

Report Date:01/20/2023

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From: SWATTER

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### Summary

We had a meeting with Yaqin about the subject of the project and summarized papers related to edge computing to establish the details of the topic. We came up with a new topic; UAV detection with Machine Learning on Edge Computing, and got advice that this topic will be better than our former topic; Determine a drone whether it is dangerous with application. Each team member studied at least three references in order to write the paper, considering which technologies were prioritized and which novelty might be present. We also drew flowchart for the system, user interface prototype for next meeting with Yaqin and assigned a role for each member in our project.

### What SWATTER completed this week:

- Combined summaries of papers regarding UAV detection
  - UAV Lightweight Object Detection Based on the Improved YOLO Algorithm [1]
    - YOLOv5-MobileNetv3Small through the characteristics of small objects in low-altitude images of UAVs solve the problem of low-power edge computing nodes when using.
  - Deep Learning With Edge Computing: A Review [2]
    - The tradeoffs between accuracy, latency, and other performance metrics is an important factor in several works discussed.
  - Design of a Scalable and Fast YOLO for Edge-Computing Devices [3]
    - SF-YOLO which has scalable convolutional blocks.
  - Scalable Object Detection, Tracking and Pattern Recognition Model Using Edge Computing [4]
    - Propose a new framework for scalable object detection, tracking and pattern recognition of moving objects that relies on dimensionality reduction with edge computing architecture.

- Had a Meeting with Mia (Yaqin) and got advice for setting details of topic
- Conduct research to understand Machine Learning (ML) and Edge Computing, and how to deploy ML on Edge Computing.
- Drew Flowchart for system. [5]
- Drew prototype of User Interface in Client Application. [6]
- Assigned a role for each member of the team.
  - Application/UI
    - Leader : Justin
    - Assistant : Joonki
  - Machine Learning
    - Leader : Gwangwon
    - Assistant : Minseop
  - Edge Computing
    - Leader : Minseop
    - Assistant : Gwangwon
  - Test/Experiment Design
    - Leader : Joonki
    - Assistant : Hyunjong
  - Writing Paper
    - Leader : Hyunjong
    - Assistant : Justin

### **Things to do by next week**

- Have Meeting with Ph.D. student, Yaqin
  - Proceed meeting about edge-computing on Jan. 23th around 10 A.M.
  - Finalize our goals and discuss details.
- Design our experimental design
  - Design our experiments after meeting.
  - Set a way for comparison of Edge-Computing processing and Server processing.
  - Decide edge-device to cell phone.

- Prepare for development about application and server.
  - Determine specific tools or programs.
- Research example source for DeepLearning models running on android applications.
  - Research how to run deep learning models.
- Write abstract draft version1.
  - Consider the keywords used in the abstract.
  - Compare other related papers.

### **Problems or challenges:**

- We need more research to find lightweight models for object detection.
  - We considered UAV detecting using smartphones as an Edge computing device for our topic. We should find a proper lightweight deep learning model because smartphone's computing power is insufficient. An optimization model should be found in a certain paper, in the future.
- We need to find how to apply edge computing to our project.
  - There was a paper related to our topic [4], so we found the possibility of a higher performance object detect model with Edge computing.
- Decide whether to use acoustic node detection for this project or not.
  - We considered both acoustic and image data for detecting UAVs. However, for portable devices, detecting UAVs by using two ML methods may be too powerful. Therefore, we should research whether it is possible to use two types of data.
- Research Real-time Detection
  - Smartphones have low computing power. Therefore, we should research the possibility of Real-Time UAV detection.

## References

- [1] YunFei Chen, "UAV Lightweight Object Detection Based on the Improved YOLO Algorithm", 5th International Conference on Electronic Information Technology and Computer Engineering (2021), October 2021.
- [2] Yunbin Deng, "Deep Learning With Edge Computing: A Review", Proc. SPIE 10993, Mobile Multimedia/Image Processing, Security, and Applications 2019, 109930A (13 May 2019).
- [3] B.-G. Han, J.-G. Lee, K.-T. Lim, and D.-H. Choi, "Design of a Scalable and Fast YOLO for Edge-Computing Devices," *Sensors*, vol. 20, no. 23, p. 6779, Nov. 2020.
- [4] Dipak Pudasaini, *et al.* "Scalable Object Detection, Tracking and Pattern Recognition Model Using Edge Computing" 2020 Spring Simulation Conference (SpringSim), 2020.
- [5]

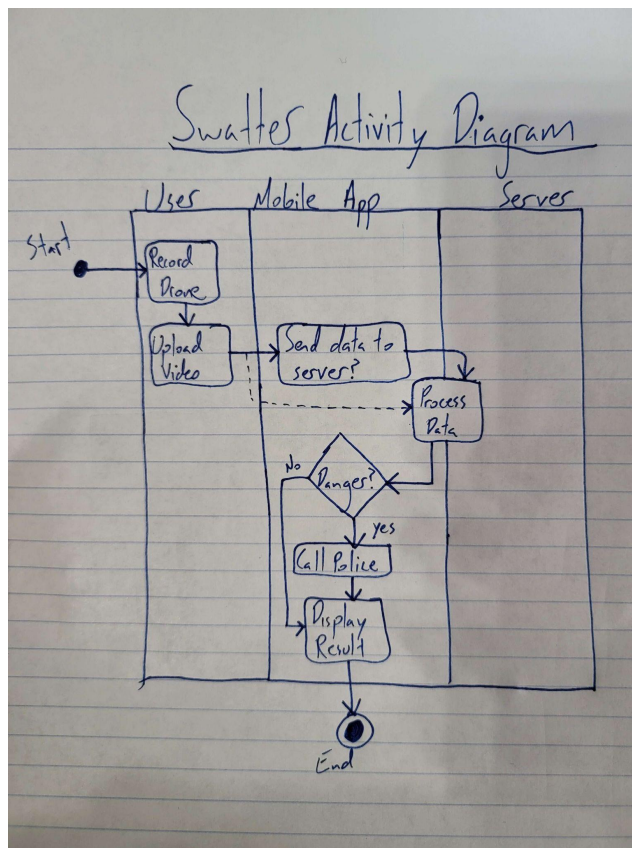


Fig1. Flowchart for system

[6]

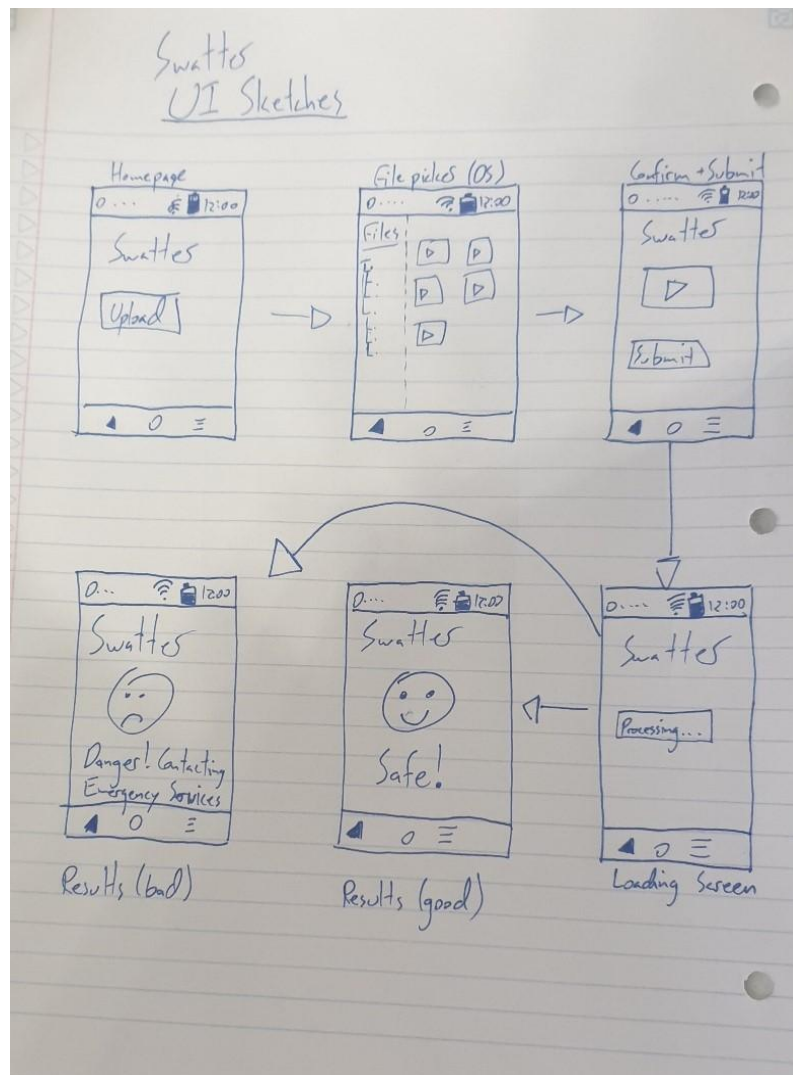


Fig2. Prototype of User Interface in Client Application