POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

SMART TRAFFIC LIGHT WITH RED LIGHT RUNNING DETECTION

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JABATAN KEJURUTERAAN ELEKTRIK

SESI 1 2022/2023

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This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electrical Engineering

JABATAN KEJURUTERAAN ELEKTRIK

1 SESI 2022/2023

CONFIRMATION OF THE PROJECT

The project report titled "SMART TRAFFIC LIGHT WITH RED LIGHT RUNNING DETECTION" has been submitted, reviewed and verified as a fulfills the conditions and requirements of the Project Writing as stipulated

Checked by:

Supervisor's name : PN. ASLINDA BINTI ZAMAH SHARI

Supervisor's signature:

Date :

Verified by:

Project Coordinator name :

Signature of Coordinator :

Date :

"I acknowledge this work is my own work except the excerpts I have already explained to our source"

1. Signature :

Name : **ASYRAF RAFIQ B. MUHAMMAD RIZA**

Registration Number : **08DEP20F1025**

Date : **18.12.2022**

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : SMART TRAFFIC LIGHT WITH RED LIGHT RUNNING DETECTION

SESSION: SESI 1 2022/2023

1. I, **1. ASYRAF RAFIQ BIN MUHAMMAD RIZA 08DEP20F1025**

   is a final year student of **Diploma in Electrical Engineering, Department of Electrical, Politeknik Sultan Salahuddin Abdul Aziz Shah**, which is located at **Persiaran Usahawan, Seksyen U1, 40150 Shah Alam, Selangor**. (Hereinafter referred to as 'the Polytechnic').

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3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the **Diploma in Electrical Engineering** to me.

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a) **ASYRAF RAFIQ BIN MUHAMMAD RIZA**) .
08DEP20F1025) ....…….
(Identification card No: - 020624-14-0721)) **ASYRAF RAFIQ**

In front of me, **PN ASLINDA BINTI ZAMAH SHARI** (.)) .....……
As a project supervisor, on the date:) **PN. ASLINDA**

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That is all and thank you..

ABSTRACT

Traffic light is a signaling devices positioned at road intersections, pedestrian crossings, and other locations in order to control flows of traffic. Traffic lights consist normally of three signals, transmitting meaningful information to drivers and riders through colors and symbols including arrows and bicycles. Although this is internationally standardized. This project is about to design a Smart Traffic light traffic light. Basically our traffic light have sensor to detect traffic congestion. Other that, the traffic light also have a camera to capture car that crossing red light. As the result, this project can decrease number of road accident cause of cross red light. The objective of this project is to develop an application that can issue summons those who violate red light. By using the telegram application the photo of the offender's vehicle that violates the red traffic light that is caught will be collected on telegram. This project was design by Light Dependent Resistance(LDR), IR sensor, traffic light module and ESP32Cam. Power that use to supply all the component is using electric energy by solar. This project that is ecologically good since it uses energy from renewable sources.

ABSTRAK

Lampu isyarat ialah peranti isyarat yang diletakkan di persimpangan jalan, lintasan pejalan kaki dan lokasi lain untuk mengawal aliran lalu lintas. Lampu isyarat biasanya terdiri daripada tiga isyarat, menghantar maklumat bermakna kepada pemandu dan penunggang melalui warna dan simbol termasuk anak panah dan basikal. Walaupun ini adalah piawaian antarabangsa. Projek ini akan mereka bentuk lampu isyarat lampu isyarat Pintar. Pada asasnya lampu isyarat kami mempunyai sensor untuk mengesan kesesakan lalu lintas. Selain itu, lampu isyarat juga mempunyai kamera untuk menangkap kereta yang melintasi lampu merah. Hasilnya, projek ini dapat mengurangkan jumlah kemalangan jalan raya yang menyebabkan lampu merah silang. Objektif projek ini adalah untuk membangunkan aplikasi yang boleh mengeluarkan saman mereka yang melanggar lampu merah. Dengan menggunakan aplikasi telegram gambar kenderaan pesalah yang melanggar lampu isyarat merah yang ditangkap akan dikumpul di telegram. Projek ini direka bentuk oleh Light Dependent Resistance (LDR), sensor IR, modul lampu isyarat dan ESP32Cam. Kuasa yang digunakan untuk membekalkan semua komponen adalah menggunakan tenaga elektrik oleh solar. Projek ini yang baik dari segi ekologi kerana ia menggunakan tenaga daripada sumber yang boleh diperbaharui.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Introduction

Traffic lights, developed since 1912, are signaling devicesthat are conceived to control the traffic flows at roadintersections, pedestrian crossings, rail trains, and otherlocations. Traffic lights consist of three universal coloredlights: the green light allows traffic to proceed in the indicateddirection, the yellow light warns vehicles to prepare for shortstop, and the red signal prohibits any traffic from proceeding [1].

However, the traffic problem is very complicated due to theinvolvement of diverse parameters. First, the traffic flowdepends on the time of the day where the traffic peak hours are generally in the morning and in the afternoon; on the days of the week where weekends reveal minimum load while Mondays and Fridays generally show dense traffic oriented from cities to their outskirts and in reverse direction respectively; and time of the year as holidays and summer. Secondly, the current traffic light system is implemented with hard coded delays where the lights transition time slots are fixed regularly and do not depend on real time traffic flow. The third point is concerned with the state of one light at an intersection that influences the flow of traffic at adjacent intersections. Also, the conventional traffic system does not consider the case of accidents, roadworks, and breakdown cars that worsen traffic congestion. In addition, a crucial issue is related to the smooth motion through intersections of emergency vehicles of higher priorities such as ambulances, rescue vehicles, fire brigade, police, and VIP persons that could get stuck in the crowd. Finally, the pedestrians that cross the lanes also alter the traffic system[2].

Nowadays, many countries suffer from the traffic congestion problems that affect the transportation system in cities and cause serious dilemma. In spite of replacing traffic officers and flagmen by automatic traffic systems, the optimization of the heavy traffic jam is still a major issue to be faced, especially with multiple junction nodes [3]. The rapid increase of the number of automobiles and the constantly rising number of road users are not accompanied with promoted infrastructures with sufficient resources. Partial solutions were offered by constructing new roads, implementing flyovers and bypass roads, creating rings, and performing roads rehabilitation.

The conventional traffic system needs to be upgraded to solve the severe traffic congestion, reduce traffic volume , optimize cars safety and efficiency , expand the benefits in health, economic, and environmental sectors , and the number of cars that cross red light. This paper proposes a simple, low-cost, that aim to develop an application that can issue summons those who violate red light. The system are controlled by Arduino uno as a microcontroller. This work contribute system of the smart traffic light and the camera to capture car that cross red light. All the picture can get in the Telegram apps.

1.2 Project Background

Smart traffic lights or Intelligent traffic lights are a vehicle traffic control system that combines traditional traffic lights with an array of sensors and artificial intelligence to intelligently route vehicle and pedestrian traffic. There are many benefit using smart traffic light system. For the first benefit of smart traffic light, save time with real time control. By using LDR sensor, this project can know the road that a road with a large number of cars. Congested routes will be given a longer duration of green traffic lights than usual. for the example, traffic light set road A for a longer green light due to the large number of cars compared to traffic lights on other roads. Next benefits is, improving air quality by reducing emissions. Roads with a lot of traffic will be given preference over those with few cars. This is because compared to roads with fewer vehicles, if a high number of automobiles halt for an extended period of time to wait for a green traffic signal, it will result in severe air pollution. this is due to the fact that if an automobile is left idling for too long, the release of carbon dioxide will grow.

1.3 Problem Statement

Figure 1 "news form utusan Borneo case car"

Every year Vehicle Accidents Caused by running a Red Light signal will increase. Because of that, some of the victims involved died due to the accident and some survived but were seriously injured. There are drivers who do not follow the road safety. This is a due of the driver's attitude in continuing to drive after the yellow traffic light turns red. When the driver is running late for work or other obligations, this frequently occurs. However, that is not the best course of action because it would annoy others. For instance, if there is an accident, not only will the driver be hurt, but other nearby residents will also be affected by the injuries and property damage.

1.4 Project Objectives

The main objective of this project is to develop an application that can issue summons those who violate red light. By using the telegram application the photo of the offender's vehicle that violates the red traffic light that is caught will be collected on telegram. Next, the photos of the offenders caught and collected in telegrams will be sent directly to the authorities such as the police and Jabatan Pengangkutan Jalan

1.5 Scope of Project

The limitation of this project is only can sent picture of car and plate number to the telegram. Next is, to connect camera with telegram must have a good network to sent the picture.

I. This project only focused on people who drive cars and commit road crimes such as running red lights

II. To display pictures of vehicles that break red traffic lights through the Telegram application to authorities such as the police and jpj. The authorities will issue a summons for those who violate the red light

1.6 Project Significance

The importance of the project that we are working on is to provide a positive experience for road users. When there is traffic jam on specific road, the duration traffic jam became green more longer dependent on the quantity of cars. This intelligent traffic signal system will reduce traffic jams and save drivers time. Additionally, this project safeguards road users. The red light camera mounted at the traffic signal can assist police or road authorities in capturing images of drivers who run red lights. The drivers will be given summonses and must pay fines. They will drive cautiously because they do not want to be penalised for breaking the laws of the road again.

1.7 Chapter Summary

End of this chapter, we can see the importance of smart traffic light with a camera to reduce the cases of red light running. We can see the significance of this effort in reducing the number of occurrences of red light violations. Furthermore, the installation of smart traffic signals can cut waiting time on the road and the emission of carbon dioxide from automobiles.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

At congested junctions, traffic lights are meant to facilitate safe and efficient traffic movement. However, the amount of safety obtained is primarily contingent on drivers' compliance with the signals. According to research, many drivers habitually disregard red lights, putting themselves and other road users at danger of serious crashes. Analyses of red light violation data from 19 crossings in four states indicated that violation rates averaged 3.2 per intersection per hour. A study done over many months at five popular crossing approaches in Fairfax City, Virginia, discovered that violation rates averaged 3 per intersection per hour. During peak travel periods, red light running was more frequent. The term "independent" refers to a person who does not work for the government. A countrywide examination of 9,951 automobiles was conducted.

2.2 SMART TRAFFIC LIGHT (Literature Review Topic 1)

In this section, we discuss previous studies which were interested in explaining and developing Smart Traffic light with red light running Detection with various approaches and methods as follow:

(paper 1)

SMART TRAFFIC SIGNAL CONTROL SYSTEM- by Krunal Kapagate*1, Navneet Bhave*2, Dwij Ghutke*3, Himanshu Wakade*4, Dr. Swapnil Khubalkar*5 , The LASER module and LDR module has to be installed on opposite sides of the road just before the zebra crossing at the signal. The ESP32-CAM module needs to be mounted on a pole such that the camera can cover the required area of the road near LASER module. The power supply to one of the red light of the signal is connect one of the GPIO pin in ESP32. 5 V supply and GND is given to CAM module through Arduino Mega Microcontroller. One of the GPIO pin of CAM module is connected to Digital output pin of LDR module. LASER emitter continuously emits laser beam but ESP32-CAM module only works when signal turns red. The programming to arduino is done is such a way that as soon as the signal turns red ESP32-CAM Module and LASER module comes into action. LASER transmitter projects its laser beam on LDR Module. As whenever any vehicle tries to jump red signal it comes forward and comes in between LASER beam and LDR module and hence the LASER beam doesn’t reach LDR. LDR detects this fault and sends signal to ESP32-CAM module and hence CAMERA of the CAM Module captures the image immediately. ESP32-CAM module has inbuilt Wi-Fi.[2]

Design and implement a smart traffic light controlled by internet of things – by Zaman Abood Ramadhan1 , Rasha hani salman2 , Bahaa Kareem Mohammed3 , Ali Hassanein Alwaily4 , ultrasonic sensor, our smart traffic system will be implemented by installing ESP 32 cam, which collected the number of cars on each side if there is a side traffic jam, and the other side is empty, the camera will send a signal to Arduino to traffic to open green light to reduce traffic jam. In addition, when a car crosses the red light, the ultrasonic sensor will send a signal to the camera to take a picture of the car number and send it via telegram and save it in the database. Our work includes a traffic light with three sides 2- The ESP32 cam will calculate the number of cars on each side when the side have a number of cars and light of this side is red light will turn the green light 3- Ultrasonic sensor works when the car crosses the red light side will send the signal to the camera to take picture of the car number below. 4- The pictures of cars crosses will send to the database by using the telegram app [1]

IOT based Smart Traffic Light Control System, Image Processing and Intelligent controls are applied to traffic data to optimize the flow of random traffic volumes. This enhances the vehicular throughput and minimizes delays in roads. Developing an Adaptive Neuro Fuzzy traffic light controller based on traffic density and waiting time of vehicles using MATLAB SIMULINK environment. • Transferring images to cloud using Thing Speak Platform and Arduino UNO. • Providing appropriate signals to traffic light based on the control action

Volodymyr Miz , Vladimir Hahanov Smart Traffic Light in Terms of CTMS based on IOT.This uses the approach of Cognitive Traffic management System(CTMS) which implements the virtual analog of existing physical traffic lights . It's system generates control signals using various sensors and car users data which is analyzed and processed by Big Data approach for further use in optimizing the current traffic light management system [7].

[5] Vishu Gupta and Rajesh Kumar, presents a method for smartly controlling the traffic lights and solving the continuously growing problem of traffic congestion.In this paper the optimisation of a single junction is proposed using adaptive control techniques .The algorithms used in this paper is HNN(Hopfield Neural Network) and GA(Genetic Algorithm).The HNN is used to determine an effective effective and optimised sequence of for the traffic lights, whereas GA is used to predict an optime green light duration which should fall between a particular range so that no lane has to wait for a longer time.In the situation of any congestion the HNN will be providing with an effective sequence which will solve the congestion problem.

Previous Research (Subtopic Literature Review Topic 1)

As a result of research, we found that it is necessary to use the appropriate tools and components to make this process a success. So, we will use light dependent resistor(LDR) as sensor in the smart traffic light system to sense the quantity of vehicles stopping at the road. The more vehicles stopping at the road, the duration of traffic light stay at green is more longer. Next we will use ESP32 cam to capture the vehicles across the road when the traffic light is red. We also used IR sensor which will detect vehicle movement. If the IR sensor sense vehicle moving through it during red light, the sensor sends signal to the ESP32 cam so that the picture of vehicle captured

ITEM/TITLE	PAPER 1	PAPER 2	PAPER 3	PAPER 4	PAPER 5
OBJECTIVE	designed a smart traffic control system by using Arduino to solve the problem of congestion	to identify people jumping red signal and inform RTO regarding the same	to improve traffic conditions. An ANFIS traffic light controller with inputs as waiting time and vehicle density	To show the effectiveness of implement red light camera at the traffic light	To design a smart traffic light using LDR technology
PROBLEM STATEMENT	The rise of the population produces an increase in the number of vehicles on the road, which creates heavy traffic in the roads and that causes many issues for the citizens and traffic cops an extra two emergency instances so it is necessary with developing technology to solve this problem.	Now a day's breaking traffic signal is becoming quite often. People are in hurry to reach their work. In order to save time people try to break traffic signals,	Traffic Congestion and traffic monitoring is one of the important problems all over the world	The red light running is one the problems that usually occur at the road. This causes the road become dangerous.	Basically, the sensors used for traffic light is highly cost and hard to install.
METHODOLOGY	ultrasonic sensor, our smart traffic system will be implemented by installing ESP 32 cam, which collected the number of cars on each side if there is a side traffic jam, and the other side is empty, the camera will send a signal to Arduino to traffic to open green light to reduce traffic jam. In addition, when a car crosses the red light,	After doing some research and interacting with traffic police officers and understandin g the whole problem we decided to design a specific system that will effectively	image sensor is used to identify vehicles in a traffic lane. The data from camera sensor is sent to cloud for analysis. The traffic data is extracted from the image using image	By installing red light camera(RLC), it encouraging drivers to stop instead of violating the red. Traditional manual enforcement methods are both resource intensive and	Light dependent resistor(LDR) will detect the presence of any vehicle in the lane of a road upon reception/non-reception of red led present on the opposite side of that particular lane. The in-built counter in the

	the ultrasonic sensor will send a signal to the camera to take a picture of the car number. Our work includes a traffic light with three sides 2- The ESP32 cam will calculate the number of cars on each side when the side have a number of cars and light of this side is red light will turn the green light 3- Ultrasonic sensor works when the car crosses the red light side will send the signal to the camera to take picture of the car number below.	detect signal jumping people and inform police immediately. We have used LASER module and LDR Sensor module to detect signal jumping and also used Camera module to take the pic and inform police	processing techniques Developing an Adaptive Neuro Fuzzy traffic light controller based on traffic density and waiting time of vehicles using MATLAB SIMULINK environment . •Transferring images to cloud using ThingSpeak Platform and Arduino UNO. • Providing appropriate signals to traffic light based on the control action	high risk, whereas red-light cameras have the advantage of operating 24 hours a day and do not involve high-speed pursuits. Red-light cameras, unlike the police, are also immune from charges of discriminatio n, as they detect only those vehicles that have violated a traffic signal.	microcontroller counts the number of vehicles going up and down in all lanes at all directions. Then microcontroller compares the total number of vehicles in each directions,accor dingly it sends its output to the traffic light present at the junction of roads.
SENSOR USED	Servo motor, ESP32-CAM, Arduino mega, Ultrasonic sensor	LASER module, LDR Module sensor and camera module	Camera module and ArduCAM Shield, Arduino uno .	Red light camera(RLC)	LDR, micro-controller

control System (Literature Review Topic 2)

Control System theory has played an important role in this project to control all the component. In my research, first paper use ultrasonic sensor, for smart traffic system will be implemented by installing ESP 32 cam, which collected the number of cars on each side if there is a side traffic jam, and the other side is empty, the camera will send a signal to Arduino to traffic to open green light to reduce traffic jam. In addition, when a car crosses the red light, the ultrasonic sensor will send a signal to the camera to take a picture of the car number.[4].

2.2.1 Microcontroller

A microcontroller a compressed micro computer manufactured to control the functions of embedded systems in office machines, robots, home appliances, motor vehicles, and a number of other gadgets. A microcontroller is comprises components like - memory, peripherals and most importantly a processor. Microcontrollers are basically employed in devices that need a degree of control to be ap plied by the user of the device

Microcontroller Basics:

Any electric appliance that stores, measures, displays information or calculates comprise of a microcontroller chip inside it. The basic structure of a microcontroller comprise of: -

1. CPU- Microcontrol lers brain is named as CPU. CPU is the device which is employed to fetch data, decode it and at the end complete the assigned task successfully. With the help of CPU all the components of microcontroller is connected into a single system. Instruction fetched by the programmable memory is decoded by the CPU.

2. Memory– In a microcontroller memory chip works same as microprocessor. Memory chip stores all programs & data. Microcontrollers are built with certain amount of ROM or RAM (EPROM, EEPROM, etc) or flash memory for the storage of program source codes.

3. Input/output ports– I/O ports are basically employed to interface or drive different appliances such as - printers, LCD's, LED's, etc.

2.2.2 Programmable Logic Control (PLC)

A programmable logic controller (PLC), or programmable controller is small, modular solid state computer with customized instructions for performing a particular task. PLCs, which are used in industrial control systems (ICS) for a wide variety of industries, have largely replaced mechanical relays, drum sequencers and cam timers. useful tools for repeatable processes because they have no mechanical parts and they can gather information. Each central processor unit (CPU) continually loops through an input scan, program scan, output scan and housekeeping mode, repetitively performing a single task while monitoring conditions. The information the controller gathers can be used as feedback to guide needed changes and improvements to processes, some of which can be performed automatically according to the device's coding

2.2.3 Arduino

Arduino is an open hardware development board that can be used by tinkerers, hobbyists, and makers to design and build devices that interact with the real world. While Arduino refers to a specific type of board design, it can also be used to refer to a company which manufactures a specific implementation of these boards, and is typically also used to describe the community around compatible boards made by other people or companies which function in a similar way. Arduinos contain a number of different parts and interfaces together on a single circuit board. The design has changed through the years, and some variations include other parts as well. But on a basic board, you're likely to find the following pieces:

A number of pins, which are used to connect with various components you might want to use with the Arduino. These pins come in two varieties:Digital pins, which can read and write a single state, on or off. Most Arduinos have 14 digital I/O pins.Analog pins, which can read a range of values, and are useful for more fine-grained control. Most Arduinos have six of these analog pins

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

We discovered that we can employ LDR as a sensor in a smart traffic light system as a result of our study process. The LDR transmits a signal to the Arduino UNO. The Arduino Uno will calculate the time it takes for a traffic light to turn green. Following that, an IR sensor is combined with an ESP32 camera. During a red light, the IR sensor detects cars on the road, while the ESP32 camera records images of the vehicles and sends them to a database.

3.2 Project Design and Overview.

As mention in previous chapter, the design controller is system with Arduino as the main controller. The design of the controller circuit using Arduino is realize using Proteus Software and then convert to PCB circuit. This project are using LDR to sense the traffic congestion. After that, this project also use IR sensor to detect car crossing the traffic light when the light is red. Then, ESP32 cam are to capture the picture of car that crossing the red light. Next, the photos of the offenders caught and collected in telegrams will be sent directly to the authorities such as the police and Jabatan Pengangkutan Jalan.

3.2.1 Block Diagram of the Project

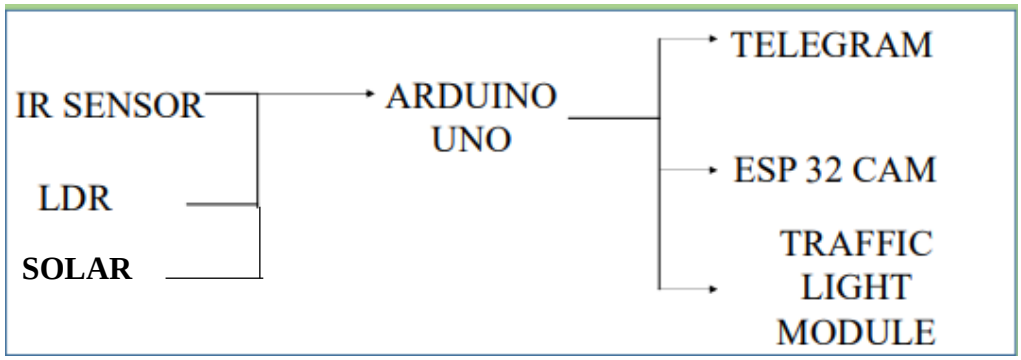


Figure 2 BLOCK DIAGRAM

LDR is installed along the road such that when a car comes to a halt, the LDR is obstructed and cannot detect light. When the LDR is unable to detect light, it sends a signal to the Arduino UNO. The Arduino UNO will respond to the signal and determine how long the traffic light will remain green. The more LDR that is obstructed, the longer the traffic signal remains green. Then, we employ an infrared sensor to detect vehicle movement. When the traffic light turns red, the IR sensor activates. When the IR sensor detects a car crossing the road at a red light, the ESP32 cam takes photographs of the vehicles. The images will then be recorded in a database.

3.2.2 Flowchart of the Project 2

Error! Reference source not found. shows the circuit diagram of the whole system.

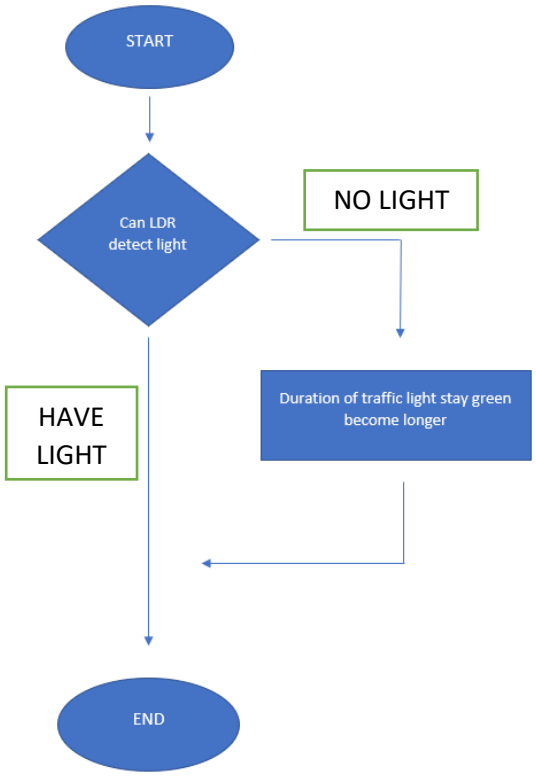


Figure 3 flowchart of the LDR system

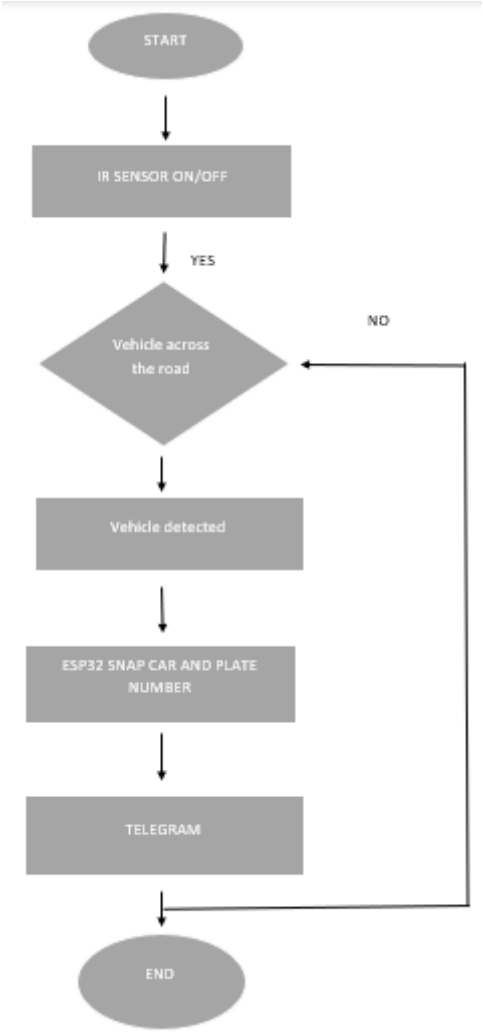
3.2.3 Project Description

Based on the flowchart figure 3, if the LDR can detect light, this implies the road has no automobile and the period of traffic light stay green doesn't change. If the LDR is unable to detect light because a car has stopped on the road and obstructed the light, the LDR will send a signal to the Arduino UNO, causing the time of the traffic light to remain green to fluctuate in proportion to the number of LDRs blocked on the road. The term "electronic commerce" refers to the sale of electronic goods. If a car crosses the road during a red light, the IR sensor detects the movement and sends a signal to the Arduino UNO. The ESP32 Cam responds to the Arduino UNO and takes an image of the car.

3.3 Project Software

This project is using the Light Dependent Resistance (LDR) will can know the road that has more number of cars/congested and if the road is congested the traffic lights on that road will be longer than the less congested road. Next, with the use of ir sensors will detect vehicles that violate red traffic lights. In addition, with the ESP32 camera, the vehicle that breaks the red traffic light will take a picture of the vehicle along with the number plate

3.3.1 Flowchart of the System



3.3.2 Description of Flowchart

The IR sensor will detect if there is a car that crossing a red traffic light. if the traffic light is green or yellow the IR sensor will not work. when a car hits a red light, the ESP32 cam will take a picture of the back of the car so that the number plate part can be taken. pictures of cars that run red lights will be saved and sent directly through the Telegram application

3.4 Prototype Development

3.4.1 Mechanical Design/Product Layout

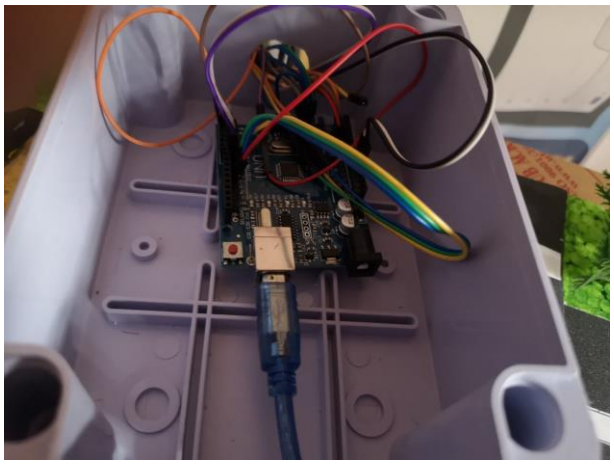


Figure 4 connection on arduino

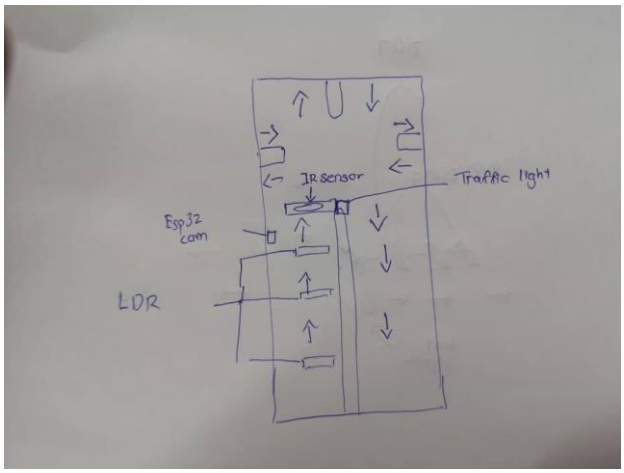


Figure 5 product design

3.5 Chapter Summary

At the end of this chapter, would explain the function of all the component that use in this project and how its work. After that, there is also a flowchart for the process of the component function and how its connect to each other. IR sensor will identify whether there is a car that crossing a red traffic light. The ESP32 cam will photograph the back of the automobile in order to capture the number plate. The LDR can detect light, implying that there are no automobiles on the road and that the duration of the traffic signal remaining green does not vary.

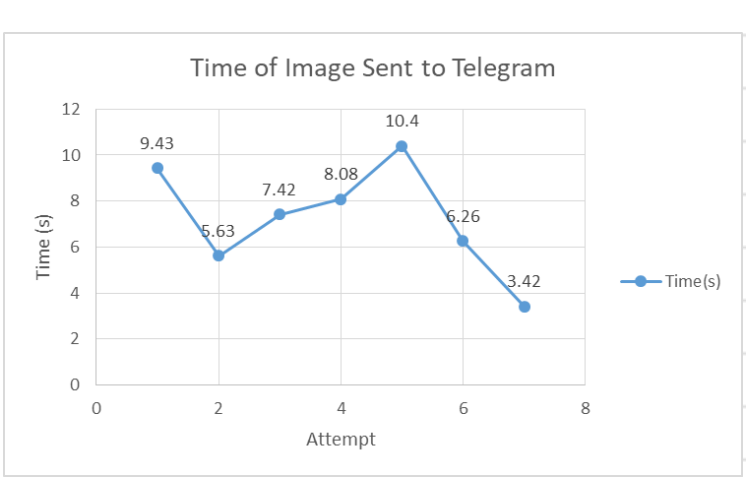
CHAPTER 4

RESULTS AND DISCUSSION

4.1 EXPECTED RESULT

We hope that the tiny project will function well and the system will operate smoothly where the LED will change the hue as we predicted. The outcome would be the traffic light influenced by LDR that are blocked from light and transmit signal to Arduino. Based on LDR, Arduino will adjust the period of traffic lights remaining green for longer. We must also ensure that the esp32 cam's connection is steady so that the images may be recorded in less than 10 seconds.

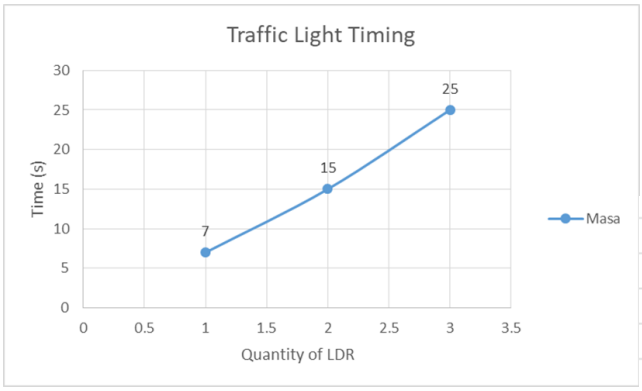
4.2 Results and Analysis



time	attempt
9.43	1
5.63	2
7.42	3
8.08	4
10.4	5
6.24	6
3.42	7

Figure 6 time of image sent to telegram

Here is the graph for time take for image form esp32camsent to telegram apps. I have made attempts as many as seven times to get the time value of the picture sending process to telegram apps. from the graph above, we can see that the time taken to process the image is less than 10 seconds. the lowest time we got was 3.42 seconds on the 7th attempt



NUM. LDR	TIME(S)
1	7
2	15
3	25

Figure 7 traffic light timing

Figure 7 is a graph and table for the amount of time allocated when LDR can detect traffic congestion. The first LDR was set at 5 seconds, the second LDR was set at 15 seconds, and the last LDR was set for a total of 25 seconds.

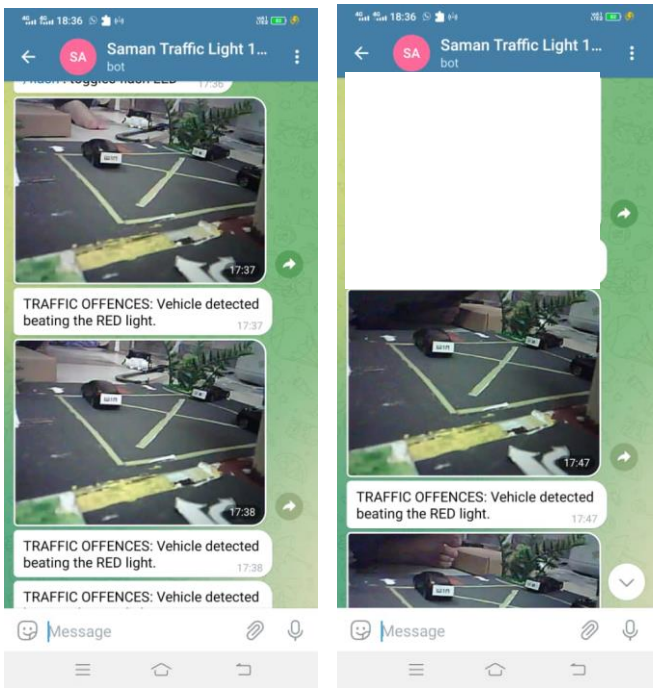


Figure 8 RESULT FROM TELEGRAM APPS

figure 8 is a display of telegram apps that have developed a bot to receive pictures sent by esp32cam. every picture taken will display the words traffic offences: vehicle detected beating the red light

Figure 9 side view

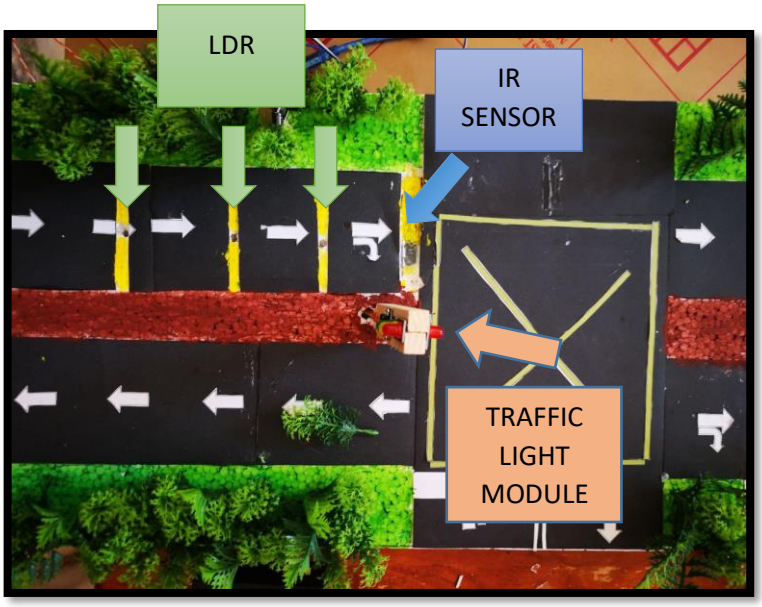


Figure 10 top vie

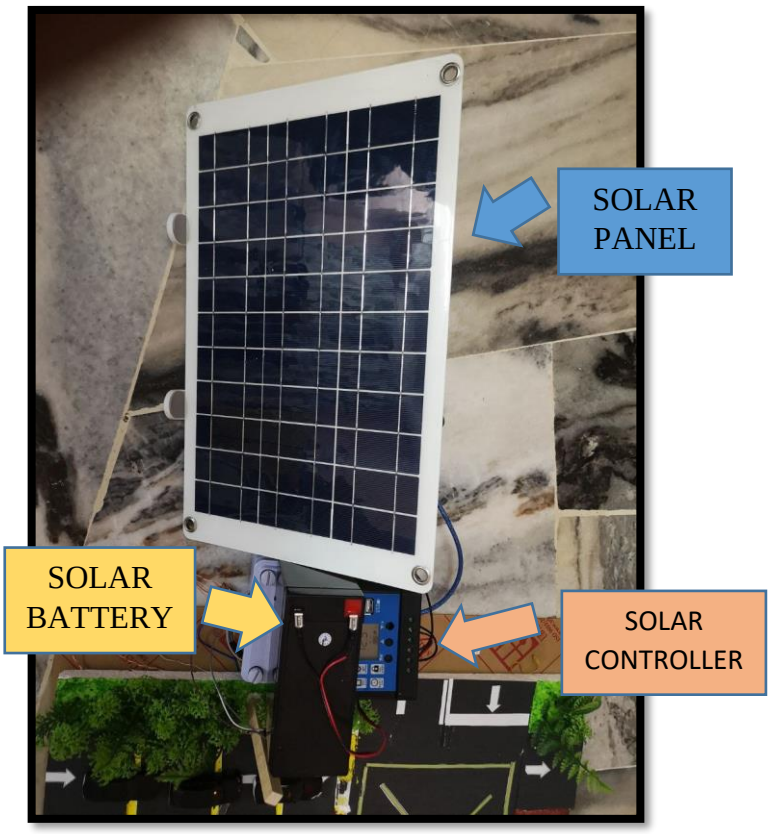


Figure 11 set of solar panel

4.3 Discussion

This project which is Smart Traffic Light With Red Light Running Detection have achieve all the objective and can reduce the number of red light running and number of case accident cause running red light. Based on the results above, I believe that this project can be used at every traffic light in Malaysia. this is because, I believe this project can overcome the problems that often occur at traffic light intersections. This project also uses solar as a power supply, this gives an advantage because of the use of electricity from sunlight. this is also a clean and environmentally friendly source of energy.

4.4 Chapter Summary

At the end of this chapter, we can see the final picture of this project after the installation process of all components is complete. the use of electricity from solar can also be channeled to all electronic components. based on observation the battery for solar takes 14 hours to fully charge.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section reveals the entire process of this project. This invention is simpler, less expensive, and has a greater future potential. This project, "Smart Traffic Signal With Red Light Running Detection," is intended to address issues that frequently arise at traffic light junctions. For example, excessively long wait times and automobile fumes polluting the air. Furthermore, drivers who often run red lights will be prosecuted based on the images acquired by the esp32cam. As a result, accidents may be decreased.

5.2 Conclusion

The Smart Traffic Light With Red Light Running Detection project is a brand-new concept. This project was designed since most traffic lights in Malaysia still utilise the traditional traffic light system, which requires users to wait for a lengthy period to change the lights due to the lack of a sensor detecting system. This project will give the traffic light system in this nation a new face; with advanced sensors installed on the system, it will be more user-friendly. This is because the LDR sensor detects traffic congestion and will establish a timer of 5, 15, or 25 seconds. This traffic signal also has an infrared (IR) light. In addition, this traffic light is also equipped with an IR sensor to detect cars that break a red traffic light. this sensor will only work when the traffic light is red. when there is a car that breaks the red traffic light, the IR sensor will send information to the arduino so that the esp32cam can take a picture of the car that breaks the red traffic light.

5.3 Suggestion for Future Work

the project still has its own weaknesses, based on observations made while experimenting with this project. One of the weaknesses of the project is that it requires strong internet access to send pictures via telegram. When the internet connection is poor, image delivery will take a long time or fail. in my opinion, the party that will install this system at the traffic lights needs to get very strong internet access or use other methods such as data stored in a database. Next, the weakness is in the IR sensor because the distance for the sensor to detect the presence of the car is very short at only 1.5 cm. Therefore, the sensor needs to be planted at the same height as the road in my opinion, for future use it is necessary to replace the IR sensor with another sensor that is more sensitive and efficient in detecting cars that break red traffic lights.. In addition, the improvement that can be made to this project is to develop a special application that can send pictures and indirectly issue a summons to the owner of the vehicle involved.

5.4 Chapter Summary

Based on observations made while working with this project, the project still has its own flaws. One of the project's flaws is that it requires high-speed internet connectivity to share photographs over Telegram. Image delivery will take a long time or fail if the internet connection is poor. For future usage, the IR sensor must be replaced with a sensor that is more sensitive and efficient in detecting automobiles that run red lights.

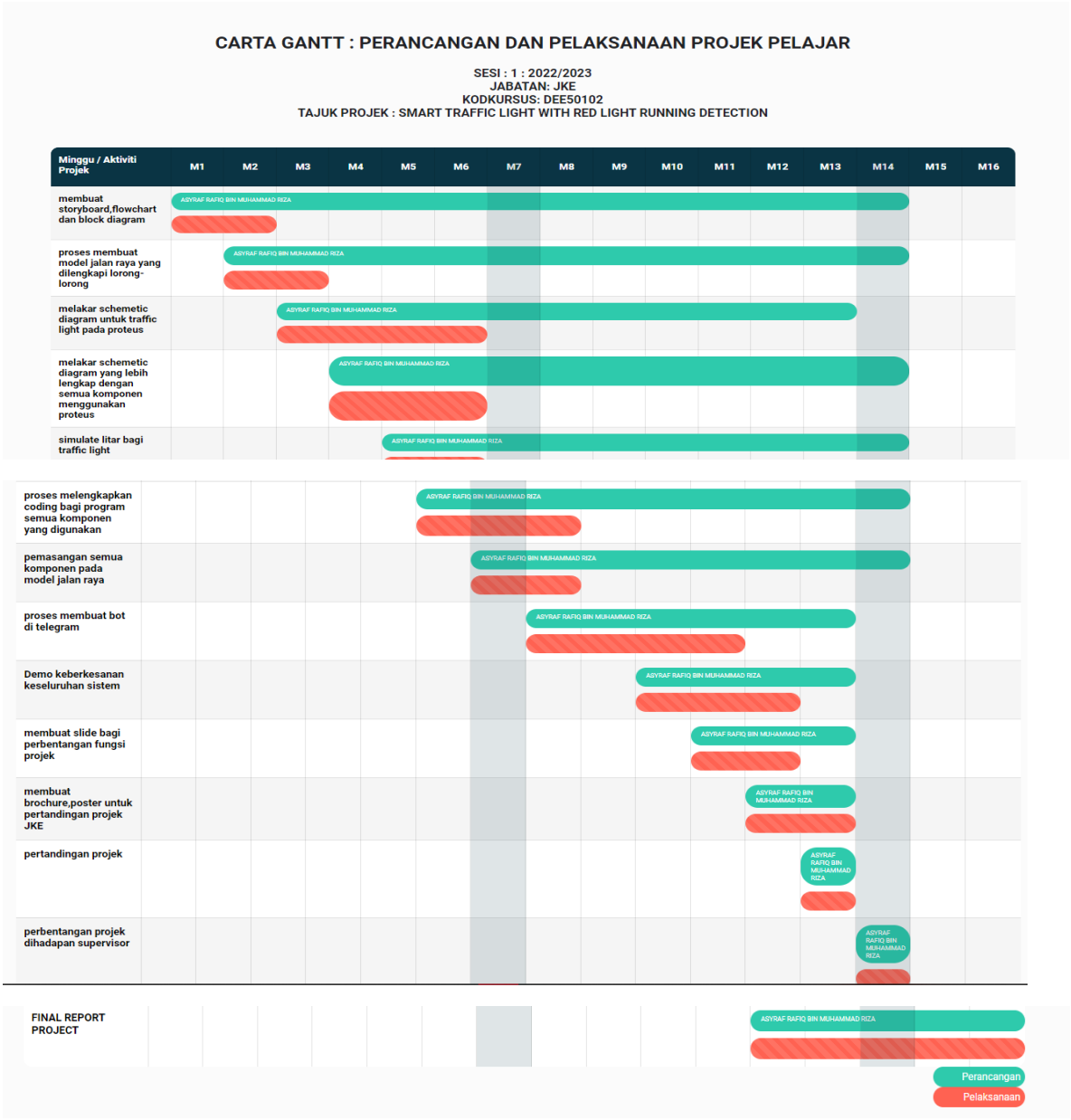
CHAPTER 6

PROJECT MANAGEMENT AND COSTING

6.1 Introduction

This section describes the entire project progress activity in the form of a Gantt chart, the cost and budget used, and the questionnaire distributed to the public.

6.2 Gant Chart and Activities of the Project



6.3 Questionaire

based on the results of the research, the number of respondents who answered the survey questions is 20 people. most of them are 18-24 years old as many as 12 people (60 percent). The second highest age percentage is 25-32 years old 25% (5 people). 85% (17 people) respondents have a driver's license and 15% do not have a driver's license. 85% (17 people) of the respondents said they had seen a driver hit a red light and 15% had never seen it. 75% (15 people) respondents stated experienced waiting for a traffic light to change from red to green for a long time and 25%(5 people) had never faced a long traffic light. 55% (11 people) of respondents stated experience traffic accidents caused by traffic light violations and 45% (9 people) had never encountered an accident. 95% (19 people) of respondents said they agree to charge a driver who runs a red light and 5% (1 person) disagree. 40% (8 people) does our country already have this smart traffic light system 40% (8 people) say there but not at all traffic lights and already have it and 40% (4 people) say that not have. 100% (20 people) said that people who break traffic lights are dangerous. the last question is what is their opinion about our product, 14 people said our product is very useful, 4 people chose level 4 (useful) and 1 person said it was not useful

6.4 Cost and Budgeting

ITEM	QUANTITY	PRICE
IR SENSOR	1 PCS	RM 3.80
TRAFFIC LIGHT MODULE	2 PCS	RM 8
ARTIFICIAL TREE	4 PCS	RM 8
PAINT	2 PACK	RM 5.4
CAR MODEL	1 PACK	RM 14 50
ARCYLIC BOARD	1 PCS	RM 30
Wood Blok	1 PACK	RM 10
SAND PAPER	3 SHEET	RM 6.70
KNIFE CUTTER	1 PCS	RM 5
POLYSTRENE BOARD	1 PCS	RM 6
UHU GLUE	1 PCS	RM 8
ESP 32CAM	1 PCS	RM30
ARDUINO UNO	2 PCS	RM 70
LDR	1 PACK	RM 3
JUMPER WIRE	5 PACK	RM 20
Others		RM30
TOTAL COST		RM258.4

6.5 Chapter Summary

The project process is all going according to plan, as seen by the gannt chart at the end of this section. Following that, the cost of purchasing stuff such as components, decorations, and model materials is RM258.4.

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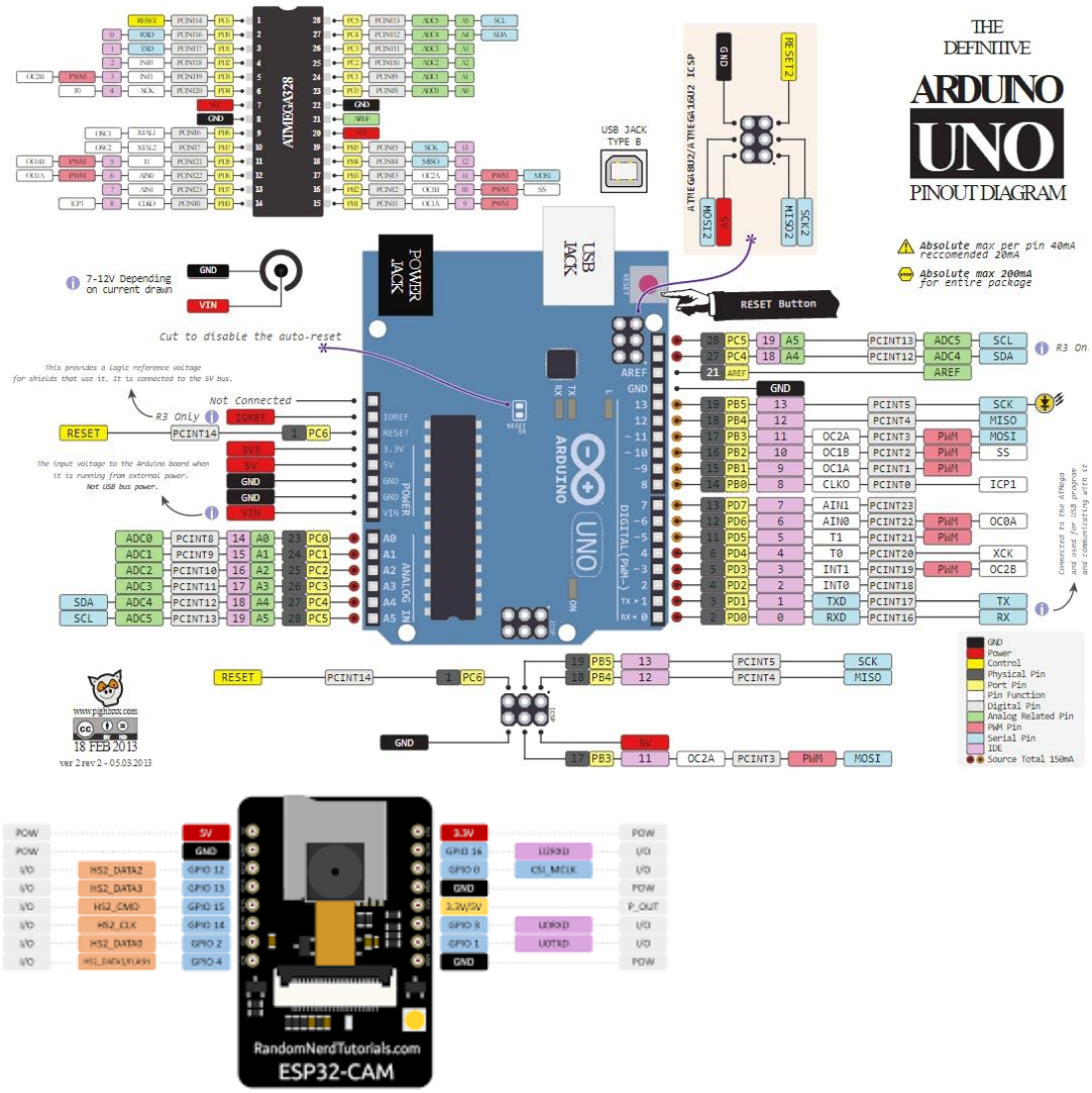
APPENDICES

APPENDIX A- DATA SHEET



APPENDIX B- PROGRAMMING

CODING ESP32CAM TO TELEGRAM

```
#include <Arduino.h>
#include <WiFi.h>
#include <WiFiClientSecure.h>
#include "soc/soc.h"
#include "soc/rtc_cntl_reg.h"
#include "esp_camera.h"
#include <UniversalTelegramBot.h>
#include <ArduinoJson.h>

const char* ssid = "TRAFFIC";
const char* password = "12345678";


int ALM1=0;
String DATA="";
String Temp1x="";
String PHx="";
String Temp2x="";
String Temp1y="";
String PHy="";
String Temp2y="";
String Temp3y="";
String Temp3x="";
String Temp4y="";
String Temp4x="";
int DataIn=0;

// Initialize Telegram BOT
//String BOTtoken = "2090109798:AAGKEnIAH8Z5rrKAcLJ0OQoiQ5y8IjzlUns";  // your Bot
Token (Get from Botfather) MZ
String BOTtoken = "5660408494:AAFxWF8IKGu0sqO8SBghr_b91Z-X1pwVJdY";  // your Bot
Token (Get from Botfather)

// Use @myidbot to find out the chat ID of an individual or a group
// Also note that you need to click "start" on a bot before it can
// message you
//String CHAT_ID = "800860225";//
String CHAT_ID = "2125024857";

bool sendPhoto = false;

WiFiClientSecure clientTCP;
UniversalTelegramBot bot(BOTtoken, clientTCP);

#define FLASH_LED_PIN 4
bool flashState = LOW;

//Checks for new messages every 1 second.
int botRequestDelay = 1000;
```

```
unsigned long lastTimeBotRan;

//CAMERA_MODEL_AI_THINKER
#define PWDN_GPIO_NUM     32
#define RESET_GPIO_NUM    -1
#define XCLK_GPIO_NUM      0
#define SIOD_GPIO_NUM     26
#define SIOC_GPIO_NUM     27

#define Y9_GPIO_NUM       35
#define Y8_GPIO_NUM       34
#define Y7_GPIO_NUM       39
#define Y6_GPIO_NUM       36
#define Y5_GPIO_NUM       21
#define Y4_GPIO_NUM       19
#define Y3_GPIO_NUM       18
#define Y2_GPIO_NUM        5
#define VSYNC_GPIO_NUM    25
#define HREF_GPIO_NUM     23
#define PCLK_GPIO_NUM     22


void configInitCamera(){
  camera_config_t config;
  config.ledc_channel = LEDC_CHANNEL_0;
  config.ledc_timer = LEDC_TIMER_0;
  config.pin_d0 = Y2_GPIO_NUM;
  config.pin_d1 = Y3_GPIO_NUM;
  config.pin_d2 = Y4_GPIO_NUM;
  config.pin_d3 = Y5_GPIO_NUM;
  config.pin_d4 = Y6_GPIO_NUM;
  config.pin_d5 = Y7_GPIO_NUM;
  config.pin_d6 = Y8_GPIO_NUM;
  config.pin_d7 = Y9_GPIO_NUM;
  config.pin_xclk = XCLK_GPIO_NUM;
  config.pin_pclk = PCLK_GPIO_NUM;
  config.pin_vsync = VSYNC_GPIO_NUM;
  config.pin_href = HREF_GPIO_NUM;
  config.pin_sscb_sda = SIOD_GPIO_NUM;
  config.pin_sscb_scl = SIOC_GPIO_NUM;
  config.pin_pwdn = PWDN_GPIO_NUM;
  config.pin_reset = RESET_GPIO_NUM;
  config.xclk_freq_hz = 20000000;
  config.pixel_format = PIXFORMAT_JPEG;

  //init with high specs to pre-allocate larger buffers
  if(psramFound()){
    config.frame_size = FRAMESIZE_UXGA;
    config.jpeg_quality = 10;  //0-63 lower number means higher quality
    config.fb_count = 2;
  } else {
    config.frame_size = FRAMESIZE_SVGA;
    config.jpeg_quality = 12;  //0-63 lower number means higher quality
    config.fb_count = 1;
  }

  // camera init
  esp_err_t err = esp_camera_init(&config);
```

```
  if (err != ESP_OK) {
    Serial.printf("Camera init failed with error 0x%x", err);
    delay(1000);
    ESP.restart();
  }

  // Drop down frame size for higher initial frame rate
  sensor_t * s = esp_camera_sensor_get();
  s->set_framesize(s, FRAMESIZE_CIF);  //
UXGA|SXGA|XGA|SVGA|VGA|CIF|QVGA|HQVGA|QQVGA
}

void handleNewMessages(int numNewMessages) {
  Serial.print("Handle New Messages: ");
  Serial.println(numNewMessages);

  for (int i = 0; i < numNewMessages; i++) {
    String chat_id = String(bot.messages[i].chat_id);
    if (chat_id != CHAT_ID){
      bot.sendMessage(chat_id, "Unauthorized user", "");
      continue;
    }

    // Print the received message
    String text = bot.messages[i].text;
    Serial.println(text);

    String from_name = bot.messages[i].from_name;
    if (text == "/start") {
      String welcome = "Welcome , " + from_name + "\n";
      welcome += "Use the following commands to interact with the ESP32-CAM \n";
      welcome += "/photo : takes a new photo\n";
      welcome += "/flash : toggles flash LED \n";
      bot.sendMessage(CHAT_ID, welcome, "");
    }
    if (text == "/flash") {
      flashState = !flashState;
      digitalWrite(FLASH_LED_PIN, flashState);
      Serial.println("Change flash LED state");
    }
    if (text == "/photo") {
      sendPhoto = true;
      Serial.println("New photo request");
    }
  }
}

String sendPhotoTelegram() {
  const char* myDomain = "api.telegram.org";
  String getAll = "";
  String getBody = "";

  camera_fb_t * fb = NULL;
  fb = esp_camera_fb_get();
  if(!fb) {
    Serial.println("Camera capture failed");
    delay(1000);
    ESP.restart();
```

```
    return "Camera capture failed";
  }

  Serial.println("Connect to " + String(myDomain));


  if (clientTCP.connect(myDomain, 443)) {
    Serial.println("Connection successful");

    String head = "--RandomNerdTutorials\r\nContent-Disposition: form-data;
name=\"chat_id\"; \r\n\r\n" + CHAT_ID + "\r\n--RandomNerdTutorials\r\nContent-
Disposition: form-data; name=\"photo\"; filename=\"esp32-cam.jpg\"\r\nContent-Type:
image/jpeg\r\n\r\n";
    String tail = "\r\n--RandomNerdTutorials--\r\n";

    uint16_t imageLen = fb->len;
    uint16_t extraLen = head.length() + tail.length();
    uint16_t totalLen = imageLen + extraLen;

    clientTCP.println("POST /bot"+BOTtoken+"/sendPhoto HTTP/1.1");
    clientTCP.println("Host: " + String(myDomain));
    clientTCP.println("Content-Length: " + String(totalLen));
    clientTCP.println("Content-Type: multipart/form-data;
boundary=RandomNerdTutorials");
    clientTCP.println();
    clientTCP.print(head);

    uint8_t *fbBuf = fb->buf;
    size_t fbLen = fb->len;
    for (size_t n=0;n<fbLen;n=n+1024) {
      if (n+1024<fbLen) {
        clientTCP.write(fbBuf, 1024);
        fbBuf += 1024;
      }
      else if (fbLen%1024>0) {
        size_t remainder = fbLen%1024;
        clientTCP.write(fbBuf, remainder);
      }
    }

    clientTCP.print(tail);

    esp_camera_fb_return(fb);

    int waitTime = 10000;   // timeout 10 seconds
    long startTimer = millis();
    boolean state = false;

    while ((startTimer + waitTime) > millis()){
      Serial.print(".");
      delay(100);
      while (clientTCP.available()) {
        char c = clientTCP.read();
        if (state==true) getBody += String(c);
        if (c == '\n') {
          if (getAll.length()==0) state=true;
          getAll = "";
        }
```

```
        else if (c != '\r')
          getAll += String(c);
        startTimer = millis();
      }
      if (getBody.length()>0) break;
    }
    clientTCP.stop();
    Serial.println(getBody);
  }
  else {
    getBody="Connected to api.telegram.org failed.";
    Serial.println("Connected to api.telegram.org failed.");
  }
  return getBody;
}

void setup(){
  WRITE_PERI_REG(RTC_CNTL_BROWN_OUT_REG, 0);
  // Init Serial Monitor
  Serial.begin(9600);

  // Set LED Flash as output
  pinMode(FLASH_LED_PIN, OUTPUT);
  digitalWrite(FLASH_LED_PIN, flashState);

  // Config and init the camera
  configInitCamera();

  // Connect to Wi-Fi
  WiFi.mode(WIFI_STA);
  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, password);
  clientTCP.setCACert(TELEGRAM_CERTIFICATE_ROOT); // Add root certificate for
api.telegram.org
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");
    delay(500);
  }
  Serial.println();
  Serial.print("ESP32-CAM IP Address: ");
  Serial.println(WiFi.localIP());
}

void loop() {
  if (sendPhoto) {
    Serial.println("Preparing photo");
    sendPhotoTelegram();
    sendPhoto = false;
  }
  if (millis() > lastTimeBotRan + botRequestDelay)  {
    int numNewMessages = bot.getUpdates(bot.last_message_received + 1);
    while (numNewMessages) {
      Serial.println("got response");
      handleNewMessages(numNewMessages);
      numNewMessages = bot.getUpdates(bot.last_message_received + 1);
    }
```

```
    lastTimeBotRan = millis();
  }


  //************************************
    while (Serial.available()) {
    // get the new byte:
    char inChar1 = (char)Serial.read();
  if (inChar1 == '*') {
      DataIn++;

    }

if (inChar1 == '!') {
  sendPhotoTelegram();
    sendPhoto = false;
      bot.sendMessage(CHAT_ID, "TRAFFIC OFFENCES: Vehicle detected beating the RED
light.", "");

    }
    if (inChar1 == '@') {
  sendPhotoTelegram();
    sendPhoto = false;
      bot.sendMessage(CHAT_ID, "Picture taken from device", "");

    }
/*
    if (inChar1 == 'Y') {
  sendPhotoTelegram();
    sendPhoto = false;
      bot.sendMessage(CHAT_ID, "PLEASE CHECK APPLICATION", "");

    }

        if (inChar1 == 'Z') {
  sendPhotoTelegram();
    sendPhoto = false;
      bot.sendMessage(CHAT_ID, "PLEASE CHECK APPLICATION", "");

    }
    */

    while (DataIn > 0){
        while (Serial.available()) {
    // get the new byte:
    char inChar = (char)Serial.read();
    if (inChar == '*') {
      DataIn++;

    }
    if (inChar != '*' && inChar != '#' && DataIn==1) {
      Temp1x+=inChar;

    }
    if (inChar != '*' && inChar != '#' && DataIn==2) {
      Temp2x+=inChar;

    }
```

```
    if (inChar != '*' && inChar != '#' && DataIn==3) {
      Temp3x+=inChar;

    }
     if (inChar != '*' && inChar != '#' && DataIn==4) {
      Temp4x+=inChar;

    }


    if (inChar == '#') {
      DataIn=0;
     Temp1y=Temp1x;   PHy=PHx;      Temp2y=Temp2x;  Temp3y=Temp3x;  Temp4y=Temp4x;
     Temp1x="";
     PHx="";   Temp2x="";  Temp3x="";
   String DAT;
     int LVL=Temp2y.toInt();

   //  DAT="ABNORMAL READING! please check application".\n";
/*
     if (LVL<20){
    DAT=Temp1y + "  LEVEL:" + Temp2y + "  NORMAL" + ".\n";
     }
      if (LVL>20){
    DAT=Temp1y + "  LEVEL:" + Temp2y + "  ABNORMAL!!" + ".\n";
     }
     */
     sendPhotoTelegram();
    sendPhoto = false;
  //    bot.sendMessage(CHAT_ID, "WARNING, "");
      bot.sendMessage(CHAT_ID, DAT);




    }
        }

    }

 //********************************************************************************
************************************


 //********************************************************************************
************************************

}
//********************************************************************************
**
}
```

CODING TRAFFIC LIGHT

```
#include <SoftwareSerial.h>


SoftwareSerial ss(2, 3); //(RX,TX)


int Mode=0;


#define IR 11
#define Rly_RED 5
#define Rly_YEL 6
#define Rly_GRN 7

#define Rly_RED2 8
#define Rly_YEL2 9
#define Rly_GRN2 10

int TRF=0;
int TMax=20;
int MODE=0;
int Timerx=0;
String Status="STOP";
float Hum,Temp,Sens1;
float Soil;
float LDR1,LDR2,LDR3,LDR4,Sens2,Sens3,Sens4;

void setup(void)
{

  pinMode(IR,INPUT);
  pinMode(Rly_RED,OUTPUT);
  pinMode(Rly_YEL,OUTPUT);
  pinMode(Rly_GRN,OUTPUT);

  pinMode(Rly_RED2,OUTPUT);
  pinMode(Rly_YEL2,OUTPUT);
  pinMode(Rly_GRN2,OUTPUT);



 ss.begin(9600);
 Serial.begin(9600);




}

void loop(void)
{

  Sens1= analogRead(A0);           //read the value from the sensor
  Sens1 = (5.0 * Sens1 * 100.0)/1024.0;  //convert the analog data to DC AC VOLTAGE
  LDR1=100-(Sens1/500*100);
```

```
   Sens2= analogRead(A1);           //read the value from the sensor
  Sens2 = (5.0 * Sens2 * 100.0)/1024.0;  //convert the analog data to DC AC VOLTAGE
  LDR2=100-(Sens2/500*100);

   Sens3= analogRead(A2);           //read the value from the sensor
  Sens3 = (5.0 * Sens3 * 100.0)/1024.0;  //convert the analog data to DC AC VOLTAGE
  LDR3=100-(Sens3/500*100);

   Sens4= analogRead(A3);           //read the value from the sensor
  Sens4 = (5.0 * Sens4 * 100.0)/1024.0;  //convert the analog data to DC AC VOLTAGE
  LDR4=100-(Sens4/500*100);
  if (LDR1<30 && LDR2>30 && LDR3>30 && LDR4>30){
    TRF=1;
  }
    if (LDR1<30 && LDR2<30 && LDR3>30 && LDR4>30){
    TRF=2;
  }
    if (LDR1<30 && LDR2<30 && LDR3<30 && LDR4>30){
    TRF=3;
  }
    if (LDR1<30 && LDR2<30 && LDR3<30 && LDR4<30){
    TRF=4;
  }


  Serial.print(LDR1);
    Serial.print("\t");
    Serial.print(LDR2);
    Serial.print("\t");
    Serial.print(LDR3);
    Serial.print("\t");
    Serial.println(LDR4);



if (digitalRead(IR)==1){
  Serial.println("TRAFFIC OFFENCES!!!!");
  ss.println("!");
  delay(4000);
}
if (MODE==0){
 digitalWrite(Rly_RED,LOW);
  digitalWrite(Rly_YEL,LOW);
 digitalWrite(Rly_GRN,HIGH);

  digitalWrite(Rly_RED2,HIGH);
  digitalWrite(Rly_YEL2,LOW);
 digitalWrite(Rly_GRN2,LOW);


}
if (MODE==1){
 digitalWrite(Rly_RED,HIGH);
  digitalWrite(Rly_YEL,LOW);
 digitalWrite(Rly_GRN,LOW);

  digitalWrite(Rly_RED2,LOW);
```

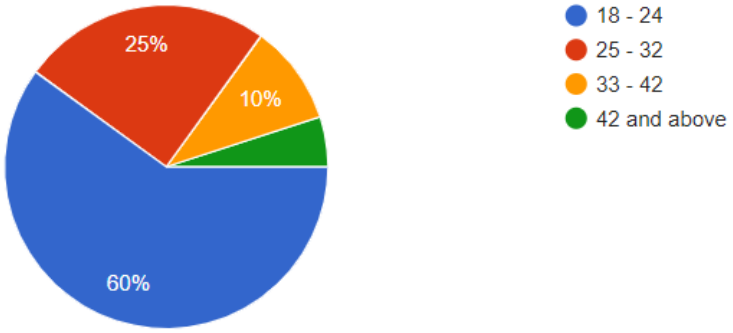
```
  digitalWrite(Rly_YEL2,LOW);
 digitalWrite(Rly_GRN2,HIGH);


}

Timerx++;
Serial.println(Timerx);
int Check=1;
if (Timerx>TMax){
   if (MODE==0 && Check==1){
     digitalWrite(Rly_RED,LOW);
  digitalWrite(Rly_YEL,HIGH);
 digitalWrite(Rly_GRN,LOW);

  digitalWrite(Rly_RED2,HIGH);
  digitalWrite(Rly_YEL2,LOW);
 digitalWrite(Rly_GRN2,LOW);
 delay(4000);
 MODE=1;
 Check=0;


  }
  if (MODE==1 && Check==1){
     digitalWrite(Rly_RED,HIGH);
  digitalWrite(Rly_YEL,LOW);
 digitalWrite(Rly_GRN,LOW);

  digitalWrite(Rly_RED2,LOW);
  digitalWrite(Rly_YEL2,HIGH);
 digitalWrite(Rly_GRN2,LOW);
 delay(4000);
 MODE=0;
 Check=0;
  }

  Timerx=0;
  if (TRF==0){
  TMax=10;
 }
  if (TRF==1){
  TMax=20;
 }
  if (TRF==2){
  TMax=30;
 }
  if (TRF==3){
  TMax=40;
 }
  if (TRF==4){
  TMax=50;
 }
}

 //#################################################
delay(500);
```

```
}



void serialEvent() {
  while (Serial.available()) {
    // get the new byte:
    char inChar = (char)Serial.read();
    // add it to the inputString:

      if (inChar =='0') {
    MODE=0;
    }
    if (inChar =='1') {
    MODE=1;

    }
     if (inChar =='2') {
    MODE=2;

    }
  }
}
```

APPENDIX C – QUESTIONAIR

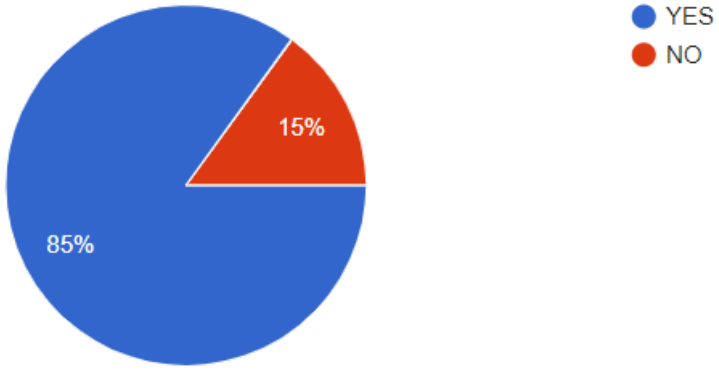
Age

20 responses



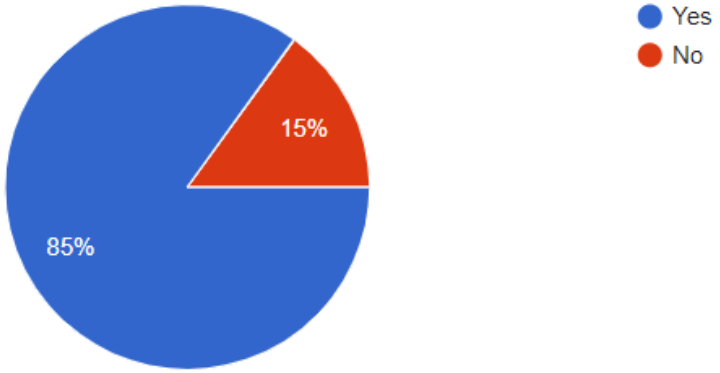
DO YOU HAVE A DRIVING LICENSE

20 responses



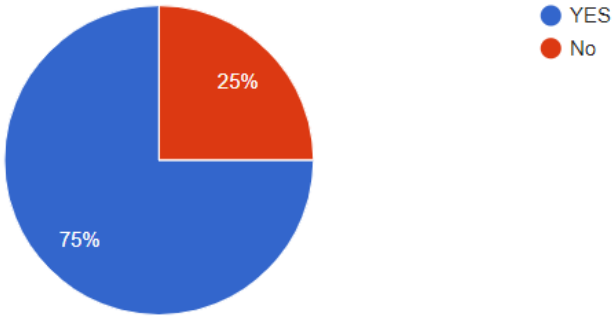
1. Have you ever seen a car driver run a red light?

20 responses



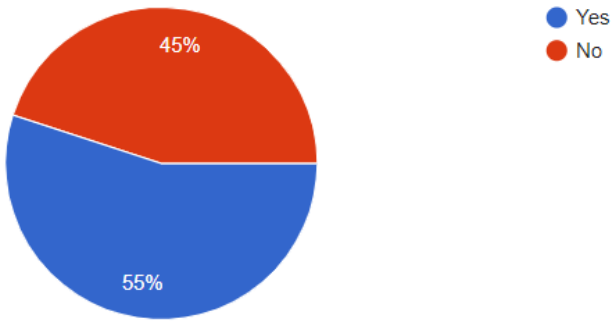
2. Have you ever experienced waiting for a traffic light to change from red to green for a long time?

20 responses



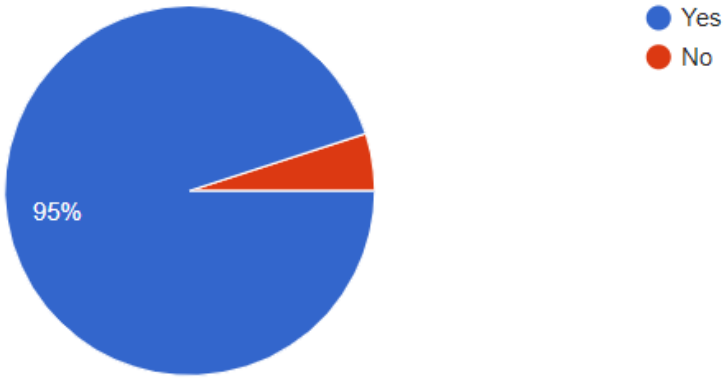
3. Do you/your related experience traffic accidents caused by traffic light violations ?

20 responses



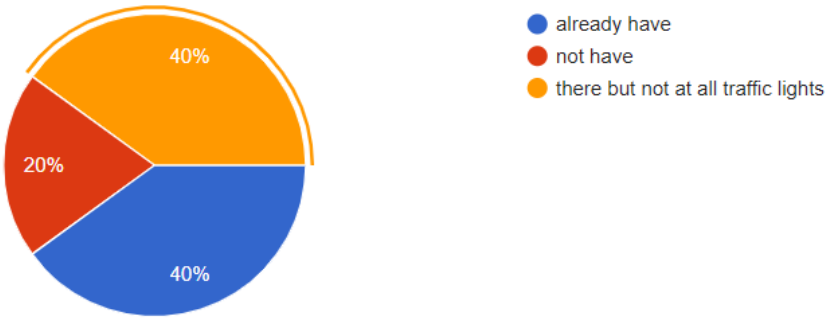
4. Do do you agree to charge a driver who runs a red light?

20 responses



5. based on your experience at traffic lights, does our country already have this smart traffic light system?

20 responses



6. In your opinion, the driver who ran the red light is dangerous/not dangerous?

20 responses

7. What do you think about our Smart Traffic Light product that is useful to reduce cases of traffic light violations?

Copy

20 responses