

# KPMIM SMART PLATE NUMBER RECOGNITION



## BORANG PENGESAHAN STATUS LAPORAN

JUDUL: [KPMIM SMART PLATE NUMBER RECOGNITION SYSTEM]

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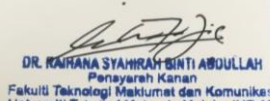
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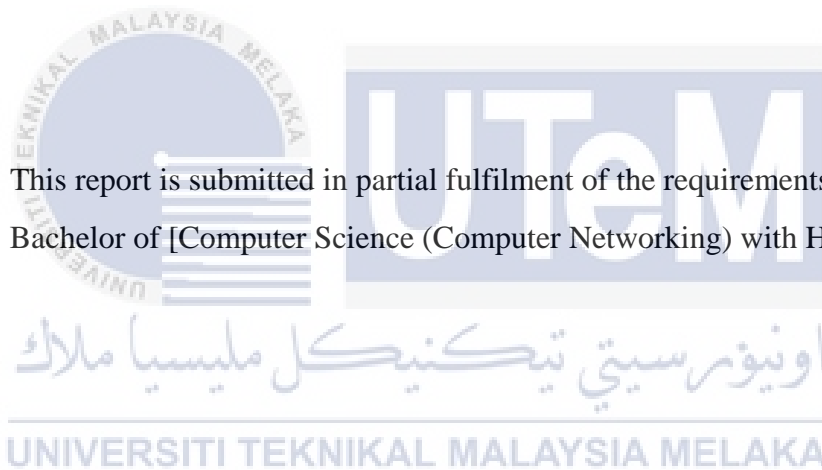
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**KOLEJ PROFESIONAL MARA INDERA MAHKOTA SMART PLATE  
NUMBER RECOGNITION SYSTEM**

**MUHAMMAD FIKRI BIN JASNI**



This report is submitted in partial fulfilment of the requirements for the Bachelor of [Computer Science (Computer Networking) with Honours.

**FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY  
UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

2021

## DECLARATION

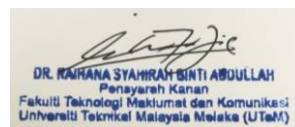
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I hereby declare that I have read this project report and found  
this project report is sufficient in term of the scope and quality for the award of  
Bachelor of [Computer Science (Computer Networking)] with Honours.

## DEDICATION

This dissertation is dedicated to my beloved parent for the words of encouragement which help complete my final year project successfully and for their cares and support. Dedication to my supervisor, evaluator and lecturer for giving me the opportunity to be a knowledgeable person. To all my friends for the helps, information shared, moral support and guidance throughout my studying in UTeM.



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I would like to thank my parents who give me moral support, suggestion and motivation for me to be able to finish this project as planned. Without their motivation, I will never able to finish this project.

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## ABSTRACT

An automatic number plate recognition system or for short ANPR is a crucial aspect in traffic congestion. The Automatic Number Plate Recognition was invented in 1976 at the Police Scientific Development Branch in United Kingdom. However, it gained much interest during the last decade with the improvement of digital camera and increase in computational capacity. Different kind of violation on the road can be minimize using ANPR system. Many smart cities and integrated parking area are using plate number recognition to control congestion, track violation and more. Plate number recognition is the most cost-effective method that can be implemented for vehicle identification. There are many conditions that need to be consider for implementing this approach such as image quality, car position, light condition and more. This project presents a smart plate number recognition system that will be implemented on Kolej Professional Mara Indra Mahkota which is located at Kuantan Pahang. The system use sensor to detect vehicle that try to pass the access gate. The system will be read the vehicle plate number and check if the plate number is in the registered plate number table which store in the local database. The system also records all the vehicle that pass through the gate so that the college administration can use the data to make analysis. The current work will be implemented with Raspberry Pi based device which is Raspberry Pi 4B and programmed through Python IDE that preinstalled in the Raspberry Pi.



## ABSTRAK

Sistem pengenalan plat nombor automatik atau ANPR adalah aspek penting dalam kesesakan lalu lintas. Pengenalan Plat Nombor Automatik dicipta pada tahun 1976 di Police Scientific Development Branch di United Kingdom. Namun, ia semakin mendapat perhatian beberapa dekad yang lalu dengan peningkatan kamera digital dan peningkatan kapasiti komputasi. Pelanggaran undang-undang yang berlaku di jalan dapat diminimumkan dengan menggunakan sistem ANPR. Banyak bandar pintar dan kawasan letak kereta bersepadu menggunakan pengenalan nombor plat untuk mengawal kesesakan, mengesan pihak yg melanggar undang-undang dan banyak lagi. Pengecaman nombor plat adalah kaedah paling jimat yang boleh dilaksanakan untuk pengenalan kenderaan. Terdapat banyak kondisi yang perlu dipertimbangkan untuk melaksanakan pendekatan ini seperti kualiti gambar, kedudukan kereta, keadaan cahaya dan banyak lagi. Projek ini membentangkan sistem pengenalan nombor plat pintar yang akan dilaksanakan di Kolej Professional Mara Indra Mahkota yang terletak di Kuantan Pahang. Sistem ini menggunakan sensor untuk mengesan kenderaan yang cuba melewati pintu masuk. Sistem ini akan membaca nombor plat kenderaan dan memeriksa sama ada nombor plat tersebut sama ada ianya nombor plat yang didaftarkan yang disimpan di dalam pangkalan data tempatan atau tidak. Sistem ini juga merekodkan semua kenderaan yang melewati pintu masuk supaya pihak pentadbiran kolej dapat menggunakan data tersebut untuk membuat analisis. Projek semasa akan dilaksanakan dengan peranti berasaskan Raspberry Pi yang merupakan Raspberry Pi 4B dan diprogramkan melalui Python IDE yang telah disediakan didalam Raspberry Pi tersebut.

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## CHAPTER 1: INTRODUCTION

### 1.0 Introduction

Kolej Professional Mara (KPM) is one of many non-government institutions that managed by Majlis Amanah Rakyat (MARA) that provide diploma and professional certificate to the student. Currently there is six KPM college around the country. Kolej Professional Mara Indera Mahkota is one of the colleges that provide four professional course which is diploma in computer networking, diploma in creative media production, diploma in English communication and diploma in accounting.

Vehicle Plate number is a number on a metal or plastic plate that attach to a motor vehicle or trailer for official identification purpose. Malaysia registration plate are displayed at the front and rear of the vehicle. The issuing of the plate number is regulated and administered by The Malaysian Road Transport Department (JPJ). Plate number also used to identify the vehicle if it is allowed to enter certain compound.

Automatic gate is a gate that use an electric motor to open and close a gate in order to control access into an area or secured compound. Usually automatic gate is used at the entrance to the facilities, and are used to control vehicular access on and off the site. Automated gate also commonly used inside the facilities such as the parking area to separate employee parking area and public parking area. Generally, automatic gate consists of two main components which is the gate and the gate operator. The gate is a physical object that is moved to block the gate opening as open and close action of the gate. The gate operator is a device or machinery that move the gate in and out of the gate opening. The gate operator can be chain-driven, gear-driven, or hydraulic and commonly electrically-powered.

Smart system is a system which able to incorporate function of sensing, actuation and control in order to analyse the situation. Commonly, smart system consists of diverse component such as sensor for signal input, control unit that make decision and instruction, actuator that perform the require action and more. Smart system can be found in many fields such as environment, automotive sector, Internet of Things, and Healthcare.

Effectiveness is an important aspect in smart system, thus smart system needs to be intelligent, instrumented and interconnected. Instrumentation give the system ability to gather data using embedded sensor which is connected by wired or wireless network. For example, smart water meter, electrical power consumption meter and gas meter always monitor the supply and demand for these utilities.

Interconnection act as a link that connect system, people and data thus creating a new way to collect, share and respond to information. Smart system needs to be intelligent in certain ways such as computing models, algorithms, and analytics abilities that will enable the system to make better and more precise decision for business, government, non-profit organization, and individual.

In healthcare, medicine is undergoing a transformation as the technologies in computing and networking become more advances. Smart system is used in healthcare as preventive and personalized to assist the medical workers in hospital to make accurate decision based on data gathered. Decision support for healthcare professional through big data analytics make healthcare services more efficient, high quality and low cost.

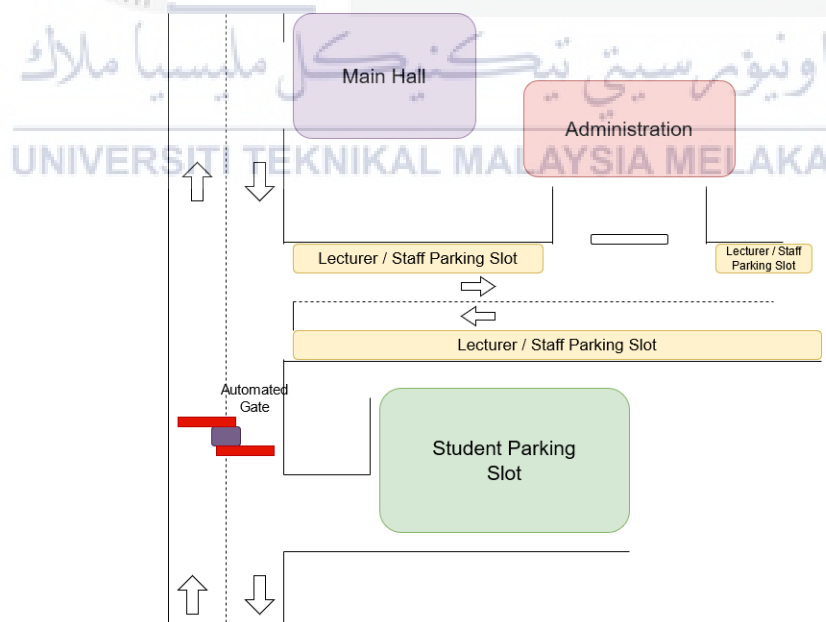
Recognition is the action of recognizing or knowledge that someone or something has been known before and able to recall the identity. In technology, recognition has been used in many ways such as to give access to certain individual or to identify that the person is present and record the data. Recognition is not bound to people, it also uses to recognize vehicle or plate number base on certain country number plate format.

Before biometric recognition was invented, Woody Bledsoe, Helen Chan Wolf, and Charles Bisson pioneered an automated facial recognition in 1960s where a computer was used to recognized human faces. In the early days, the facial features need to be established by human before they could be used by computer. Now, recognition system uses multiple element to be used as identification such as eye, fingerprint, voice and more.

Recognition system is a system that runs recognition programme of human individual, biometrics used as a form of identification and access control. There are many types of recognition system such as Facial recognition system that detect and identify individuals by their facial details. Fingerprint recognition system is a method to verifying a matching between two fingerprints. Plate number recognition system is a system that use an image, and use certain method to detect a words and number in the picture

### 1.1 Problem Statement

Kolej Professional Mara Indera Mahkota has two types of student which is resident and non-resident. Resident students are the student from year one and two while non-resident students are year 3 and above. Resident students are not allowed to bring their car or motorcycle, however the college has provided a dedicated parking spot for them, alongside with non-resident's vehicle. Meanwhile, for Lecturer and staff, they have their own dedicated parking spot that has been reserved to make sure all lecturer and staff do not have problems when parking their cars.



Problems came across when there is some student that illegally use lecturer's parking spot and forcing them to find another place to park. Because some of the lecturer need to rush, they start to simply park their cars at unsuitable places such

as on the grass and under a tree. The problems become worse when they started to double park their cars and obstructing others. There were also reported that small crash occurs in the tight area once in a while.

In the other hand, the parking slot for lecturer and staff was near to the office main building where all official and very important person (VIP) will use as the main entrance to the administration buildings. This area also being used by student and visitors as their main path from the academic building and administration building. This situation will cause congestion to the traffic due to small area and overload of vehicle in the area. Besides, the congestion become worse when college's bus also needs to access the area to pick up or drop student and staff back from outside event. Student illegally entering the compound using their cars will exacerbate the situation and making it worse to manage.

Currently, the college use automated gate that need an access card in order to open the gate. This system has disadvantages when lecturer or staff do not have the access card whether they loss the access card or they forgot to bring it. In addition, there were reports says that student is able to duplicate the access card and entering the compound freely. This has been happened for a quite some time and causing congestion at the reserved area for lecturer and staff.

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**Table 1.1: Summary of Problem statement**

PS	Problem Statement
PS1	Parking slot for lecturer/staff frequently used by student
PS2	Access card system being compromised where student was able to duplicate the card.

## 1.2 Project Question

This project is aimed to develop a product and a system that can overcome all the problems faced in current system. The product also needs to be innovative and

suitable to be applied at the targeted area. Project question is needed to clarify the main requirement of the project before implementing.

**Table 1.2: Summary of Project Question**

PS	PQ	Project Question
PS1	PQ1	How to avoid student from using lecturer and staff parking spot?
PS2	PQ2	How to improve access card system?

### 1.3 Project Objective

**Table 1.3: Summary of Project Objective**

PS	PQ	PO	Project Objective
PS1	PQ1	PO1	To investigate current automated gate parking slot system.
PS2	PQ2	PO2	To develop a plate number recognition system as identification.

PO 1: To investigate current automated gate parking slot system. There are many weaknesses in the current automated gate system that contribute to other problems in the college. The system should give access to lecturer and staff while restrict student to enter the compound.

PO 3: To develop a plate number recognition system as identification. The recognition system will give access registered plate number which is belong to lecturer and staff. This system eliminates the access card that easily being infiltrated.

### 1.4 Project Scope

The main purpose of this system is to provide an automated access gate system that use plate number recognition to give authorization into the vehicle restricted area. The Plate number recognition technology used in the automated gate system



provide a higher level of security and restriction because student cannot access the restricted are with their cars. Besides, they cannot change their plate number as it is considered against the law.

This project will focus on automated gate system that use plate number recognition as identification. Resources for this project will be the main control unit which is Raspberry Pi that use Raspbian operating system. A camera that will be used to record and capture the image of the plate number, and python coding that will process the image and detect character based on the image captured.

The user for system is focused on Kolej Professional Mara Indera Mahkota lecturers and staff. All lecturer and staff need to declare and register their vehicle before the system is implemented on site. Any user other than lecturer and staff of the college need to have special privilege or permission from the administration to get access through the smart plate number recognition system.

### 1.5 Project Contribution

This project has many advantages to the college and it contribute to many aspects. The current access gate system can be enhanced and improved by implementing this system. Furthermore, this project able to cover flaws that unhandled by the current access gate system. This project based on the idea of providing more intelligent system that was able to detect and decide the appropriate decision to be made.

**Table 1.4: Project Contribution**

PS	PQ	PO	PC	Project Contribution
PS1	PQ1	PO1	PC1	Manage and control the use of vehicle by student in the essential college's area.
PS2	PQ2	PO2	PC2	Reduce the number of traffic user in the targeted area.
PS3	PQ3	PO3	PC3	Provide smart and efficient way to authenticate user through the access gate system.

## 1.6 Project Organization

### Chapter 1:

In this chapter mainly focus on this project's introduction which include the project background and the project to be developed. In this chapter also explained the problem statement, objective, scope, outcome and conclusion. This is for establish base idea and overall project.

### Chapter 2:

This chapter about reviewing others previous project that related to this project. Focused on reading material and published thesis explanation. This chapter also describe related published thesis, journal and articles about recognition system, ANPR, recognition algorithm. Those paper are analysed to extract valuable information for this project.

### Chapter 3:

Project method are explained in this chapter which describe phase and stages in completing this project using selected methodology. Milestone also describe in this chapter which give the full timeline for the project's progress.

### Chapter 4:

In this chapter, problem analysis, analysis requirement and design are being discussed in detailed manner. Problem analysis from chapter 1 is discussed in this chapter as well as analysis requirement, which consist of software requirement and hardware requirement. Design of the project include circuit diagram, logical design, physical design and flowchart.

### Chapter 5:

This chapter mainly focus on the testing phase for the project. Testing plan, test design and analysis of the project. Testing plan consist of test organization, environment and schedule. The test result then will be analysed for testing phase.

Chapter 6:

This chapter discussed about the overall summary of the project which consist of observation both strength and weakness of the project. Improvement for the project also being discussed for future works.

### **1.7 Conclusion**

In conclusion this chapter describe the overall details and general understanding regarding the project purpose, aim, reason and impact of the project on targeted audience. The next chapter will be literature review which to identify related work and issues related to the project.



## CHAPTER 2: LITERATURE REVIEW

### 2.0 Introduction

In a project development, literature review is one of the important parts because identifying information that are related is required to help in the project. Plate number recognition that currently develop or research will be discussed in this chapter. Providing a more understanding regarding to this project is the main focus of this chapter. In order to meet the objectives and scope of the project, literature review is the best way because it can provide strong evidence to support implementation on project justification through this method.

Figure 2.1 shows the subtopic for this chapter. Subtopic that will be discussed includes the Introduction, Plate number recognition, Microprocessor and microcontroller, sensor, Communication and Related works. The main objectives for this research is to give ideas and knowledge that can be used to develop smart plate number recognition system.

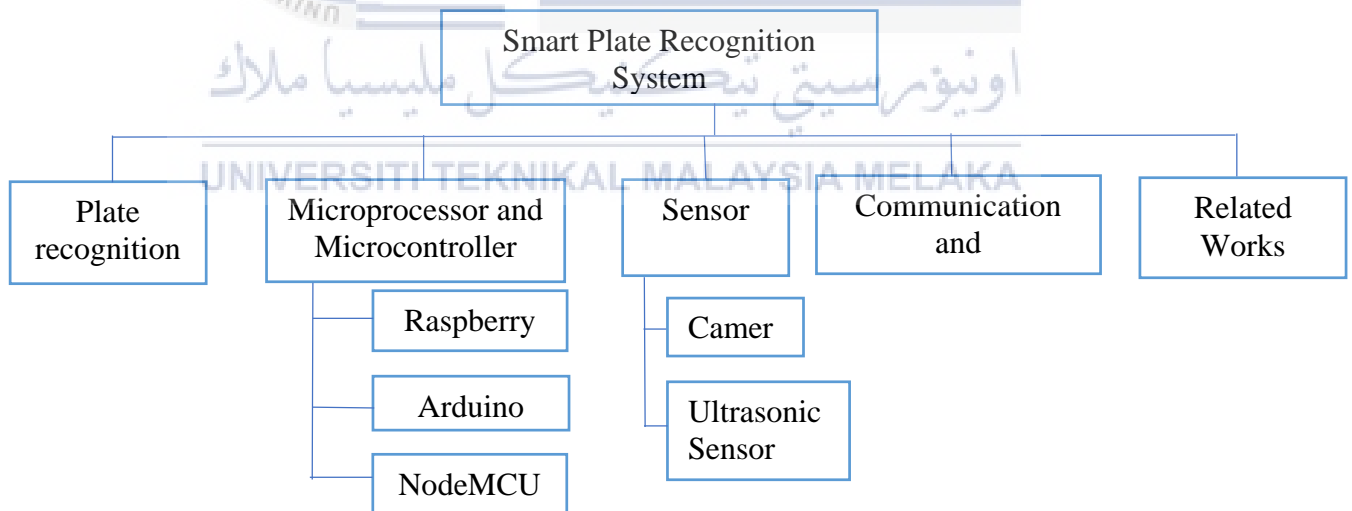


Figure 2.1 Overview of Literature Review

### 2.1 Plate Recognition

License Plate Recognition is a technology that able to automatically recognized any character from video footage or picture captured for security or traffic analyse

purpose. Character recognition algorithms for License Plate Recognition are used for many intelligence infrastructures such as electronic payment system and arterial management system. License Plate recognition also known as LPR compose of three processing steps which is extraction of license plate region, segmentation of the plate character, and recognition of each character. The true recognition rate and error recognition rate relies on the first two steps which are incorporate with image processing technique on a still image or frame sequence from a video.(Anagnostopoulos et al. 2008)

Algorithms that being used for plate recognition is Automatic License Plate Recognition (ALPR) and the approach vary based on condition such as image quality, car position, light, single or multiple image and more. Besides effectiveness, License Plate recognition also cost-effective technique that can be used for vehicle identification. There are many types and variation of plate number format as well as environment cause challenges in the process for plate detection. Plate variation such as location is the car plate exist in different location on each image. An image may content many or no plate number is under quantity variation. In addition, size may be differed as the size of the plate in an image depends on distance and zoom factor. Plate may have variation in character and background colour due to plate type.

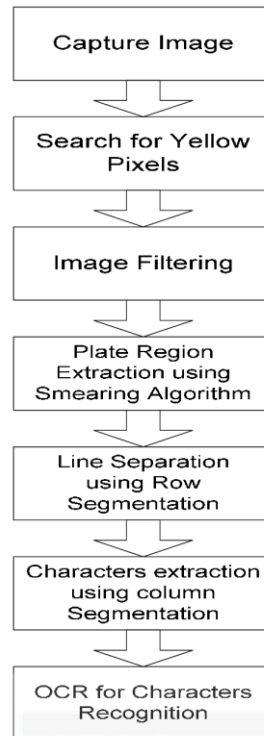


Figure 2.2 : System flow

Plate number in different nation may be written with different fonts and language. Standard and vanity such as there are plate number that customized and not following the standard format. Plate number may be covered by dirt or broken, tilted or changed position, and lastly plate may have others variation such as frames and screw. (Qadri and Asif 2009)

## 2.2 Microprocessor and Microcontroller

### 2.2.1 Raspberry Pi

Raspberry Pi is a low-cost Single Board Computer (SBC) are designed to improves computer education especially pre-university level. The Raspberry Pi is a system on chip (SoC) which is a single board carries all the essential circuit. For example, the Central Processing Unit, Graphic Processing Unit, input, output and processing circuit are carried in the same board. Raspberry Pi able to programming hardware, driving electronic circuitry and collect data through various ways because the availability of General Purpose Input Output (GPIO) pins features.



Figure 2.3 : Raspberry Pi

In addition, Raspberry Pi adaptable with a keyboard, mouse and display monitor with HDMI cables. The first generation of the computer came with SD card slot that can be used to boot Linux operating system which is Raspbian OS. Newer generation computer have micro SD Card slot replacing the previous SD Card slot. (Yamanoor and Yamanoor 2016)

#### 2.2.2 Arduino

Arduino microcontroller is an open source platform. Arduino provides strong base for hardware and software. There are many various of Arduino board such as Arduino 101, Arduino Zero, Arduino Due, Arduino Yun, Arduino Leonardo, Arduino Uno and more. All various board have different specification in terms of hardware and user base application. In year 2005, some research students at Interaction Design Institute in Ivrea, Italy start the Arduino project to provide a platform for Hobbyist, Embedded System Professionals and Developers to creatively create project by integrating various device such as sensor and actuators.

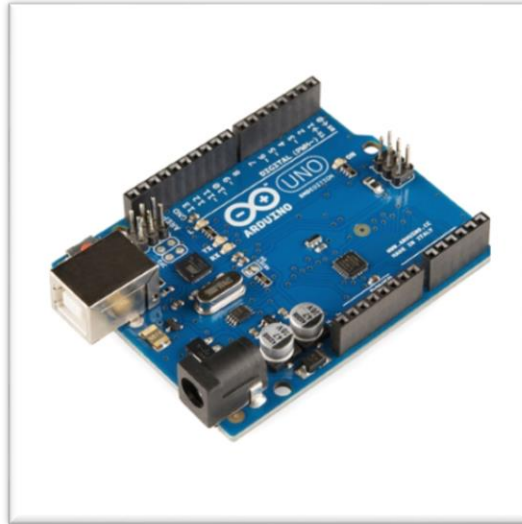


Figure 2.4 : Arduino UNO

Arduino has a strong Integrated Development Environment (IDE) used by all researcher because it is platform independent base for Arduino hardware as well as able to run on multiple operating system platform. The IDE was cross platform application based on Java Technology. (A. Nayyar and V. Puri 2016)

### 2.2.3 Node MCU

Node MCU is simply a paring of firmware and hardware based around the esp8266-12e module which is a low-cost Wi-Fi enable microchip with a full TCP/IP stack and microcontroller capabilities. The developers originally tied the term node MCU to their open source firmware which ran on the esp8266-12e based development kit. As time passed, the name node MCU become common with the development board. In the early days, user can programme the board using the lua programming language but as the open source community wrote libraries, the programming language fell out of favour. The libraries allowed the board to be programmed with the Arduino IDE using the more popular Arduino programming language.