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Summary

The research was conducted in 4 teams. The front-end team improved web design implementation showing the initial target and shooting point. The IoT team devised a protocol implementation that improves MPLR. The computer Vision team compared the training performance of the gun sound classification model conducted with spectrogram and Mel-spectrogram. The paper team modified the "Relative Work" and "Method" section and wrote the "Implementation" section.

What Sharpshooter completed this week:

- Compared Spectrogram and Mel-Spectrogram
  In the case of Using Mel-Spectrogram Image, the accuracy is 98.45%, recall is 98.39%, precision is 97.9% and F1-Score is 98.17%. In the case of using Spectrogram Image, the accuracy is 98.42%, recall is 98.55%, precision is 97.7% and F1-Score is 98.14%. The result difference is very tiny, but using a normal spectrogram is superior to using Mel-spectrogram.

- Experimented on Tony's farm
  The temperature was 12 degrees Celsius; the humidity is 64%, the wind velocity is 6m/s and the UV index is Level.1. The Camera setting is as follows, MMH (Middle of target minus Height of camera location) is 53cm, MTC (Middle of the target to Camera location) is 153cm, CTT(Camera location to Target)is 127cm and angle of the camera is 33.89 °. The direction of the sunlight was heading 220 degrees southwest. The experiment results in 100m about Image transmission with LoRa were successful. There was no packet loss and the packet transmit speed was 1.8 sec. Target extraction results were demanding. So, the team did an effort for finding the optimal angle.

- Experimented in K-square
  The temperature was 3 degrees Celsius; the humidity is 80%, the wind velocity is 2m/s and the UV index is Level.1. The camera setting is as follows, MMH (Middle of target minus Height of camera location) is 55cm, MTC(Middle of the target to Camera location) is 190cm, CTT(Camera location to Target)is 160cm and angle of the camera is 32.63 °. The direction of the sunlight was heading 225 degrees southwest. The experiment results in 5m about Image transmission with LoRa were successful. There was no packet loss and the packet transmit speed was 1.8 sec. Target extraction results were still challenging.

- Enhanced the image detection to extract the target image
  The effects of light reflection and lighting on dark and bright areas were controlled using homomorphic filtering and gamma correction [1]. Thereafter, the initial target obtained by applying Canny Edge detection and contour is as shown in Fig. 1, 2.

Fig. 1. Before (Left image) pre-processing and After (Right image) pre-processing at K-SW

Fig. 2. Before (Left image) pre-processing and After (Right image) pre-processing at Tony's farm

Things to do by next week
- Try to detect the target image when the background color is white in the outdoor test
- Make and apply the MPLR protocol
- Complete to write the implementation section and revise the relative works section of the paper
- Test the image transmission time and packet loss with various distance as 10m, 50m and 100m

Problems or challenges:
- It is hard to detect the target image when the background color is a light color.
- Sound detection model detects non-gunshot sounds as gunshot sounds, so the team must collect more datasets of gunshot sounds.
- The team should consider the gunshot sound with a silencer.

References
[1] S. Li, H. Guo, W. Sun and X. Sun, "A low-illuminance image enhancement method in YUV color space," *2022 14th International Conference on Measuring Technology and Mechatronics Automation (ICMTMA)*, 2022, pp. 286-291, doi: 10.1109/ICMTMA54903.2022.00062.