Report Date: 06/17/2022

To: ematson@purdue.edu, ahsmith@purdue.edu, lhiday@purdue.edu and lee3450@purdue.edu
From: BEST (Beacon-based Evacuation System and Technology)
Bacon Beacon
- Hwawon Lee (andylhw12@soongsil.ac.kr)
- Yoonha Bahng (tlol91@cau.ac.kr)
- Dohyun Chung (sosvast@cau.ac.kr)
- Jiwon Lim (senta2006@kw.ac.kr)
- Suhyun Park (2061013@pcu.ac.kr)
- Seongmin Kim (aliveksm@kangwon.ac.kr)
- Myoung Oh (oh278@purdue.edu)

Summary

At the Algorithm part, Q-learning method was researched and an outline of our code was designed. Our server and Raspberry pi are connected by HTTP connection. Localization experiments were completed.

What "BEST" completed this week
- Localization experiments were completed
  - The experiments with the unit distance from 0m to 3m by 0.1m were all completed.
  - The collected data was visualized using matplot.

- Build Regression model
  - Based on the collected RSSI of the beacon signal, the regression model was built.
  - The input of the model is the collected RSSI of the beacon signal and output is estimated distance between the device and the beacon.
  - SVR (Support Vector Regression) was used to calculate the distance.

- The Blueprint of K-SW 1st floor was designed for the Q-learning algorithm[2].
  - The blueprint is necessary for generating a common Q-table.
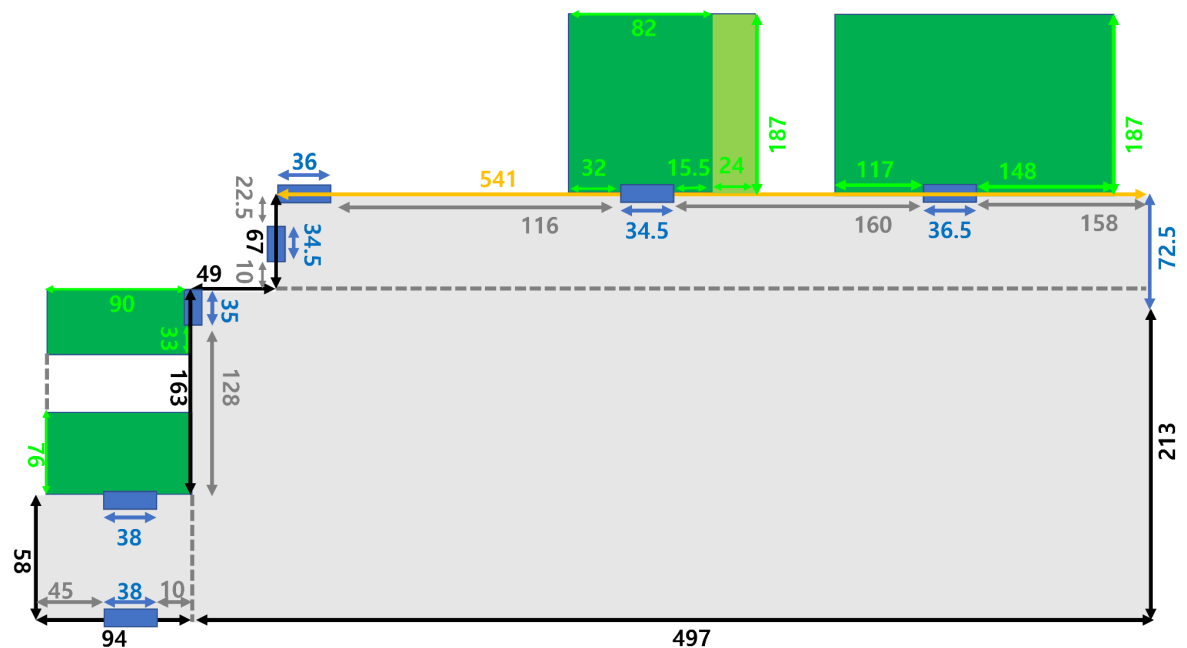
Fig. 1. Measured ground floor of K-SW square.
Fig. 1. Length measured by the ruler by hand.

- Gradient Boosting Model (GBM)
  - Studied the paper[1], learned about elementary theory and mathematical formulas.

Things to do by next week
- Writing experiment and algorithm design part of the paper
  - Experiment and algorithms are the two primary things to our study. That is why it needs to be described thoroughly in order to understand our paper. Paragraph including how the algorithm is designed and how the experiment conducted will be written.

- Merge path-finding algorithm to server
  - Path-finding algorithm will be finished by next week. It will be run by server and deal with multi-thread environments[2].

- Machine Learning training for localization
  - Regression model of localization was made[1]. Since collecting data was finished, Machine learning will be the core part of localization.

Problems or challenges:
- Can not find enough data set for Gradient Boosting Model (GBM)
  - There's not enough resources for the GBM. Postponed the action of finding and choosed to set the parameter temporarily to run the program. GBM will be run by simulated data for now.

- Replacing the Blueprint of K-SW building by measuring it ourselves.
  - Due to the fact that the blueprint is essential to indoor localization and path finding, we had to measure it out by a ruler which is not very precise.

- Implementing algorithms exceeded estimated time.
  - Both Q-learning and Localization teams struggled to implement algorithms. Estimated time was exceeded. It will be done by next week hopefully.

References
[1] S.-J. Yoo and S.-H. Choi, "Indoor AR Navigation and Emergency Evacuation System Based on Machine Learning and IoT Technologies," *IEEE Internet of Things Journal*, pp. 1–1, 2022, doi: 10.1109/jiot.2022.3175677.

[2] A. Kumar, "building-evacuation-q-learning," *GitHub*, Jun. 07, 2022. https://github.com/KumarUniverse/building-evacuation-q-learning (accessed Jun. 10, 2022).

[3] Longquan Jiang, Bo Zhang, Qin Ni, Xuan Sun, and Pingping Dong, " Prediction of SNP sequences via Gini impurity based gradient boosting method," IEEE ACCESS, vol. 7, pp. 12647-12657, 2019.