Indoor Navigation

Building Indoor Navigation app without using GPS

실내 측위 네비게이션

GPS기능을 사용하지 않고 실내 측위 네비게이션 개발하기

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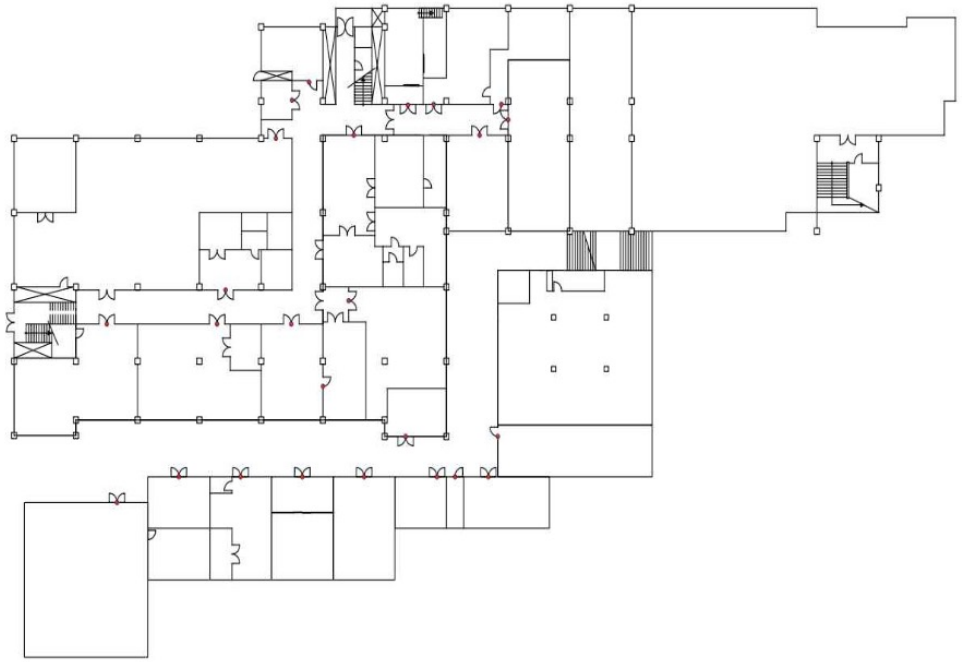
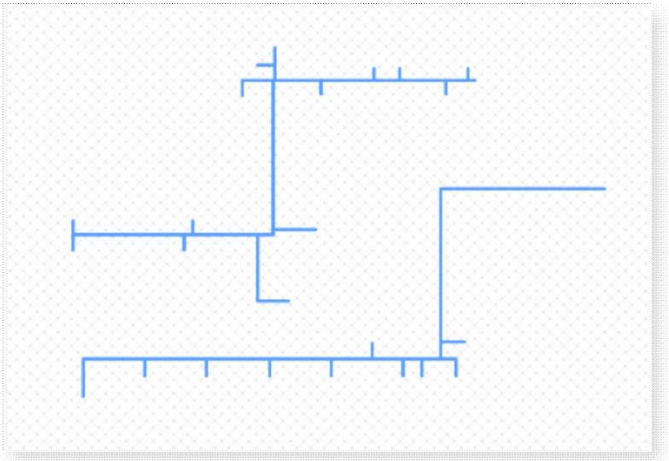
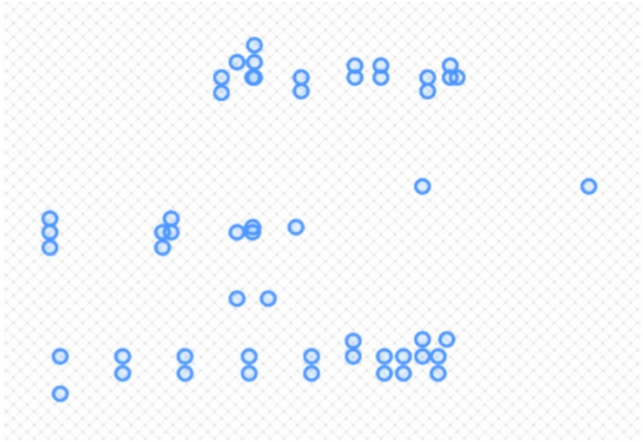
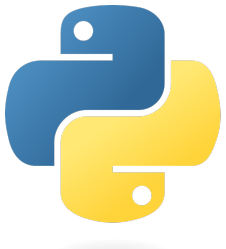
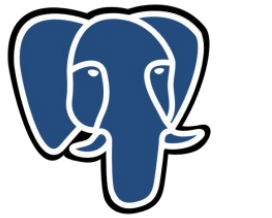
Progress Before Midterm Presentation



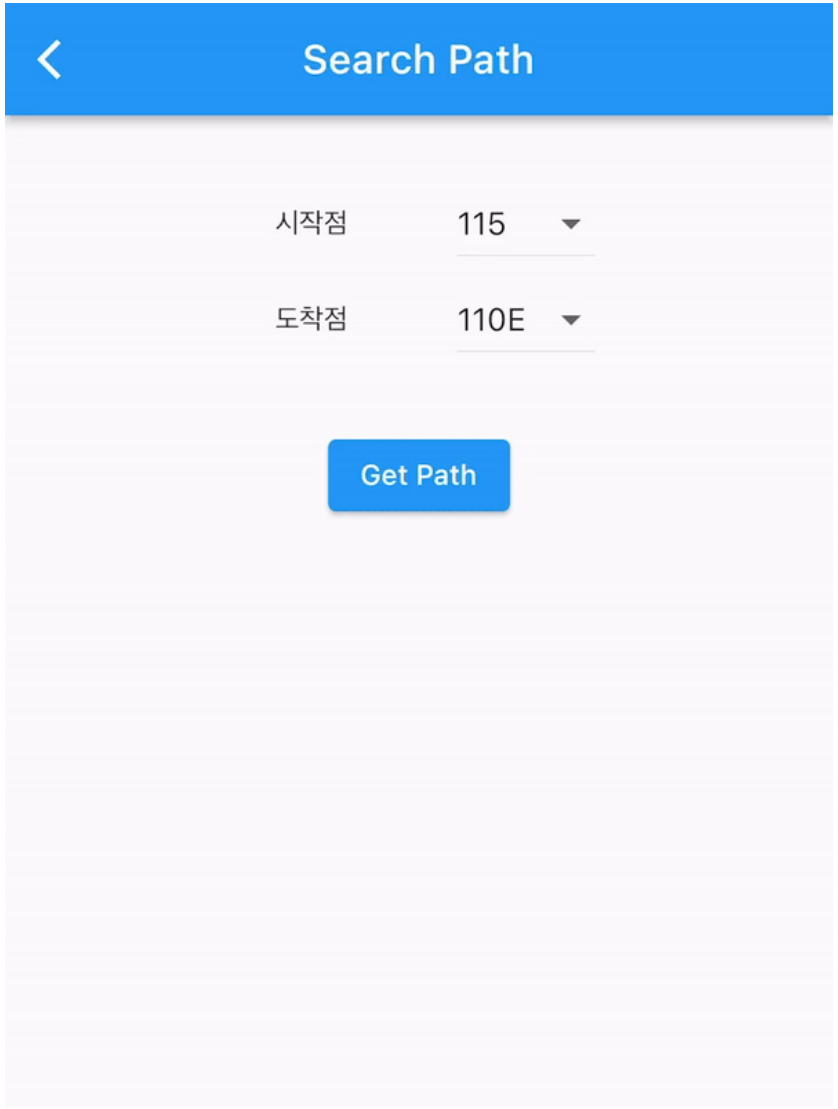


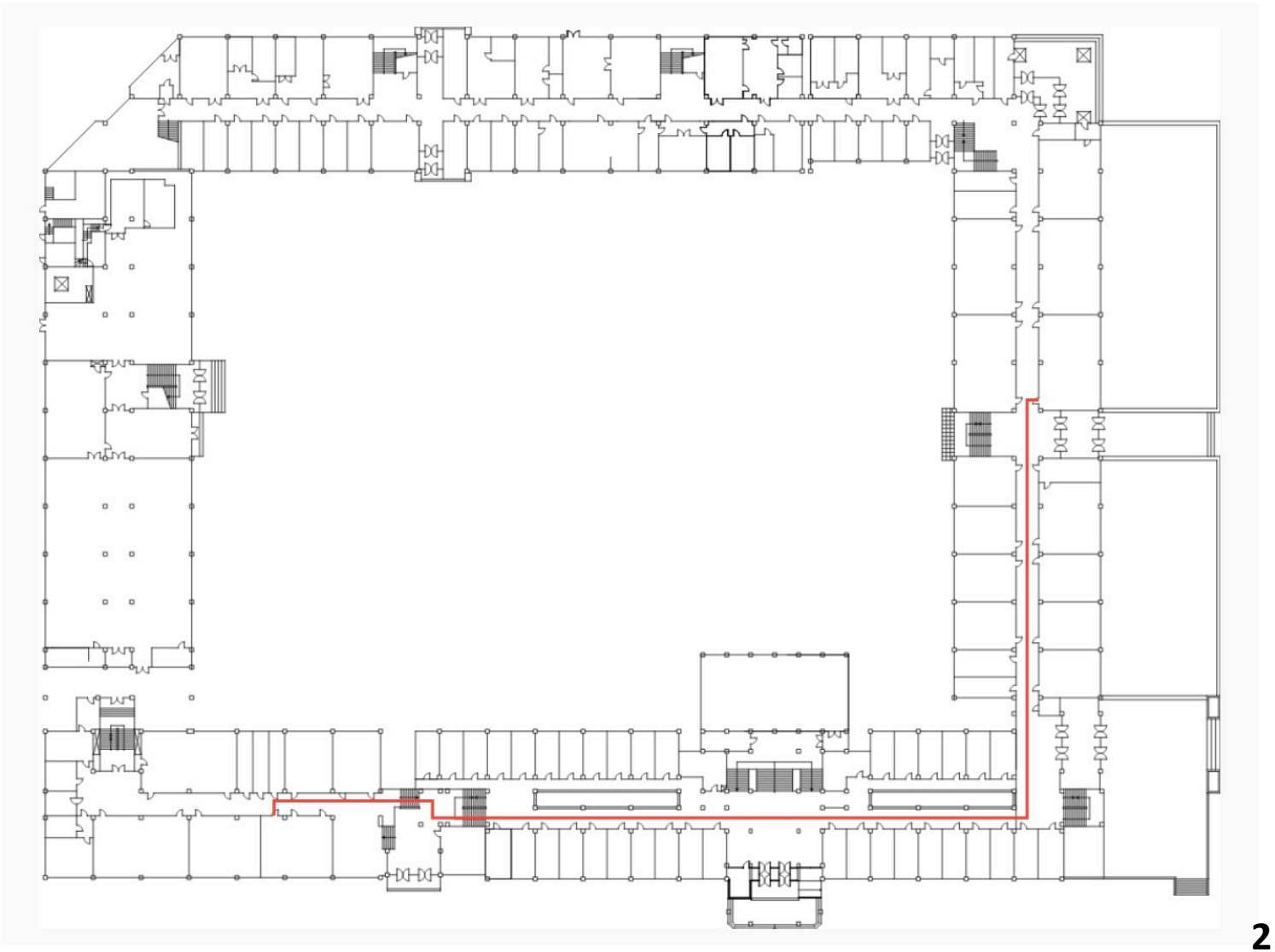




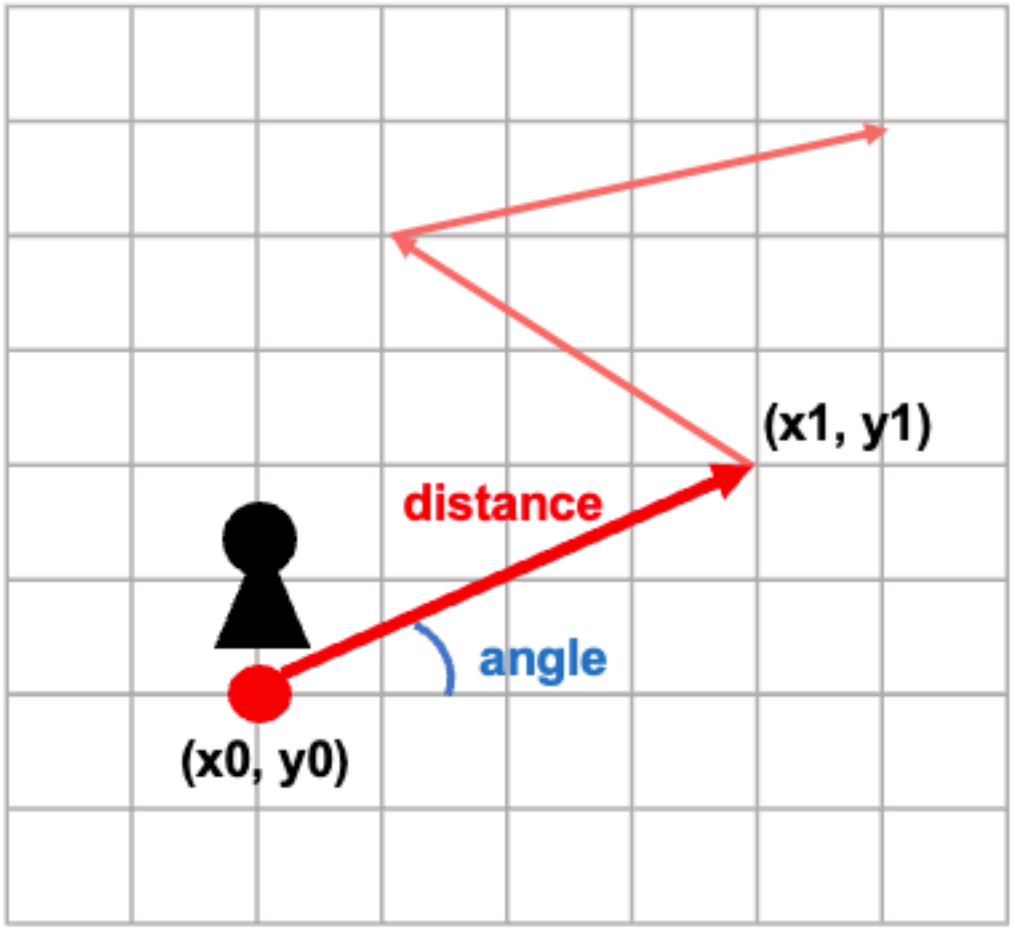


Route Display Feature





Principle of Pedestrian Dead Reckoning (PDR)



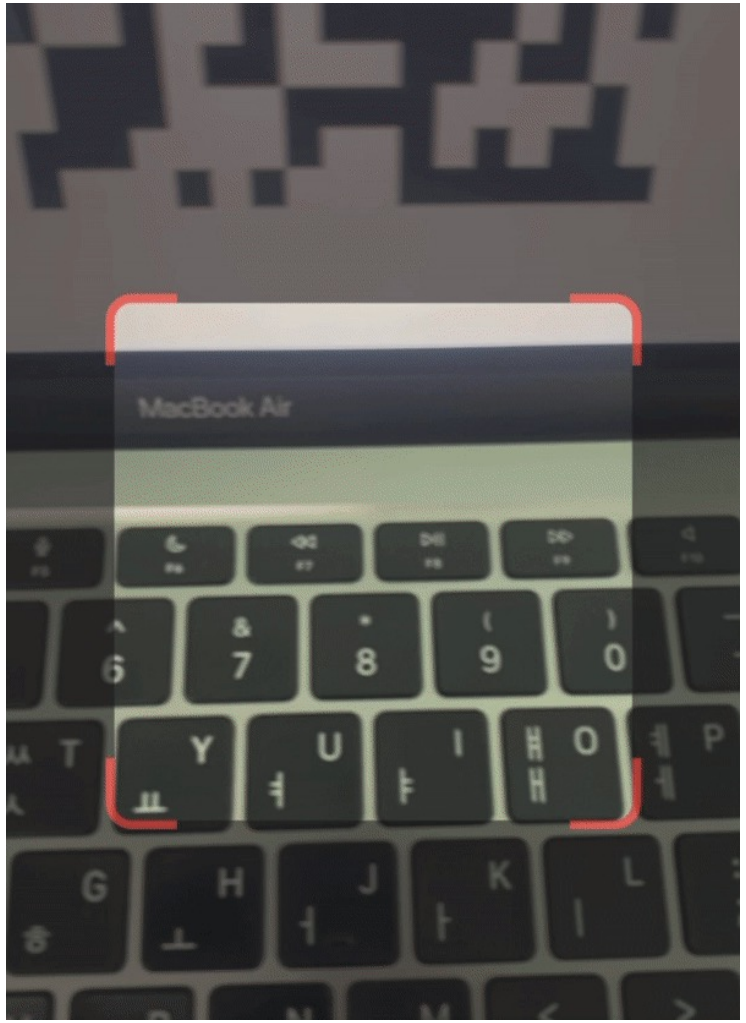
What we need

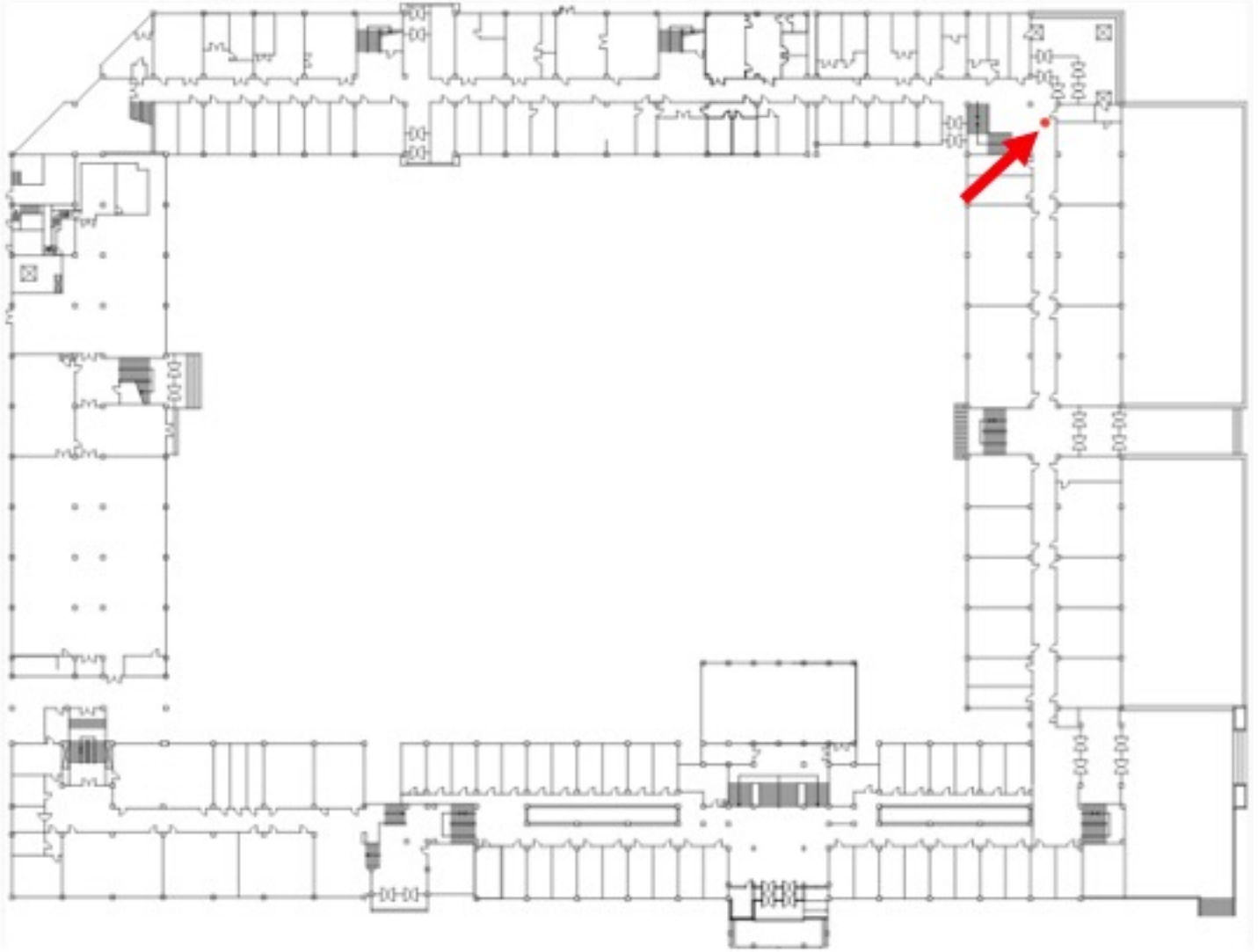
1. Initial Position and Orientation
2. Angle Information
3. Distance Information

$$\boldsymbol{Angle} = Yaw\ from\ Gyroscope\ Sensor$$
$$\boldsymbol{Distance} = Number\ of\ Steps \times Size\ of\ Each\ Step$$

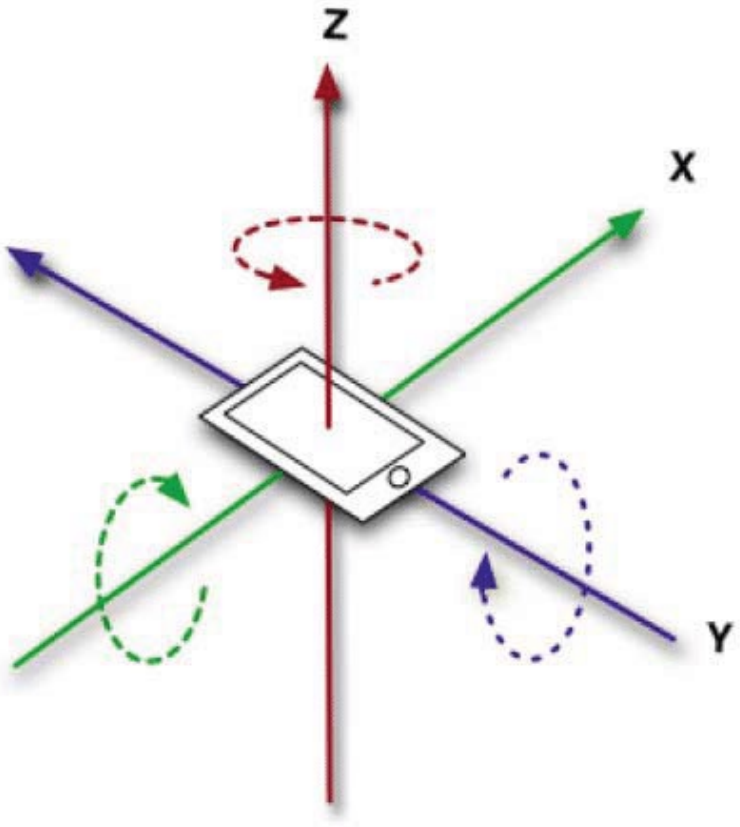
$$x1 = x0 + \boldsymbol{Distance} \times \cos(\boldsymbol{Angle})$$
$$y1 = y0 + \boldsymbol{Distance} \times \sin(\boldsymbol{Angle})$$

Initial Position and Orientation Setup Using QR Code





Acquiring Angle Information (Yaw data)



Yaw data

: The degree of rotation around the z-axis

Gyroscope sensor

: Measures angular velocity for each axis

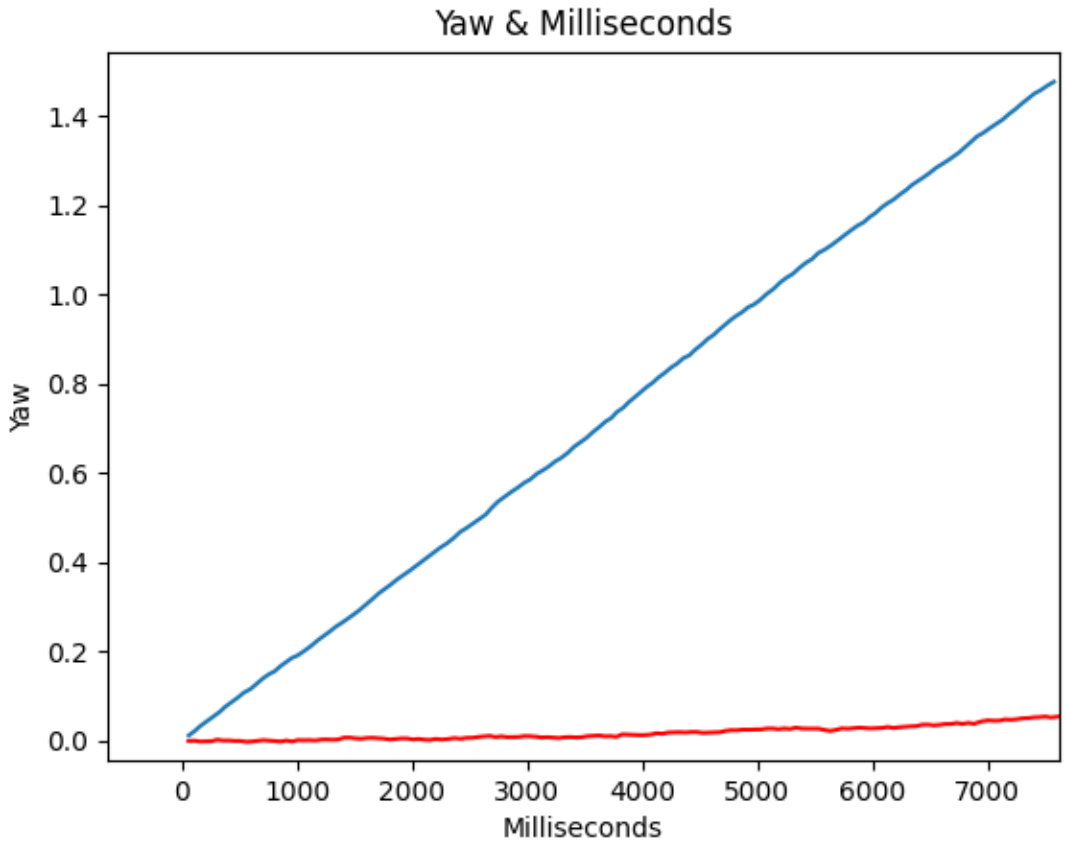
Problem of Gyroscope sensor

: Gradually lose accuracy over time

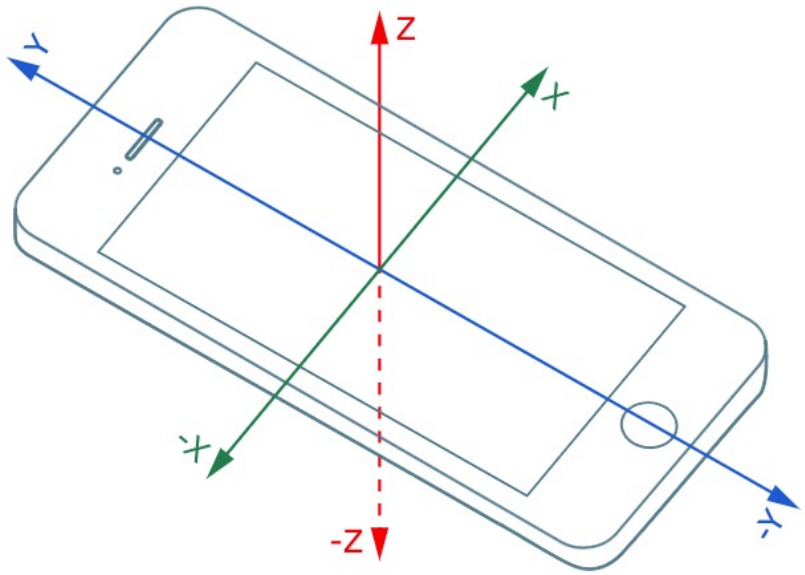
Acquiring Angle Information (Yaw data)

Before

After



Acquiring Distance Information (Number of Steps)



Number of Steps

: Measures the sensor's movement during walking

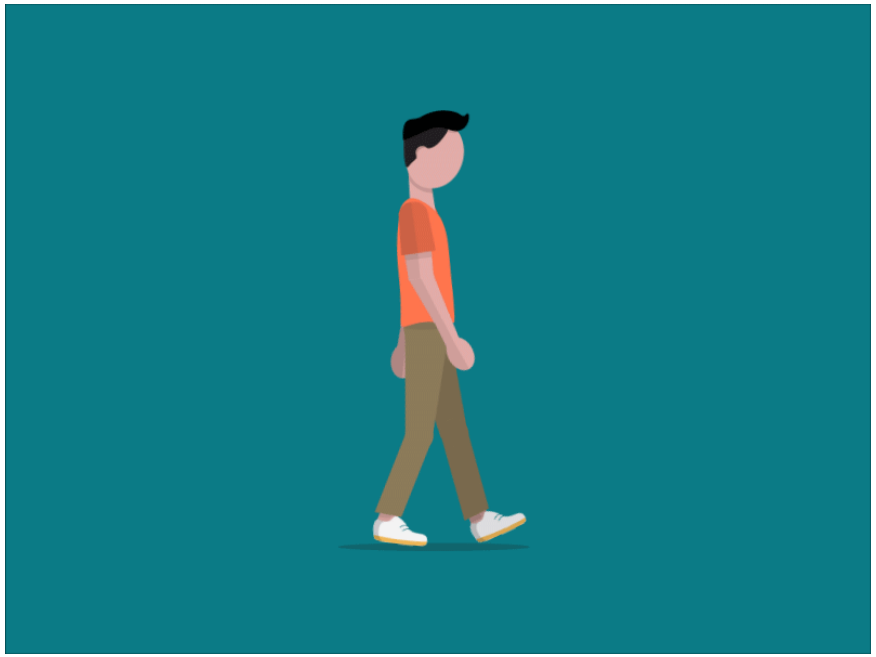
Accelerometer Sensor

: A sensor that detects acceleration for each axis

Variation in Values

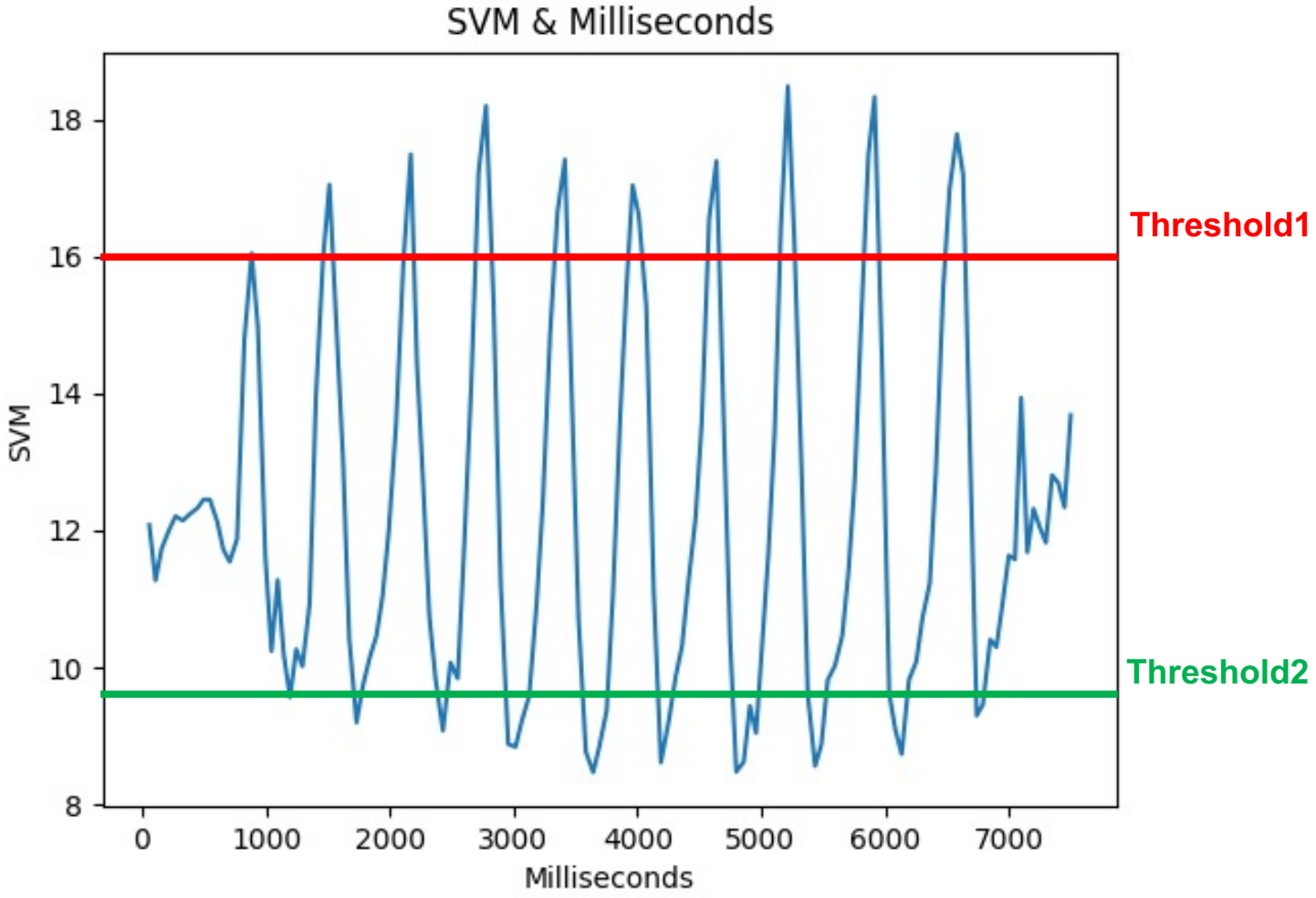
: Values change when there is movement

Acquiring Distance Information (Number of Steps)

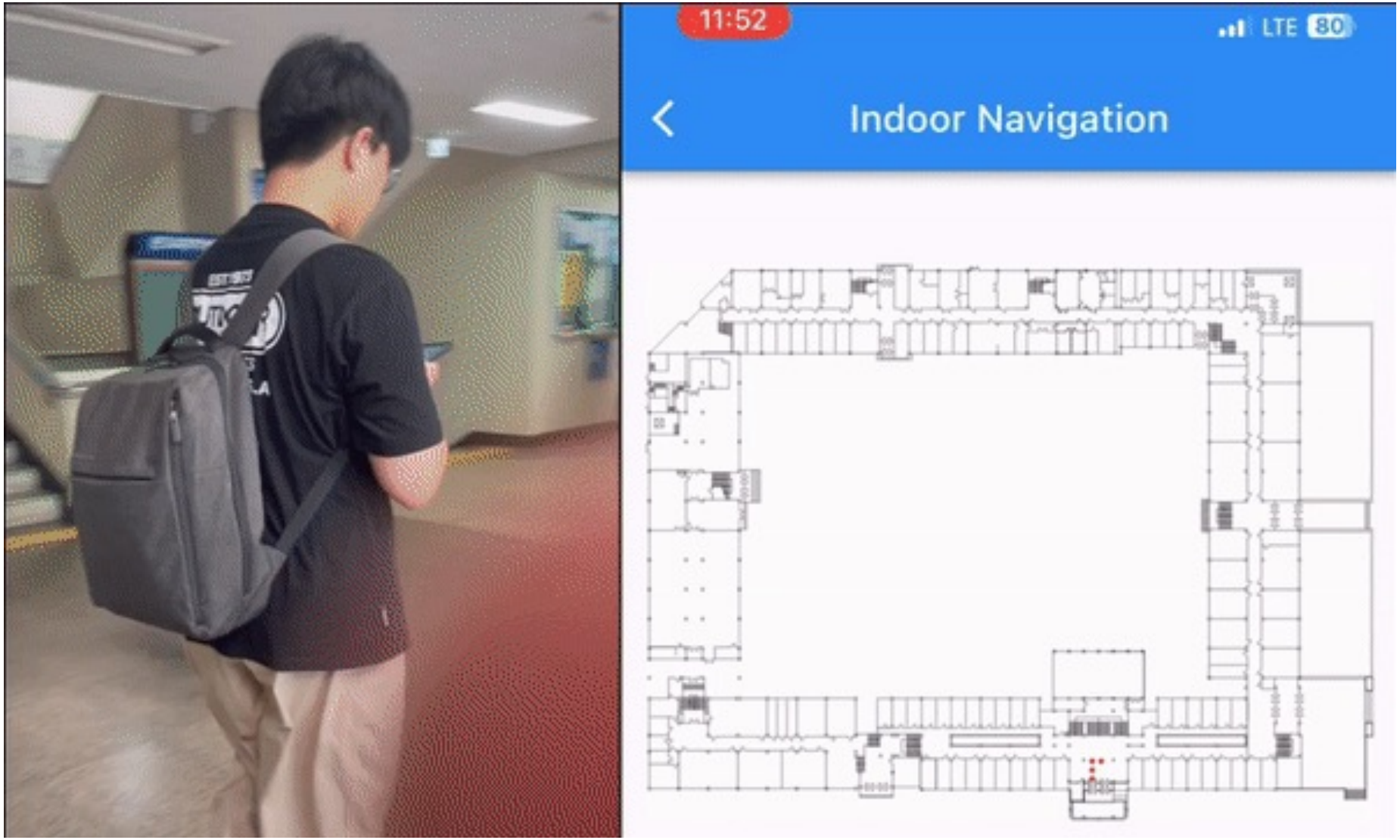


$$SVM = |accX| + |accY| + |accZ|$$

Signal Vector Magnitude



Result



Result

Angle data

- Using regression equation with a slope of 0.000196 to correct the measurements.

Distance data

- Highest accuracy was achieved when setting Threshold1 and Threshold2 to 16.0 and 12.0, respectively.
- Collecting more data, we can use statistical methods to calculate the thresholds.

PDR(Result)

- Reasonable level of accuracy, even without explicitly fitting to the path.

Reference

Images

- QGIS icon image(p.1) [https://qgis.org/]
- Python icon image(p.1) [https://www.python.org/]
- PostgreSQL icon image(p.1) [https://www.postgresql.org/]
- Gyroscope sensor image(p.5) ["Classification of Human Activity based on Sensor Accelerometer and Gyroscope Using Ensemble SVM method" by Nurul Hardiyanti, Armin Lawi, published in the 2018 2nd East Indonesia Conference on Computer and Information Technology (EIConCIT), DOI: 10.1109/EIConCIT.2018.8878627, Fig. 2.]
- Accelerometer sensor image(p.7) [https://www.w3.org/TR/accelerometer/]
- Walking human GIF(p.8) [https://www.behance.net/gallery/40701089/Slow-Walk-GIF] (Begance by Nina Reichenberg)

Equation

- SVM (p.8) [한영환, '가속도 센서를 이용한 걸음수 검출 알고리즘', 한국재활복지공학회논문지 제9권 제3호, 2015, 페이지 245-250"]