The Prototype of Traffic Violation Detection System Based on Internet of Things

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Abstract. The objective research is to create a tool that can help the officer’s area traffic control systems (ATCS) at the Department of transportation from Bandung City to check for violations of the vehicles stopped on a zebra cross area. The methods used in this study is using the method of prototyping. Prototyping method consists of five stages, communication, quick plan, modeling and quick design, construction of a prototype, and deployment. This method is suitable for the development of tools that the façade is still in prototype form. As for the prototype produced in the form of violation detection tool vehicles that stop at zebra cross area. Sensor infrared module would catch the front side of the object form of the vehicles stopped outside of a predetermined limit. The next signal sent to the mini PC Raspberry Pi to run the camera so you can take a picture of the license plate number of the vehicle. After that, the picture of the license plate number of a vehicle is identified breaking will be processed and changed into the form of a string in the system. Next string will be converted to external in the form of sound using google voice as a warning to the offender road markings. The results of research is a tool that can detect violations of the vehicle at the intersection with detecting plate number of the vehicle. Thus, the tool expected to assist officers in noting violations automatically.

1. Introduction
Transport is need in daily life, as for the most popular transportation in Indonesia is ground transportation. As we know, Bandung is one of the largest road transport user quantity in Indonesia. It has a solid traffic intensity, the myriad problems that have emerged, one of which violations committed by drivers at the intersection. Currently, violations can only be seen manually by using CCTV (closed-circuit television) which was installed at the intersection. This was not effective because the number of officers is not proportional to the ratio of the violation. [1,2]

In the previous research, conducted the application traffic violations detection based on The Internet of Things that is detecting an object of the license plates number of a vehicles. [1,9] As for the resulting accuracy of the tool created earlier is still less than 70 percent. We can fix this by using the API (application programming interface) OPEN ALPR. The OPEN APLR is an API for image processing that is changing the image of letters and numbers on the license plate number of the vehicle into a string.
As for the accuracy of image processing OPEN ALPR is already in the test and the result is an average of more than 70 percent. [6,9]

The purpose of this research is to create a tool that can help officers in detecting violations at every intersection traffic lights effectively by using the hardware and software that is integrated with the accuracy rate of more than 70 percent.

2. Method
In this research are using a prototyping method that consists of several stages including communication, quick plan, modeling, and quick design, construction of the prototype, and deployment and feedback. Here is a picture of prototyping methods (see Figure 1)

![Figure 1. Prototyping method [2]](image)

2.1. Communication
Communication is the stages of the model prototype to be used as a description of what was gained in the process of research to identify and evaluate the problems and obstacles that occur and the expected needs so the repair can be performed. At this stage is conducted observations from a system that is already running, so it becomes the input for the development of the internet of things based system. [3,4]

2.2. Quick Plan
The planning is done by describing the needs of a support system, starting from the needs analysis of the hardware and the software to users of the system.

2.3. Modeling and Quick Design
In this stage, modeling using block diagrams to illustrate the workings of the system from any hardware. Further, do well the functional needs analysis for software development as a liaison to any hardware. [5]

2.4. Construction of prototypes
Assembly hardware integrated through software that is built and then tested the reliability function. It aims to find out the extent to which it can reach the target research.

2.5. Deployment
After the Assembly, then the hardware and software are tested continuously to measure accuracy, the speed of processing, external information generated. Then, users provide feedback from a lack of system development. [7,8].

3. Results and Discussion
Based on the stages of prototyping method, the system architecture to be built is shown in Figure 2:

![Figure 2. Architecture system](image)

Every car or motorcycle that they violated will be on detection by infrared sensor modules are mounted parallel to the boundary of the area of zebra cross. Then the signals from infrared sent to Raspberry Pi as a mini PC control module the camera to capture the image in the form of a license plate number of the vehicle identified violation. Picture of the license plate number of the vehicle is sent to the Web Service that is used as an interface through the internet network. After that, the image in the conversion into a string form using the Application Programming Interface (API) Opel ALPR. After the data plate number violation in turn into the form of a string or character, then in the process of using google voice API to change into external sound connect to speakers. [8,9,10]

The existence of this system, the officers of the ATCS does not need to supervise offenders one by one. However, the system can automatically identify and perform actions admonished to motorists who violate. Here is a picture of a system interface that can be used by officers of the ATCS in the monitor and detect violations of the vehicle at the intersection of automatically using the Internet of Things. (Figure 3)
The officers of the Department of transportation of the ATCS Bandung accessing this system should enter the username and password that is already determined. Furthermore, the officers set the infrared sensor module so that it is automatically activated when in a State of traffic lights are red. Next, the system will display images and detect vehicle license plates breaking. After that, a warning sound will automatically be processed through the Mini PC raspberry PI-linked to some (API) via the internet network. [6] After that, the data will be stored automatically into the database. The following is an example of log violation detection accuracy of vehicles stored in the database in Table 1:

Table 1. Vehicle Violation Detection Log

| No | Plate Number | Time           | Accuracy |
|----|--------------|----------------|----------|
| 1  | B457UTY      | 2019-02-03 21:33:40 | 95 %     |
| 2  | B2089RFF     | 2019-02-03 21:35:50 | 90 %     |
| 3  | B166LJX      | 2019-02-03 22:13:22 | 63 %     |
| 4  | D5161JF      | 2019-02-04 21:33:40 | 98 %     |
| 5  | B1021UJB     | 2019-02-06 13:33:40 | 91 %     |
| 6  | D6161LX      | 2019-02-06 13:35:21 | 89 %     |
| 7  | B1690BA      | 2019-02-06 13:35:57 | 90 %     |
| 8  | D5161JF      | 2019-02-07 10:10:37 | 92 %     |
| 9  | D6161LX      | 2019-02-07 10:11:44 | 91 %     |
| 10 | D1541ACF     | 2019-02-19 08:03:11 | 92 %     |

In this research, prototype tools can generate accuracy detection of an image of the license plate number of the vehicle in violation of more than 70 percent. In contrast to previous research [6,9], the level of accuracy of detection of images ranging from 60-70 percent.
4. Conclusion
Based on the results of testing a system built, then concluded that this tool can help the officer’s Area Traffic Control systems (ATCS) to observe and detect violations that occur at the intersection. The level of accuracy and the detection of vehicle number plate image processing is 80%. ATCS Officers do not have to check one by one offense; it can be done automatically by the system. Then the result of the detection of the offense can be stored automatically and recorded in the database. Suggestions for this research, so that the accuracy of the detection vehicle number plates can produce a good accuracy, it is necessary to use a camera with a resolution above 1024 pixels with a minimum distance of 20 meters between the detection vehicles and the camera being used.

Acknowledgment
The authors would like to thank the Department of Transportation in Bandung City for providing data and facilities used in this research.

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