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From: SharpShooter

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Summary

First, we researched some papers to specify our project topic and decided on our topic. Second, we drew our overall system architecture. Third, we started to write the abstract and introduction sections of our paper. Lastly, we had a meeting with Purdue students.

What SharpShooter completed this week:

- Researched papers to confirm project topic
We researched some papers to specify our project topic with some keywords like gunshot accuracy, gun shooting accuracy, predict shootings accurate, gunshot detection in noisy environments, and real-time target detection and tracking. Each team member read papers related to their field like computer vision and networking and summarized findings to each other. We confirmed our topic that is long distance real-time shot tracking system using LoRa and YOLO.
- Drew three versions of system architecture
We drew the three version of overall system architecture. We will choose one version lastly, after testing all the three versions.
 1. In the first version of system architecture that is illustrated in Figure 1, if a shooter shot a rifle, an acoustic sensor detects the sound. Raspberry Pi camera starts recording a video. Then, transmit the video using LoRa, and Raspberry Pi 4B processes the video and visualizes it by using HTML and JavaScript. Finally, display it on the tablet next to the shooter.
 2. In the second version of system architecture that is illustrated in Figure 2, if a shooter shot a rifle, an acoustic sensor detects the sound. Raspberry Pi camera starts recording a video. Then, Raspberry Pi 4B processes the video and visualizes it by using HTML and JavaScript. After that, transmit the codes by using LoRa, and Raspberry Pi 3B receive it and transmit to tablet. Finally, display it on the tablet next to the shooter.
 3. In the third version of system architecture that is illustrated in Figure 3, if a shooter shot a rifle, an acoustic sensor detects the sound. Raspberry Pi camera take a picture. Then, transmitter send the picture to receiver using LoRa, and Raspberry Pi 4B processes the picture and visualizes it by using HTML and JavaScript. Finally, display it on the tablet next to the shooter.

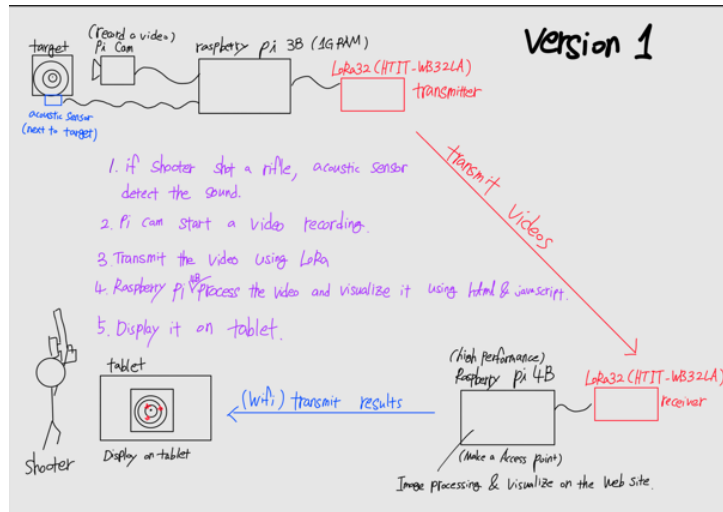


Fig. 1. First version of system architecture

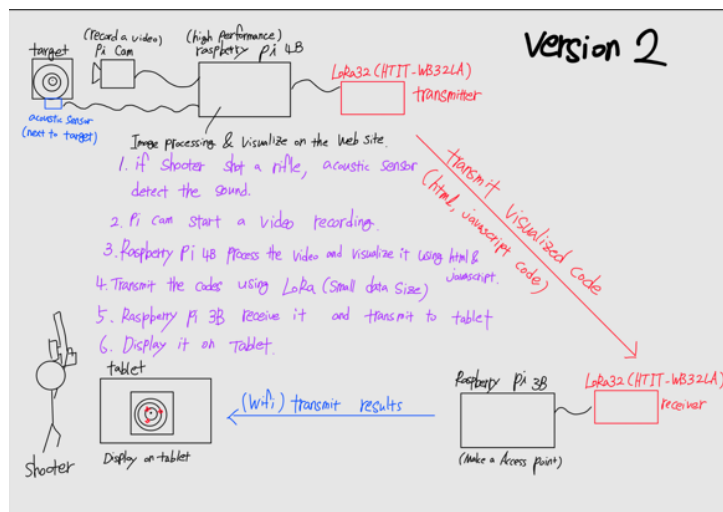


Fig. 2. Second version of system architecture

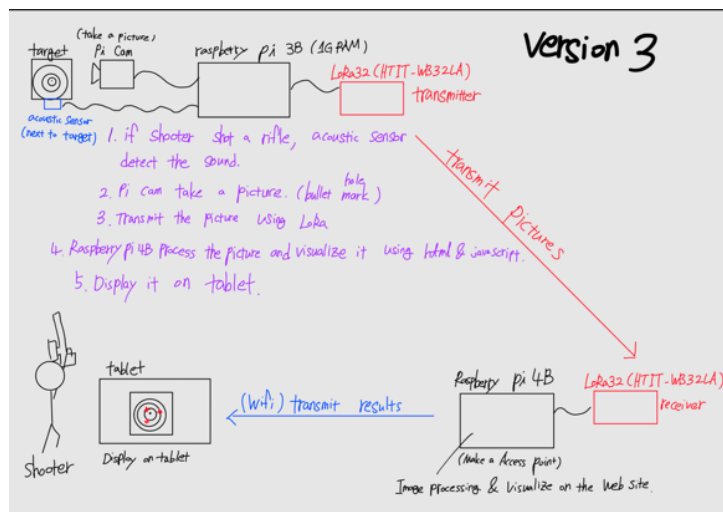


Fig. 3. Third version of system architecture

- Wrote abstract part of our paper
We have started to write our papers. We made a rough draft of abstract, and we are writing the introduction section.
- Met Purdue students
We met Purdue students, Ethan and Sophia. We checked their schedule and fixed our schedule. Ethan will come to KSW on next Monday, Thursday, Friday and Sophia will come to KSW on Tuesday, Wednesday, Thursday.
- Visited Tony's farm
We visited Tony's farm last Saturday. There, we learned about the ShotMarker [1].

Things to do by next week

- Study about the acoustic sensor that we will use to detect gunshots
- Review papers related to our project
- Set the environment computer vision (Python with OpenCV) and Raspberry Pi deployment and integration

Problems or challenges:

- LoRa networks can transmit a small amount of data even if it is far from each other. This is a big advantage, and this is why we apply LoRa networks in our system. We should transmit video with LoRa networks, but the transmission speed of LoRa networks is too low to send video smoothly [2]. We should find methods to transmit video, so we read many papers.
- We would need a GPU for computer vision modeling such as YOLO, but it is impossible on a Raspberry Pi. We decided to use the toolkit OpenVINO of the Intel as an alternative solution [3].
- We are writing introduction section now, but we need to research some backgrounds about our project.
- We should understand LoRaHat which is helpful to establish our system, then we have to make a solution how to communicate with LoRa.
- We experienced Shotmarker on Tony's farm. However, the installation and web system interlock were cumbersome. To improve this, we will apply acoustic sensor, computer vision and distance measurement using a laser sensor.
- We all have only J-1 Visa, so we are prohibited from buying a gun, and we cannot get enormous dataset about shooting gun. Therefore, we need aid of the Purdue students.

References

- [1] A. MacDonald. ShotMarker. (2020). [Online]. Available: <https://autotricker.com/pages/shotmarker>
- [2] A. Carlsson, I. Kuzminykh, R. Franksson, and A. Liljegren, "Measuring a LoRa Network: Performance, possibilities and limitations," in *Internet of Things, Smart Spaces, and Next Generation Networks and Systems*. Springer, Sep. 2018, pp. 116-128, Sep. 2018, [Online]. Available: https://link.springer.com/chapter/10.1007/978-3-030-01168-0_11
- [3] OpenVINO. (2022). [Online]. Available: <https://www.intel.com/content/www/us/en/developer/tools/openvino-toolkit/overview.html>