



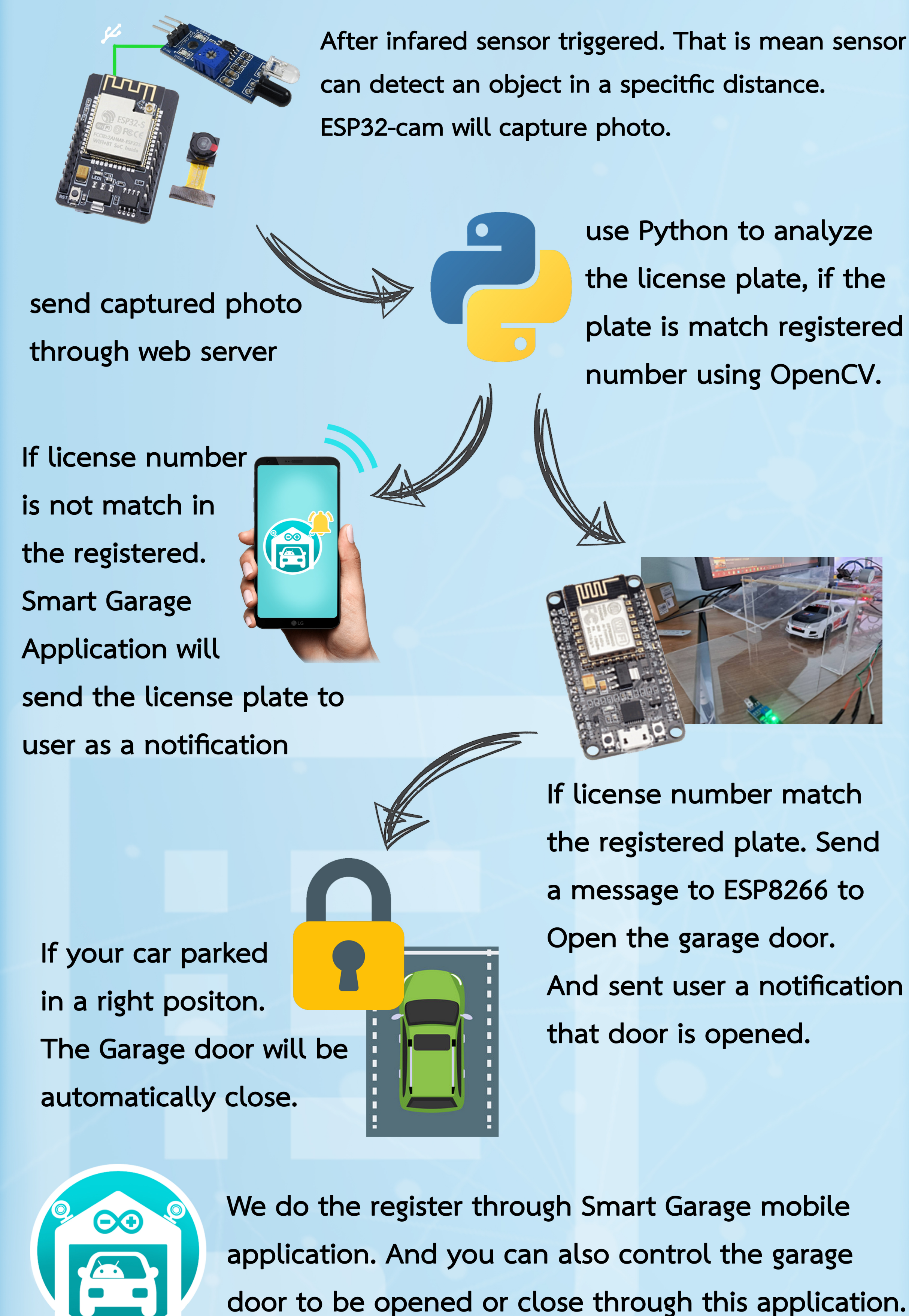
Smart Garage

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Abstract

Internet of things (IoT) technology has become a part of human daily life. It can facilitate, increase work efficiency, increase work efficiency and improve security for humans. Including how we applied these modern technologies on things and people's houses. Whether inside the house, around the residence, a parking lot or even a garage. In this article we present an improvement of the household garage security system using IoT technology. We present the system with a model. The system can detect a car license plate. When the car is at a specific distance, a small camera will capture a picture of the license plate and pass it to the main system to analyze and compare with the registered license plate. If the license plate number matches the registered plate number, the door will be opened. There are sensors in the garage that will help the driver park the car in the right position. The door will be closed automatically. Users can also control and monitor the working process through a mobile application on android platform. Moreover, we study the performance of using one camera and two cameras for analyzing the license plate. This project reveals an enhanced level of security by using the Internet of Things which is affordable and easy to implement.

Procedure



Related Knowledge

1. Open source Computer Vision Library (OpenCV)

It is a Library for programming and developing software to be able to do image and video processing using C++, Python, Java and MathLab. It is used to develop an open source system that can be used to create Machine Learning or AI. Mostly for object recognition and facial recognition.

1.1. Perspective Transformation

It is to change viewer's perspective as to improve an image processing procedure. It needs to be changed in a 3x3 matrix grid size with the straight line remained after the changes. And it needs to have at least 4 corresponding points to find the transformation matrix.

1.2. Image stitching

It is to do an image combination with an overlapping perspective to create a panoramic photo in high resolution.

2. Tesseract OCR

It is a tool that can be used to do an optical character recognition (OCR) which is available to use under Apache 2.0 license. It can be both used directly or through an API to retrieve a message or text from an image. Tesseract OCR supports a wide variety of languages including Thai.

3. Levenshtein Distance and Text Similarity

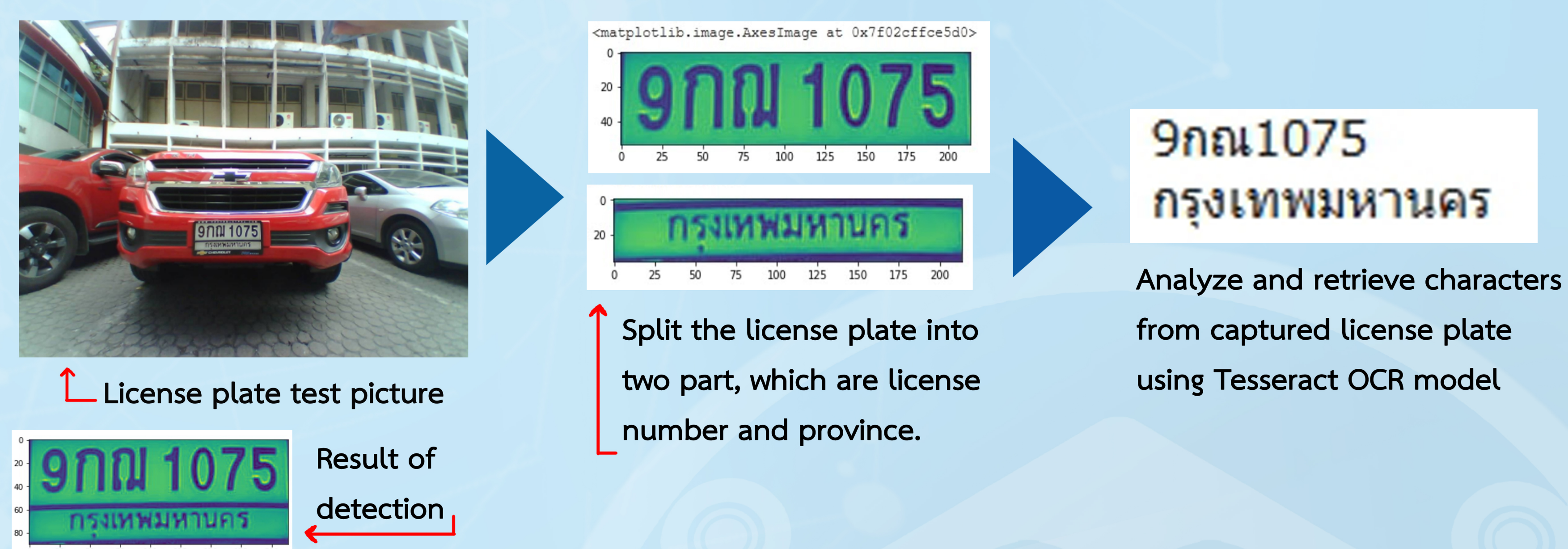
It is a procedure to measure the two different sets of characters, between original characters set and compared set. The difference is measured by the number of characters that need to be cut out, inserted and replaced in the compared sets until they look exactly like the original characters set.

4. Internet of Things

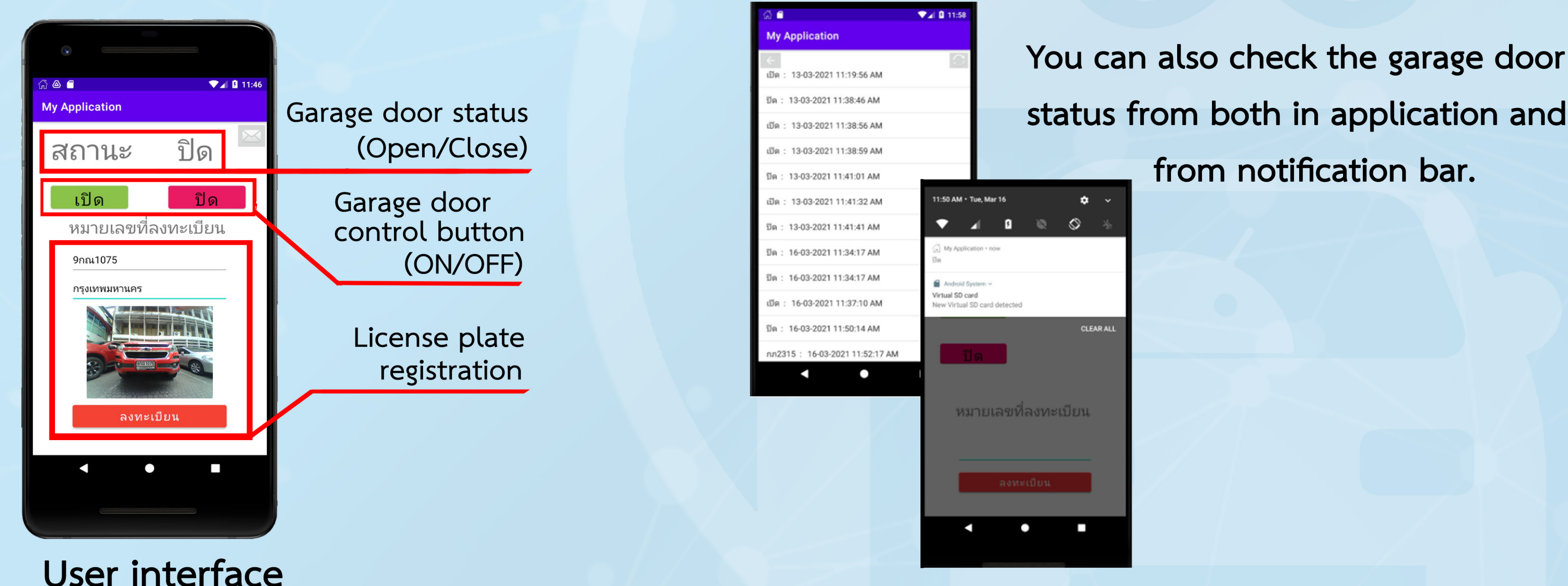
A concept about connecting things together in order to communicate between devices. They can be used to send and receive the data between things or what we called Machine to Machine (M2M) which is an internet technology to connect the device to any other tools together.

Result

License plate analyzing (In Python)



Mobile Application



References

- [1] Syed Zain Masood, Guang Shu, Afshin Dehghan and Enrique G. Ortiz. License Plate Detection and Recognition Using Deeply Learned Convolutional Neural Networks. [Online] 2017, <https://paperswithcode.com/paper/license-plate-detection-and-recognition-using> [28 May 2020]
- [2] Frank Hofmann. Levenshtein Distance and Text Similarity in Python. [Online] 2018, <https://stackabuse.com/levenshtein-distance-and-text-similarity-in-python/> [18 January 2561]
- [3] Geometric Transformation of Image. [Online] 2016, Geometric Transformations of Images - Morange Wiki [3 August 2559]

Conclusion

In conclusion, microcontroller boards and sensor are connected and work together to build a smart garage. Microcontroller boards communicate with each other with both wired and wireless. The ESP32-CAM board will capture pictures when a car is at a specific distance. The license plate image of the car will send to the main system. The main system will compare the license plate image to registered plates. In the license plate detection process, the edges of the license plate are detected first. Then we change the image's perspective and convert it to square pattern to make it easier when splitting the plate into two parts. We use Tesseract to retrieve characters from an image and be able to proceed in other devices. The license plate registration can be done through the mobile application and also controlling and monitoring garage status.