

A Tool Detects Violation of Road Markings Using Ultrasonic Sensors Based on Internet of Things

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Abstract

In our daily lives, of course we often see the number of motorbike or car vehicles that do not care about the traffic lights, even though the traffic is red, but there are always vehicles that stop or even slightly cross the white line that is specifically for pedestrians so that can pass when the traffic lights are red. Internet of Things (IoT) can connect devices to each other that are interconnected remotely and manage conditions that occur directly and can be controlled via a smart phone[6]. After analyzing the needs, the author will build a Tool to Detect Road Marking Violations Using the Internet-Based Ultrasonic Sensor on the grounds that all the components needed in building the tool already exist. Which is where the driver will be exposed to a photo if it crosses the marking line that has been provided on the highway. Because the concept of the internet of things involves tools with users to communicate. The composition of the algorithm, the author uses python which has become the default programming language raspbian operating system. Algorithm construction in the tool is a red light algorithm, an ultrasonic sensor algorithm, an image capture algorithm, and an algorithm for sending text and images via email. Traffic officers will be facilitated because the tool is in accordance with the traffic light seconds, can take pictures, and also officers are informed in the form of text and images.

I. INTRODUCTION

Technology is a breakthrough that can answer all problems of human limitations. With the many benefits presented by new technologies, it seems to reduce people's sense of security in safeguarding life. For example, in our daily lives, of course we often see the number of motorbike or car vehicles that do not care about traffic lights, even though the traffic is red, but there are always vehicles that stop or even slightly cross the white line that is specific to them. pedestrians to be able to pass when the traffic lights are red. Internet of things is a concept of objects that interact or exchange data using internet networks[5]. In an effort to deal with the bad habits of technology users of motor vehicles or cars, the writer will apply the concept of the internet of things into "A tool detects violation of road markings using ultrasonic sensors based on internet of things"

II. RELATED WORKS/LITERATURE REVIEW

Internet of things

Internet of Things (IoT) triggers the rapid development of electronic technology in various sizes. In addition, electronic equipment is generally equipped with a network module that allows equipment to be connected to the internet network [5]. The phenomenon of the internet of things which is a new technological trend that is developing into a new thing in today's society. The technology is able to change the device into a new thing in today's society. The technology is able to turn devices into something valuable such as for monitoring and analysis. A scenario that utilizes internet and computer network connections that are developed against an object, sensors, and devices that are

used daily (though not computers) through the basis of the ability to create, exchange, and use data with minimal human interaction.[7]

Design of tool

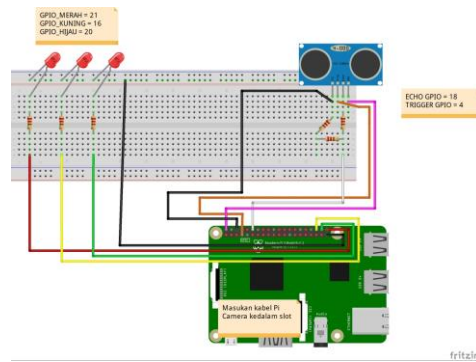


Fig. 1. Design of tool

There are many choices for implementing IoT-based tools. Primarily is embedded-based equipment (embedded equipment) that is equipped with a network module, both wired (wireless) or wireless (wireless) so that this equipment can communicate with the outside environment

Raspberry Pi

Raspberry Pi is a single computer board (SCB) or microprocessor that has been equipped with a GPIO (General Purpose Input Output) pin so that in addition it can function like a PC computer but can also function as a receiver of data through its input-output pin.[1]

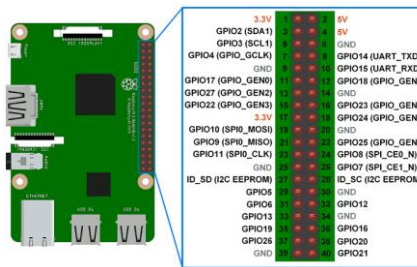


Fig. 2. Raspberry Pi

Ultrasonic Sensor

Ultrasonic sensors work based on the principle of reflection of sound waves, where these sensors produce sound waves which then capture it again with a time difference as the basis for sensing. The time difference between sound waves emitted by the recapture of sound waves is directly proportional to the distance or height of the object that reflects it. Pin out of ultrasonic sensors are GND Pin, GPIO Echo (18), GPIO Trigger (4), VCC. Jumper cables are placed as shown below. [2]



Fig. 3. Ultrasonic sensors

Pi Cam camera

The camera is an optical device that can record an event or events in the form of images. Put in the camera slot in the Raspberry Pi, this camera only works for the Raspberry Pi microcontroller. But this camera only has 2 megapixel quality. [1]



Fig. 4. Picam

Traffic light module

GPIO_output (21) Merah, GPIO_output (16) Kuning, GPIO_output (20) Hijau, GND. Connected via a jumper cable, resistor and also a breadboard. The traffic light module is similar to three LEDs, each of which has red, yellow and green colors.[3]



Fig. 5. Traffic Light Module

Breadboard

1 piece of breadboard to hold cables and resistors so that they can connect all the components needed in the construction of devices to detect violations of road markings.[4]

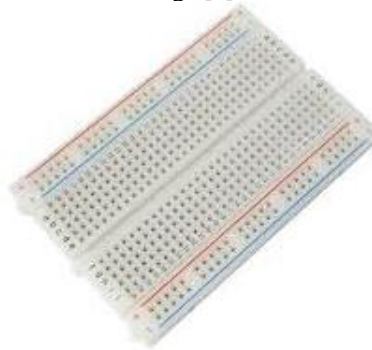


Fig. 6. Breadboard

III. METHODS

Planning from the problem analysis stage, designing tools to detect violations of road markings, and testing or implementing them. Analyzing problems - problems that occur, the tool to detect violations of road markings, as well as the ease of use of users in using the tool. Designing a tool design to detect violations of road markings through the initial stages. Conduct a test of the tool to detect violations of road markings to find out how well the tool's performance detects the problematic vehicle in detecting. Some of the methods used to collect data are

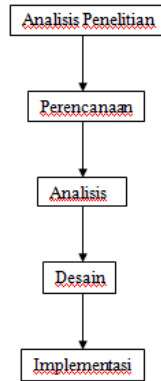


Fig. 7. Research's steps

Design of Algorithm

The working principle of this tool is, detection based on the presence or absence of motorized vehicles stopping or moving past road markings provided in traffic. Every time a violation of a road mark is detected. the tool will send notifications in the form of text and images with the same date and time of the day the violation occurred. The steps are as follows:

- 1 Red traffic lights
- 2 Ultrasonic sensors detect violations.
- 3 Take picture
- 4 Send images and text with Gmail

Flowchart

This chart shows a sequence, a procedure, or as mentioning the names of parts, flow of a process.

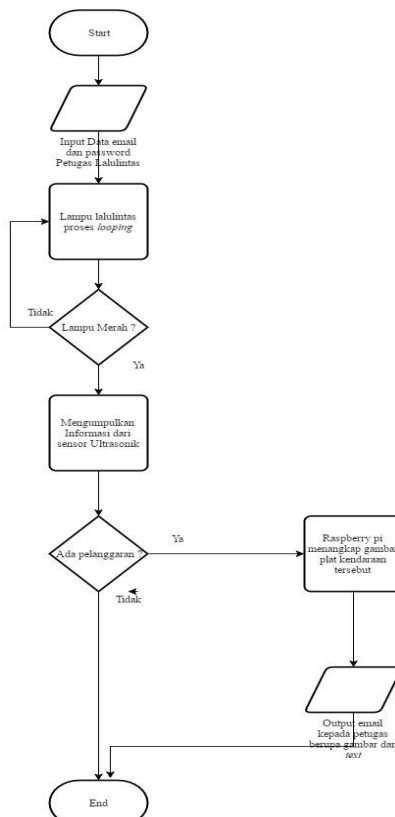


Fig. 8. Tool Flowchart

IV. RESULTS

Output results generated with the concept of the Internet of Things (IoT) offer interesting potential such as devices that can be controlled via smart phones between devices with each other that are interconnected remotely and notify the conditions that occur directly.

All parts of the Tool

The width of the curb is limited to 17 cm, and the distance is still within the reach of the ultrasonic sensor. An overview of the tools like the one below



Fig. 9. All Parts of the Tool

Mockups are adjusted with appropriate illustrations to illustrate the highway along with the traffic lights inside.

Traffic lights configuration

- At the vulnerable time of 1 - 20 seconds the lights will turn green and vehicles, both cars and motorcycles, are welcome to go.
- At the vulnerable time 17-20, the yellow light will activate simultaneously with the green light, and vulnerable at 57-60, the yellow light will reactivate simultaneously with the red light.
- At the vulnerable time of 21 - 60 seconds, the red light will activate along with the sensor

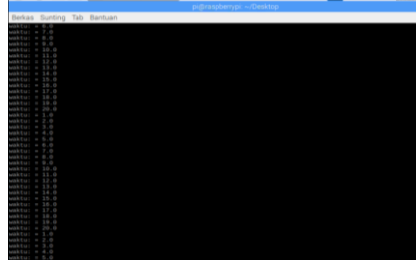


Fig. 10. Display the remote desktop

Violation of road markings detected

The display when the green light and yellow light are on indicates the vehicle is welcome to move forward to its destination. In this condition, neither vehicle that crosses the mark line will be hit by a capture camera or even an ultrasonic sensor will not be detected at all. Display The traffic lights are red, the vehicle is required to stop, if there is no violation then the traffic lights will roll to green without any warning to the officer. During the red light seconds running, this algorithm does not stop to detect, take pictures, and also send them to officers.



Fig. 11. Display of the green, yellow and red lights

Take picture and send it by email

When traffic is red the vehicle should stop, but if there is a violation the ultrasonic sensor will respond immediately. The sensor will make the camera capture images of vehicles that violate the markers and are processed by raspberry

pi according to the algorithm and automatically sent to the officer. Every second a red light, this tool has been designed to carry out this algorithm and will continue to repeatedly to detect, take pictures, and send information in the form of text and images to the officer. Officers will be more flexible in monitoring traffic and anticipating every violation of road markings. Until finally the traffic lights turn green the algorithm will stop and let motorists go to their respective destinations.

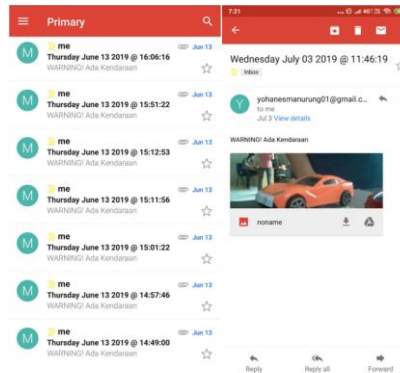


Fig. 12. Mail warning the violation of markings's road

The mail will be sent every time a violation occurs in a red traffic light condition, the contents of the mail are text and images.

V. DISCUSSION

After testing the tool for detecting road markings violations, the results can be obtained that:

1. The sensor can detect motor vehicles that violate road markings when the traffic lights are red
2. Automatically capture pictures of any vehicle that violates the markers using picam
3. Images and text will be automatically sent by raspberry pi to the traffic officer email address
4. The time has been set to distinguish green, yellow and red lights

VI. CONCLUSIONS

Based on the tools made by the author and which have been described in previous chapters, the conclusions can be drawn as follows:

- a. The tool has been proven to detect violations when the traffic lights are red based on a questionnaire that has been filled by 20 people.
- b. The tool has been proven to be able to send information in the form of images and text via email to officers whenever a violation is detected.

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