Hong Kong Student Science Project Competition 2023

Template of Extended Abstract (Invention)
(Word Limit: 1,600 words, Pages: 3 pages only)

Team Number: SAPE177

Project Title: Vision Impossible 無所遁形

Project Type: Invention

***To our best knowledge, there are / ~~are no~~ * similar works in the market*; (if there are,) related product links are as below:**

https://hk.nec.com/en_HK/solutions/bysolutions/video_analytics/index.html

The enhancement our project made / the difference with related products are:

Different levels of alert will be sent to the user to decide what kind of follow up action should be made.

Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.

I. Background

Most of the traditional security surveillance systems are simply a passive monitoring device, they monitor a place over a period by videorecording. When an incident (especially involving crimes) occurs, the owner and the related authorized person need to check the video playback to find the evidence, which is time-consuming and not able to reduce the risk of crimes occurring. Our invention is trying to fill the gap of lacking prediction of suspicious objects in the traditional products.

Reviewing the increasing needs of AI surveillance systems in the market, we aimed to create a security system which can find out the abnormalities in a place where the security patrols are lacking, therefore providing a safer and a more sustainable living environment for all.

II. Objectives

In order to strengthen the existing security surveillance systems, we aimed to create a device which will be able to detect strangers with suspicious objects, record the evidence and send it to the designated device automatically. The AI security surveillance system - “Vision Impossible” can provide immediate alerts to designated devices automatically. By the AI object detecting function of recognizing suspicious objects, the owner can receive the alert at anytime and anywhere. By the preliminary screening of suspicious objects in the system, the user can act immediately to prevent or avoid the incidents and crimes.

III. Methodology

Raspberry Pi, LabelImg, IFTTT and TensorFlow to be the hardware for inputting data, the software for grouping and classifying images, the interface for receiving the requests and sending a signal and the machine learning platform respectively.

IV. Design of Invention

Firstly, at least 150 photos of each specified object were labeled and grouped. Then, the data is uploaded to TensorFlow and becomes a trained model. By adjusting the parameters of the trainning or the later compiling process with CNN. As a result, the platform can convert the trained data sets into a format which can be exported to Raspberry Pi.

After uploading the trained model in the Raspberry Pi, it can be started to use as an AI security surveillance system. The camera connected to the Raspberry Pi will capture the real-time photos and send them to the trained model, after that the model will identify the presence of the specified objects. If any suspicious objects were detected, a warning email will be sent to the designated email address and a warning light will be turned on. By checking the email, the user will know the specified suspicious object was detected and the alert level of that object. Besides, in order to prevent too many emails being sent due to one same suspicious object being detected, the system will decline the photos which were identified consecutively.

V. Application / Market Need

Our main focus for the invention is providing immediate response to the user who wishes to prevent and avoid the incidents and crimes to occur. Also, the data set is able to update from time to time because new weapons or tools may arise soon.

VI. If your team will compete the Sustainable Development Award, please indicate the specific sustainable development goal the project is related to, and provide justification for competing for this award. *(Word limit: 300 words)*

The aim of our project is preventing accidents and crimes through object detection. The systems can auto-detect suspicious objects and send alerts to the user before an incident happens. Therefore, the system can help to build a low crime rate community and make the society more sustainable.

VII. If your team will compete the Social Innovation Award, please list the target group or social issue the project focuses on, and provide justification for competing for this award. *(Word limit:*

NA

VIII. Conclusion

- Make a **data-driven** conclusion of the project and the way forward of the invention process
- Justify if the proposed project meets the objective(s)

The detection of specified suspicious objects is achieved by using Raspberry Pi and TensorFlow platform, After training about 900 photos of the 4 designated objects, the accuracies of detecting spanner, hammer, knife and gun are 72.7%, 73.6%, 74.9%, and 73.2% respectively. The accuracy is acceptable. Overall, the invention can meet our target.

☐ **Our project is developed based on previous project and the enhancement is below:**

NA