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Summary

Draft of literature review was written for the paper. Sample iOS application was executed via Google MediaPipe. Drone programming is started by using the official Tello SDK. In this project, there are many methods. After discussing, the network has been decided between LoRa, Wifi, TCP socket and UDP socket. Next, the server has been compared between Firebase, Thingsboard and AWS for selection.

What "Gangsture" completed this week:

- **Writing the literature review**
  - Compared more than 10 papers related to "drone gesture controlling" and summarized some challenges and problems mentioned from them.
  - There are some challenges such as, latency delay, on board processing, necessity of extra sensors, and implementation of dynamic gestures.
  - From those challenges, defined the problem statement and specified the direction of the project.
  - It would be helpful to write the literature review of the final paper in the future and for the first presentation.
- **Running sample example iOS application provided by Google MediaPipe**
  - Google provides example app with MediaPipe (e.g. HandTrackingApp, FaceEffectApp, etc)
  - Bazel and Tulsi was set to run iOS application.
  - It is necessary to build Apple-targeted software integrated with Google.
  - Provisioning profile and certificate was created for the iOS app.
- **Studying drone programming, UDP socket networking and server**
  - Identified a DJI Tello drone Python interface using the official Tello SDK.
  - Keyboard Controls and Image capture are available in Python interface.
  - User Datagram Protocol (UDP) refers to a protocol used for communication throughout the internet.
  - UDP results in speedier communication because it does not spend time forming a firm connection takes time, eliminating this step results in faster data transfer speeds.
  - Firebase is a software development platform offered by Google. It helps to quickly build web applications without managing infrastructure.
  - The Firebase Realtime Database is a cloud-hosted database.
  - The Realtime Database provides a flexible, expression-based rules language, called Firebase Realtime Database Security Rules, to define how your data should be structured and when data can be read from or written to.

Things to do by next week

- Give the first presentation on next Monday.
- Control the drone to ascend from take-off to descend by landing.
- Complete abstract and literature review of the final paper.
- Research and study papers related to this project.

Problems or challenges:

- **Choosing the network and server**
  - Candidate of the network: LoRa, Wifi, TCP socket, UDP socket
  - What the network in this project need is distance, speed and available of sending video. LoRa is mainly used for sending over long distance but, lacks sending videos. Wifi is built in Tello Drone which we use. TCP and UDP socket can send video well and they are used a lot as networking drones.
  - Candidate of server: Firebase, Thingsboard, AWS
  - Firebase has a benefit at making applications and it has own database. AWS is popular in IoT server but, it is expensive. Thingsboard is lower quality than AWS but, Thingsboard and Firebase are free servers.
- **Problem for using UDP**
  - UDP can cause data packets to get lost as they go from the source to the destination. Also, it is relatively easy for a hacker to execute a distributed denial-of-service (DDoS) attack.
  - It is necessary to use FortiDDoS which UDP can be secure by.
- **Problem installing Tulsi**
  - The error occurred when *sh build_and_run.sh* was executed on terminal to install Tulsi.

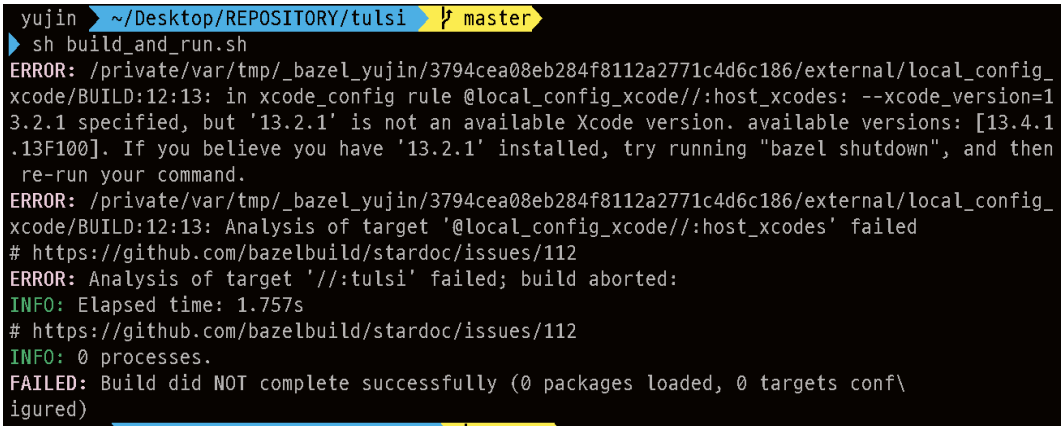

Fig. 1. The image of cmd shows build error

  - The problem was solved by revising number of *xcode_version* variables in build_and_run.sh.

References

[1] A. Findelair, X. Yu and J. Saniie, "Design Flow and Implementation of a Vision-Based Gesture-Controlled Drone," 2022 IEEE International Conference on Electro Information Technology (eIT), 2022.

[2] F. Patrona, I. Mademlis and I. Pitas, "An Overview of Hand Gesture Languages for Autonomous UAV Handling," 2021 Aerial Robotic Systems Physically Interacting with the Environment (AIRPHARO), 2021.

[3] Y. Chen, L. Zhang, Y. Liu and Y. Chen, "Research on gesture recognition control of UAV based on CNN+FCN," 2019 IEEE 4th Advanced Information Technology, Electronic and Automation Control Conference (IAEAC), 2019.

[4] J. Jun, B. Zhao, P. Zhang, F. Jia and P. Fang, "Interaction with UAV Formation based on Gesture Recognition with Leap Motion," 2021 33rd Chinese Control and Decision Conference (CCDC), 2021.

[5] A. Menshchikov et al., "Data-Driven Body-Machine Interface for Drone Intuitive Control through Voice and Gestures," IECON 2019 - 45th Annual Conference of the IEEE Industrial Electronics Society, 2019.

[6] "What is User Datagram Protocol (UDP)?," *Fortinet*. [Online]. Available: https://www.fortinet.com/resources/cyberglossary/user-datagram-protocol-udp. [Accessed: 23-Sep-2022].

[7] "What is UDP? | cloudflare." [Online]. Available: https://www.cloudflare.com/learning/ddos/glossary/user-datagram-protocol-udp/. [Accessed: 23-Sep-2022].

[8] L. Rosencrance, G. Lawton, and C. Moozakis, "What is User Datagram Protocol (UDP)? definition from searchnetworking," *SearchNetworking*, 04-Oct-2021. [Online]. Available: https://www.techtarget.com/searchnetworking/definition/UDP-User-Datagram-Protocol. [Accessed: 23-Sep-2022].

[9] "MediaPipe on iOS," *mediapipe*. [Online]. Available: https://google.github.io/mediapipe/getting_started/ios.html#create-an-xcode-project. [Accessed: 23-Sep-2022].