IoT BASED SYSTEM FOR COASTAL RECREATIONAL SUITABILITY USING EFFECTIVE MESSAGING PROTOCOL

AHMAD FARHAN BIN AHMAD ZAKI

FACULTY OF COMPUTING AND INFORMATICS
UNIVERSITI MALAYSIA SABAH
2022

UMS
UNIVERSITI MALAYSIA SABAH

IoT BASED SYSTEM FOR COASTAL RECREATIONAL SUITABILITY USING EFFECTIVE MESSAGING PROTOCOL

AHMAD FARHAN BIN AHMAD ZAKI

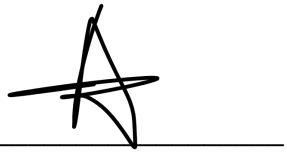
THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE WITH HONOURS (NETWORK ENGINEERING)

FACULTY OF COMPUTING AND INFORMATICS
UNIVERSITI MALAYSIA SABAH
2022

UMS
UNIVERSITI MALAYSIA SABAH

DECLARATION

I hereby declare that the material in this thesis is my own except for quotations, equations, summaries and references, which have been duly acknowledged.



11 February 2022

Ahmad Farhan Bin Ahmad Zaki
BI18110076

UMS
UNIVERSITI MALAYSIA SABAH

CERTIFICATION

NAME	: AHMAD FARHAN BIN AHMAD ZAKI
MATRIC NO.	: BI18110076
TITLE	: IoT BASED SYSTEM FOR COASTAL RECREATIONAL SUITABILITY USING EFFECTIVE MESSAGING PROTOCOL
DEGREE	: BACHELOR OF COMPUTER SCIENCE WITH HONOURS (NETWORK ENGINEERING)
DATE OF VIVA	: 17TH JANUARY 2022

CERTIFIED BY:

SUPERVISOR	**SIGNATURE**
DR. FARASHAZILLAH BINTI YAHYA	DR . FARASHAZILLAH YAHYA PENGARAH PUSAT PENGURUSAN DATA & MAKLUMAT UNIVERSITI MALAYSIA SABAH

UMS
UNIVERSITI MALAYSIA SABAH

ACKNOWLEDGMENT

First and foremost, I would like to express my gratitude towards my supervisor Dr Farashazillah for the continuous support throughout the duration of my final year project. Her patience, motivation, enthusiasm and knowledge in the field has helped me throughput the development stage and production of this thesis.

Furthermore, I would like to offer my appreciation to my examiner Dr Tan Soo Fun and Madam Shaliza Hayati for the advices and insights on the production of my final year project. Your guidance and advice carried me through all the stages of writing my project.

I would also like to give special thanks to my family as whole for their continuous support and understanding me when doing my research, writing report and funding me to buy an IoT equipment. Your prayer for me was what sustained me this far.

Lastly, I would like to thank all my lecturers in the Faculty of Computing and Informatic for teaching and enlightened me with the knowledge in this field.

Ahmad Farhan Bin Ahmad Zaki

11th February 2022

UMS
UNIVERSITI MALAYSIA SABAH

ABSTRACT

The Internet of Things (IoT) has gained significant research interest as one of the recent developments in cyberspace technologies. The influence of the Internet, data collection, and interpretation in everyday physical objects play a crucial role in supporting community and industry. This project was initiated to develop a Monitoring System using IoT in Outdoor Development Centre (ODEC) by using efficient messaging protocols for the Coastal Recreational Suitability Project, a collaboration project between the Faculty of Computing and Informatics and the Faculty of Science and Natural Resources (FSSA) Universiti Malaysia Sabah. The first problem statement provides an easier way to record the data daily and easily monitor the changes. Nowadays, they record the data manually and are not publicly available. Thus, a web-based system will help them visualize the data much better using an IoT rather than manually plotting the graph. This can help monitor the environment on the ODEC beach. The second problem statement is the challenge to deploy and select the standard and effective messaging protocol. The required protocols vary according to the IoT device configuration and the messaging requirement for the situation. Even though IoTs are seen as sensor actuators limited in processing and storage capabilities, the messaging protocol is essential so the IoT devices can work with high efficiency. Messaging protocol is a persistent challenge to IoT industries. Therefore, it is vital to consider each protocol's advantages and disadvantages to determine the best-fit scenarios. This project will specifically look for the Message Queuing Telemetry Transport (MQTT) approach as a communication medium between a sensor and a web-based system. A quantitative approach will be employed to evaluate several well-known current data interchange protocols, especially for MQTT. After implementing the MQTT protocol to the system, the evaluation and tests will present the analysis using MQTT. The next stage will involve designing the web-based system for coastal recreational suitability using MQTT via SocketIO.

Keywords: IoT, MQTT, web-based system, SocketIO

UMS
UNIVERSITI MALAYSIA SABAH

ABSTRAK

Internet Pelbagai Benda (IoT) telah menarik minat dalam penyelidikan yang signifikan sebagai salah satu perkembangan terkini dalam teknologi ruang siber. Pengaruh Internet, pengumpulan data, dan penafsiran dalam objek fizikal sehari-hari memainkan peranan penting dalam menyokong komuniti dan industri. Projek ini dimulakan dengan mengembangkan Sistem Pemantauan menggunakan IoT dan penggunaaan protokol pesanan yang cekap untuk Projek Kesesuaian Rekreasi Pantai, sebuah projek kolaborasi antara Fakulti Pengkomputeran dan Informatik dan Fakulti Sains dan Sumber Asli (FSSA) Universiti Malaysia Sabah. Pernyataan masalah pertama adalah memberi cara yang lebih mudah untuk merekod data setiap hari dan melakukan pemantauan di pantai Outdoor Development Centre (ODEC). Pada masa kini, mereka merekod data secara manual dan data tersebut tidak tersedia untuk rujukan awam. Oleh itu, sistem berasaskan web menggunakan IoT akan membantu mereka mendapatkan penglihatan data dengan lebih baik. Ini dapat memantau persekitaran pantai ODEC dengan lebih efektif. Pernyataan masalah kedua adalah mengenal pasti cabaran cabaran dalam memilih protokol pesanan standard dan menggunakannya secara berkesan. Protokol yang diperlukan berbeza-beza mengikut konfigurasi peranti IoT dan mengikut keperluan pesanan. Walaupun IoT dilihat sebagai sensor yang keupayaan pemprosesan dan penyimpanan yang terhad, protokol pesanan sangat penting untuk peranti IoT untuk berfungsi dalam kecekapan yang tinggi. Protokol pesanan adalah cabaran besar dalam industri IoT. Oleh itu, sangat penting untuk mempertimbangkan kelebihan dan kekurangan setiap protokol untuk dalam konteks senario yang sesuai. Projek ini secara khusus akan mencari pendekatan Message Queuing Telemetry Transport (MQTT) sebagai perantara komunikasi antara sensor dan sistem berasaskan web. Pendekatan kuantitatif akan digunakan untuk menilai beberapa protokol pertukaran data semasa yang terkenal, terutama MQTT. Setelah melaksanakan protokol MQTT ke dalam sistem, analisis dan ujian menggunakan MQTT akan dilakukan. Tahap seterusnya akan melibatkan perancangan sistem berasaskan web untuk kesesuaian persisiran pantai menggunakan MQTT dan SocketIO.

Keywords: IoT, MQTT, Sistem Web, Soket IO

UMS
UNIVERSITI MALAYSIA SABAH

TABLE OF CONTENTS

		Page
TITLE		i
DECLARATION		ii
CERTIFICATION		iii
ACKNOWLEDGEMENT		iv
ABSTRACT		v
ABSTRAK		vi
TABLE OF CONTENTS		vii-ix
LIST OF TABLES		x-xi
LIST OF FIGURES		xii-xvi
LIST OF ABBREVIATIONS		xvii
CHAPTER 1 INTRODUCTION		
1.1	Project Background	1-2
1.2	Problem Background/Motivation	2-3
1.3	Problem Statements	3-4
1.4	Objectives	4-6
1.5	Project Scope	6-7
1.6	Organization of the Report	7-9
1.7	Summary	9
CHAPTER 2 LITERATURE REVIEW		
2.1	Internet of Things (IoT)	10-12
2.2	Application in IoT	12-14
2.3	IoT Architecture	14-16
2.4	Communication Protocol	16-19
2.5	Existing Systems	19-21

UMS
UNIVERSITI MALAYSIA SABAH

2.6 Evaluating Criteria Effective Messaging Protocols 21-24
2.7 Experiments in Messaging Protocol 24-26
2.8 Summary 27

CHAPTER 3 METHODOLOGY

3.1 Introduction 28
3.2 Methodology 28-30
3.3 Step in Prototype Methodology 30-34
3.4 Hardware and Software Requirement 34-38
3.5 Summary 39

CHAPTER 4 SYSTEM ANALYSIS AND DESIGN

4.1 Introduction 40
4.2 System Analysis 40-54
4.3 Data Flow Diagram 54-58
4.4 System Design 58-61
4.5 Data Dictionary 62-69
4.6 Entity Relationship Diagram (ERD) 69-70
4.7 System User Interface 70-75
4.8 Summary 75

CHAPTER 5 PRELIMINARY EXPERIMENT & IMPLEMENTATION

5.1 Introduction 76
5.2 Preliminary Experiment 76-90
5.3 Network Topology 90
5.4 Software Tools for Development 91-93
5.5 Database Implementation 93-97
5.6 System Implementation 98-104
5.7 System Module 104-113
5.8 Summary 113

UNIVERSITI MALAYSIA SABAH

CHAPTER 6 TESTING

6.1 Introduction 114

6.2 Unit Testing 114-122

6.3 Integration Testing 122-124

6.4 IoT Testing 124-125

6.5 User Acceptance Testing 125-130

6.6 Summary 130

CHAPTER 7 CONCLUSION

7.1 Introduction 131

7.2 Project Summary 131-132

7.3 Future Work 132-134

7.4 Summary 134

REFERENCES 135-139

APPENDICES

Appendix A 140

Appendix B 141

Appendix C (I-V) 142-153

Appendix D 154

UMS
UNIVERSITI MALAYSIA SABAH

LIST OF TABLES

	Page
Table 2.0: Summary of Authors on Message Size, Throughput, Power Consumption For MQTT	26
Table 4.1: Data Dictionary for Admin Table	62-63
Table 4.2: Data Dictionary for Camera	63-64
Table 4.3: Data Dictionary for Explore Data	64
Table 4.4: Data Dictionary for Map Location	65
Table 4.5: Data Dictionary for Permission	65-66
Table 4.6: Data Dictionary for Reset Password	66-67
Table 4.7: Data Dictionary for odec_beach / likas_beach / gaya_island	67-68
Table: 4.8 Data Dictionary for sensor_reading_data	69
Table 5.1: Throughput and Network Usage	85
Table 5.2: Power Consumption (kWH)	88
Table 5.3 Existing System versus Proposed Method	89-90
Table 6.1: Unit test for MQTT in Raspberry Pi	115
Table 6.2: Unit test for NodeJS Server	115
Table 6.3: Unit test for Login/ Signup/ Forgot Password Page	116
Table 6.4: Unit test for Main Page	117
Table 6.5: Unit test for Explore Page	118
Table 6.6: Unit test for IoT Reading Page	120
Table 6.7: Unit test for Sensor Entry	121
Table 6.8: Unit test for Security with Motion Detection	122
Table 6.9: Integration Test for Coastal Recreational Suitability	123

UMS
UNIVERSITI MALAYSIA SABAH

Table 6.10: IoT test for Coastal Recreational Suitability 124

Table 6.11: SUS scores of respondents 128

UMS
UNIVERSITI MALAYSIA SABAH

LIST OF FIGURES

	Page
Figure 1.0 Machine to Machine of HTTP, MQTT, and CoAP	2
Figure 2.0 Internet of Things communication network	11
Figure 2.1 IoT architecture	15
Figure 2.2 TLSV1.2 Architecture	19
Figure 2.3 MQTT Message Format	22
Figure 3.1 Research Model	29
Figure 3.2 Prototyping Model	29
Figure 3.3 MQTT Architecture	32
Figure 3.4 HTTP Architecture	33
Figure 4.1: Use Case Diagram	41
Figure 4.2: Context Diagram	54
Figure 4.3: Data Flow Diagram Level 0 Coastal Recretional	55
Figure 4.4: Data Flow Diagram Level 1 HiveMQ Broker	55
Figure 4.5: Data Flow Diagram Level 1 Subscribe and Broadcast	56
Figure 4.6: Data Flow Diagram Level 1 Store Messages	57
Figure 4.7: Data Flow Diagram level 1 Store Images	57
Figure 4.8: Data flow Diagram level 1 Managed Webpage	58
Figure 4.9: Block diagram For Coastal Recreational Suitability	59
Figure 4.10: Flowchart for Coastal Recreational Suitability	60
Figure 4.11: Wiring diagram for Coastal Recreational Suitability	61
Figure 4.12: ERD Diagram for Coastal Recreational Suitability	70
Figure 4.13: Homepage Module	70

UMS
UNIVERSITI MALAYSIA SABAH

Figure 4.14: Explore Module 71

Figure 4.15: About Us Module 71

Figure 4.16: Sensor Entry Module 72

Figure 4.17: Sensor Reading Module 72

Figure 4.18: Motion Detection Module 73

Figure 4.19: Login Module 73

Figure 4.20: Sign Up Module 74

Figure 4.21: Reset Password Module 74

Figure 4.22: Admin Module 75

Figure 5.1: WebSocket Client 77

Figure 5.2: Raspberry Pi, Arduino & IoT sensor 77

Figure 5.3: Rain Sensor & Humidity 77

Figure 5.4: Python Code 78

Figure 5.5: Wireshark packet summary 79

Figure 5.6: Socket IO Server 79

Figure 5.7 HiveMQ cloud broker 80

Figure 5.8 Publish Message to the Broker. 80

Figure 5.9 Wireshark Packet Summary 81

Figure 5.10 Application Data Packet Detail (1) 81

Figure 5.11 Application Data Packet Detail (2) 82

Figure 5.12 Single Packet Parameter 83

Figure 5.13 Ntopng Flow Talker 83

Figure 5.14 Cloudflare speed test 84

Figure 5.15 Current Wi-Fi 85

UNIVERSITI MALAYSIA SABAH

Figure 5.16 Other Wi-Fi signal 85

Figure 5.17 Network Topology 90

Figure 5.18 Raspberry Pi Code 92

Figure 5.19 HTML, CSS, and JavaScript Code coded using Sublime Text 92

Figure 5.20 MQTT Broker 92

Figure 5.21 Heroku Server 93

Figure 5.22: Web server from Mudahhosting 93

Figure 5.23: Database Admin Table 94

Figure 5.24: Database Camera Table 94

Figure 5.25: Database Explore Table 95

Figure 5.26: Database Map Location 95

Figure 5.27: Database Sensor Reading Data 96

Figure 5.28: Database Reset Password 96

Figure 5.29: Reset Password Email 97

Figure 5.30: Database Gaya Island 97

Figure 5.31: Database Likas Beach 97

Figure 5.32: Database Odec Beach 97

Figure 5.33 Arduino Code 98

Figure 5.34 Library used in this project 99

Figure 5.35 Broker Initialization 99

Figure 5.36 Publishing Data to JSON format 100

Figure 5.37 Database Insertion 100

Figure 5.38 HiveMQ cluster Details 101

Figure 5.39 MQTT.fx Data on Plain Text Decoder. 101

Figure 5.40 Server-Side 102

UMS
UNIVERSITI MALAYSIA SABAH

Figure 5.41 MQTT Credential 102

Figure 5.42 Console Log on Node.js server 103

Figure 5.43 Client-Side JavaScript Server 103

Figure 5.44 Javascript Parse Method 104

Figure 5.45 PHP Fetch Data 104

Figure 5.46 Login Module 105

Figure 5.47 Login Module Success 105

Figure 5.48 Visible Navigation Tab 105

Figure 5.49 Invisible Navigation Tab 105

Figure 5.50 Sign Up Module 106

Figure 5.51 Reset Password Module 106

Figure 5.52 Homepage Module 107

Figure 5.53 Homepage Module 107

Figure 5.54 Explore Module 108

Figure 5.55 Explore Module 108

Figure 5.56 About Us Module 109

Figure 5.57 About Us Module 109

Figure 5.58 About Us Module 109

Figure 5.59 IoT Reading Module 110

Figure 5.60 Sensor Entry Module 110

Figure 5.61 Motion Module 111

Figure 5.62 Assign Permission Module 112

Figure 5.63 Approve Data Module 112

Figure 5.64 Verification Popup 113

Figure 6.1 Gender Responder Pie Chart 125

UMS
UNIVERSITI MALAYSIA SABAH

Figure 6.2 Age Responder Pie Chart 126

Figure 6.3 Gender Responder Pie Chart 126

Figure 6.4 Type of Employment Responder Pie Chart 127

Figure 6.5 State Responder Pie Chart 127

Figure 6.6: Number of SUS score of each statement 129

UMS
UNIVERSITI MALAYSIA SABAH

LIST OF ABBREVIATIONS

DFD - Data Flow Diagram

ERD - Entity Relationship Diagram

HTTP - Hypertext Transfer Protocol

IoT - Internet of Things

ISO - International standardization

JSON - JavaScript Object Notation

M2M - Machine to Machine

MQTT - MQ Telemetry Transport Telemetry Transport

pH - Power of Hydrogen

QoS - Quality of Service

SUS - System Usability Scale

TCP - Transmission Control Protocol

TLSV1.2 - Transport Layer Security Version 1.2

WQ - Water Quality

UMS
UNIVERSITI MALAYSIA SABAH

CHAPTER 1

INTRODUCTION

1.1 Project Background

Good water quality is an essential factor before doing an activity on the coastal beach. This project aims to develop an IoT-based web system to collect data from sensors and present the results to users. The data collected from the sensor can be viewed as a graph to monitor the water quality of coastal waters. Next, the development of networks such as 4G has given a fast boost to IoT-based solutions. Thus, it is possible to connect the IoT to the system to make the water quality much easier and faster.

Next, monitoring the water quality using the correct messaging protocol. HTTP protocols are the famous ones to use for IoT devices. However, research shows others protocols that give more effective results for communication between client and server, such as MQTT. With the exponential rise in IoT-enabled systems' overall usage, the collected amount increases rapidly. We can see this on our project when there are many sensors, so there is a lot of consistent data that needs to be sent simultaneously. In addition, data collected must be handled according to their specifications to build more valuable services. The essential things are that Figure 1 indicates several application layers protocols available in IoT used in communication. Besides, IoT has low power usage and computing efficiency, so there is a need for efficient application layer protocols. Thus, choosing the proper protocols by following user requirements and standards is needed. The Internet of Things (IoT) technologies are the answer because they can still track coastal recreational activities' water quality and provide analytical data using an efficient application layer protocol. This will include an early alert mechanism if pollution exists and using the MQTT protocol via SocketIO.

UNIVERSITI MALAYSIA SABAH

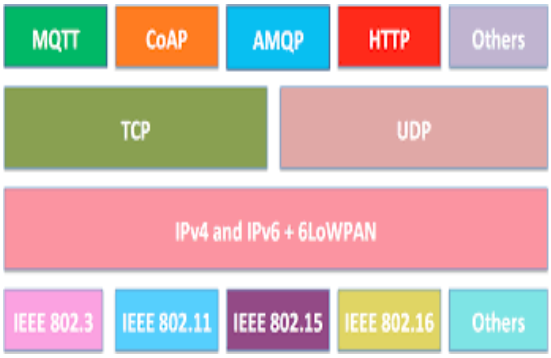


Figure 1.0 Machine to Machine of HTTP, MQTT, and CoAP

1.2 Problem background/Motivation

Better coastal water quality enhances recreational activities but recognizes poor water quality. The associated risks are not readily available to the public. There are already sensors available in some coastal regions that track data over time. The data collected by the sensors usually have a particular meaning. The data variables include the water temperature, humidity, coastal temperature, enterococci, pH, turbidity, and total dissolved solid in coastal waters. Often, the data are less known and may suggest an alarming incident.

Next, the Internet of Things (IoT) has been the foundation for digital transformation and automation, creating innovative market offerings and changing the way we live, operate, and entertain ourselves. Finding the correct type of protocol for communication is an essential part of any IoT project. Unlike the Web, which uses a single message protocol like HTTP, IoT cannot rely on one protocol to satisfy its needs. A variety of protocols for data collection applications have been designed, such as MQTT and CoAP. This clearly shows that IoT's future depends on several messaging protocols. No protocol should accommodate all potential instances of IoT use. This project aims to create a system that uses the MQTT approach as a communication medium in the Coastal Recreational Suitability system. Thus, after this study, the consumer will split his usage into MQTT protocol based on his

UMS
UNIVERSITI MALAYSIA SABAH

specifications and appropriateness. This crucial assessment would outline message protocols focused on the static variable.

1.3 Problem Statements

The main problem is that less research has been explored to indicate the water quality for recreational suitability at ODEC beach. The number of visitors to visit UMS increases every year as UMS is open to visitors to all tourists. Thus, beach care is essential to environmental conservation with many visitors.

Other foreseen problems may include contaminated water causing water pollution to ODEC beach. There is no indicator either it is safe to swim. Local authorities lack water quality monitoring, and if they do test, not every beach is tested daily. Typically, testing checks for E. coli bacteria in freshwater and enterococcus bacteria indicate fecal contamination in ocean water. If levels go beyond an established limit, the beach should be closed to swimming. Next, E. coli is a tiny microorganism and hard to see by the naked eye. Thus, water monitoring for coastal recreational beaches must be monitored daily and notified if the level exceeds the limit.

There is no standardization of protocol in the IoT world in terms of messaging protocols. Thus, a variety of protocols are created with their purpose and benefit. Selecting a suitable protocol before starting developing the system would be crucial. For example, if the project is nearly done develop, the sensor cannot communicate with the server properly; thus, the data are not consistently sent to the server. Choosing the MQTT protocol will offer more benefits to the IoT user. It gains real-time data that work together with SocketIO.

In terms of IoT architecture is the storage system size issue. A typical IoT device can accumulate thousands of data; thus, an extensive storage system is needed. Currently, raspberry pi has 32 GB of storage. The storage problem was possibly fixed using a cloud service instead of a local service to store data. The next problem is that since this project is an IoT-based coastal recreational monitoring, some sensors are not water-resistant such as DHT22, some modules of the rain

UMS
UNIVERSITI MALAYSIA SABAH

sensor, motion, and USB camera. Monthly calibration is needed to increase and maintain the sensor's accuracy, so the data collected are consistent and accurate. The calibration is required, especially components merged into water such as pH sensor, TDS sensor, temperature sensor, and dissolved oxygen sensor.

1.4 Objectives

1.4.1 Project Objectives

This study aims to examine different contact protocols in the IoT context. There is a wide range of vendors of varying specifications for IoT hardware. Some guidelines have been established to fulfil particular universal objectives and norms. This thesis concentrated extensively on procedures, their benefits, and the kind of conditions that were ideal for them. It gives us a more significant idea of selecting between different types of communication, whether it may be hardware or a standard protocol. To evaluate the most used procedures, detailed tests were performed. Then on collected IoT data, more data processing was conducted. This study uses hardware development boards such as Raspberry Pi, Arduino Uno, and ESP32 controller. Those hardware chips are viral in IoT development. The research will create a low-cost IoT coastal water quality monitoring development and design.

This project's primary purpose is to develop a system that monitors water quality for coastal recreation around Sabah in future. The target users are JFIPU which are the FSSA beach, quality team. This project will serve modern monitoring for beach quality, so there is an indicator for the user to inform whether it is safe to swim or not. As we know, contamination in water, such as on the beach, will affect human health, such as diarrhoea. Thus, to overcome this, we must have a method to monitor water quality effectively and effortlessly. The public can access coastal recreational water quality to provide first level awareness to their citizens (Waikato Regional Council 2019). The objectives of this project are:

1. To investigate and analyse the MQTT messaging protocols for the IoT-based monitoring system in message size, throughput and power consumption.

UMS
UNIVERSITI MALAYSIA SABAH

2. Design and develop the IoT-based web-based system coastal recreational suitability using Raspberry Pi and Arduino with MQTT over SocketIO.
3. To evaluate the system usability scale using a questionnaire about the system usefulness, information quality, interface quality and system capabilities.

Several projects and academic work were merged to make this analysis more successful, such as message duration, throughput, and power consumption. The web-based system will be implemented HTTPS to be more secure and encrypted between the web server and web browser. The connection from the MQTT broker will be on SocketIO as it enables one to view the data directly to the web-based system. Using MQTT, the web-based system's display should be fast and not delayed. Indeed, it would benefit the system as it can get real-time data compared to using HTTP requests. This work will simplify the set-up of an MQTT framework and establish real-time water quality monitoring for coastal beaches with persuasive messaging and expense. The primary motive of this work was the engagement with a virtual device of various IoT architectures in the context every day. In terms of protocols, networking modes, and hardware, this further recognized how IoT systems are integrated and that not all IoT systems should be the same.

1.4.2 Project Outcome

This project's output will potentially benefit people monitoring daily on coastal recreational ODEC UMS and provide a systematic platform to do the monitoring. This project's main event benefits visitors who want to play activities on the water, such as swimming and scuba diving, by providing water quality information.

As we know, Sabah has many attractive places for beautiful beaches. Suppose the project can give the authority to take the first action. In that case, it will help boost the tourism industry. It also benefits future research involving coastal recreational water quality around Sabah and the possibility of Malaysia. The primary outcome also includes:

I. Evaluation of MQTT protocol in terms of message size, throughput, and power consumption.

UMS
UNIVERSITI MALAYSIA SABAH

II. A web-based monitoring system using MQTT protocol that can collect data from sensors and send it to the MQTT broker and lastly communicate via SocketIO.

III. Provide an extra security feature for the coastal recreational area by detecting motion and capturing images using a webcam.

For experimentation, of MQTT protocol will be developed using a HiveMQ broker. With sensors constant but with different architecture and design, the result may be varied for each protocol while measuring message size, throughput, and power consumption. Socket IO is needed to connect to the web-based system on this project. The requirement is to publish/subscribe to the messages directly from the web-based system. The following reason for using Socket IO is that other functionality requirements need to go over HTTP/HTTPS rather than MQTT directly, such as database and JavaScript graph plotter.

A web-based monitoring system was also developed with the graph plotter to analyze and see the sensor's result quickly. It would help update the visualization for the user in real-time. From server development, it can surely help analyze the real-time issues that can arise through data collection, processing, and management and provide the customer with a smooth flow of applications through data collection and representation.

Data analysis can also be carried out on particular data sets that have been collected from various sensors in future work and can recognize improvements to the data collected, such as prediction algorithms between nodes.

1.5 Project Scope

The study will analyze the application protocol implemented in IoT for ODEC beach, Universiti Malaysia Sabah. The analysis will be done to determine the output of the MQTT protocol in a web-based system. Every application has different requirements to focus on battery life, bandwidth, security, or latency. We focus on power consumption and throughput for this project to become cost-effective.

UMS
UNIVERSITI MALAYSIA SABAH