Automated vehicle detection by using Internet of things and big data analytics- a study in Royal Oman Police

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Abstract

Technology is an essential thing in our life in various aspects, the technology used to increase security in the world. Through this project, technology has been employed to detect the wanted vehicles, as we know the crimes are increased every day, vehicles stealing, and terrorists, therefore if there is no security in any countries that caused instability and the economy will be very because weak nobody came to the country without security to make investments on it, so every country seeking to make its country security. Therefore, this project will help the security sector to observe and control the road, which will help to determine the route of vehicles fastly through cameras on the roads which capture the vehicle plate numbers and stored in storage data that can authorized persons back to the data and looking for specific plate numbers. In addition, the main operation room of the security sector gets a notification while the wanted car pass-through camera on the road by phone. The main objective of this project is to employ technology to increase the level of security in the Sultanate, by using low-cost technologies.

Introduction

Automation is the most used nowadays, Due to automation the life be easy and it helps people to be creative, through this project I will use this revolution to detect vehicles plates number, as everyone knows all countries seek to be their counties secure and without any security disturbances such as terrorism and Criminals, by the way, I will use Raspberry Pi which as a small computer that has special features that can execute this project. The Raspberry Pi on this project is the Backbone of the project. This project will be useful for various sector and organizations who their work required to know plate number of vehicles. The reorganization of vehicles number is run through capture the image, extract the vehicles' number, plate number segmentation, at the end recognize the character.

The purpose of design and implementation of this project is to increase the security in Oman, and the security sector to work professionally, which the result will be decreased the criminals and manage the vehicle on the road, and reduced the cost and effort to catch the wanted people.

This project will capture the vehicle plate number during the vehicle pass through the camera which is installed on the road then there will be some of the processes then the authorized official will receive a notification by smartphone to inform authorized official when vehicle pass through the specific road. This project will provide self-monitoring and instant notifications, and storing numbers that passed through the camera.

Related work

The internet of things has been implemented in a variety of fields in the past. In the Sultanate of Oman Internet of things has been deployed to a variety of areas (Al-Jaafari, Ahmed, Bhatt, & Khan, 2019) (Zameer, Saqib, Naidu, & Ahmed, 2019) (Muhsin, Bhat, Mohamed, & Khan, 2019) (Muhsin, Bhat, Ahmed, & Khan, 2019). We have also witnessed the implementation of IoT with other technologies to achieve the desired results (Bhat, Kameshwari, & Singh, 2020) (Bhat, Singh, & Mohsin, Cloud Implementation to Assist Teachers of English to Speakers of Other Languages in HEI's in Sultanate of Oman, 2021) (Al-Jaafari, Ahmed, Bhatt, & Khan, 2019). The system of ANPR normally consist of two main components are camera capture the vehicle plate and the system to extract number from vehicles through using some tools to recognize the number (Friedrich, Jehlicka, & Schlaich, 2008). The extract of a number runs through several phases which obtain the image, number detection, determine in the picture, and change the pixels of the image to numerically readable characters.

The algorithm can run into four stages to extract the number (Reddy, 2017), they are pre-processing which this step came directly after image gain, and then extraction of license plate region which determines the location of plate number from the image, then character segmentation to remove any additional zero-padded area to be easy to extract the number, at the end stage is character recognition (Sharma & and Sasi, 2007) (Mane, Bade, & and Patil, 2019).

The installation of the camera is most important because it should be installed in a suitable place to get the perfect result of the system, when installing the camera, it should be considered that the distance and the height of the camera to get good result of the system. Some equations can be used to install the camera in a good place (Mandi, Shibwabo, & and Raphael, 2007).

Architecture

Vehicles parking: Many organizations use this system to manage and organization of parking, and can use it to allow the specific vehicle to use specific parking, and also to be the parking area more secure. And also can use it for toll cabins many counties use it to manage the charge of using a road. In addition, I can use it for automatic payment for electrical stations that will reduce the number of employees on station and some of the countries use it for collect information like this system can be used to count several vehicles which use the specific road.

The main objective of this project is to utilize the technique to identify and recognize the vehicle's plate numbers through using the camera, Raspberry Pi, LED indicator, and GSM module.

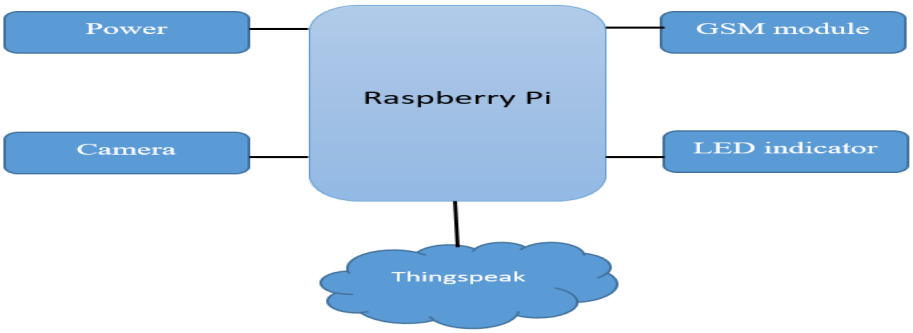

Figure (1)

As shown in the above figure (1) the Raspberry Pi is a core of the project which connects to the camera, GSM module, and LED indicator, and using python programmer, and OpenCV.

Raspberry pi3 is a small computer and it is improved by the UK through the raspberry pi foundation, the raspberry pi consists of an operating system and it is required to put an SD card to storage for a long time. And also 4 USB ports, 100 bases for Ethernet, and full-size HDMI, 1GB RAM. As shown in figure (2).

Figure (2)

The Raspberry Pi Camera is as image sensor which has specific characteristic depend on the pixel of the image, I used this camera to capture the plate number of vehicles. As shown in figure (3).

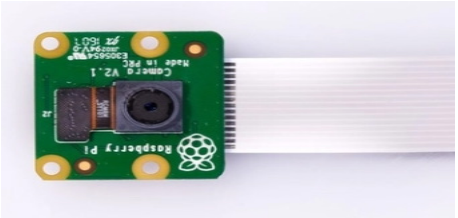

Figure (3)

Light-Emitting Diode (LED) is an electronic device that generates light, this device is used to connect to the raspberry pi to show the output of the process of the device, as I used to show the number of vehicles and the processes. As shown in figure (4).

Figure (4)

GSM module is a device that can establish communication through SIM, I used this device when the camera capture the plate number the raspberry pi sends a notification immediately by the GSM module. As shown in figure (5).

Figure (5)

Thingspeak is an analysis platform service for IoT that allows collect and analyze live data which receive from the IoT device. I use this platform for my project to analyze and match the vehicle's plate number and also it will store the data as shown in figure (6).

Figure (6)

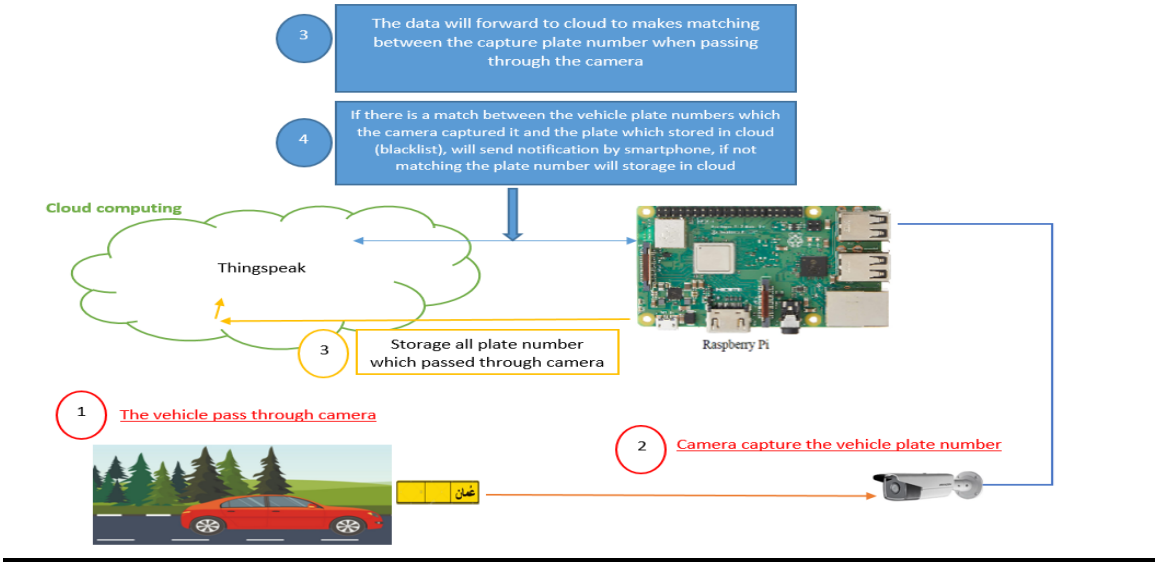

Figure (7)

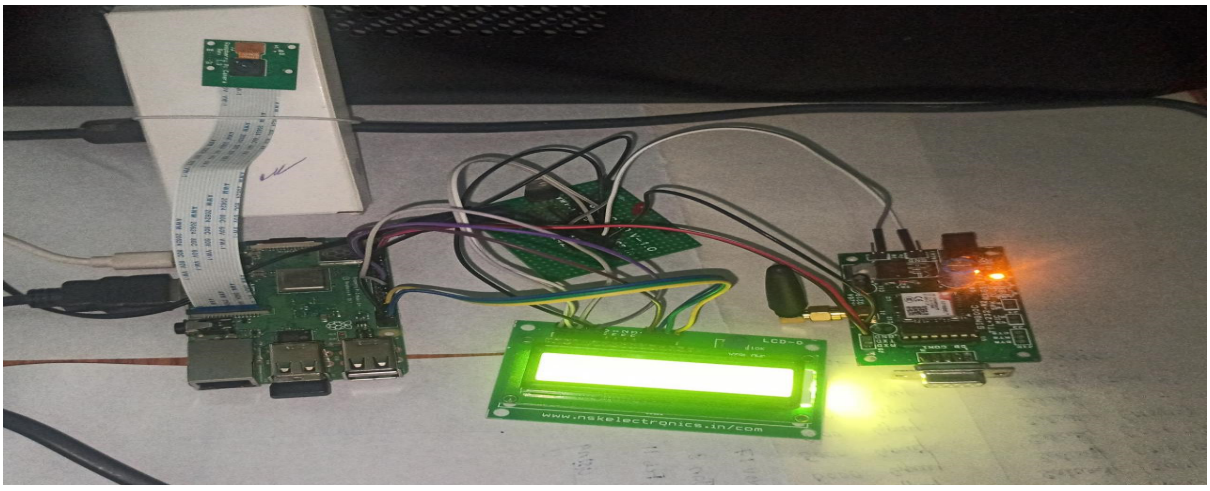

Figure (8)

Through this project, I used the thingspeak for the execution of the process to matching the plates number and decide if send a notification or not. As shown in the below figure the number of vehicles matches, so immediately the notification will be sent to the authorized official. As shown in figure (9).

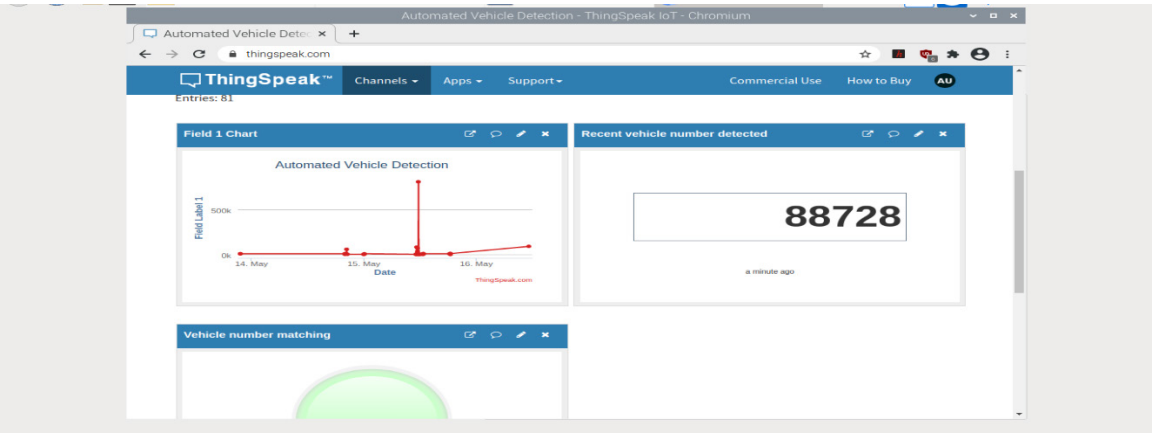

Figure (9)

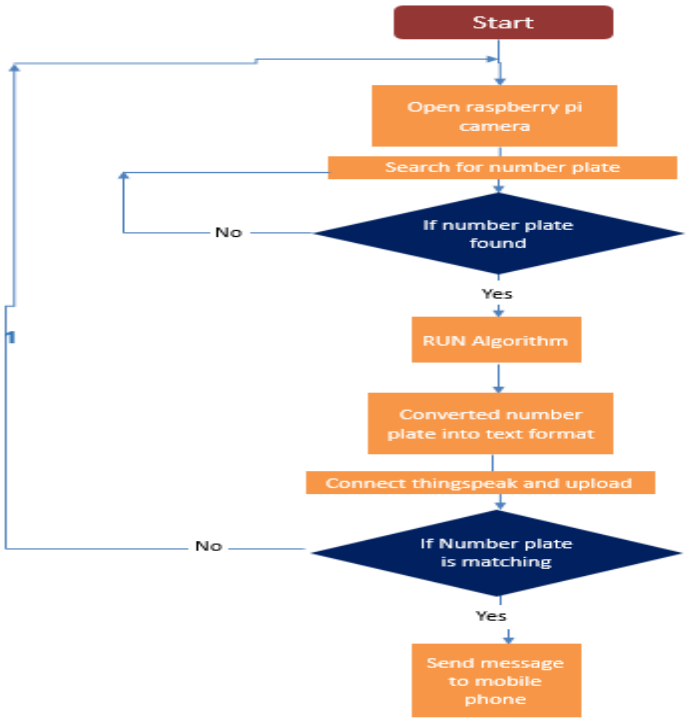

Figure (10)

The above diagram shown the Flowchart of the proposed system as shown in figure (10).

Conclusion

As this performance and simple capabilities which used in this project, the results was great which make it perfect choice to implement like this project, in addition, we can use this idea to different things like parking, tolls, and many

application. The cost of the system is low than other systems and we can depend on it. This paper has valuable information for detect vehicle plate numbers, in the future can use renewable energy like solar panels to supply power to the device which I designed.

Acknowledgment

We are thankful to Almighty Allah for bestowing us the knowledge to carry out this research study. We are thankful to the Faculty of the Middle East College for always providing guidance. We are extremely thankful to all our friends and mentors who lend their helping hand during this research study.

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