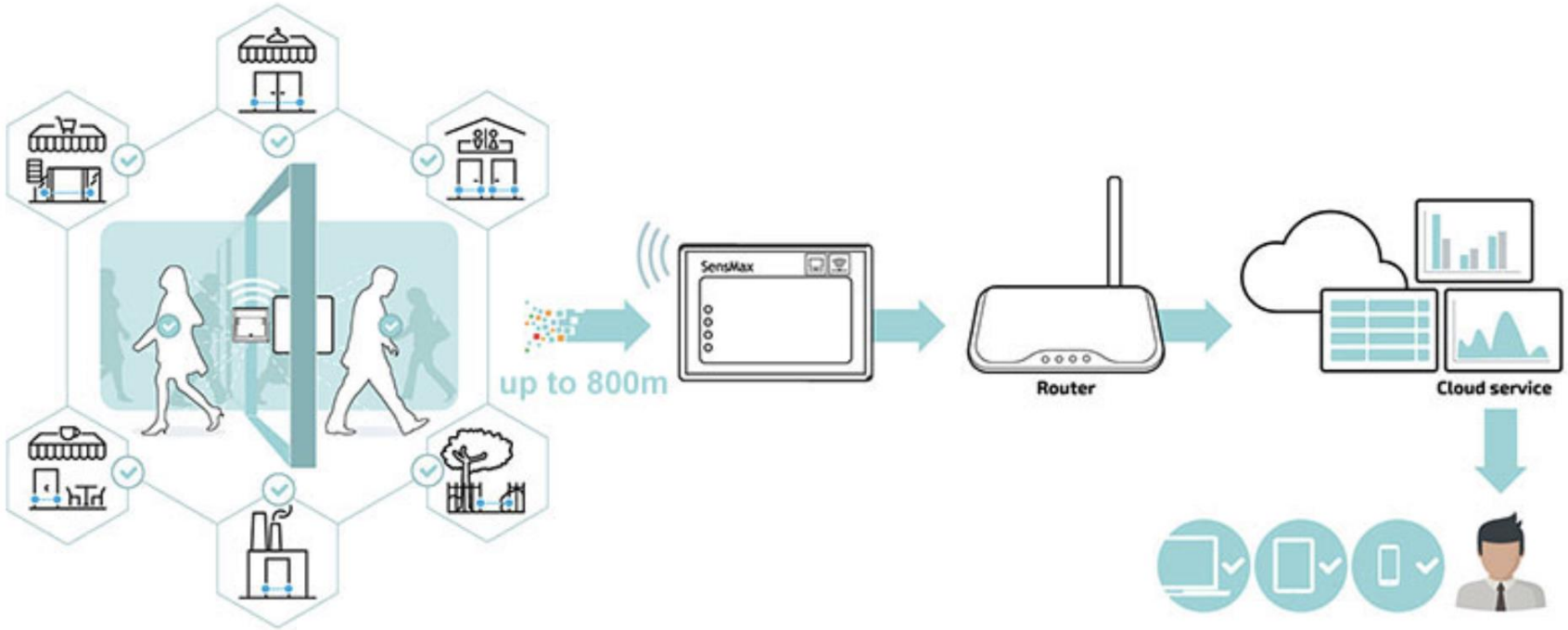
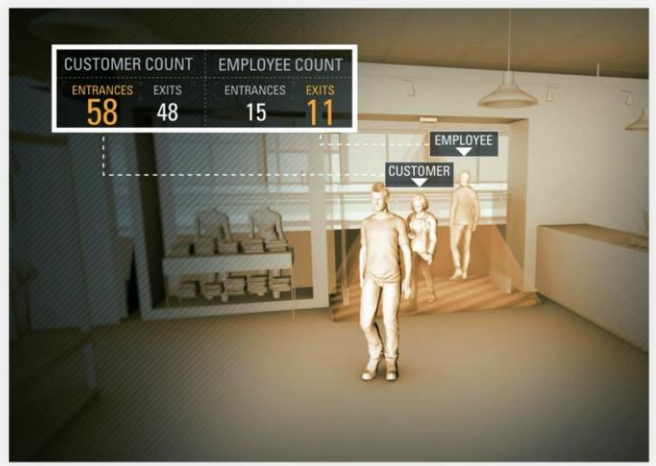
Current Technology 3

- Commercial people counting system (SensMax)
- Only at entry



Current Technology 4

- Commerical people counting system (ETG@HK)



Project idea and Expected outcome

- Object detection:

- Monitor the chair availability (in real time)
- Navigation with IBeacon
- Extension: Mask wearing check

- Real time availability:

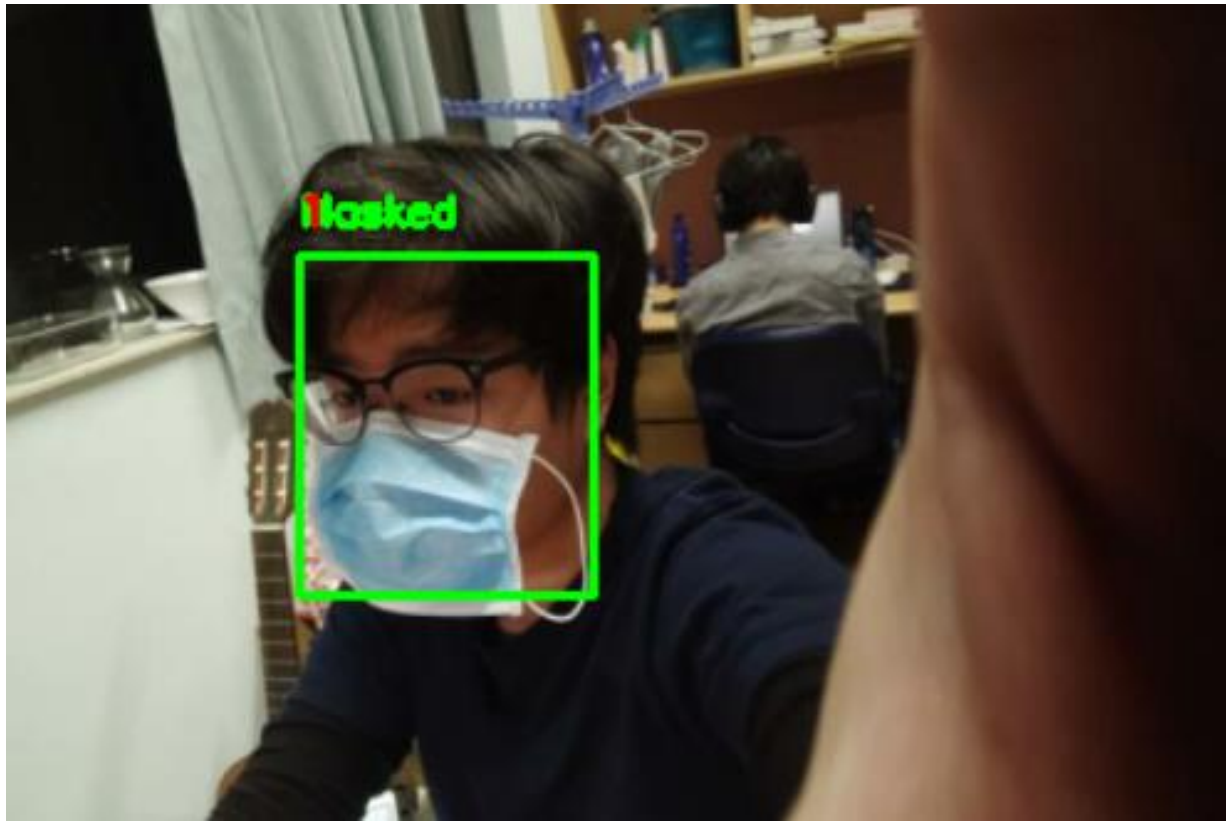
- Students could go to the library which has more vacancies.

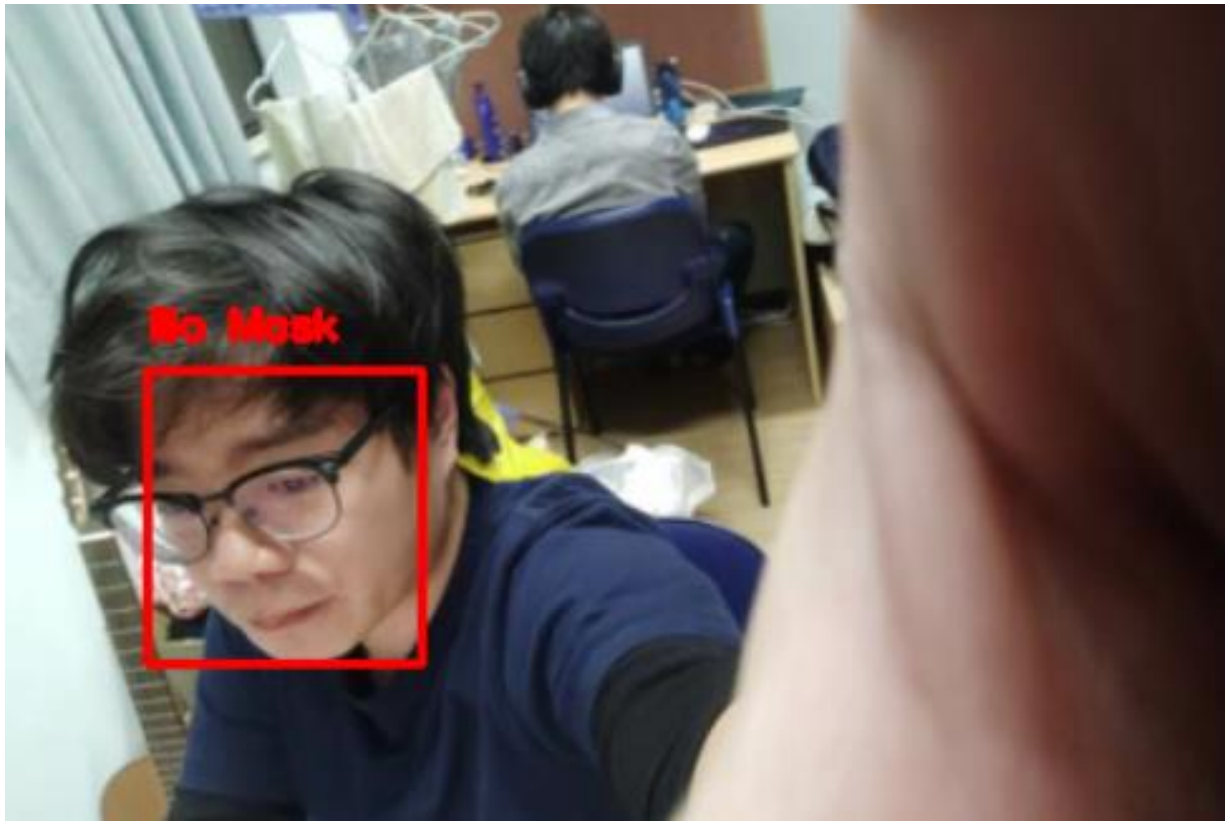
- Analysis of library:

- Librarians could make use of the system to count people.

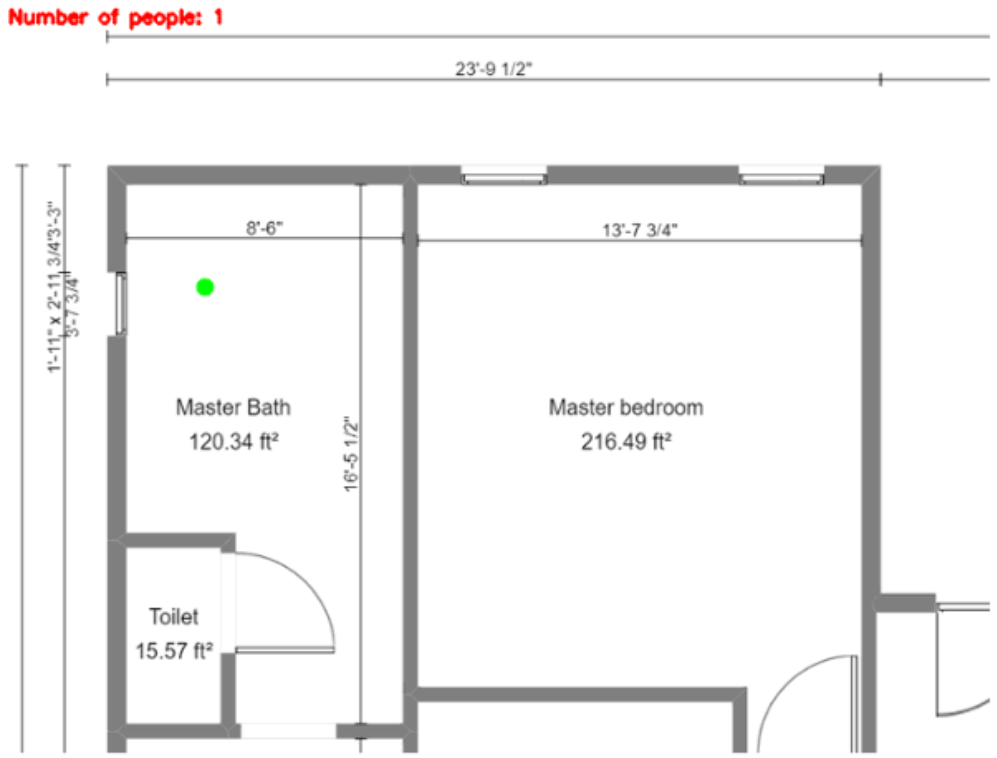
Demo: Python

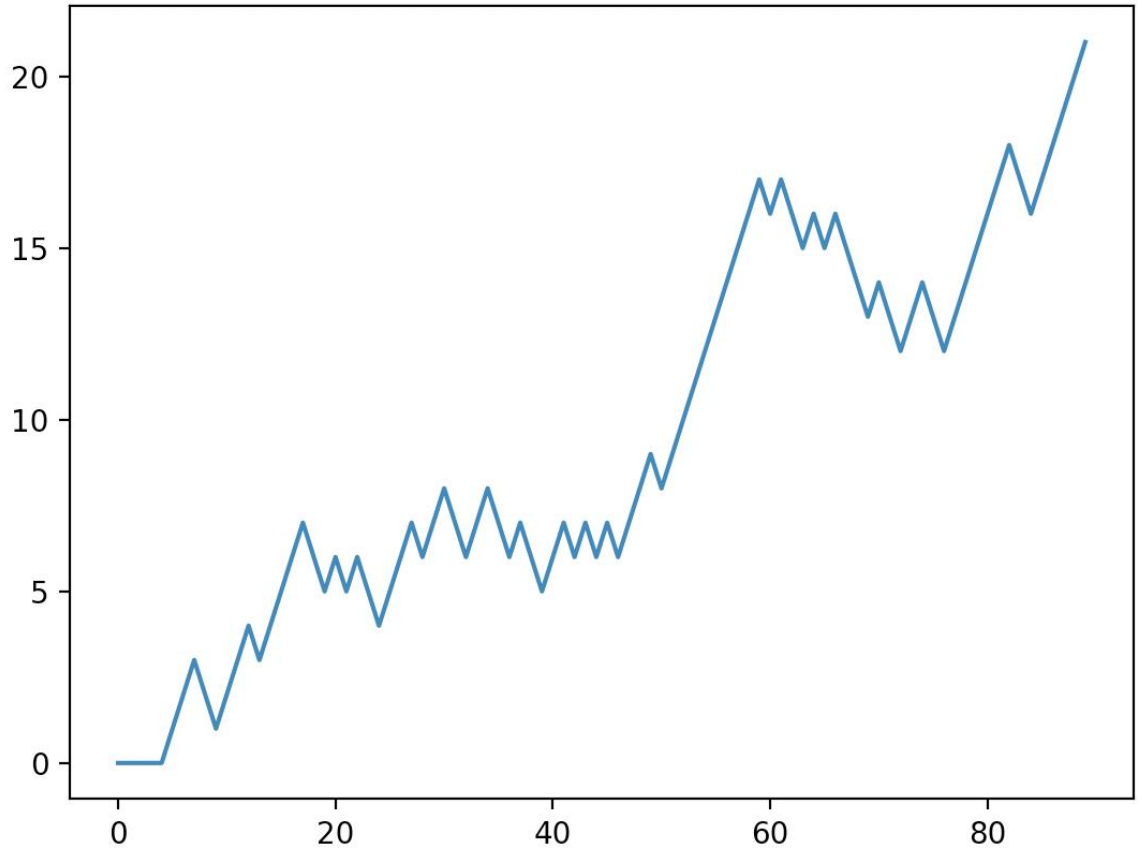
Object detection: Opencv





Expected Result





Publish-Subscribe model

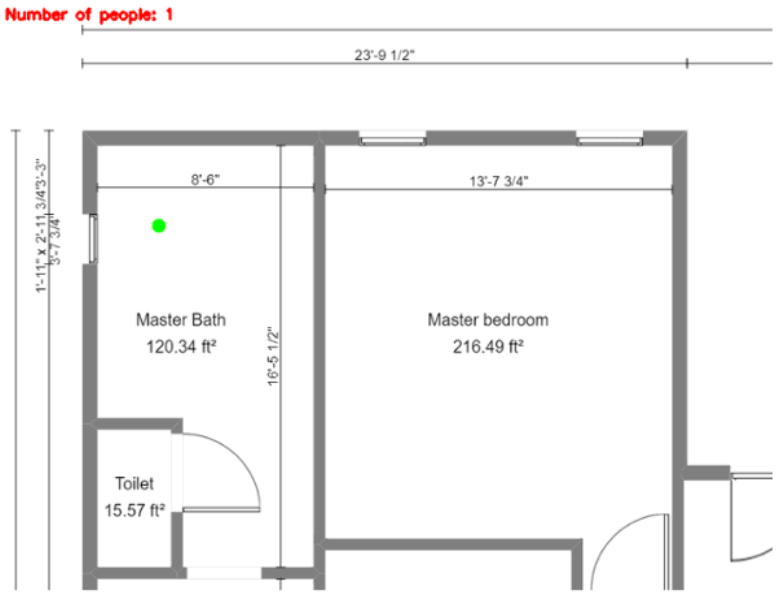
- Each camera would monitor several chairs.
- Based on MQTT protocol, the status would publish to the server through Wi-Fi if there is a change.
- The server then updates the user interface.
- Users could access the webpage to find vacancies.

Edge computing

- Each room has a micro-controller connected with several cameras.
- The data would be processed at the edge before sending (only) the results to the server.

(Green dot: wearing a mask)

(Red dot: not wearing a mask)



Data Analytics

- At the back-end, the flow of people could be analyzed.
- Could also use to check the population and improve the facilities such as number of chairs and air cleaner.

- Students can track their studying time

from the application