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From: BEST (Beacon-based Evacuation System and Technology)
Bacon Beacon

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Summary

Making PowerPoint presentation and scripts were important issue of this week. We made presentation aims to audience who do not have knowledge about network devices, but we got feedback that it is presentation to professor not seminar. Scripts and PowerPoint were modified, and the flow of the presentation was fixed to emphasize the topic.

Also, Articles were modified. And concluded the Abstract and chapter 1. Due to the feedback to our team, in progress chapter 2 of the paper.

What "BEST" completed this week

- Getting Ready for PowerPoint Presentation
  - Presentation was made by every presenter, and references were added by the others. As we got feedback that our goal is not described well, Introduction were swiped out and written again.
  - The PPT was divided into parts: Roles & Responsibility, Background, Related Work, Overview and Future Plan.

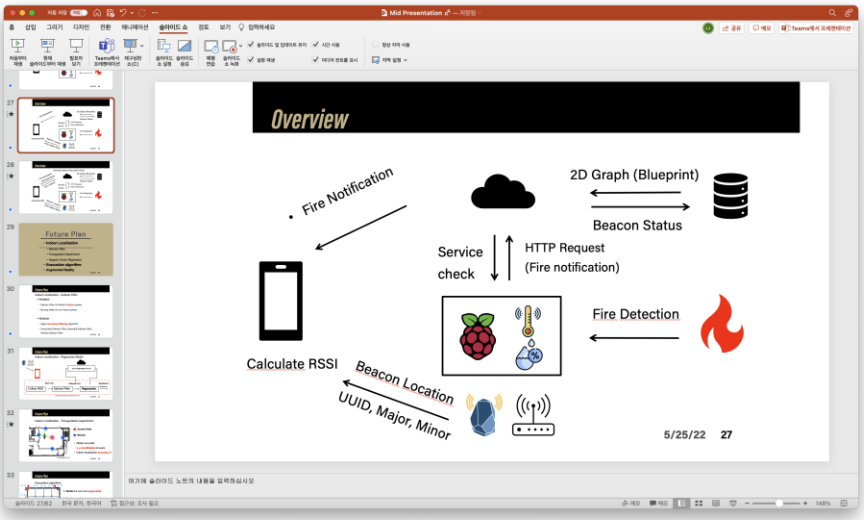

Fig. 1. PowerPoint Presentation
Fig. 1. Working on writing a presentation

- Prepare for Q&A
  - Questions are predicted
    - List of predicted questions were
      1. How to deploy beacons in the building?
      2. How many beacons are you going to use?
      3. Why do you use the beacons and the access point for indoor localization?
      4. Why do you consider Dijkstra Algorithm as path finding algorithm?
      5. Why does server-clients use socket communication?
      6. What if one of the beacons is not working in fire evacuation time?

- Write Related Work of paper
  - BLE beacon
    - In previous work [1], varying advertising intervals of BLE beacon affects localization accuracy. BLE beacon periodically broadcasts Bluetooth signals representing it's identity. A mobile device can estimate the position of the user by receiving the signal from BLE beacon. RSSI values are generated based on the received signal. If BLE beacon frequently broadcasts the signals, the mobile device can achieve a high packet receiving rate. However, frequent signal broadcasting yields depletion of BLE beacon's battery.

  - Kalman Filter
    - To improve the indoor localization accuracy, trilateration and Kalman Filter are commonly used [2]. The Kalman Filter is consists of two steps: Prediction and Correction. The Kalman Filter will be used to stabilized the RSSI data we collected.

  - Trilateration
    - Trilateration is used as the way in [3]. 3 beacons closest to the user have the strongest RSSI values. When receiving the beacon signals at a mobile device, the device calculates RSSI values with the signals. 3 beacons which transmit the signals generating strongest RSSI values are used for calculation. Each beacon is set on a coordinate system. The distances between the receiver and the beacons are calculated by a machine learning model. With the coordinates and the distances, the target location can be estimated.

  - Evacuation Path Finding Algorithm (Dijkstra)
    - Dijkstra algorithm is utilized for generating an optimal evacuation route [4]. The estimated target location is set as a start node of Dijkstra algorithm. The route with the lowest cost is selected as the evacuation route. If fire breaks out in the selected path, a new evacuation route has to be found. Among safe routes without fire, the new route having the lowest cost will be selected and guided to the user.

Things to do by next week

- Finish chapter 2 of paper

    - Related work will be concentrated on sophisticatedly locate the target position by using trilateration with the 3 nearest beacons.

- Trilateration Experiment
    - The experiment will be conducted by new iBeacons and the access point.
    - Collect the RSSI of the beacons and utilize two beacons with the strongest signal.
    - Apply trilateration, can obtain the accurate coordinates of the user.

- Request for the blueprint of the K-SW building
    - The blueprint of the building will be converted into a 2-dimensional graph for the path planning algorithm.

Problems or challenges:

- Preparing for the presentation
    - According to the feedback, the script didn't describe the exact topic of the project. There was a challenge about modifying the presentation organized.
    - The script was improved to explain the problem situation, the motive to solve the problem more intimately.

References

[1] C. H. Lam and J. She, "Distance Estimation on Moving Object using BLE Beacon," 2019 *Int. Conf.* on Wireless and Mobile Computing, Networking and Communications (WiMob), Oct. 2019, doi: 10.1109/wimob.2019.8923185.

[2] S. Sadowski and P. Spachos, "Optimization of BLE Beacon Density for RSSI-Based Indoor Localization," 2019 IEEE *Int. Conf.* On Communications Workshops (ICC Workshops), vol. 2019 IEEE *Int. Conf.* on Communications Workshops (ICC Workshops), no. 2019 IEEE *Int. Conf.* on Communications Workshops, May 2019, doi: 10.1109/iccw.2019.8756989

[3] S. Sadowski and P. Spachos, "RSSI-Based Indoor Localization With the Internet of Things," IEEE Access, vol. 6, pp. 30149–30161, 2018, doi: 10.1109/access.2018.2843325.

[4] K. Shimizu and D. Kushida, "Evacuation Guidance System Using Beacon Information and Dijkstra's Algorithm," 2021 IEEE 3rd Global *Conf.* on Life Sciences and Technologies (LifeTech), Mar. 2021, doi: 10.1109/lifetech52111.2021.9391946.