

# IOT Final Project

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Team: 跟不上我的速度吧 哈們!

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# Outline

- Motivation
- Hardware architecture
- Software architecture
- Algorithm
- Experiment and result
- Future work

# Motivation



# Hardware

- Arduino Nano 33 IOT \* 2
- Web Camera
- Speakers
- Servomotors
- DFplayer (Mini mp3)



# Hardware architecture



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Player1



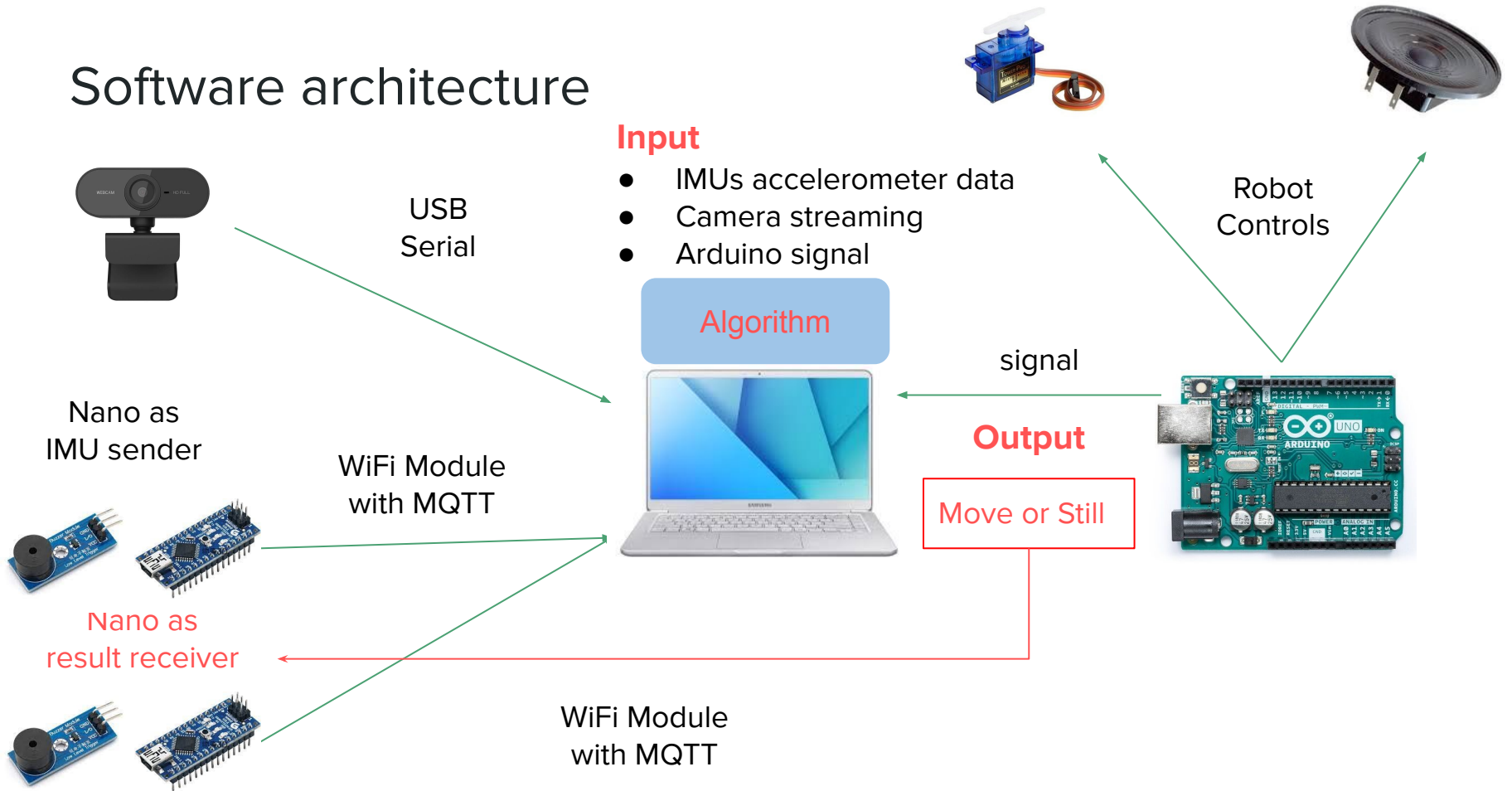
Player2



Arduino Nano 33 IOT  
6-axis IMUs  
WiFi module

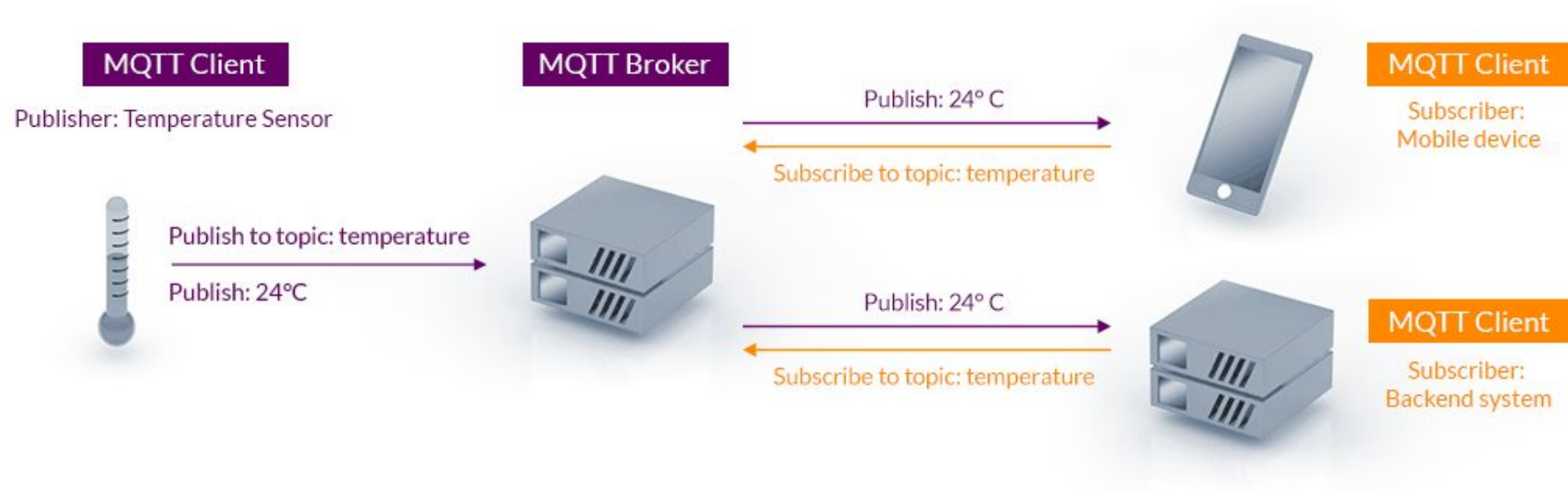
Laptop as server to compute the Videos and IMUs information for movement detection

# Software architecture



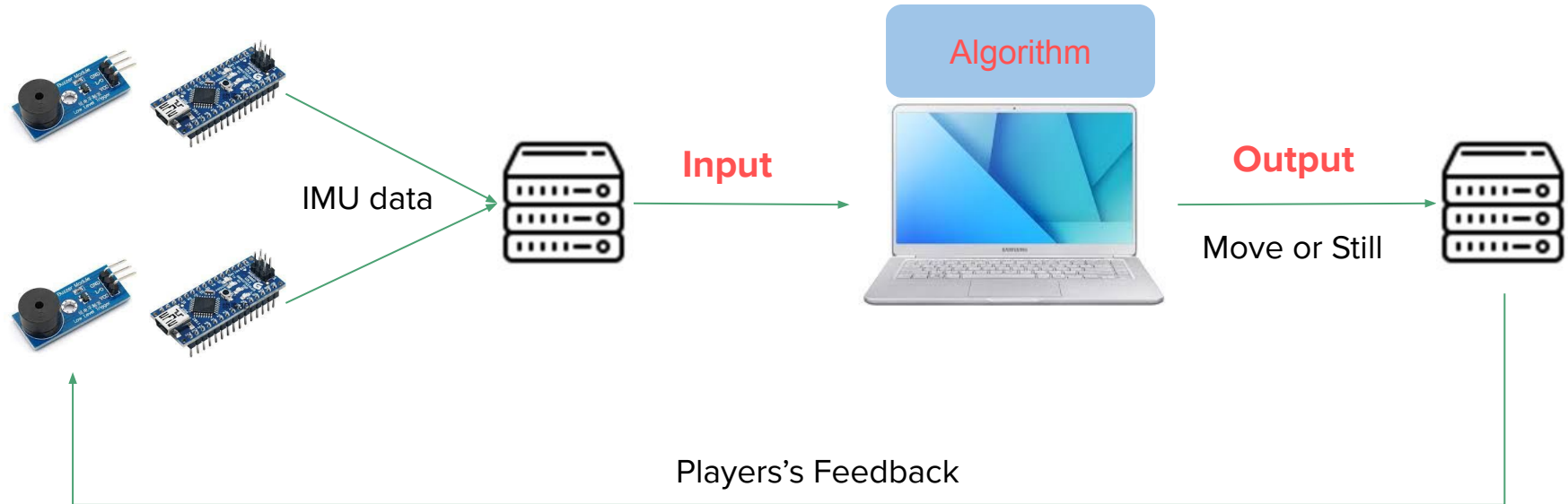
# Integration with MQTT

- MQTT Publish / Subscribe Architecture



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- MQTT Publish / Subscribe Architecture





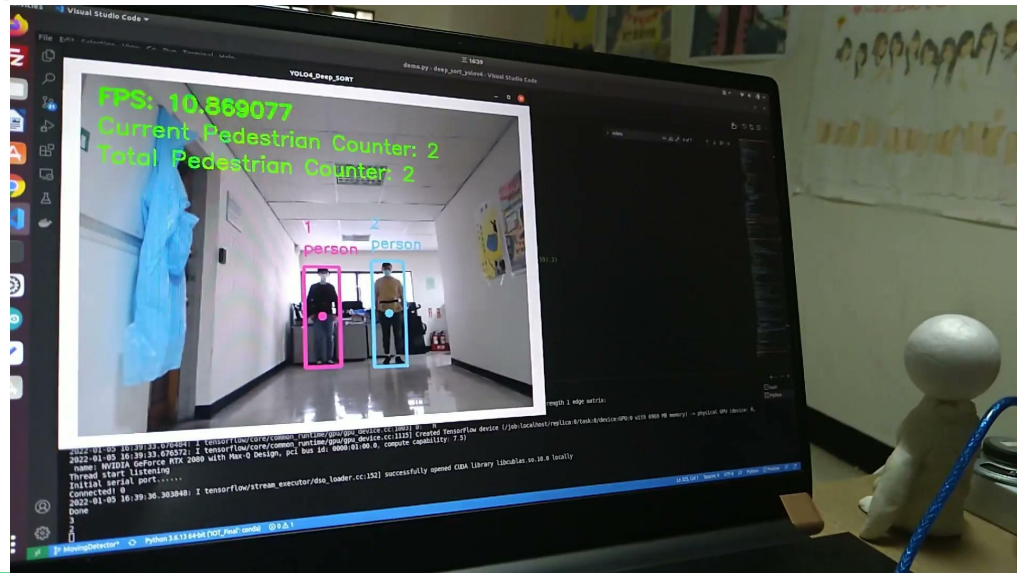
# Algorithm

- Human bounding box detection and tracking with Yolov4
- Human movement detection with moving average (OpenCV) algorithm
- Calculate Intersection over Union between bounding box and moving contour

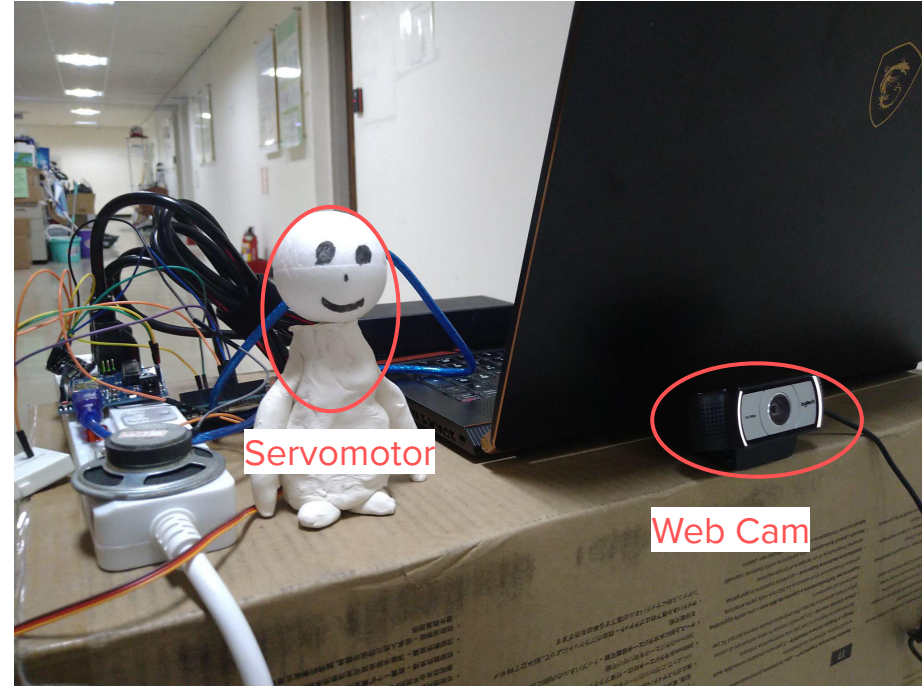


# Experiment and result

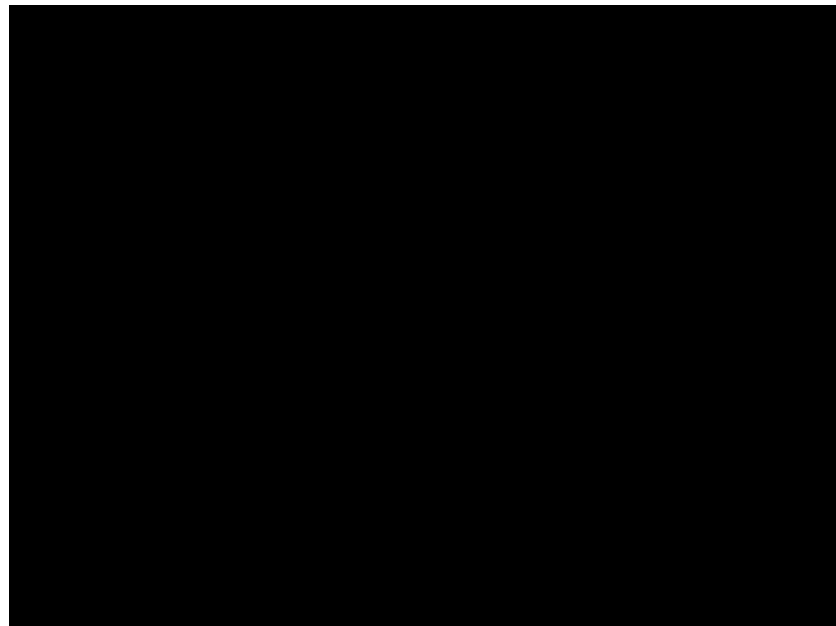
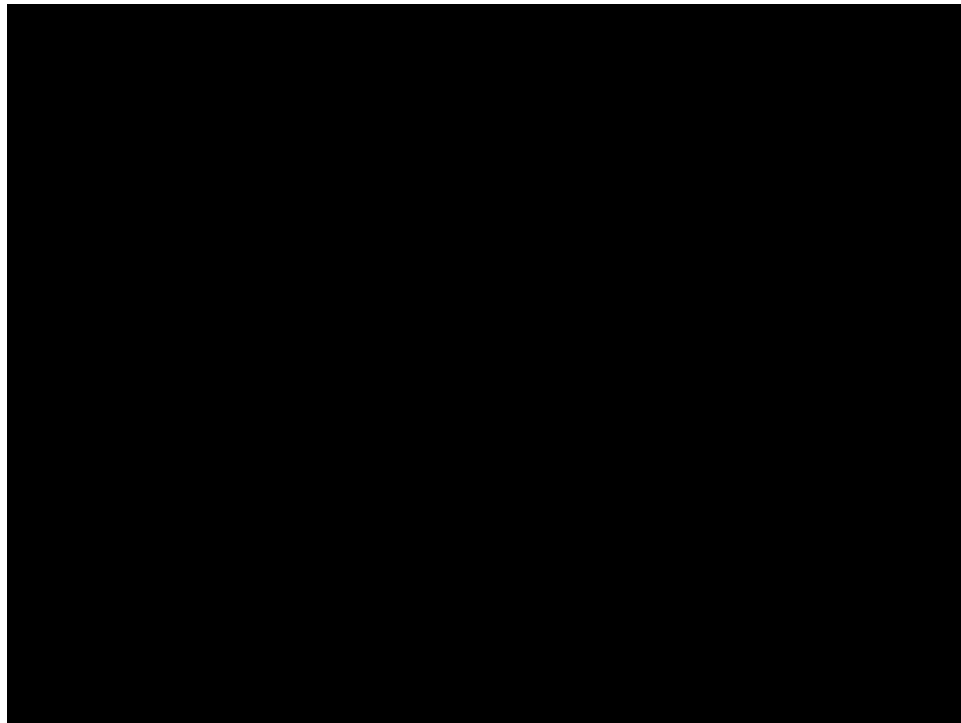
- Setup:
  - Random rotation frequency ( 1.5, 3, 6 second)
  - Movement either detected by sensing or visual movement
  - Win the game if escape from camera scene!



# Experiment and result



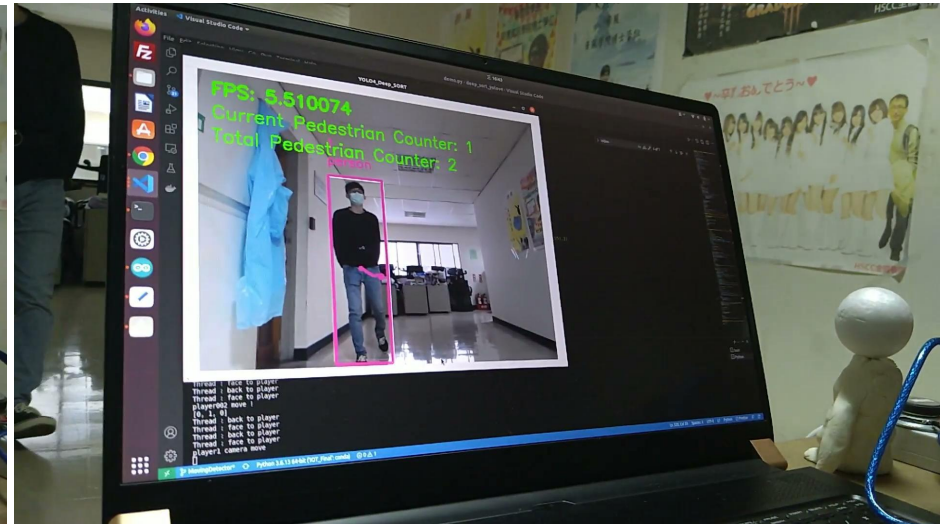
## Experiment and result



The image shows a laptop screen with a Visual Studio Code editor open. The main window displays a video feed from a camera in a hallway. Two pedestrians are visible: one in the foreground wearing a black shirt and jeans, and another further down the hallway wearing a brown shirt and dark pants. Bounding boxes are drawn around each person. Above the first person is a yellow label "person", and above the second person is a blue label "player". In the top left corner of the video frame, green text reads "FPS: 4.408605". Below that, it says "Current Pedestrian Counter: 2" and "Total Pedestrian Counter: 2". At the bottom of the screen, a terminal window shows a log of events:

```
Thread | first back to player
Thread | back to player
Thread | face to player
Thread | back to player
Thread | back to player
Thread | player's camera move
Thread | back to player
Thread | face to player
Thread | player's camera move
```

A small white figurine is placed on the desk next to the laptop.



## Future work

- Improve the vision-based algorithm to increase and stabilize the FPS
- Add human tracking for more complex scenes e.g., occlusion, interaction
- Add more sensors to detect movement more accurately, but suffer from synchronization problem
- Use laser sensor and positioning IR camera sensor to add some atmosphere to the game

Thanks for your attention