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# TIMER TRAFFIC LIGHT CONTROL USING RASPBERRY PI

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***Abstract***

*As time goes by and the development of the times is very rapid increase in the number of vehicle volumes is increasing from year to year, coupled with automotive manufacturers who release their products at prices below the standard. This of course can increase the volume of congestion which is the main problem, very heavy traffic causes more time wasted and consumes fuel. The solution offered to overcome the congestion problem is a Timer Traffic Light control system, which is a traffic management system on each road segment used to reduce congestion in traffic lights that occur in big cities today. For the future, this is very much needed, given the increasing number of vehicles queuing at the traffic light. In this study a controller model of Timer Traffic Light was created based on image processing with the Background Subtraction method using the Raspberry Pi. The Background Subtraction method is used to process images containing objects that have been captured on the highway using a camera, the images obtained can classify the condition of the road with parameters of empty, medium, and solid conditions. The images obtained are then forwarded to the Timer Traffic Light controller system with the hardware and software used in this study.*

*Keywords : Raspberry PI, Traffic Light, Background Substraction.*

## 1. Introduction

Information technology has now entered almost all aspects of life. Technology was built with the aim of alleviating previously complex human work to be simpler[1]. The use of computers in the future is able to dominate human work and defeat human computing capabilities such as controlling electronic equipment remotely using internet media, IOT (Internet of Things) allows users to manage and optimize electronics and electrical equipment that uses the internet[2]. Interaction is an inseparable part of human life. One area in computer engineering is how interactions between humans and computers are formed[3]. The rapid development of science and technology in the era of globalization has triggered many changes in social life including the development of human thought to create a new innovation in various fields, especially in the field of technology and information. The difference in the characteristics of IT users is also influenced by many factors, one of which is the behavioral aspect[4]. Information technology, especially computer technology, has the potential to improve the performance of individuals and organizations, so many decision makers invest funds for information technology[5]. Big cities in Indonesia are growing rapidly. Population growth is quite high, as well as an increase in the economy of the community demanding a high rate of development, so that it causes a high increase in mobility also from the actors of development in these big cities[6]. Heavy traffic causes more waiting time and consumes fuel. This traffic jam also causes people to lose time,

lose opportunities, and cause frustration. One of the efforts that have been made to overcome the congestion problem is the construction of new roads. However, efforts to make new roads are also constrained by problems of limited land, long construction time, and environmental density. One solution offered to overcome the problem of congestion is with a control system. Traffic Light Timer. facilitate pedestrians to be able to cross safely and reduce the level of accidents caused by collisions due to differences in road flow, because the function of traffic lights is very important it is necessary to control and control easily so as to facilitate traffic at the intersection[7]. Congestion that occurs in big cities can be overcome by a good traffic management at each crossroads, namely maximizing vehicle capacity and minimizing driver waiting time. Because its function is so important, the traffic lights must be able to be controlled or controlled as easily as possible in order to facilitate the flow of traffic at a crossroads[8]

## 2. Research Method

In this study a literature review method was conducted on existing research, to determine the difference with previous research. Many previous studies have been conducted with regard to Literature Review regarding the concept of using sensors against Raspberry PI. Identifying gaps and identifying methods that have been carried out by several researchers, the 10 (ten) Literature Reviews are as follows :

1. Research conducted by Ridho Prakoso AL Farisi, from the University of Lampung in 2018 with the title "Design of a Traffic Light Timer Control Model with Background Substraction Method" This research shows that the Traffic Light Timer Control Model has succeeded in classifying the queue density of the vehicle, being able to control the timer, and Traffic Light lights automatically based on vehicle queues with an overall process time of around 2 seconds[9].
2. Research conducted by Agus Adria, from Syiah Kuala University in 2011 with the title "Design of Automatic Traffic Light Control" This research explains the AT89C51 microcontroller aims to get a control system that can later be used to reduce congestion in traffic light that occurs in big cities now[10].
3. Research conducted by Tri Daryanto, and Panji Tri Pratomo, from Mercu Buana University in 2010 with the title "DESIGN AND MAKING APPLICATION OF TRAFFIC LIGHT CONTROL SYSTEM BASED ON OFFICE TIME (CASE STUDY OF TOMANG PLACEMENT)" This study explains the traffic control system can optimize controlling traffic lights by using a timer, where the system implemented is a real time control system so it is more efficient[11].
4. Research conducted by Laksono Budi Prianggodo, and Ratnasari Nur Rohmah, from the Muhammadiyah University of Surakarta in 2016 with the title "Designing Object Tracking Robot Based on Raspberry PI" This research describes Object tracking which is a technique in the field of computer vision used for tracking a moving object[12].
5. The research conducted by Riansa EP Tolah, Rizal Sengkey, and Yaulie DY Rindengan from the Faculty of Electrical Engineering Manado in 2015 with the title "Designing Automatic Traffic Light Simulation Using Digital Images Toar-Lumimuut Intersection Case Study" This study explains MATLAB 2009a and Camera Digital as a processing and input of traffic light images. Sampling of traffic light crossing images is still in the form of a prototype (miniature Toar-Lumimuut Junction) for digital image processing[13].
6. Research conducted by Eka Nurhidayat, Alfin Indra Septiana, Andhy Nursyah Putra, Ady Syaripudin, Dede Irawan Saputra in 2018 with the title "Adaptive Traffic Light Control System Design on Four Intersections Based on PLC Omron CP1E" This study explains adaptive traffic light control works by detecting the number of vehicle queues in a lane, this system works with sensors that detect the length of the vehicle queue. There are three sensors that will detect the vehicle queue length on each lane[14].
7. Research conducted by Derfian Mahardika Putra from the University of Jember in 2017 with the title "Prototype Control and Monitoring System of Moisture Resistant Through

8. Android-Based Local Blynk Server" This study describes one of the features possessed by the Blynk application, namely the local server which means it can communicate with one network, the advantage of this mode is the delivery of more stable data[15].
9. Research conducted by Alfiah Khoirunisa from Raharja University in 2019 with the title "Optimization of Information Management Report Assignment on a Content Management System Based Website" This study explains the learning methods created to maximize and streamline time[16].
10. The research conducted by Untung Rahardja from Raharja College in 2009 with the title "Automatic Car Speed Control System Simulation" This study explains the car control system automatically by utilizing ultrasonic sensors that make the car control its speed by detecting objects around it[17].
11. Research conducted by Muhammad Aria, Riezky Faizal from the Indonesian Computer University in 2017 with the title "Integrated Embedded Traffic System Traffic System" This research explains the function of Traffic Light which is so important that traffic lights must be able to control or control as smart as possible. The work system used in the design of this traffic is to know the length of the queue in each section of the road, then the entire section is compared to follow from the longest to the shortest. That way, the information processing system of the sensor will determine which segments will take precedence in the order earlier[18].

From 10 (ten) literature reviews, the monitoring system uses Raspberry PI as the interface of the monitoring system. In this study the system was made to monitor the movement of objects by monitoring the Blynk application that can display data and history of the movement of objects using a smartphone or gadget.

## 3. Findings

### 3.1 Design

The specifications of the prototype that are made have 4 (four) capabilities including :

1. there is a grapic history of the movement of objects in the blynk application in real time;

2. accessed in real time remote monitoring from a cellphone or gadget via the internet network;

3. detect the movement of objects around the sensor;

4. there is an LED on the blynk application if the sensor reads a movement;

In the shower consists of 2 (two) parts, namely hardware and software, which consists of 5 (three) hardware and 1 (one) software including:

### A. Hardware

The block diagram of the hardware section is shown in Figure 1. The design concept is to add a microcontroller component, a WiFi adapter (ESP8266), an electric power adapter, and a RWCL 0516 sensor.

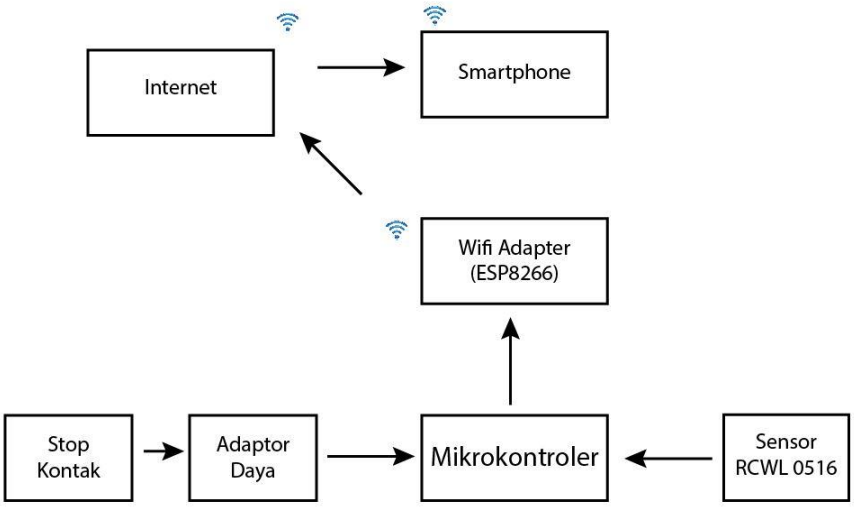


Figure 1. Tool Block Diagram

Raspberry Pi

Raspberry Pi, often abbreviated as Raspi, is a Single Board Circuit (SBC) computer that has the size of a credit card. Raspberry Pi can be used for various purposes, such as spreadsheets, games, and can even be used as a media player because of its ability to play high definition video. Raspberry Pi was developed by a non-profit foundation, Raspberry Pi Foundation which was developed by a number of developers and computer experts from the University of Cambridge, England[19].

Figure 2. Raspberry PI

Sensor RCWL 0516

RCWL 0516 is a Doppler radar microwave motion sensor module, works by reading the surrounding sound waves and this sensor can read movements up to 4 meters distance from the object to the sensor.

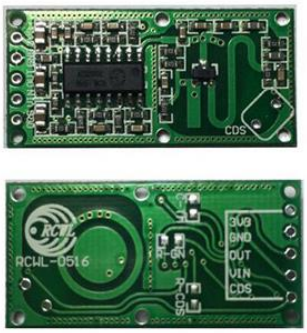


Figure 3. Module RCWL 0516

ESP8266 Wifi Module

Quoted from wikipedia, The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer, Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands[20].

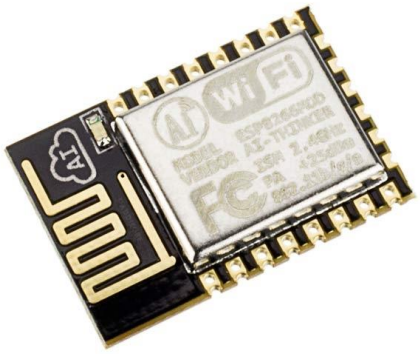


Figure 4. Module Wifi ESP8266

Background Subtraction

Background Subtraction is the process of finding objects in an image by comparing the existing image with a background model. Background Substraction has an important role in Computer Vision, one of which is in the case of a monitoring system.
Background Subtraction is a method generally used to detect moving objects on video from a static camera (stationary camera)[21].

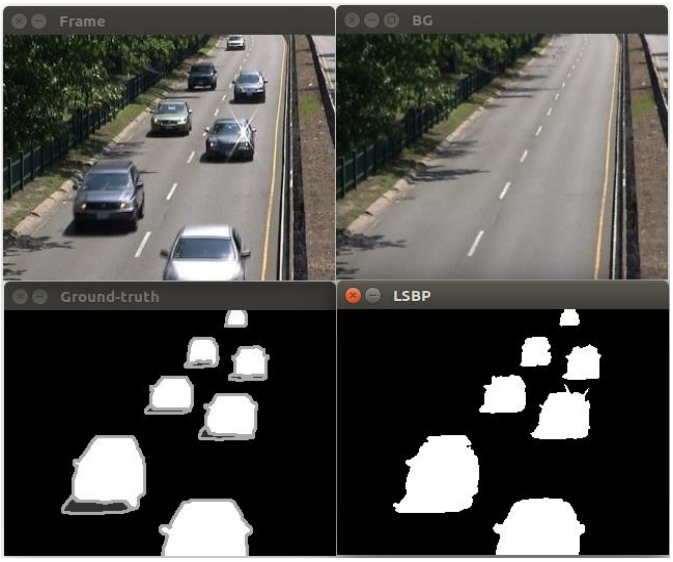


Figure 5. Background Subtraction Method

**B. Software**

Blynk application program on a microcontroller chip using Raspberry PI that has been installed ESP8266, Figure 5 shows the flow chart of the remote monitoring application.

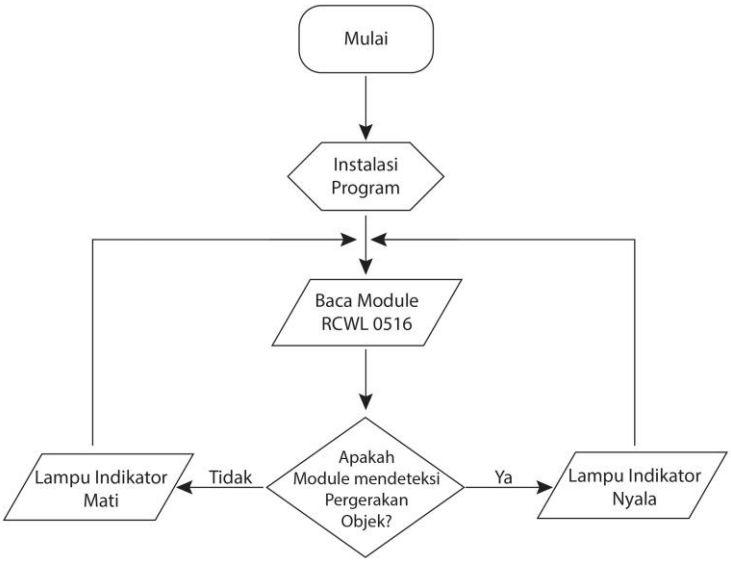


Figure 6. Application Flow Chart

On the flow chart (Figure 6), the program will send data in the form of digital output from the RCWL 0516 module through the ESP8266 module.
The specifications of the software used are as follows:
a. The program on Arduino microcontrollers uses Arduino language with a number of related libraries, such as ESP8266.
b. The program on smartphones uses applications that are already available to control devices via WiFi networks (based on ESP8266), namely Blynk.

### 3.2 Readings for RCWL 0516 Module

To be able to communicate between the microcontroller and the wifi module and connect with the Blynk application using a special library added to Raspberry PI, namely Blynk and ESP8266. This library functions to connect with Blynk servers that communicate via the internet with the ESP8266 module. The use of the library in sketch (source code) is shown in the following script.

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
char auth[] = "462e457a5eff43b4b9e8a670243xxxxx"; //token blynk
int ip = 8; //pin input
int val = 0;
int led = 13; //pin output
void setup() {
  Serial.begin(9600);
  pinMode (ip, INPUT);
  pinMode (led, OUTPUT);
  Blynk.begin(auth, "RAHARJA", " "); //koneksi wifi
}
void loop() {
  val = digitalRead(ip);
  Serial.println(val, DEC);
  if(val >0)
  {
                                        digitalWrite(led, HIGH);
  }
  else
  {
                                        digitalWrite(led, LOW);
  }
  delay(1000); //waktu delay
  Blynk.run();}
```

3.3 Remote Monitoring Application

Remote monitoring and control of cellphones via a WiFi network is done using the Blynk application. Blynk is an application designed for the Internet of Things (IoT), Blynk (2016) .. This application can be used to control hardware devices, display sensor data, store data, visualize, and others.

Blynk application

Blynk is an IOS or Android based application to control microcontroller in the form of Arduino through the internet. The blynk application can help administrators monitor something practically. *Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things*[22]. The appearance of the Blynk application is shown in Figure 6 of Blynk.


Figure 7. Blynk's appearance on the gadget

### 3.4 Measurement of Object Movement

The measurement results of the values of some object movements are shown in Tables 7, 8 and 9. The data generated by the RCWL 0516 sensor output in the Blynk application actually has a difference of 1 second.


Figure 8. Graph of no movement

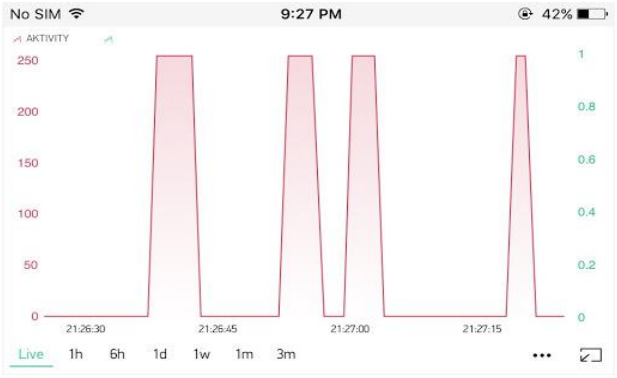


Figure 9. Graph of infrequent movement


Figure 10. Graph of frequent movements

## 4. Conclusion

Based on the above problems, there are 3 (three) problems that have been resolved with 5 (five) methods used in between

1. This tool can adjust Traffic Light properly using Raspberry Pi in accordance with the desired time based on vehicle density.
2. This tool can be accessed by users in a fairly remote range.
   This tool can help users in monitoring the room outside the work area

## 5. Suggestion

Based on the research results described above, the author concludes 3 (three) suggestions for further development, namely :

1. Add solar panels as an additional energy supply to keep the traffic light timer on when the main supply turns off / power off.
2. Add sensors and additional methods to more clearly know the density of the vehicle.
3. This tool can still be developed in terms of design and components used.

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