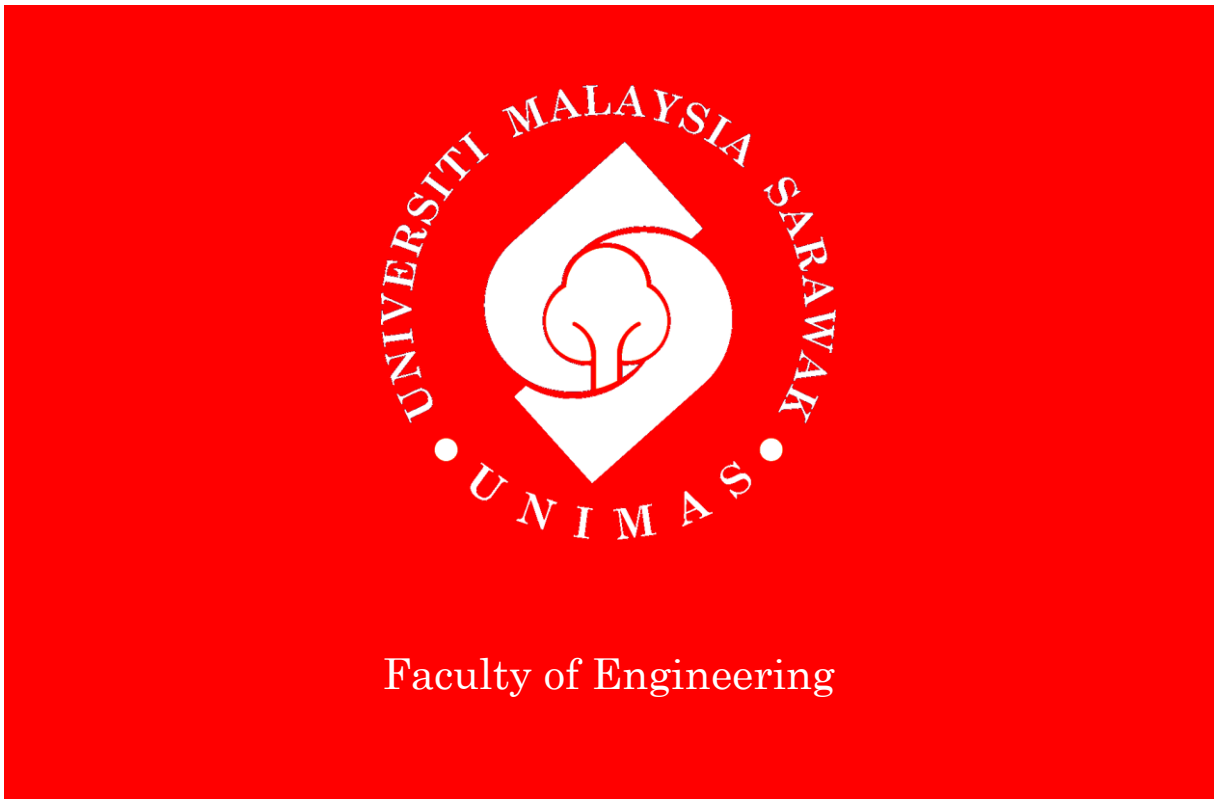

URBAN TRAFFIC MANAGEMENT SYSTEM BY CCTV MONITORING

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45506

Bachelor of Engineering (Hons) in Electronics (Telecommunications)

2018

UNIVERSITI MALAYSIA SARAWAK

Grade: _____

Please tick (√)

Final Year Project Report [√]

Masters [ ]

PhD [ ]

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This declaration is made on the ...8th.. day of ..June...2018.

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I CLAUDIA SARA ANAK SENIN, 45506 from Faculty of Engineering (PLEASE INDICATE STUDENTS NAME, MATRIC NO. AND FACULTY) hereby declare that the work entitled **Urban Traffic Management System by CCTV Monitoring** is my original work. I have not copied from any other students' work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

11/6/18
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I DR. SHAFRIDA BINTI SAHRANI (SUPERVISOR'S NAME) hereby certifies that the work entitled **Urban Traffic Management System by CCTV Monitoring** (TITLE) was prepared by the above named student, and was submitted to the "FACULTY" as a * partial/full fulfillment for the conferment of **Bachelor of Engineering (Hons) in Electronics (Telecommunications)** (PLEASE INDICATE THE DEGREE), and the aforementioned work, to the best of my knowledge, is the said student's work.

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URBAN TRAFFIC MANAGEMENT SYSTEM BY CCTV MONITORING

CLAUDIA SARA ANAK SENIN

A dissertation is submitted in partial fulfilment
of the requirement for the degree of
Bachelor of Engineering (Hons) in Electronics
(Telecommunications)

Faculty of Engineering

Universiti Malaysia Sarawak

2017/2018

This Final Year Project Report Is

Dedicated To My Parents and My Siblings

ACKNOWLEDGEMENTS

To My God Father Almighty. It is with deepest serve gratitude to the Lord that I was able to finish my final year project report with ease and good heartfelt.

Firstly, I would like to express a big thanks to my final year supervisor, Dr. Shafrida binti Sahrani for all the sacrifices that she made especially her contribution toward the project sponsorship and time that she make for me. Thank you so much for guiding me all the way to the end of my report and project.

After that, I would like to convey my biggest thanks and gratitude towards both of my beloved parents for their endless support to me during my project completion. It is for their unending prayers and sponsorship that I was able to get to this point.

Last but not least, my appreciation is for all my close friends especially the final year team, Eileen and Halida for their support. Not to forget my best friends and classmates for the unending support towards me and keep me positive during bad times and days.

ABSTRACT

The growth of human population in urban cities causes a hike in vehicle density. Therefore, traffic control system plays a significant role in alleviating the traffic congestion. The traffic control system provides safety and ease to both drivers and also pedestrians. Nonetheless, the usability of accustomed traffic control signals fails in terms of time management and flow control to the road users. This creates irrelevant waiting time for the drivers. This project proposes the application of Indigo Vision Closed-Circuit Television (CCTV) camera provided by Kiwitech Sdn. Bhd as a monitoring-based traffic management system to overcome the problem of traffic control system in terms of flow and time management. The CCTV will be used as an input sensor that provides a real-time traffic data. Arduino board, Ethernet shield (Wiznet 5100) and LEDs (Light Emitting Diode) are used to setup the prototype system. It is use to demonstrate the T-junction added with green light delay interval time. The delay time will be programmed by using C++ programming language which will be compiled through Arduino IDE software. The Ethernet shield will act as the sender of the traffic data. The data will be transmitted to the server which will be done by CIDTS Unimas (Centre for Information Development and Services). Mobile application used by user will received the information provided by the server. The proposed project will improve the time management for road user to reach their destination. It can be further used on a larger scale in real time for better and safer road using Mobotix IP (Internet Protocol) camera that can analyse the traffic count automatically.

ABSTRAK

Pertumbuhan populasi manusia di bandar-bandar utama menyebabkan jumlah kenderaan di jalan raya semakin meningkat. Oleh itu, sistem kawalan trafik memainkan peranan utama dalam mengurangkan kesesakan lalu lintas. Sistem kawalan trafik yang berkesan dapat memberikan panduan dan menjamin keselamatan pengguna-pengguna jalan raya. Namun, penggunaan sistem kawalan trafik yang biasa kurang memuaskan dari segi pengurusan masa dan kawalan aliran trafik terhadap pengguna jalan raya. Hal ini meningkatkan masa menunggu bagi setiap pengguna. Projek ini dicadangkan untuk mengatasi masalah sistem kawalan trafik yang sedia ada dengan aplikasi kamera litar tertutup daripada *Indigo Vision* yang disediakan oleh syarikat *Kiwitech Sdn. Bhd* untuk bertindak sebagai sistem pemantauan pengurusan lalu lintas. Kamera litar tertutup tersebut akan digunakan sebagai sensor input yang menyediakan data masa sebenar. Selain itu, papan Arduino, perisai Ethernet dan LED digunakan sebagai sistem prototaip bagi projek ini. Simulasi masa tunda lampu hijau pada persimpangan T akan didemonstrasikan pada prototaip yang disediakan. Prototaip ini digunakan untuk simulasi masa tunda lampu hijau dibuka di persimpangan T. Masa tunda tersebut akan diprogramkan menggunakan bahasa pemprograman C++ dari perisian *Arduino IDE*. Perisai *Ethernet* akan bertindak sebagai pengirim data trafik. Data trafik akan dihantar ke *server* yang disediakan oleh Pusat Khidmat Teknologi Maklumat dan Komunikasi (PKTMK) Unimas. Pengguna-pengguna jalan raya akan menerima data trafik yang diminta menerusi aplikasi mudah alih yang disediakan. Projek ini akan memperbaiki pengurusan masa setiap pengguna jalan raya. Ianya boleh digunakan pada skala yang lebih besar dengan aplikasi kamera *Mobotix IP* yang boleh menganalisis data trafik secara automatik.

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LIST OF ABBREVIATIONS

AC	-	Alternating Current
CCTV	-	Closed-Circuit Television
DC	-	Direct Current
FTDI	-	Future Technology Device International
GSM	-	Global System for Mobile
IP	-	Internet Protocol
IR	-	Infrared
ICSP	-	In-Circuit Serial Programming
IoT	-	Internet of Things
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
MAC	-	Media Access Control
PTZ	-	Pan-Tilt-Zoom
PIC	-	Peripheral Interface Controller
PIR	-	Proximity Infrared
PWM	-	Pulse Width Modulation
USB	-	Universal Serial Bus
VCR	-	Video Cassette Recording

CHAPTER 1

INTRODUCTION

1.1 Project Overview

Nowadays the problem regarding traffic congestion is getting serious day by day. The allocation of the same fixed delay timing on each road leads to more delay towards road users. It commonly occurs at the road intersection. Therefore, an efficient traffic control management system is needed. In the proposed system, a Close-Circuit Television (CCTV) camera from Indigo Vision which has the feature of Pan-Tilt-Zoom (PTZ) will be used to monitor the traffic at junctions. The information such as traffic condition and location obtained from CCTV will be sent to the server via Ethernet shield and Arduino Uno board acting as the hardware. Road users are able to access the information through a mobile application and server provided by CIDTS Unimas. Therefore, an efficient traffic system is established to allow road users continuously monitor the traffic flow to plan their journey ahead and hence reduces traffic congestion.

1.2 Problem Statements

In the rapid development of the city, the increase in number of vehicles has been exponential [1]. Thus, results in traffic congestion that causes excess delays. From that, the society wasted most of their daily hours in the traffic. Besides, it leads to a decrease on the productivity in the individual, thereby, stepping up the stress level and health deterioration in a person. Moreover, this problem indirectly adds to the rise in pollution level as engines remains on in most cases, a huge volume of natural resources in forms of petrol and diesel is consumed without any fruitful outcome [2].

For evolving countries like Malaysia [3], traffic are controlled by two way. First one is to use traffic lights. The traffic lights will change at a pre-determined same fixed time delay for each road. The system is lacking in terms of the road condition to

road users. This would affect their journey time to their destination. The existed traffic light that is being used now is sufficient to the public but it is not efficient enough for the road users. This is because the fixed pre-determined signal lights work at any time even if the opposite road has higher congestion. Other the other hand is to control manually by the traffic polices during peak hours. Polices, for example, control the road by the end of office hours which is at the time interval of between 4 to 5 pm. However, the traffic flow is not uniform and dynamic.

Traffic congestion happens daily but sometimes at a different time. Hence, police officers are unaware about the situation. Due to that, there is time waste process. Apart from that, the release of carbon dioxide from each vehicle during the traffic congestion increases the chance of thinning the ozone layer. From that, more diseases such as cataract and cancer will arise due to the UV (Ultraviolet) rays. Hence, a monitoring based traffic system is proposed to alleviate those problems.

1.3 Description of Project

1.3.1 CCTV monitoring based traffic management

The proposed system is based on the verification and monitoring analysis. This system is generated by the CCTV where it detected and recorded the traffic data during the peak and non-peak hour. The CCTV is mounted on the traffic pole itself at a certain height. The specification of the CCTV is that, it can be rotated for 360 degree gives a better view at each of the intersection sides. In addition, the user can be informed on the traffic based on the data information collected through the CCTV.

Arduino Uno board will be programmed based on the data received. The green time interval will be increased and given during the highest peak hour which has the highest vehicle volume with appropriate short vehicle extension. This will allow the signal to react better to variations in traffic demand thereby maximizing the efficiency of the signal operation. Arduino Uno board is connected to a server to send the traffic information and location to a mobile application. The road users will access the mobile application to acquire the traffic information.

1.4 Project Aim

The aim of this project is to lessen traffic congestion and boost the efficiency of the traffic control management system thereby improving the traffic flow.

1.5 Project Objectives

The objectives of this project are:

i. To **identify** the current issues regarding on traffic management at the T-Junction and its compatibility with Arduino Uno.

ii. To **design** a traffic management system based on the traffic data collected through CCTV by using Arduino Uno and Ethernet shield board.

iii. To **develop** a monitoring based traffic management system incorporated with a mobile application to improve the traffic flow.

1.6 Scope of Project

This project is focusing on the traffic management system using Arduino Uno and Ethernet shield board. The delay time will be programmed to Arduino Uno by using C++ programming language. Operating system used throughout the project is Arduino IDE. The software is responsible to coding and decoding the Arduino Uno and turn the Ethernet Shield (Wiznet 5100) on. The information on traffic will be received through CCTV from Indigo Vision. Meanwhile, the server will accept the traffic data obtained. It can be accessed by the road users by means of mobile application.

1.7 Expected Outcomes

Upon the completion of this project, the expected outcomes are:

- Able to have a clearer vision on the problems regarding traffic congestion and ways to reduce it.
- Able to design Arduino-based traffic control management system relying on the CCTV data of the traffic.
- Able to develop an improved traffic control system and increase the efficiency of the traffic flow.

1.8 Project Outline

This project consists of:

Chapter 1 is divided into 7 subparts which are project overview, problem statements, description, aim of the project, project objectives and scopes, expected outcome and project outline. This introduces some basic concept on the monitoring based traffic control system. The application of the proposed project will be briefly discussed.

Chapter 2 is the summarisation of the researches that is related to this project. Comparison on other traffic control system will be discussed.

Chapter 3 introduces the process diagram and flow chart of the traffic control system on junctions. The procedures and steps to set up the project, hardware and software will be conferred.

For Chapter 4, the result will be shown in the form of figures and final outcomes. Every explanations on the data obtained and transferred will be discussed in depth to match with the objectives of the project.

The last chapter which is Chapter 5 will enlighten on the summary of the project wholly. All the data obtained were summarized altogether. Limitations and recommendations were listed and proposed in order for any improvisation in the future.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Traffic lights have been developed since the early 1912 [4]-[5]. It was implemented to alleviate the traffic flow mainly at the junctions, pedestrian crossings and other locations. Red, yellow and green colours are used as the universal colour in traffic light [6]. The meaning behind green light is it allow the traffic users to proceed to the designated road, yellow light indicate that the user should get ready to stop before the stop line and red light signal is when the car should be at a complete stop.

Serious problem arises due to the traffic congestion that affects the transportation flow in urban cities. Asean countries such as India and China [6]-[7] are many of the main developing countries that is included in this matter. Although the traffic light system has been optimized by adding or replacing more traffic officers and embedded traffic systems, the heavy flow of traffic is still a major problem to deal with. This is especially junctions with multiple types of nodes [8].

The increase in capacity of automobiles and high number of road users are not accompanied with upgraded infrastructures that could accommodate the constantly rising percentage of road users. It reduces the productivity of an individual. Hence, lots of working hours is wasted in the traffic congestion. To deal with this problem, new roads with multiple lanes can be constructed, flyovers are implemented, creating roundabouts and road maintenance.

2.2 Traffic light

One of the most important public facilities that played an important role to the public is the traffic light. The first traffic light was installed in London, United Kingdom in the year of 1868 [9]. The design for traffic light combined by three

semaphore arms are connected with red and green gas lamp for night time use and operated by police constable. It was built by railway engineer J.P Knight [10]. Even though it was said to be successful at controlling the traffic, its operational life was too brief. It exploded on 2 January 1869 [11] as a result of gas line leaking. It was then abandoned till the existence of electric signal available.

New invention model of traffic light is made by the Americans [12]. Cleveland was the first to be installed with the Red-Green systems. Polices manually operate the three colour signals by switches. In the year 1926 [13] automatic signals which work on a time interval were installed. As the year goes by, technologies kept upgraded and computers were improved with new systems. Hence, the traffic light subsequently improved and it can be monitored and change lights accordingly. The diagram of traffic light is shown in Figure 2.1.

Figure 2.1: Traffic light diagram [13]

Traffic lights alternate the right of way accorded to road users by displaying lights of a standard colour which is red, yellow and green following a universal code. The typical sequences of colour phases are shown in Table 2.1.

Table 2.1: Sequences of colour phases in traffic light

Colour phase	Instruction
Green	Allowing the traffic to proceed in the direction destined for the vehicles
Yellow	Providing a warning that the signal will soon change from the green light to red light
Red	Prohibits any traffic from moving at all

2.3 Junctions

Road junction or an intersection consists of two or more roads that is on the same level and it either met or cross each other. Traffic lights, roundabout and an island are ones that often control the junction [14]-[15]. The most common type of junction arrangement is priority junction. One or more minor road is required by the junction to stop the major traffic flow. Hence, the traffic congestion can be alleviated. The capacity, sightlines, visibility and turning circles are taken into consideration. Few factors are refined for the junction's growth. It is on the local area plans, predicted population growth and existing traffic count. All users' needs are assessed to determine the junction choice. Junctions can be categorized into the following four classes which are T-Junction, 4-Way Junction (Crossroad), and Ghost Island Junction.

2.3.1 T- Junction

T-Junction is one of the simplest priority junctions. It is an at-grade junction that consists of two roads. The minor roads joined with the major with an approximately at right angles. This junction is simple and allocated with arm labelling convention [15]. Figure 2.2 shows the layout of the simple T-Junction.

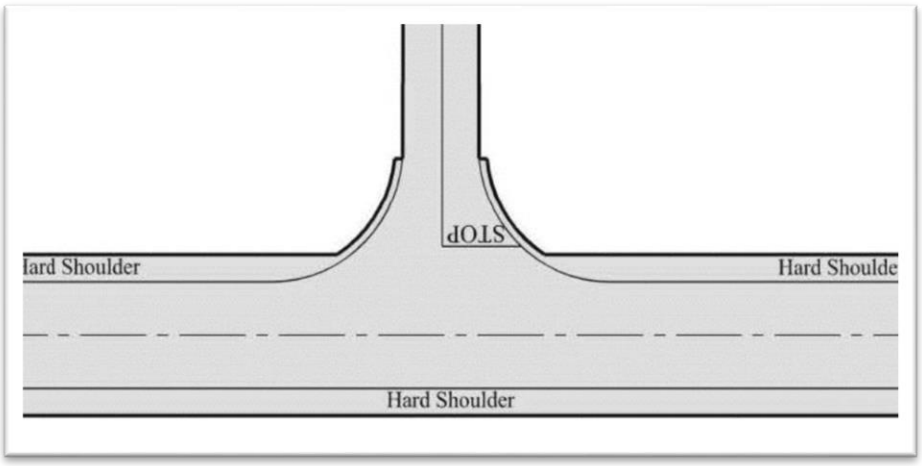

Figure 2.2: T-Junction [15]

2.3.2 4-Way Junction (Crossroad)

4-Way Junction is a junction that consists of two roads or streets that cross each other. The crossing roads are exactly perpendicular to each other for areas like block. The two roads of the junction can cross at a different angle compared to other junctions. Moreover, in a few cases when reaching an intersection**,** the junction of the two road segments may be offset [16]. The diagram from Figure 2.3 shows the details of the design for the 4-Way Junction.

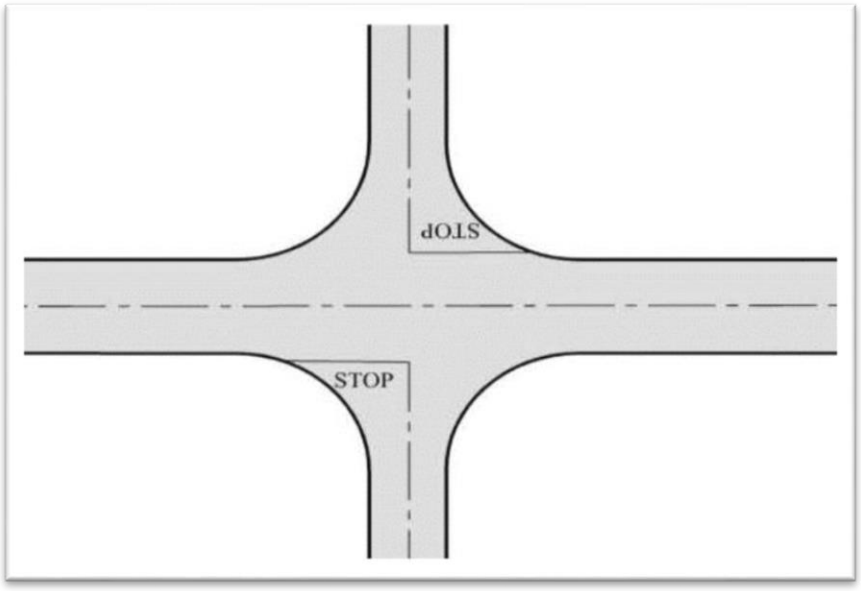

Figure 2.3: 4-Way Junction (Crossroad) [16]

2.3.3 Ghost Island Junction

Ghost Island junction takes the form of a dedicated traffic lane for vehicles turning right from the major road, at junctions under priority control. It is provided with non-physical separation by road markings to allocate road spaces. The purpose of Ghost Island is providing right turning vehicles with a degree of shelter from the through traffic flow. Figure 2.4 shows the layout of the Ghost Island Junction [17].

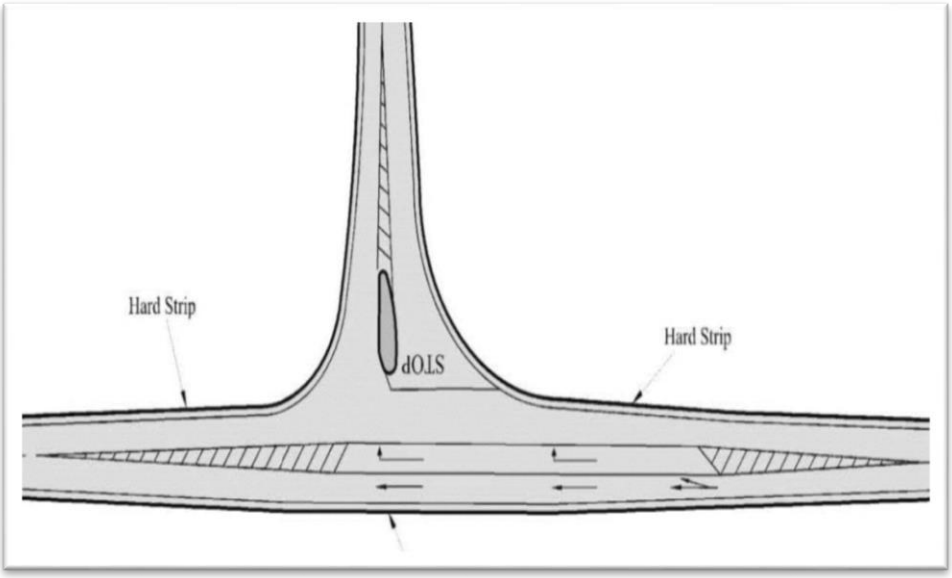

Figure 2.4: Ghost Island Junction [17]

2.4 Closed-Circuit Television (CCTV)

Closed-Circuit Television (CCTV) [18]-[19] is a system whereby the signals from it is monitored privately especially for the purpose of surveillance and security. In the 1970s, the video surveillance replaced the system which uses Video Cassette Recording (VCR) saw live-feed CCTV. The video that is recorded could be stored for analysis and helped with expand of the applicability of CCTV systems.

Moreover, cameras had to be controlled manually in the early years. It was offered only with the application of grainy black and white images. Even though it has limited abilities back then, such system is primarily used by the wealthy. Surveillance systems were still raw and expensive to be used. It is used at a large scale event such as law and order enforcement. Now, it has broadly being used for businesses and banks as the technology become more developed and the demand for it became more apparent.