DECLARATION

I hereby declare that the work reported in this thesis was carried out by me under the supervision of Engineer Etinosa Noma-Osaghae in the Department of Electrical and Information Engineering, Covenant University. Also, I declare that to the best of my knowledge, no part of the report has been submitted here or elsewhere in a prior application for the award of a degree. All sources of knowledge used herein have been duly acknowledged.

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ABSTRACT

This project gives details on the creation of a system for order shuttle in Covenant University known as Covenant University Shuttle Management System. The challenge of findings a shuttle and delay in entering a shuttle is being solved in this project. It uses both a Chatbot and an RFID system to ensure clients get a shuttle to pick them up. The Chatbot is based on telegram, which is a rule-based Chatbot and it uses an inline keyboard to guide a user through the steps in ordering a shuttle. The RFID is majorly for payment and this payment provides a way to quickly pay for the service being offered to one which is the shuttle ride. The System uses both Chabot and RFID for flexibility and security. The Chabot was created using python programming language and MY SQLite. The RFID system was created using Arduino Uno IDE, Python programming language and my MySQLite. Queue theory was used in the analysis of this project to view the current behavior of the existing shuttle method, and the proposed methods' behavior and proves the efficiency of 96 %.

Keywords: RFID, Telegram-bot, Arduino Uno.

CHAPTER ONE

INTRODUCTION

1.1 Background of The Study

There has been a lot of stress in easing students, faculty, staff and other people who use shuttle services, majorly because of the unpleasantness of waiting on the queue and uncertainties for a shuttle arrival time. This has led to disorderliness in shuttle stance and could even be dangerous because people get to stand on the road where cars are passing in some extreme scenarios. A shuttle management system will be a step in the right direction to correct this unpleasantness in Covenant university and other tertiary institutions globally. This is because automation is the order of the day, and technological advancement has led to the rise in ease of accomplishing various tasks. The Shuttle management system focuses on easing students, faculty, staff, and other people who use the service, the stress of coming from long distances, and waiting in queue with uncertainties for a shuttle to arrive. This can be achieved by using a Chatbot complemented by an RFID system and would be used both by students and people who are not students to order a shuttle ride, responded quickly by the admin and coordinated by an algorithm. The system should be in such a way that it can simulate human conversation, and it should be fast. The Chatbot would simulate human conversation, and an RFID would make sure people enter the shuttle fast and confirm their payments. The RFID authentication system is an extension of the shuttle management system, and it makes it possible for clients who order shuttle rides to authenticate their identity on shuttle entry. Chatbot, using artificial intelligence (AI), simulates human conversations [1]–[3]. Users utilizing the shuttle management system should be able to request as if having an actual conversation. Software that are engaged in and interacted with by humans are what these Chatbot systems are typically perceived as [4]. Local computers and phones typically use Chatbots, although the internet browser is what it is being used by most of the time. This Chatbot is used in a university

shuttle management system to order a shuttle because it simulates what ordinarily should be done by a human, which is to order a shuttle. There would be a given time for the next ride approaching, delivered to any user who requests a ride but was declined due to the vehicle being complete. And this is because the shuttle management system has been processed to take in queries and process them. The system helps the client go from one destination around the university premises. Other than the Covenant university shuttle management system algorithm, various algorithms can also be used to get the Chatbot to meet the user's request.

Speed in the system must be part of the shuttle management system, which can be obtained effortlessly using an RFID system. This speed is necessary for situations where many people need to enter a shuttle within a short time interval. An RFID, for instance, can be used to authenticate a process in case of authentication to store information and can also be held using software [5].

1.2 Problem Statement

The challenge at bus stops because several students want to go to different locations, and for every shuttle that arrives, these people try to enter it. This has led to uncertainty of shuttle arrival, which has also led to rowdiness at the bus station. It makes such individual or group of individual unsure of the state the incoming shuttle is, and whether entering the incoming shuttle is possible due to the number of people already waiting with one. So, it gives such a person or group of people the impression that the chances of entering a shuttle ride during rush hour are dependent on how fast and smart one can be run after an incoming shuttle.

Along the run, this can be dangerous because people are standing on the road where cars should be passing, and it is because everybody [both students and people who are not a student] wants to enter a shuttle. This also includes places outside covenant university, so long the shuttle is not restricted to carrying the client to such place; Furthermore, staff and faculty who need to go to the

gate should be considered because the shuttle is meant for everyone, so long one has money to pay for the ride. Therefore, a solution is necessary to create a system that improves how the shuttle should attend to clients.

1.3 Motivation and Significance of the Study

1.3.1 Motivation

Humans are relieved from doing monotonous and tedious work because more spaces are becoming digital, and processes are being handled and automated. To further advance the organization in its impressive use of advanced technology and innovation, such ideas should be applied to the system of this tertiary institution.

The motivation for this project came from the thought of the airport system, Covenant University MYQ printer system, and the ATM. The airport system, in this case, where passengers get to book for an airline and certainty of time of departure and seat reservation is sure. The Covenant University MYQ printing system and the ATM have similar concepts, in this case, where clients get to have an account for ease in making various transactions and seeing transaction records.

The significance of the bot is to allow queuing up of clients and delivering an arriving shuttle type to them easy, to bring orderliness to the shuttle system. The RFID system would be a form of authentication before the user gets into that particular vehicle. The shuttle management system bot will use text, graphics, and an inline keyboard to communicate with the user on the telegram platform. The RFID system uses LED light to grant access to users and a sound from a buzzer to deny users from entering a shuttle.

As Covenant University, the tertiary institution is solely focused on heading toward the fulfilment of being part of the top ten best universities in the world's university ranking, this shuttle management system is only fitting.

1.3.2 Significance

This project serves as a great assistance to the strategic and business unit of the University as it provides a solution that promises an increase in the financial aspect. This project also offers faculty, staff, students and other people ease in finding solutions to arriving at their destination on time. It increases the productivity and the ease of students finding shuttle in the university. This project offers insight into natural language processing and artificial learning in creating conversational agents, especially one directed towards a tertiary institution.

1.4 Aim and Objects

1.4.1 Aim

The aim of this project is to develop and implement a shuttle management system for Covenant University.

1.4.1 Objectives

The objectives of this project are to:

1 design and implement a Chatbot to register and book passengers.

2 design and implement an RFID for payment system.

3 evaluate the performance of the shuttle management system.

1.5 Methodology

1 Objective (1): the design and implementation of the Chatbot used to register and book passengers was done using python programming language and MySQLite software.

2 Objective (2): the design and implementation of the RFID for payment system was done using Arduino Uno IDE, python programming language and MySQLite software.

3 Objective (3): the performance of the shuttle management system was done using queue theory.

1.6 Relevance of the Project

A university shuttle management system for both students and non-students proves to be useful as it provides a quick access to shuttle in the university environment and outside the university environment. This reduces the rush time at shuttle stance to enter a shuttle and it provides a quick way of entering a shuttle.

1.7 Project Organization

The following chapters in the project are arranged as follows:

Chapter 2: An analysis of the application fields and methodologies of the Covenant University shuttle management system. This would cover both the Chatbot system and the RFID system.

Chapter 3: Present details and methodology of the shuttle management system implemented in a tertiary institution, Covenant University.

Chapter 4: A report on the performance of Covenant University shuttle management system

Chapter 5: A summary of the findings from this project and recommendations for future research into the subject addressed in this project.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

A University shuttle management system is a system that can help organize the way shuttle is being booked in a university, making shuttle usage in a university environment more orderly. This can be achieved using a technology that makes identifying of a unique object possible, like an RFID [6]–[12]. The objects being identified in this case is the unique client. A software like a Chatbot makes sure this unique client has placed order prior to identification at the shuttle point. So, a Chatbot makes the booking, and an RFID authenticates the person that ordered for the shuttle. A shuttle management system using both a Chatbot and an RFID brings comfort in knowing where a shuttle is and how to get to the shuttle. Shuttle management system is what an environment like Covenant University should make use of because technology is taking over the globe and part of what this technology does is to assist people in getting to their destination on time using phone applications like uber, bolt and lots more. And a shuttle management system is an addition to the normal shuttle system already on ground. This chapter covers the history of RFID, Chatbot, methodology of RFID and Chatbot, review of related works and summary

2.2 History of RFID and Chatbot and RFID.

2.2.1 Brief history of Chatbot

Alan turning wondered, in the year 1950 if it is feasible for a computer program to interact with a specific group of people without realizing that their interlocutor was artificial (i.e., the person who takes part in the dialogue or conversation was from an artificial source)[13]. In 1966, the first Chatbot with ELIZA was constructed with the ability to return users sentence in a form that is interrogative[4]. A software program called “ELIZA”, functioning with the MAC time-sharing system, which makes natural language conversation of special kinds between computer and man possible[4]. Eliza’s knowledge has limited, and this was one of the draws back of the Eliza;

furthermore, Eliza lacks the ability to retain persistent conversation and it is unable to discover or learn context from discussion. Eliza was source of inspiration for subsequent Chatbot. Paper that has being highly cited are very useful and should contain that which would aid for future research or follow-up research[13][14]. According to analysis done by [14], analysis showed that the paper that are highly cited, the pros of the research as it relates to human behaviour that has caught the attention of widespread analysis of the 100 highly cited papers reveals that Chatbots have been applied to topics and issues that have been scarcely investigated and analysed. In view of method of the research, the analysis reveals that the published papers between the year 2003 and the year 2009 tended to be analytical research design or system design article; from the year 2010 to the year 2015, the research design was focused on nonexperimental survey methods. Between 2016 and 2020, numerous Chatbot research articles were produced, but few scholars only made use of mixed and qualitative methods such as qualitative interviews to analyse the value of AI-based Chatbots for users. Starting from the field of application, although the effectiveness of Chatbots in different areas were discussed by a reasonable amount of Chatbot research, the highly citation rates of 100 articles that were first found reveals that taking the view of the following field, a lot of studies using Chatbot were not accurate: AI, computer science information system, and medical information fields. Moreover, in depth discussion is yet to be done on the research in various field. Using the field of education for example, the published research in education in the top 100 articles were only 11, which reveals that, even though attention has been given to the research of Chatbot and analysis of Chatbot in education-by-education researchers, more research is the field of education is needed to conducted[14]; Furthermore, the article that had a thing to do with education (this is talking about learning of language), out of 100 articles were only five, which means that space is available for conducting research on Chatbot in human behaviour studies from the view

of educational technology in the future. In the view of there being a need for future research to be conducted in terms of educational filed as made mention by [14]. In [15] proposed that has the advantage of providing a Chatbot which improves and simplifies teaching for professors and learning for students as well as reducing faculty burnout and raising and raising the speed of comprehension. The relevance of this is that in a situation where a student in a class doesn't comprehend a particular thing been taught in class and needs it to be explained, a Chatbot would be the best to handle such situation. Chatbot has improved over the years and now integrated in this age for chat platforms and a very good example is telegram, occupying fifth place and is both a cloud-based mobile and desktop messaging application and its currently the one of the most highly rated chat software today[16].

B2B marketing has increasingly used Chatbots. A study was conducted by the use of survey data and 132 B2B employees gave out data on as it relates to the survey. The study examines how attitude was developed towards the use of Chatbots within organization for marketing employees. Affordances and disaffordances of Chatbot influences employees' perceptions (i.e., effectiveness and discomfort with using Chatbots), according to the study, and the results from the study supported that model[17]. Research on AI has been carried out and it is for the purpose of improving the normal transaction or interaction that would have been carried out by a real human being[4], [6], [7].

[18], through providing an innovative dimension and scale system of service quality in the AI context and contributing to practice by giving three kinds of stakeholder specific suggestion based on the paper's research results, a study which gives benefits to academics was made by the paper. A method known as AI Chatbot service quality scale development (AICSQ) was made use of and it majorly took three phases. The first phase was focused on developing multiple-level dimension

of AICSQ by adopting the coding method of grounded theory, which is suitable for studying under-researched and emerging phenomena. In phase 2 and phase 3, quantitative sections of AICSQ scale development was being focused on. AICSQ with reliability and validity in phase 2 was obtained in the paper, then nomological test was conducted in phase 3 through further constructing and examining a structed model.

1.2.2 Brief history on RFID

Radio frequency identification system has been used, is being used currently and would still be used in the future. It used in multiple fields which include health, academic, education different industries etc[2], [9]– [12]. The major concept which is a tag, reader and an antenna has been explored [19] and used in these fields above listed. A very popular case where RFID tags can be used is for attendance purpose in [21]. [21] proposed a system which both removes the unnecessary minutes spent on normal manual attendance in relation to the proposed system and keeps record of entries which can be made use of in case of statistical purpose like the giving of the attendance score to the right person or place, and further task that are administrative. More research would need to be carried out on RFID because this particular paper only limits RFID to attendance & assessment system, but RFID can do a lot more than these e.g., smart monitoring of rodents for analysis of social behavior [8], health systems where patients get to be monitored by a doctor remotely[5]. For [21], the system has both the software and the hardware design. The software design made used for programmable microcontroller in the project majorly confer about the main function of the system designed. The major consistent of the hardware for the project are Arduino microcontroller, Bluetooth module, GSM module and biometric scanner. The Hardware constitute of Arduino is made up of a simple open hardware design, an Atmel AVR processor and on-board input/output support. The main constituents of the software are a standard programming

language compiler and the boot loader that runs on the board. A control method that is multiple, and is based on method, for observing design architecture, and assessment is made use of in this project as the method. The wireless control is separated and are controlled by an android mobile phone's GUI, it not only provides remote function for a larger coverage but also in-house control and authentication system. An android mobile phone's GUI is what is responsible for the separating and the operating of the wireless control. It both provides remote function for a large coverage and controls that are built in a house and authentication system. When talking in terms of authentication, security should be a paramount thing to talk about. The method used in [21] was both wired and wireless system, controlled by Arduino Uno. An RFID authentication protocol, proposed, based on two stages of authentication is shown in [22]. A new initialization (IA) and termination (TA) stages of an RFID authentication protocol was presented in the paper that improves the RFID security and privacy by authenticating the tag and the server without using the real tag's values (secret key and identifier). Another proposed authentication protocol based on monitoring the transmissions between readers and tags in a system was proposed in [14]. A robust yet resource-aware authentication scheme for passive RFID tags and their readers is proposed in this system, namely, Decoy-based authentication. Features from the RF signal are extracted to eliminated unauthorized tags from accessing the service when the tag is authenticated using the decoy-based authentication. Since RFID tags are resource-constrained devices, one of the main applications of this work is to remove any cryptographic dependency. And hence it removes the burden of performing computationally intensive cryptographic keys and passwords. RFID security can even be further used to track a location in event of a theft or need to track a particular person or thing. A GPS system can be used to acquire the location however if one needs to get more details about the distance and all RFID could also be used [10], [23]. In [23], a description of an

RFID-based positioning system was given, for an experimental pipe-less plant. With the use of a trilateration algorithm using Received Signal Strength Indicators (RSSI), the position of each Automated Guided Vehicle (AGV) in the setup is calculated. A method for alleviating of reading errors in an RFID based localization system algorithmically is presented in this paper.

A filter is proposed in this paper for the preprocessing before the calculation of the position to overcome the problem of bling spots. Based on the probable location in the overall grid of RFID tags, ambiguous RSSI values that correspond to multiple possible distance between the reader and a tag are reinterpreted. Also, improvement to the positioning precision from an average error of about 45 millimeters down to less than 25 millimeters by the elimination of invalid data points is brought about by the proposed filter. The application of the filter to the trilateration algorithm decreases the average absolute position error decreases to from about 45mm to 25mm. This paper proposes a filter for the preprocessing before the calculation of the position to overcome the problem of blind spots using passive RFID tags. Hence, for the purpose of reducing the ambiguity of the data collected, a filter is proposed. To identify and eliminate inaccurate RFID information, the proposed filter uses knowledge about geometrical patterns of the hardware setup, and it does this by comparing calculated position with what is geometrically probable. Hence the compensation of signal loss and ambiguous RFID data is done by the filter. This filter gives an error from about 45mm to less than 25 mm. [20] is a study, aiming to give encouragement to the academics and industry research for the purpose of emphasizing the core applications for RFID-IoT. Also, to continue developing more innovative solution to impact the SCM industry. The strength made mention in this paper on using tag are listed as follows: Tag detachments are negligible as they could be disposed easily, it is easy to implement and trace, the probability of missing and failure detection rate is reduced, the system is easier to develop and maintain, “Place

and go" scenarios are fulfilled, being able to read multiple tags at once and it is cost effective. The existing literature in [20] has highlighted some limitations which are also as follows: Many academicians have discussed the application, problem, and challenges in adopting RFID technology, but most study do not put into account or consideration relating RFID with IoT. Lack of study is present in the supply chain management using RFID-IoT technology against high implementation cost, effectiveness, interoperability scalability and compatibility. Considering a system's dynamics especially, most of the studies have only been focused on analyzing the challenges of RFID but none of them relates RFID to IoT. In the future, there is a lack of studies that specify the changes required in supply chain management to adopt RFID-IoT. RFID can also be brought to the factory. A performance analysis of the RFID Manufacturing Execution System has been made within the Learning Factory environment, In [7]. How products with RFID tags on them are fast enough to pass near the RFID head to have successful reading or writing of the data. The result was analyzed, and conclusion was made for the work-place design. The experiment's aim was to check if the RFID head will manage to successfully read 8 bytes of memory from the RFID tag at some passing speed. The maximal speed according to the equipment manufacturer for reading 8 bytes of data is 4.2m/s for EEPROM type of RFID tag. [19] presented the beauty of using RFID and mobile technology around construction professionals, the barrier in using this technology. Furthermore, the professional's agreement to it being a prevention of health on the construction site. And this was achieved by the use of a questionnaire which was design directed to a total of 40 construction workers out of which 34 responded effectively and their responses was analyzed in "Gauteneng province South Africa" via the use of random sampling. These professionals include, quantity surveyors, architects, urban and regional planers, civil, mechanical and electrical engineers. The strength of this particular paper is that, the data provided by the

questionnaire shows that this technology showed the possibility of improvement of the safety of construction workers via effective monitoring of their activities using technology. A study on RFID datasets from a manufacturing shop floor was shown in [11]. The impact of three perspectives is examined and these includes working time, the sequence of processing and machine on the product. RFID increases productivity, convenience, and efficiency.

2.3 Methodology of RFID and Chatbot: Implementation, approach, strength, and weakness.

The Methodologies for both Chatbot and RFID is seen in this section. These methodologies also cover their strength and weakness.

2.3.1 Methodology of Chatbot: implementation approach, strength, and weakness.

Chatbots primary goal according to [13] is focused on achieving classifying them in informative, Chat-based/conversational, and Task-based Chatbots and are described in the diagram in figure 2.1 below.

Chatbot Categories		
	Knowledge domain	Generic
		Open Domain
		Closed Domain
	Service provided	Interpersonal
		Intrapersonal
		Inter-agent
	Goals	Informative
		Chat based/Conversational
		Task based
	Response Generation Method	Rule based
		Retrieval based
		Generative
	Human-aid	Human-mediated
		Autonomous
	Permissions	Open-source
		Commercial
	Communication channel	Text
		Voice
		Image

Figure 2.1 Categories of chatbot.[13]

Strength is that it saves time. The weakness is that it needs to be improved constantly so it would meet up to the trending technology for better performance. The methodology is that it can be implemented using a programming language and the performance may be viewed using queue theory (Kendall's notation)

2.3.2. Methodology of RFID: implementation approach, strength, and weakness.

RFID system is a technology that is contactless. RFID does various things including object identification (due to the name), animals, and people associated with a transponder that can be

brought, stuck, attached, and implanted [6]. In an RFID, there is a standard layout for the chips and this layout is demonstrated in figure 2.2.

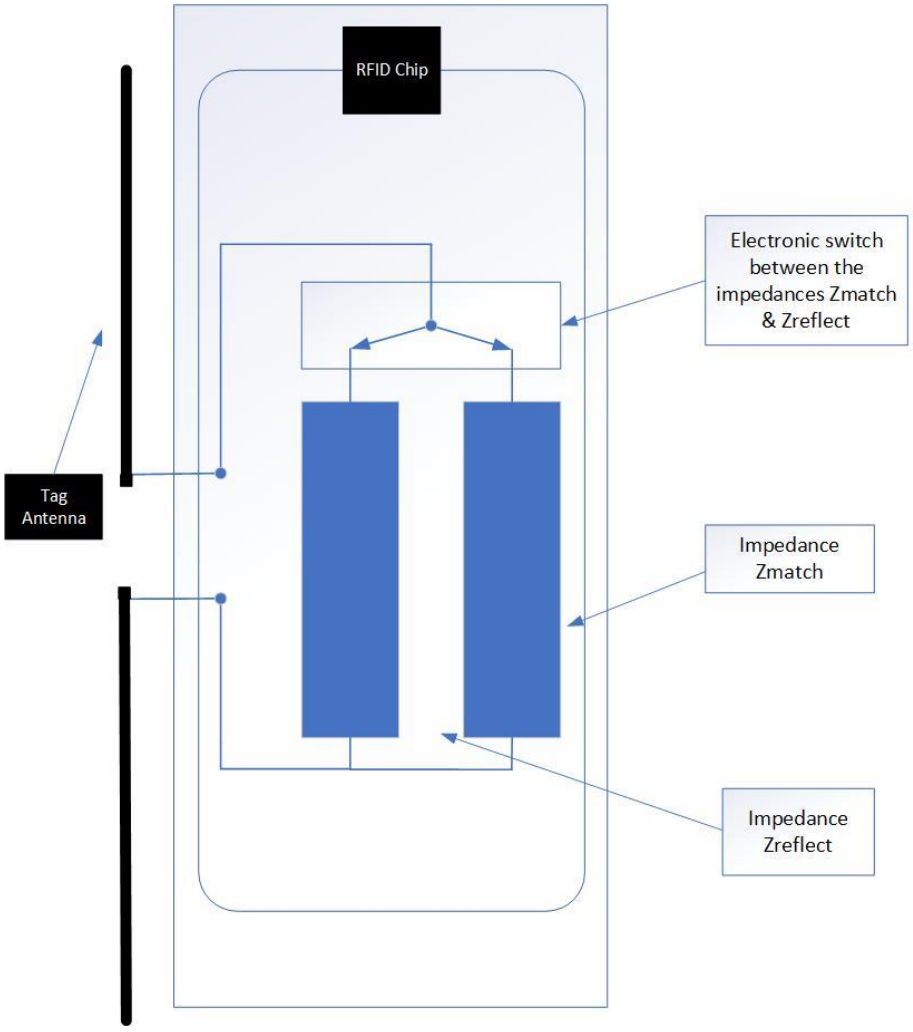

Figure 2.2 simplified tag architecture [6]

This figure 2.2 gives a model that is broken into simple term of any tag.

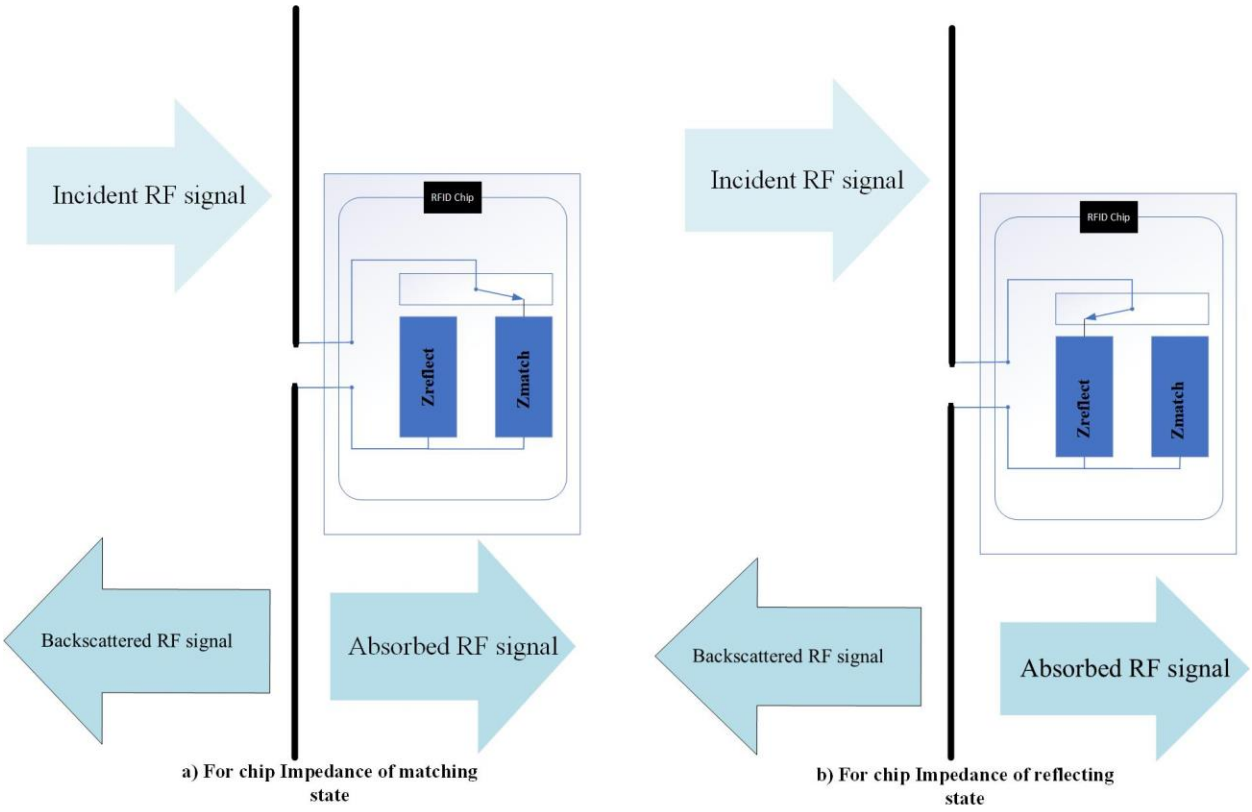

Figure 2.3 RF signals that are backscattered and absorbed in RFID communication [6]

Figure 2.3 gives diagrammatic explanations to the two major of tag communication and this correlate with the two states “a” and “b”.

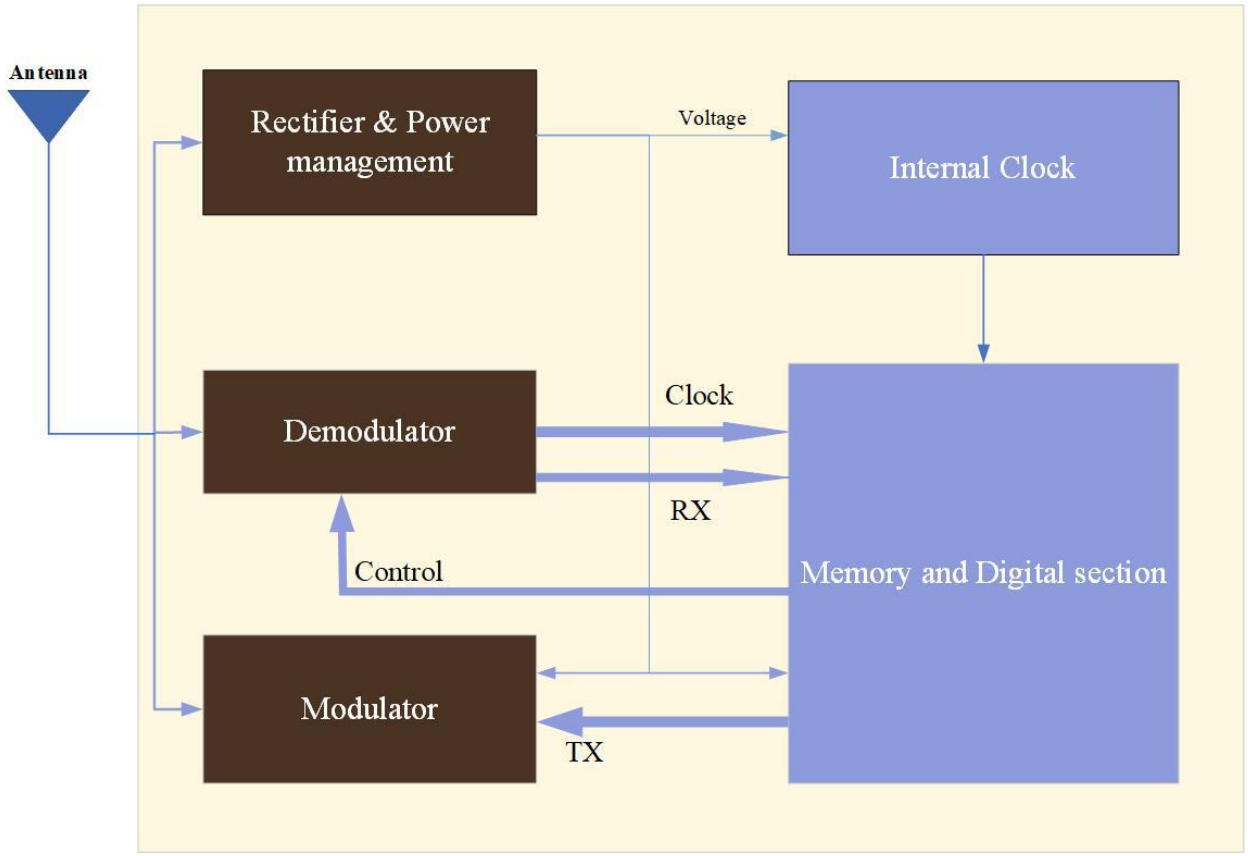

Figure 2.4 Simplified architecture of RFID chip [6]

A model of an RFID structure is given in figure 2.4

According to table 2.4, numerous variant and different standards, in term of RFID, exist and are summarized.

Table 2.1 Major features of Standards of RFID [6]

Frequency type	**Frequency range**	**Read range**	**Coupling type**	**Existing standards**	**Application at the service of Humanity**
Low Frequency (LF)	From 125 KHZ to 134 KHz	0.1 meters	Magnetic Near field	11784/85, 14223, 18000-2	Ticketing, smart card, tagging, access, animal laundry.
High Frequency (HF)	13.36 MHz	1 meter	Magnetic Near field	18000-3.1, 15692, 14443A, B, C	Small item anti-theft, supply chain, management,

					library…
Ultra-High Frequency (UHF)	900 MHz From 902 to 928 MHz in United States. From 868 to 871 MHz in Europe. From 950 to 956 MHz in Asia	From 2 to 20 meters	Electromagnetic Far field	EPC CO, C1, C1G2, 18000-6	Transportation vehicle ID, access, security, supply chain, large item management.
Microwaves	2.4 GHZ	10 meters	Electromagnetic Far field	18000-4	Transportation vehicle ID, road toll, access, security, supply chain, large item management.

The Strength is that RFID makes process faster because tags and cards are used to represent different groups of unique codes and can used to separate objects. Application to humanity services can be rendered by RFID: aim on the fields of autonomy and handicap. There are numerous examples of applications of RFID, and it would be illusory to make an exhaustive list. RFID is used each day by millions of people, and this is done even without evening knowing them: badges for motorway tolls or access to workspaces, passports, electronic car keys, cargo ticketing, passes, electronic car keys, cargo tracking, etc.: RFID is ubiquitous and increasingly seamless. Nowadays, access control and logistics has almost unavoidable for application of RFID, for which it is used for its main application: identification.

Nevertheless, the RFID technology is also made use of in less common application and renders particular services e.g., helping the disabled etc. Furthermore, the most assured way for future applications seems to be mixed solution coupling other technologies with RFID. For guidance,

monitoring, and autonomy for people with disabilities and/or elderly, a variety of applications exploiting RFID identification are summarized in table 2.2.

Table 2.2 Application examples of RFID [6]

Circumstances and application	**Utilization of RFID**	**Types of RFID**	**Other information and/or communication technologies merged with it.**
The observing of student's temperature who have disabilities enrolled in Taiwan. Monitoring of the health and motor activities of wheelchairs users.	Identification of people	High Frequency (HF)	Dedicated Web application
Connectivity between patient and their environment	Recognition of Wheelchair	Low frequency (LF)	Smart sensor networks (standard IEEE 1451.4) + data transfer (standard IEEE802.15.4)
Patients and environment connection	People and objects recognition	Near field communication (NFC)	6loWPAN technology architecture based on IoT

Home medication	Drug (and also location) recognition	Near field communication (NFC)	PDA reader
A guiding payment system in shopping that is automatic	Object recognition	Low frequency (LF)	Zigbee
Voice assistance in libraries	Book and compact disk recognition	Low frequency (LF)	Wireless transmission at 433 KHz.
Dysfunction cure to the sensory integration for children that are young	People and objects recognition	Low frequency (LF)	Sensor networks, database, virtual reality
U-Learning and E-Learning	People and objects recognition	Low frequency (LF)	Technology of Bluetooth and Wireless Fidelity (Wi-Fi)
Significant games that are remedial and for disorder in language	People and objects recognition	Low frequency (LF)	Physiological sensors, Wi-Fi, Bluetooth, tablet.

As shown by these examples, the HF and LF RFID technologies are being made use of widely in many applications dedicated to autonomy and disability. The Weakness of RFID technology has

limitation. Some have limitation with respect to its distance, some have limitation with respect to speed of reading from the tag and writing to the tag etc. [6] gives a detailed description of LF and HF RFID. It also gives a description to the future work using UHF RFID.

2.4 Review of related work on shuttle management system

[24] carried out a survey with the aim of using customized shuttle to minimize the usage of cars on workdays, and Harbin city was taken as case study. The research reveals reasons people rather send use private cars as an option and this is illustrated in the figure 2.5 and 2.6. The research also gave reasons more people will prefer a public transportation with comfort and convenience. A Chatbot and RFID system would make this process a lot better because some people prefer to interact better with a Chatbot rather than a physical person [25].

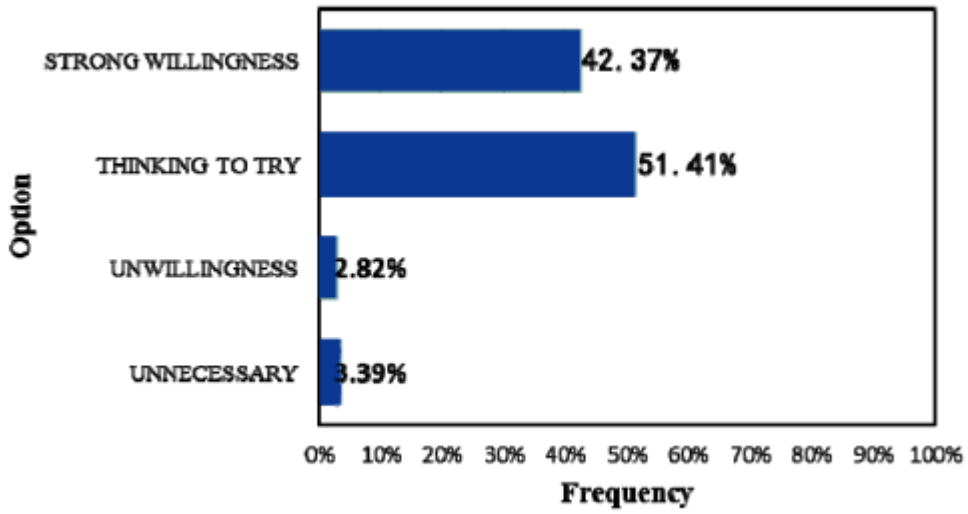

Figure 2.5 A chart that shows the extent to which a customized shuttle would be adopted so long the price is good. [24]

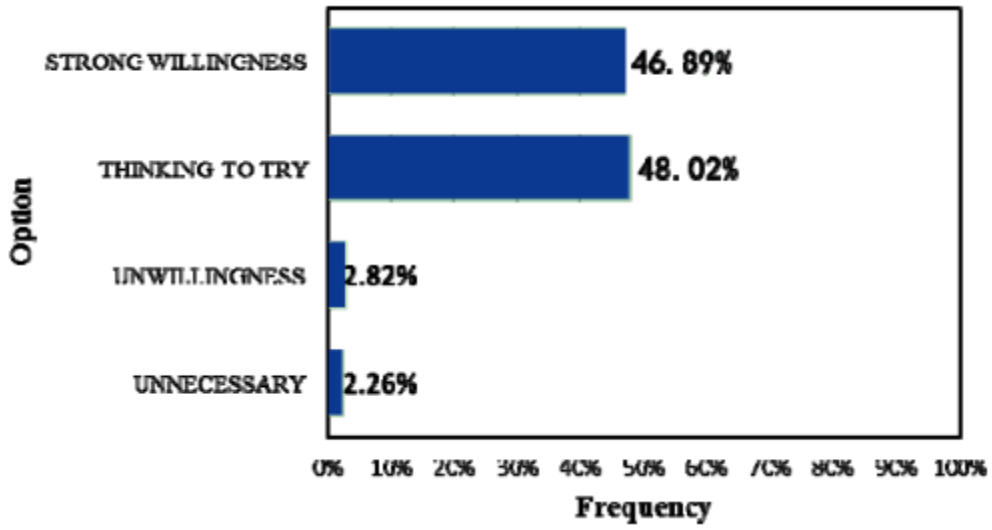

Figure 2.6 A chart that shows the extent to which a customized shuttle bus would be adopted so long it meets the travelling demands and it not as expensive as private cars [24]

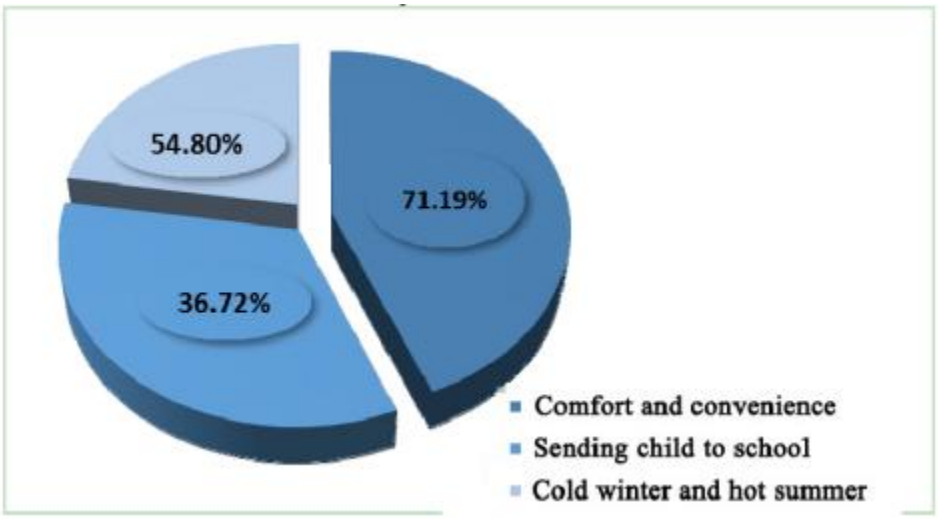

Figure 2.7 The reason of the traveler's travel by private car [24]

Figure 2.7 gives a pie chart description of percentage of what people prefer a shuttle service to include. According to [24], there is a strong willingness for people to think about using customized shuttle service, so long the customized shuttle bus's ticket price is reasonable and taking the vehicle is immediate and accessible.

Technology including Chatbot and RFID would make the process a whole lot faster because more business and concepts are using various software and creative business plans to add profit to such

organization and to suit the user. Examples of these includes: the fintech world and business world [3], [9], [17], [25], [26] health sector [1], [5], [27] in even in the academic sector [15],

It is important to use a platform which is popular and known by a lot of users like WhatsApp or Telegram, and this is because there would be more people to test the data [16].

As technology advances more ideas are being discovered and one is the electric vehicle[28]–[30]. It can also be charged when the battery is low because the program knows where a charging point should be[29].

Electric vehicle which are driverless [30] can be used for people going to short distance hence the use of RFID would come into place to authenticate passengers even as they are entering. Driverless shuttle makes transportation a lot faster for short distance travel and Covenant University environment is a very good example of such [30].

[19] presented the beauty of using RFID and mobile technology around construction professionals, the barrier in using this technology. The data provided by the questionnaire shows that this technology showed the possibility of improvement of the safety of construction workers via effective monitoring of their activities using technology. The barrier made mention of in this article are listed as follow: cost of implementation, Low technical know-how, security of data, communication range, Storage of data, the additional weight the sensor would being on the PPE, the ethical issues, and the power that is ready for use (power's availability). [5]. Proposes a protocol for securing data in RFID. Novel COVID 19 (nCOVID 19) brought about need for social distancing so patients where isolated. The backed server of the system can obtain all the RFID tag's communications if it is too powerful. [8]. Presented in this word is the social behavior of moving mice. Although it requires days of committed work, so the result can be obtained. RFID Data Driven Performance Evaluation in Production Systems [11] shows how RFID affect

manufacturing shop floor. There was increase in productivity using this approach but there were limitations related to computing power. [21] illustrates a physical application of RFID and wireless database records but have its pros and cons. Integration and testing of the RFID-enabled Smart Factory concept within the learning Factory [7] which shows how RFID affects manufacturing and had it limitations. And it also gave vital information relating RFID read speed. [20] shows how RFID-IoT is applied in the academia and industry which had its strengths and weaknesses. How time interval complex events processing in an RFID system is supported is shown in [31], which has its advantages and its disadvantages. The usage of dummy data for RFID tag and reader authentication is shown in [12] and was made possible using a protocol but the weakness is that the data was simulated and not empirical. [10] uses a technique which derived location of targets. Its advantage is accuracy and its limitation many like need to carry out test in a real-life scenario. [22] uses protocols that improved RFID security however future study should find better security protocol and systems. [23] shows a method for alleviating of reading errors in an RFID based localization system algorithmically. The application of the filter to the trilateration algorithm decreases the average absolute position error decreases to from about 45mm to 25mm. [32] provides detailed research on improving the time effectiveness and planning control of the prefabricated components used in the construction industry by providing a demonstration of the system. [33] which is used an MCU as a component of choice and because of its software radio future unlike wireless communication hardware. Limitations relating to power and cost are present in this study. [34] proposes a mobile platform which is low in cost and with a four-wheel chassis that is secure and firm and given support by the interface of an Arduino Uno and a Raspberry Pi. Xatkit is a Chatbot development framework is used in [15] uses a platform to which improves teaching for staff and increases comprehension. Limitations are related to inability for speech recognition to

perform well. [35] gives how google docs improves collaboration in academia with limitation relating to slow internet connection. Daylight saving time policy and energy consumption [36] shows how daylight-saving time policy does not led to energy saving. Limitations of [36] relating to justification for diminishing productiveness of farmers is present. Identified in [14] is the highly cited papers and determines the areas of application for Chatbots. Its limitation shows that little room is given to Chatbot in education and other aspects. [37] shows how to achieve energy saving by artificial intelligence however future research should look into such topic for better results. [38] revealed study in the self-reported food safety practices of the food handlers at home engaged in online business in terms of personal hygiene. More research needs to be carried out in the related field of study. [39]. Proposes a modal that is economic-based (i.e., based economically) and allocation model which is for flexible resources that are residential. [40] proposes a face recognition based smart classroom attendance management system using computer vision and deep learning implemented on a Raspberry Pi. [40] has its limitations like poor lighting. [41] proposes a protocol for confirming identities of things or people using RFID. This is called and ultralightweight RFID and it makes usage of cloud server known as CRUSAP. [42] gives suggestion to a novel approach for a classification that extracts the most out of the two simples yet defining sutures of a flow. [42] takes advantages of all time and size-related information available in a network flow but the classification is accurate for things like VoIP but less for other areas. In [43] a scheme to establish a variable radius mixing region is proposed. More efficient design needs to be done in the future study. The aim of the presented topic in [44] is at a predictable approach that is fundamental (basic), and this for the purpose of digitally monitoring the process parameters with most priority when aluminum casting is being produced. A near real time monitoring is proved from the result for the experiment, however the network pace transference is based on this

[44]. [27] gives a description of Chatbot in mental health. It improves processes but need for special software for the Chatbot to function is present [27]. [1] shows four AI-Powered health Chatbot and it made use of NPL (Natural language processing), Core Engine (Application programmable interface) API etc. Future research needs to be carried out to improve the area of study [1]. To explore how consumers in emerging markets interact and engage with banking Chatbots when conducting bank transaction is the sole purpose of [3]. This paper shows that respondent felt that more task can be accomplished quickly using bank's Chatbot. Future research needs to be carried out for a quantitative approach in the survey rather than qualitative approach [3]. Continuance intention to fintech Chatbot is predicted in [25]. Comparison by future research should be done on impact of different cues in different context [25]. In [18] establishment of multi-level dimensions of AICSQ and development of the associate scales by adopting the mixed-method approach. [18] shows description of services rendered by a Chatbot. Future research needs to be carried out on other locations to get information about Chatbot services [18]. In [45] applied edge caching technology to the assisted relay communication network to study the impact of caching technology on the performance of mobile relay systems. The approach in [45] proves to be better than other methods in terms of performance. UAV can be affected by large-scale and small-scale can affect UAV according to [45]. In [46], an explanation as to why social phobia customers prefer to use of Chatbot service that is anthropomorphic is given. It adds to the existing area, knowledge relating to social phobia by giving well detailed explanation of how various Chatbot affects people and the study should investigate other area [46]. [47] aimed to explore the characteristics of Chatbots in Arabic language that have been reported in the literature of papers reviewed. Dip dive into the techniques used to develop these Chatbots were not given because it does not serve the purpose of the scoping review. [48] proposed an extended meta-UTAUT framework to search out

the existing limitation, by putting into consideration (system factors) in the model. Future studies are needed to extend the meta-UTAUT framework with other system factors to broaden one's knowledge. Using Artificial neural network (ANN) model [49], a novel prediction method combining clustering of data was presented. Cloudy and rainy days gives less better result for the prediction accuracy in [49]. One-round delegated quantum computing protocol is proposed in [50] via generalizing the classical rational sumcheck protocol. Reward gaps is small in the sumcheck-based protocol. Through construction of ANN model, [26] gives predictions relating to the banking sector. Perceptron neural network model is used in commercial banks to make good prediction effects. More research needs to be done for evening better prediction accuracies. Backpropagation is not as good in comparison with model for prediction accuracy. The challenge faced with speaker verification in situations unseen or unknown during development was tackled is seen in [51]. Handling trails with multiple enrollment sample is unavailable for the proposed model in [51], hence future work needs to be investigated the sector. [4] give review of how a Chatbot should go because it was one of the first paper recorded, that birthed Chatbot. [17] Stated in this paper is how Chatbot how Chatbots' affect employees How Chatbot's effectiveness affect employee is shown in this paper. Further study needs to be carried out in other aspect including academia. A deeper understanding of process in the industry is shown in [9]. The result obtained from this study will give enterprise better view of how to improve supply chain performance. Table 2.3 gives description of related work.

Table 2.3 Related works.

S/N	Title of paper	Author of the article	Summary of the article	Strength or positive thing of the article	Weakness of the article

1.	Chat Programs in the Frame of Control System	[16]	Using LoRA media and chat software in the frame of control system this paper shows the further development of Grafana project.	One can create public or private servers, and there is no limit to how many servers one can run. network in a quick and easy way.	no article has been found with open SCADA for process control, monitoring and chat notification.
2.	A prediction Model of Electric Vehicle Charging Requests	[29]	This aims to predict the average charging rate and charging time of multiple requests by taking into account the inter-arrival of charging requests and the charging state of each electric vehicle.	A predictive function-based model for handling multiple charging demands and predicting average charging rates and charging times was achieved based on the work in this paper.	Mainly, one of the major obstacles to the large deployment of electric vehicles is the uncertainty of drivers to get suitable and vacant places at a charging station constitutes.
3.	Chatbots: History, technology, and applications	[13]	The History, Technology, ways of applying natural dialog system or in simple terms chat bot was done in this research.	This paper was a bibliographic research type and hence limitations of existing chat bot was pinpointed which majorly security of personal data of user	This study made mention of it using only English bibliographies for research while studies in other languages may contain useful information.
4.	Chatbots applications in education: A systematic review	[2]	This paper analyses previously published papers and systematically addressed	This study gave answers to various questions relating to education and these	This study focuses only on chat bot in educational field but little consideration of

			research question in education.	questions. It also adds to the existing literature on chat bot application.	the health, social and so on.
5.	RFID: A Key technology for Humanity	[6]	This paper gives description about an RFID	A final main point that has to do with the contribution of RFID to the idea of green and recyclable technologies.	The Ultra Hight Frequency range with awesome and new functionalities, and capabilities are the expectation to next steps of evolution.
6.	Experimental study on the engine energy flow of a heavy-duty vehicle under C-WTVC	[52]	This article shows ways to improve cost of maintain of a heavy-duty vehicle along the run.	Various ways of improving a heavy-duty vehicle were shown in this article.	Ideal condition is an exception for the efficiency of the heavy-duty vehicle under C-WTVC to stay within 20% and 43%, so further research needs to be carried out.
7.	HTTP request pattern-based signatures for early application layer DDoS detection: A firewall agnostic approach.	[53]	This paper shows HTTP request patterns as signature to build a firewall agnostic Early Detection Module (EDM) for AL-DDoS attacks.	With a Sample Entropy based anomaly detection mechanism, it is demonstrated that the use of EDM significantly reduces the detection latency for AL-DDoS attacks.	The algorithm proposed in the paper is used for detecting application layer distributed denial of service however more research need to be carried out to be able to detect other types of attack.

8.	The Key Contributing Factors of Customized Shuttle Bus in Rush Hour: A Case Study in Harbin City	[24]	Reviewed in this paper are factors that promotes or discourage shuttle management system	There was a survey done in a particular city and this survey showed what clients like to see in a shuttle before using it as a means of transportation.	Further study needs to be carried out in other cities and other factors affecting shuttle to know how to enhance shuttle ride.
9.	Acceptance of driverless shuttles in pilot and non-pilot cities	[30]	The adoption of driverless shuttles from a survey of residents in pilot cities and non-pilot cities in the United States is what this study investigates.	Early insights into how driverless shuttle can be accepted and also factors affecting it is provided in this study.	The survey only captured stated preference from responses, rather than actual behaviors of taking driverless shuttles.
10.	Optimal energy management of fuel cell hybrid electric vehicle based on model predictive control and on-line mass estimation	[28]	This article reveals ways to improve a fuel hybrid vehicle.	Provided in this paper is a reliable theoretical basis to address varying-mass vehicle energy management problems.	For continuous mass changes, the designed mass estimator performs very poor, and it makes the controller unsuitable for buses and similar scenarios.

2.5 Summary

This chapter gives the description of the concepts used in the shuttle management system. These concepts are RFID system, Chatbots, like electric cars and they're operation rule etc. An RFID can

be used in conjunction with a Chatbot system because of the second option of the study, which shows how shuttle management should be cost friendly. The RFID would function to ensure authentication in the user, and this is because the RFID should have been in communication with a database which stores the user's identity. The database could also be shared with a Chatbot and with a website.

CHAPTER THREE

SYSTEM ANALYSIS AND DESIGN

3.1 Introduction

Given in this chapter is a detailed method followed to implement the shuttle management system. It covers the steps followed in creating the Chatbot which is hosted on telegram and the RFID payment system and gives an understanding of the workings of the different elements involved in the functionality of the Chatbot system. An explanation of the rule based Chatbot coupled though the Python software is given. In addition, MySQLite database is used as the database to store inputs received from users for both the Chatbot and the authentication and Microsoft excel. This chapter covers the architecture of a shuttle management system and ends with a summary of the methodology.

3.2 Architecture of shuttle management system.

Covenant university shuttle management system uses both a Chatbot and an RFID for authentication and payment. Chatbot architecture is an example of the booking/ordering system. The architecture used in various scenarios is dependent on various factors like use-case, domain, Chatbot type, etc. However, the basic conversational flow remains constant. The RFID reads that from a database through the RFID reader using a microcontroller and an ESP-32 ESP-01.

The architecture of this system management system consists of:

Chatbot / session / front end application interface.

Kendall notation for a queue.

Interface and payment/authentication.

Application database for processing actions to be performed by the chat bot.

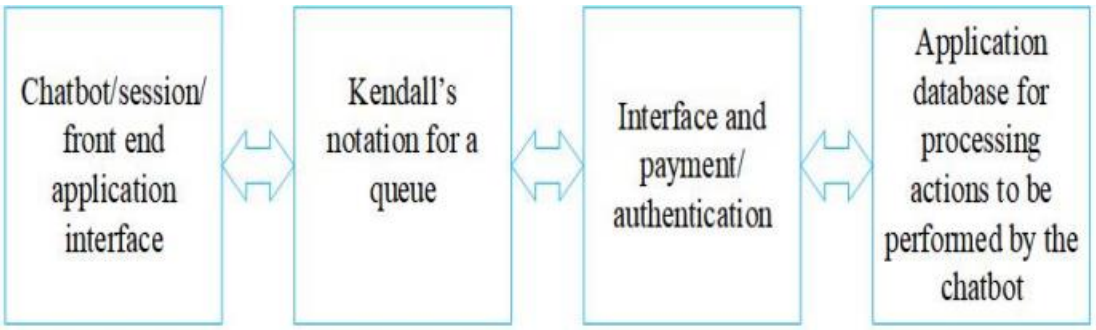

Figure 3.1 Block diagram of Covenant university shuttle management system

The figure above, Figure 3.1 illustrates the structure of a university shuttle management system and how interaction occurs between the user and the system. A function has been designed for the user to communicate with the Chatbot through inline keyboard. The function keeps the chat window running so far, the user is engaged in conversation on telegram. The Chatbot has a client end, user end and admin end. There could be multiple admins and multiple clients but only one admin.

In the chat window for customers, the Chatbot shows a user their balance and displays a list of inline keyboard buttons, all for the user to click or input their desired options/response and then the Chatbot matches it with what is has stored in the database to give back an output. In the chat window for admins, the Chatbot displays the role of that particular user, in this case an admin, and then displays a list of inline keyboard buttons, all for the user to click or input their desired options and then matches it with what is has stored in the database to give back an output to the user.

Kendall's notation for a queue gives a description to a queuing system. The shuttle management system uses this concept, and it uses the one for the single queue multiple servers. The server in this case is the admin and the queue are a list of requests waiting to be responded to. The application database obtains the response which is given to the user.

3.2.1 Covenant University shuttle management system front end application

In the creation of software applications, the user interface is a very important element to design. It is how the software user interacts with the system software, both for the client and the admin. For this system's Chatbot, Covenant University Shuttle Management System, python programming language is the platform used to build the Chatbot's interface and it is for telegram application.

Python programming language enables the creation of software application. This programming language can be used to create various types of applications. With the understanding of this tool, a simple and easily understood interface was created for the shuttle management system's Chatbot and authentication's program.

3.2.2 Kendall's notation for a queue.

The technique that this system works upon is the Kendall's notation for a queue.

A/B/C/K/Z.

Where A and B can be:

M: Markovian (Exponential) or Memoryless

D: Deterministic (Constant)

G: General Distribution

Z: is either First in first out (FIFO) Last in last out (LIFO), RS, PS, Priority

Default value: for K is infinite and for Z is FIFO.

Kendall's notation: Has two descriptions for capacity which is unlimited and limited for both one server and multiple servers.

Queue methods: For both the established and the proposed system, the unlimited capacity for single queue and multiple queue single server is made use of in the Covenant University Shuttle Management System. This method was used on some relevant information relating to shuttle gotten from a shuttle driver on 17th January 2022 and from experience.

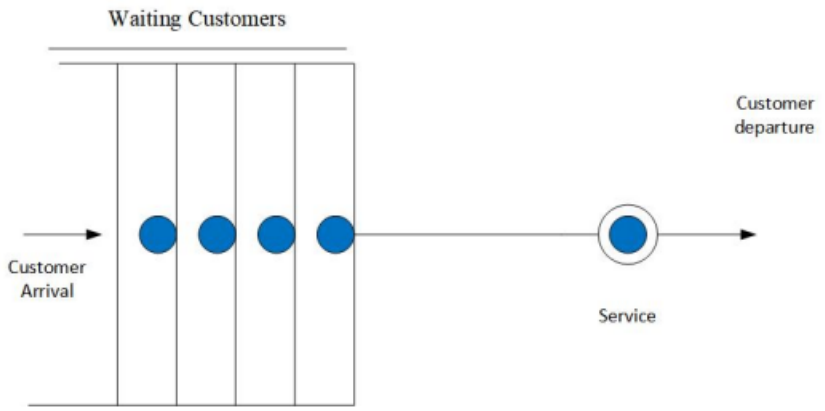

Figure 3.2 unlimited capacity for single server

Figure 3.2 shows how an unlimited capacity single queue is for a single server.

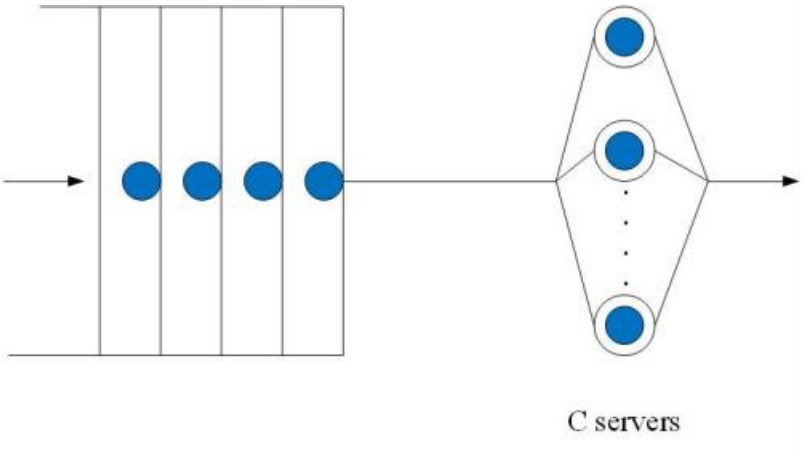

Figure 3.3 unlimited capacity for multiple server

Figure 3.3 shows how an unlimited capacity single queue is for a multiple server.

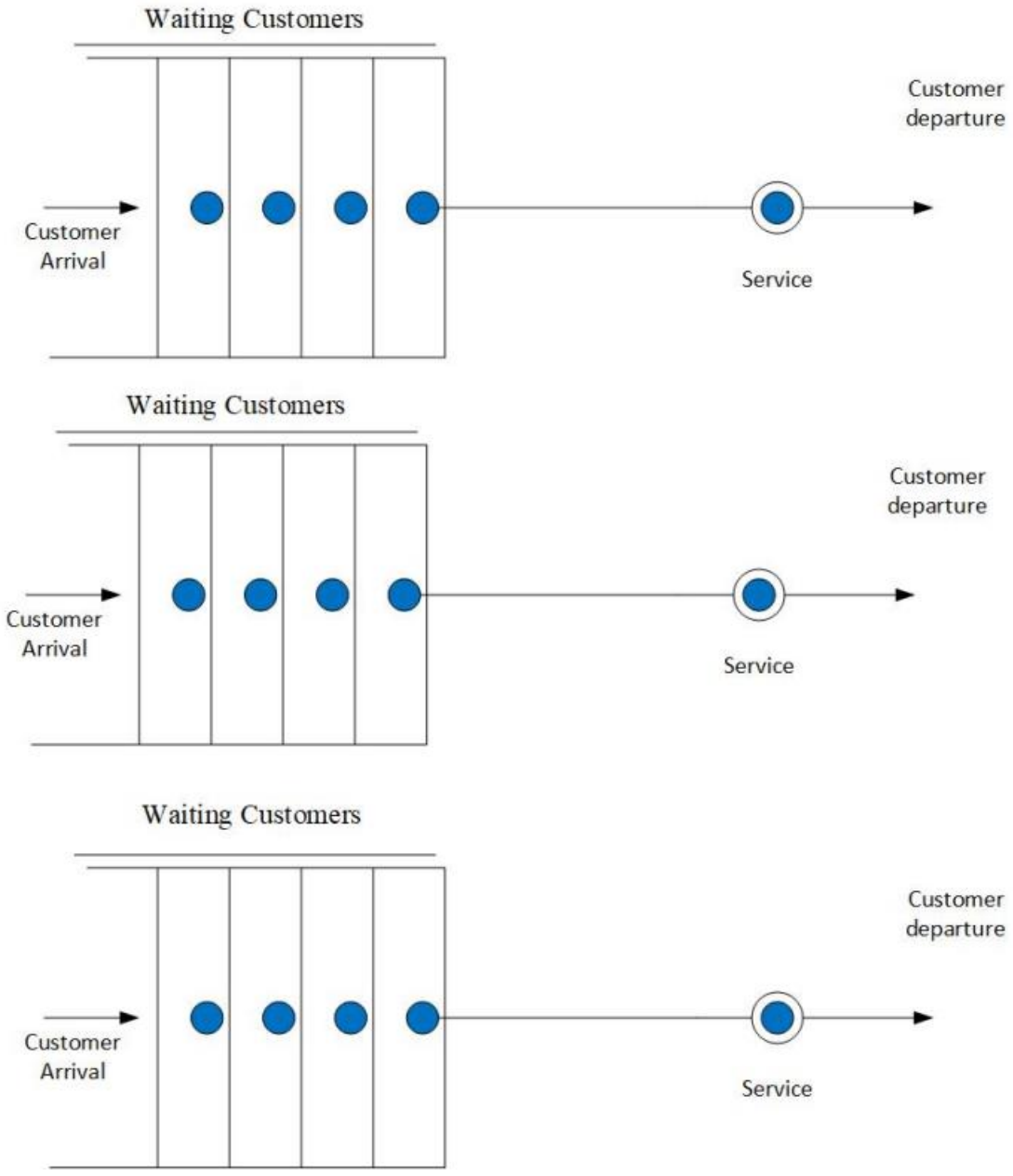

Figure 3.4. Multiple queue single servers

Figure 3.4 shows the queue for multiple queues and single servers.

According to figure 3.2, the unlimited capacity for single server is explained. The shuttle management system for both the proposed system and the established system can be viewed using figure 3.2 and figure 3.3 because sometimes a single shuttle comes while some time multiple of

them comes. Either way the customer enters the queue until the shuttle is filled and the server would need to go and drop the customers. For the proposed system, Covenant university shuttle Management System, single sever can be used in situations where the idle time is less, whereas the multiple server system can be used when the more. Mixture of both the proposed and already established system can be used to obtain a very efficiency system and these would be made use of in CUSMS. Table 3.1 gives a description of the formulas for single queue single server and multiple queue multiple servers.

Table 3.1 below to compute different queuing theory related works.

Description	Single queue single server	Multiple queue singular server
Prob [system is empty (idle)]	$P_o = \mathbf{1} - \frac{\lambda}{\mu}$	$P_o = \frac{1}{\Sigma(\frac{1}{n!}(\frac{\lambda}{\mu})+\frac{1}{s!}(\frac{\lambda}{\mu})^s \frac{s\mu}{s\mu-\lambda})}$
Average number in the queue	$L_q = \frac{\lambda^2}{\mu(\mu-\lambda)}$	$L_q = Ls - \frac{\lambda}{\mu}$
Average number in the system	$L = \frac{\lambda}{\mu-\lambda}$	$L= \frac{\lambda\mu(\lambda/\mu)s}{(s-1)!)!(s\mu-\lambda)\text{^}2} P0 + \mu\lambda$
Average time in the queue	$Wq = \frac{\lambda}{\mu(\mu-\lambda)}$	$W_q = \frac{L^2}{\lambda}$
Average time in the system	$W = \frac{1}{\mu-\lambda}$	$W = \frac{L}{\lambda}$
Is the arrival rate	λ=1/ [inter-arrival time]	

Is the service rate	$\mu = 1/[\text{inter-service time}]$	
Utilization factor	$\rho = \lambda / \mu$	$\rho = \lambda / \mu c$

Where the meaning of the following is,

λ = arrival rate

μ = service rate

W = Average time in the system

W_q = Average time in the queue

L = Average number in the system

L_q = Average number in the queue

P_o = Prob [system is empty (idle)]

ρ = Utilization factor.

C = number of servers

3.2.3 Application's Database

This Chatbot collects user inputs and stores it in the database. This data is usually structured (sometimes called organized data) and it comes from different places, in this case of this project, from Covenant University students or non-student, and also the admins. The Chatbot needs this data to identify and forwards different inputs to either the client or the admin when the need arises. The database that stores both the user's booking request and the RFID authentication request is called "mysqllite".

In comparison with a fully functional database example being the MySQL, PostgreSQL etc. that requires a separate process in a “server”, an MYSQLlite is a “serverless” database. It is integrated into the application so one does not need to configure anything. One has the option to write the database into a disk or put everything into a memory. Minimal configuration is required, and it runs on a self-contained manner, meaning that there an Operating system to interact with it is not needed to interact with it as do normal database application. The shuttle management system data was fed into the database which was “MySQLite” using both an automatic and the manual approach.

Manual: In this design method, data is manually fed into the database. An example is in the case of creating an RFID code database for students. It can be done manually using python to MySQLite. The Python creates a database file which could be opened with MySQLite application. The relevance of this is using the RFID student’s database as example is that students don’t have to always input their RFID code, but it has been stored permanent on the system.

Automatic: A user’s data can be fed into the database using the automatic approach which is a way to continually feed the system the user’s details. This is method entails sending details about user from the telegram software into the MySQLite database. It is relevant for transaction records, time, username, account, notes, etc. In this work, the shuttle management system works with both a manually and an automatically designed database. The manual data, which is the RFID code was gotten from RFID cards and the automatic data was gotten from clients already registered with the software using the telegram application.

Tables in database: Tables of that consist of the database for Covenant University Shuttle Management System includes tables for both the automatic and manual method of accessing the database

Tables for automatic method: For the Chatbot application of the shuttle management system has six tables and this is the part for the automatic feeding part of the shuttle management system that gets data fed into the MySQLite database automatically. They include: The admin, the ordered items, orders, products, transactions, users.

1 Admin: This table gives room to input admins details for the system
2 Orders: This table gives room to input data relating to description of the summary of the transaction done by the ordering process between the client and the admin.
3 Products: this table gives room to input an admins product which in this case is the vehicle.
4 Transaction: This table gives room to input data by the admin in crediting a users account.
5 Users: This table gives room to input data of the users on telegram.
6 Orderitems: this table gives room to input data relating to the shuttle system orders made by various individuals.

Tables for manual method: The manual database contains only 1 table. The table is divided into three columns which are “student id”, “name”, “rf id code”. This table gives room for input of names of students, their matric number and their rfid code for payment

3.2.4 Interface: Python Programming Language

Python programming language gives room for the creation of software application. This programming language can be used to create various types of applications. With the understanding of this tool, a simple and easily understood interface was created for the shuttle management system’s Chatbot and authentication’s program. Python programming language makes use of

different libraries, and these libraries gives it room for an extended functionality. An example of what this library does is creating a link between the server and telegram, creating a link between the server and the RFID authentication device, creating a link between the server and the database which in this case is mysite, creation of a room to develop the Chatbot application which also includes the inline keyboards etc. The project consists of the Chatbot and RFID authentication. The Chatbot software is that which enables the user to make a request or to order a ride. The RFID authentication: software by which a customer authenticates his/her identity. Table 3.2 gives description of the hardware components and their functions.

Table 3.2. Hardware part and their functions

Hardware and software parts	Functions
Application	To create a link between the RFID reader and the database
Database	A set of user's RFID code list stored in MySQLite for authentication
MFRC522 RFID READER	The device by which reads the details of an RFID card or tag to a system.
RFID tags/cards	A card/tag which has RFID chip layout and stores information to be read by a unique RFID reader.
Arduino	A micro-controller that coordinates the entire process of the authentication system

ESP8266 ESP-01	A device which allows wireless communication and would in the case of this project be used to wirelessly send RFID details of the scanned card/tag

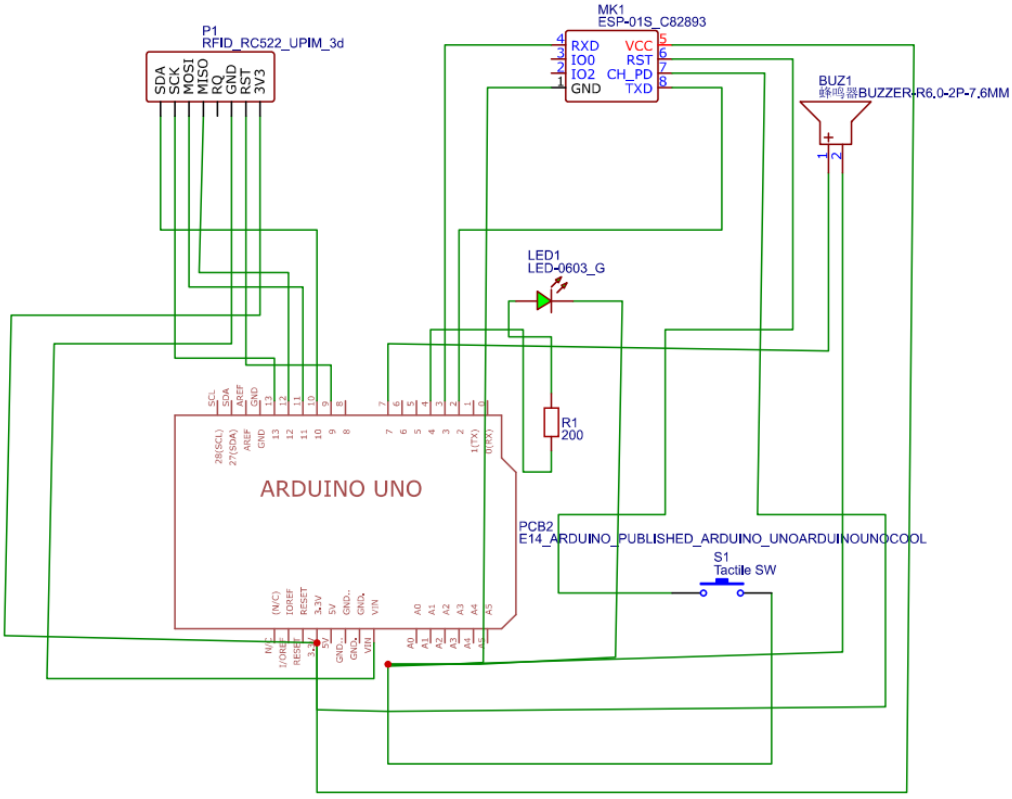

Figure 3.5 RFID circuit diagram

The circuit diagram above in figure 3.5 describes an RFID system which includes the Arduino Uno, ESP-01 ESP-8266, the buzzer, LED, MFRC522 RFID reader and tags, jumper cables and the circuit diagram for the connection. Table 3.2 gives description of relevant python modules, their functions, and their use in this project.

Table 3.2 Relevant python module and its function

Python module	Function	Use in project
SQLAlchemy	This library makes communication between python programs and databases possible	Communication between python programs and databases is made possible by this.
Logging	This is a standard library that provides the facility to work with the framework for letting out the log messages from python programs.	This would log the state of the bot
Telegram	This is a module for sending notifications through telegram.	Communication with telegram client
Bottle	Bottle is a web framework, and it is capable to server http request. Furthermore, this module needs no other dependencies, and it rests on only python standard library.	It will be used to query the database and sends back a JSON Object to the request made by the ESP8266 ESP-01.
Paste	Service of a deployment server will be rendered by this module	Since the bottle module comes with its own non-Threading server, but the paste will behave as a http server that is multithreaded I.e enables the application to serve multiple

		requests in situations of project expansion.

3.2.5 Flow Chart Description of User Interaction with Covenant University Shuttle Management System.

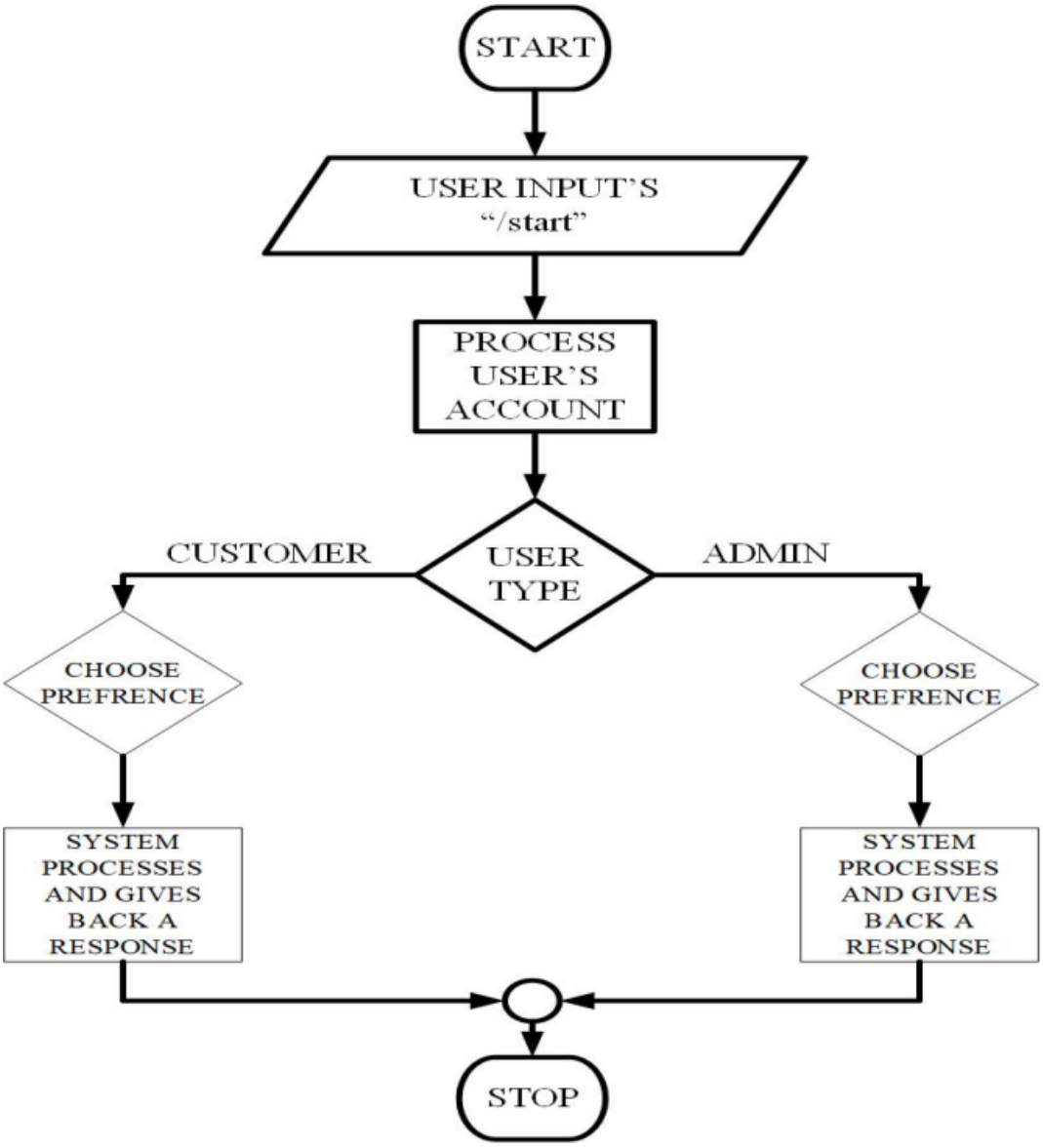

Figure 3.6 Flow chart of shuttle management system

From the flow chart diagram above, the shuttle management system operation starts up when the user inputs the word "/start". The system is programmed to analyze the user's telegram account by default and gives a response of a user interface either for an admin or a customer. This user interface is made up of inline keyboard which the user would have to input a choice, so the machine knows the user's preference either for the customer or the admin and the system gives back the appropriate output for such user.

3.2.6 Use Case for The Application

A use case is a behavior diagram used in system engineering that visualizes interactions that are observable between the actors (the system customer and admin) and the system under development. In Figure 3.6, a basic understanding of the interaction of the customer and the admin with the shuttle management system is laid out which is to authenticate a user which comes to enter a ride using a Chatbot. The admin can also go to customer mode if they prefer to order a ride themselves.

The system user (customer and admin) only interacts with Chatbot with the user interface (UI). The user inputs press a key on the inline keyboard and receives a response from the database. This database through the interface (python source codes) provides the relevant response to the user's input

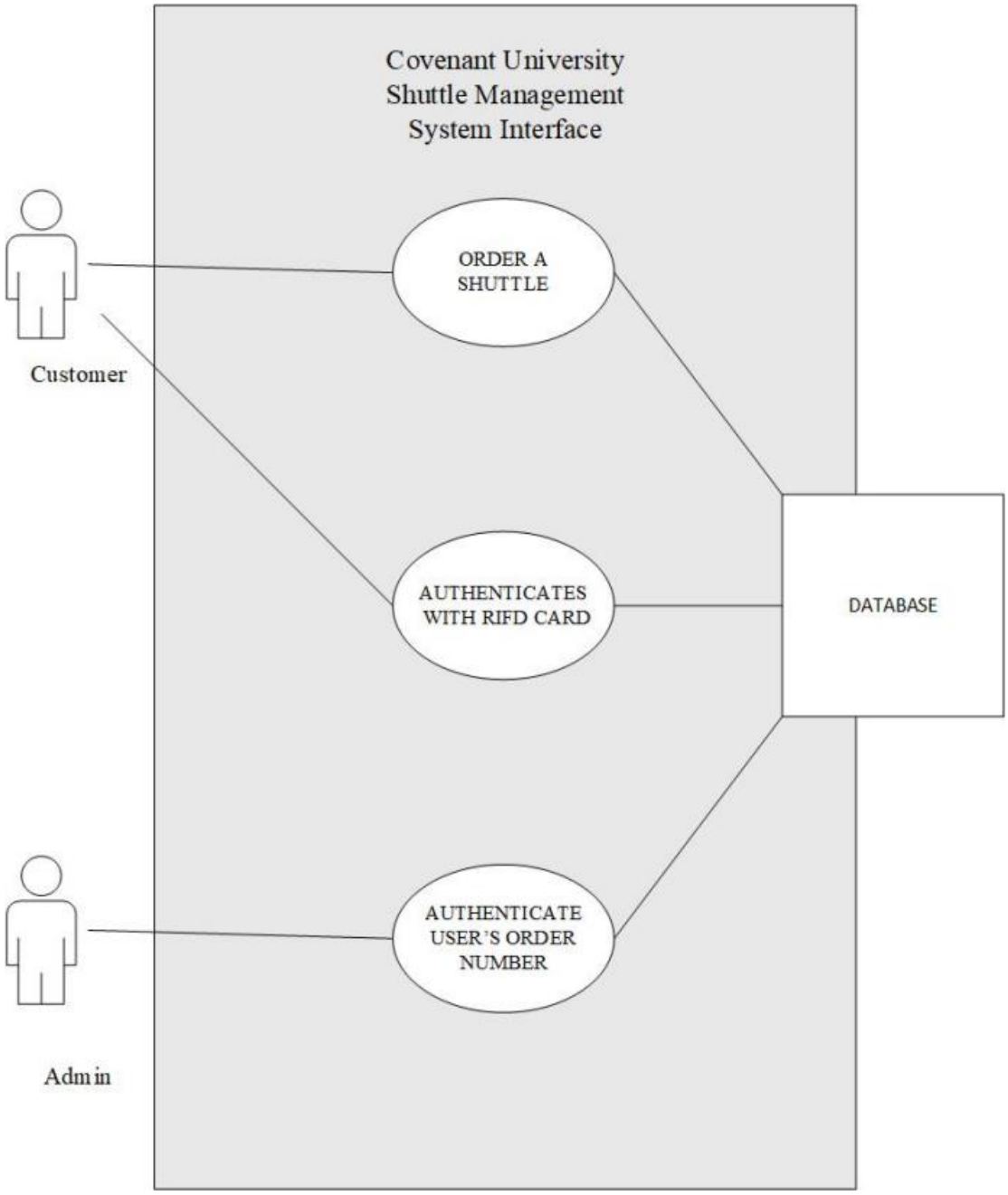

Figure 3.7 Simple use case diagram of Covenant University shuttle management system.

According to figure 3.7, the shuttle driver only authenticates customer order number. Customer can use RFID, Chatbot or both to access a shuttle service.

Table 3.3. give description to the BEME used in Covenant University shuttle Management project.

Table 3.3 BEME

S/N	Items	Unit	Cost (₦)
1	Laptop	1	285,00.00
2	Python Software	1	
3	13.5mhz MFRC522 RFID kit	1	1,500
4	13.5mhz RFID card	5	750
5	13.5mhz RFID tags	1	300
6	200ohms Resistor	1	30
7	ESP8266 ESP-01	1	1,700
8	BREADBOARD	1	750
9	BUZZER	1	400
10	green LED	1	5
11	Jumper cables male – male	40	750
12	Multimeter	1	3,500
13	Soldering iron	1	1,600
14	Arduino Uno	1	10,500
15	Arduino 9V battery connector	1	300
16	Duracell battery battery	1	2,200
17	Vero board	1	250
18	Tact button	1	20
19	Switch	1	80

		Total	309,630

3.3 Summary

This chapter gives description of the Covenant University shuttle management system methodology.

The OR gate representation shown in table 3.4 below is shows that a user can use a shuttle so long the output is 1and not 0, but this may affect the service rate.

Table 3.4 OR gate representation of CUSMS.

System	Input 1	Input 2	Output
No RFID nor chatbot	0	0	0
RFID	0	1	1
Chatbot	1	0	1
RFID and chatbot	1	1	1

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Introduction

This chapter details the execution result of the conversational system for a tertiary institution. As mentioned earlier, the Covenant University shuttle management system is tailored specifically towards Covenant University clients both students and staff. The execution results display the several functionalities and range of typical a scenario that can occur using the established system and its limitations. And how the proposed system would help overcome these limitations for both the Chatbot and the authentication/payment system. Therefore, this chapter shows how to access of the Chatbot interface, the error handling for the Chatbot, Chatbot response rate, RFID payment system and system evaluation and the summary.

4.2 Accessing the Chatbot Interface

The shuttle management system is in two phases, the Chatbot and the RFID authentication. The Chatbot is implemented as a telegram application. This application can be installed by any user using a mobile device, a personal computer (PC), an iOS device or any device that telegram application can be downloaded. When a user searches for the name of the bot which is “CUSMS”, it comes up and it is being clicked upon and the user enters the word “/start” to begin the operation of the code. The interface should open and if it is being ran for the first time, that person who opened the bot becomes the owner and the user is being taken to the “admin page” according to figure 4.1 however the Chatbot’s owner could still be edited in the myslite database. The admin can assign new admins. If a user is not an admin, it automatically opens up the interface in figure 4.2. The figure 4.2 is the default customer interface and it has only N0.00 as the amount.

Transactions could be carried out by the admin to credit a customer's account and this is because that is the only way a shuttle could be booked in the order ride inline keyboard key.

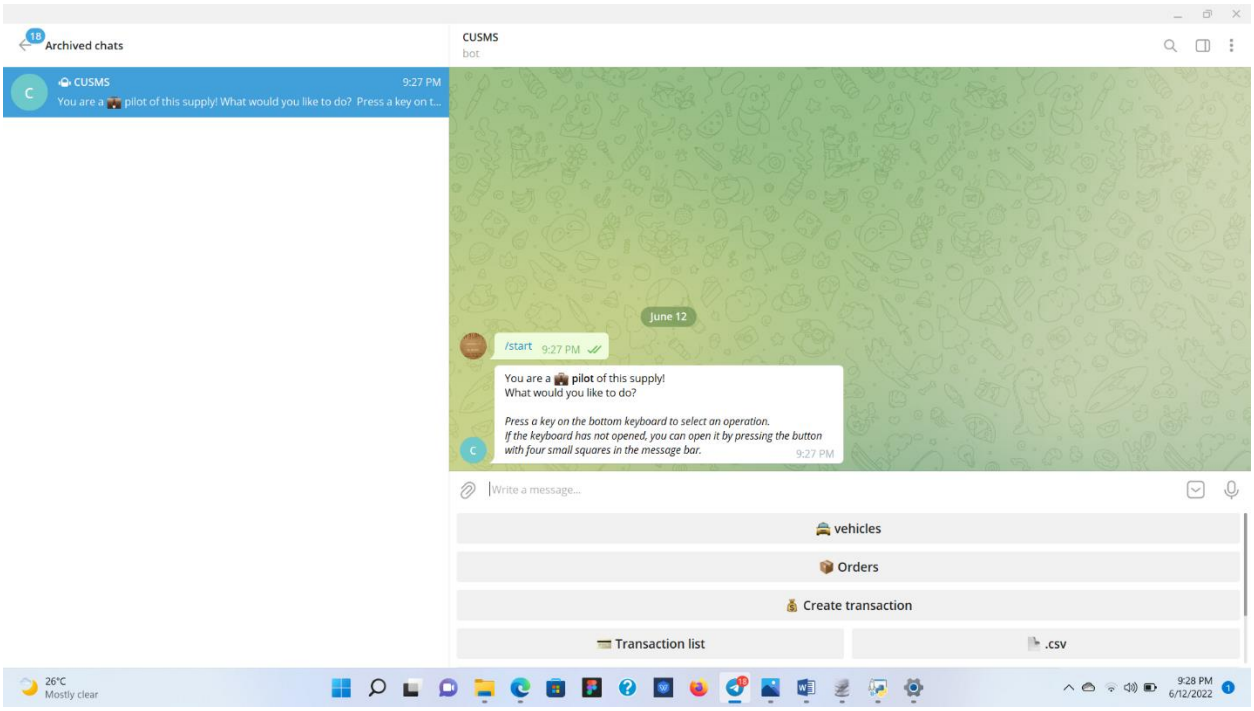

Figure 4.1 Admin interface

This bot interface according to figure 4.1 could receive orders, modify vehicles, create transactions and switch to the user mode.

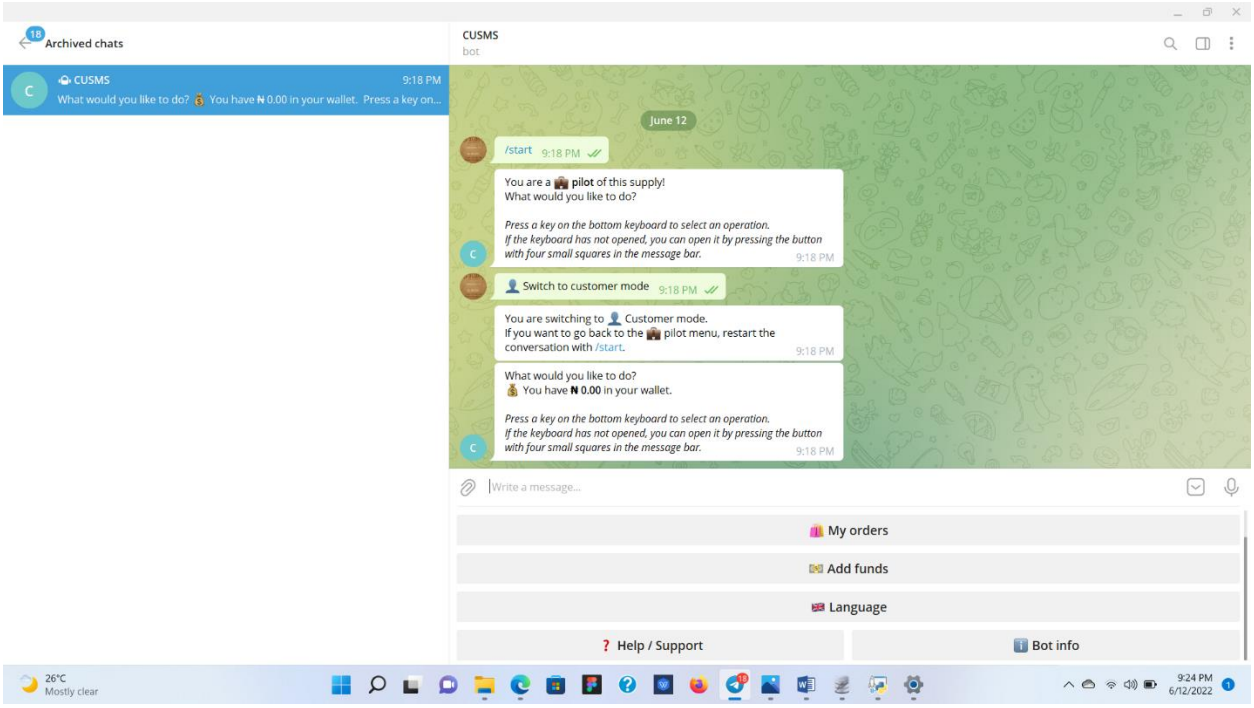

Figure 4.2 customer interface.

This bot interface according to figure 4.2 belongs to the customer, and one could carry out transactions and check transaction history. The available commands include: my orders, add funds, language, bot info, help/Support.

4.3 **Error handling testing for Chatbot**

This bot is a rule-based bot, and it online responds to the inline keyboard keys except in cases that the bot request for a location input which is gotten from the “order ride” section. The Chatbot can automatically detect an error if the python source code is tampered with or if there is maintenance correctly going on at the backend. It shows the user (either customer or admin) a message according to figure 4.3. This could be because of maintenance or because the backend has been tampered with.

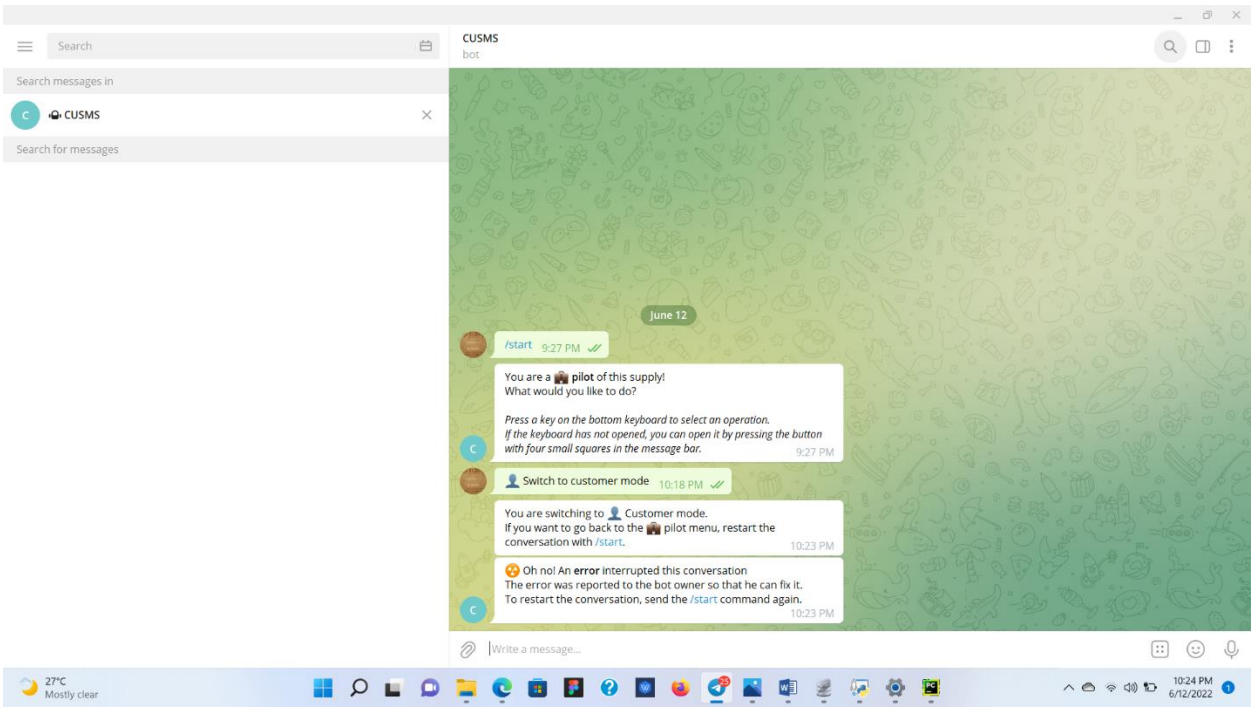

Figure 4.3 Response detection.

The figure 4.3 above comes up only when the bot goes into an error, usually from the backend (python script and MySQLite). It displays *"☢ Oh no! An error interrupted this conversation The error was reported to the bot owner so that he can fix it. To restart the conversation, send the /start command again.*".

4.4 Chatbot response rate

The response rate of Covenant University Shuttle Management System Bot is satisfactory. Every registered telegram user would have a unique account bot for customer and admin. So long the internet connection is stable to host the program and the memory is enough, the bot shouldn't give any issue, however some bugs could still be present because this is a product of copyleft.

4.5 RFID payment program

The RFID payment system is used for paying the shuttle rides.

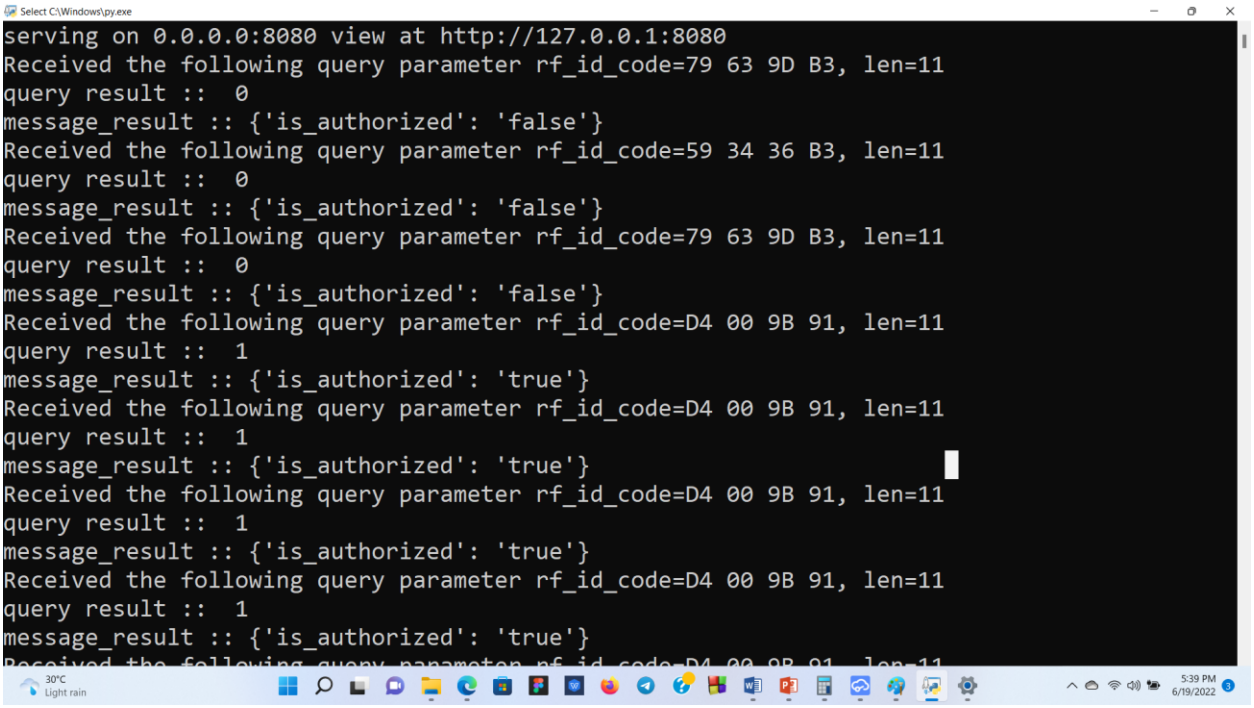

Figure 4.4 RFID payment system backend user interface

The figure 4.4 above shows the user interface of the payment system of the RFID for administrator. The Boolean true is for “1” which means the RFID card/tag is valid and the Boolean false is for “0” which means the RFID card is not a valid card/tag.

Figure 4.5 RFID payment system.

The figure 4.5 above shows the hardware system payment which is to be used by an RFID. Either a green LED light comes on which indicates a valid card or a buzz sound which indicates a card that is not valid.

4.6 System Evaluation on established system and proposed system

This section uses queue theory to show the performance of shuttle management in the system already running and the system being proposed.

4.6.1 Evaluation on established system

To perform an evaluation of the covenant university shuttle management system, the already established system would be analyzed using queue theory then the CUSMS would be analyzed using queue theory for both the Chatbot and RFID. The single queue single server and single queue multiple servers is utilized for the CUSMS and for the already established system.

According to interview taken on the 17th of January 2022, there are about 7 shuttles which includes 3 Toyota corollas, 2 Siannas and 2 hiace buses. Table 4.1 gives a description of the vehicle gotten from this interview

Table 4.1 vehicle description.

Vehicle Description	Number of vehicles	Seats number
Toyota Corolla	3	4 * 3 = 12
Sienna	2	9 * 2 = 18
Hiace	2	20 * 2 = 40
Total	**7**	**70**

Using Toyota corolla as case sample, a model using queue theory would be check for both multiple server single queue and single queue multiple servers. The active time for a shuttle is from 6:30AM to 10PM and the rush hours are from 7:30AM to 9:30AM and 4:30PM to 6:30PM. And the remaining time which is about 4hour and thirty minutes (6:30AM to 7:29AM and 6:31PM to 10PM). The available shuttle bus stops include Cafeteria 2, Electrical and Information engineering department, Civil engineering department, Mechanical engineering department, Lecture theater shuttle stance, chapel shuttle stance. Two possible scenarios would be modeled for the queue

theory analysis which are single server and multiple servers taking scenario 1 and scenario 2 respectively. Using chapel shuttle stance as location case sample due to its location in relations to hall of residence. Taking the average of the total vehicles gives 4 vehicles and some useful information from assumptions is given which the table 4.2.

Table 4.2 Scenarios and instance of shuttles on a typical day

S/N	Instances	λ (per minutes)	μ (per minutes)	C (servers)	ρ (Utilization factor)
1	Instance 1	0.3	10	4	0.03
2	Instance 2	0.2	10	4	0.01
3	Instance 3	0.1	10	4	0.02

Scenario 1 (multiple server): For this system with Kendall's notation being M/M/ 4/ ∞ / FIFO, λ = 0.3333 (customers per minutes arrive at the shuttle stance), μ = 10 (customer per minute are served), C = 4 (serving Toyota corolla shuttles). Computing for probability that the system is empty, the average number of units in the system, the average amount of time a unit will spend on the system and the utilization factor. Solutions

Probability the queue is empty

$$\mathbf{P_o} = \frac{1}{\Sigma\left(\frac{1}{n!}\left(\frac{\lambda}{\mu}\right)+\frac{1}{s!}\left(\frac{\lambda}{\mu}\right)^{s}\frac{s\mu}{s\mu-\lambda}\right)}$$

$$\mathrm{Po} = 1/\left[\sum_{\mathrm{n=0}}^{\mathrm{c-1}} \frac{1}{\mathrm{n!}}\ [\lambda/\mu]\right] + 1/\mathrm{C!}\,[\lambda/\mu]\text{^}\mathrm{c} * (\mathrm{C}\mu/\mathrm{C}\mu - \lambda)$$

$P_o = 0.9672$

Average number in the System

Ls = $\frac{\lambda\mu(\lambda/\mu)s}{(s-1)!)!(s\mu-\lambda)^2}$ P0 + μλ

Ls = $\frac{0.333310(0.3333/10)4}{(4-1)!(410-0.3333)2}$* 0.96752 + $\frac{0.333310}{10}$

Ls = 0 unit in the system, on average

Average Time a unit spend in the system

$\mathbf{W_q}$ = W_s– 1/μ

W_q = W_s–1/10

Wq = −0.1 minutes in the queue, on average

Scenario 2 (single queue single server): For this system with Kendall's notation being M/M/ 1/ ∞ / FIFO. λ = 0.3333 (customers per minutes arrive at the shuttle stance), μ = 10 (customer per minute are served). Computing for average number present within the system, average time a unit spends within the system. Solution is given below.

λ = 0.333(1/3) customers per minutes arrive at the shuttle stance

μ = 10 (1/ (6/60)) customer per minutes are served

Average number within the System

L = λ /μ - λ

L = 0.034447 meaning about 0 people present within the system

Average Time a unit spend within the system

W = 1 / μ- λ

W = 1/10 - 0.333

W = 0.103444 minutes is the average time in the system.

single server single queue utilization factor is calculated using the three instances is given below.

computed for the three instances as follows:

$\rho = \lambda / \mu$

$\rho = 0.3333/10$, for inter-arrival time of 3 minutes

$\rho = 0.2/10.$, for inter-arrival time of 5 minutes

$\rho = 0.1/10.$, for inter-arrival time of 10 minutes

Instance 1 = (7:30AM - 9:30AM and 4:30PM – 6:30PM) $\rho = 0.03$

Instance 2 = (9:31AM to 4:29PM) $\rho = 0.02$

Instance 3 = (6:30AM - 7:29AM and 6:31PM – 10PM) $\rho = 0.01$

The description of the graph below in figure 4.6 and figure 4.7 uses utilization factor against time divisions. The above queue theory analysis for scenario one and scenario two shows the already established system is good in terms of speed, and the delays are minimal but only when a crowd willing to enter a shuttle approach. Since the delay is minimal, one could use Poisson distribution process to represent μ and λ with the values 0.3333 and 10. from 7:30AM to 9:30AM, 9:30AM to 4:30PM, 4:30PM to 6:30 PM and 6:30PM to 10PM are the three instances. Hence, the entire hours between these hours a shuttle is active are 15hours thirty minutes. Since it takes an average of about 6 minutes to drop a passenger and return, taking chapel as reference point, the 15 hours thirty

minutes could be divided by 6 which gives one hundred and fifty-five minutes (155). This divisions are plotted against utilization factors is the three instances in the figure 4.6 and 4.7 below.

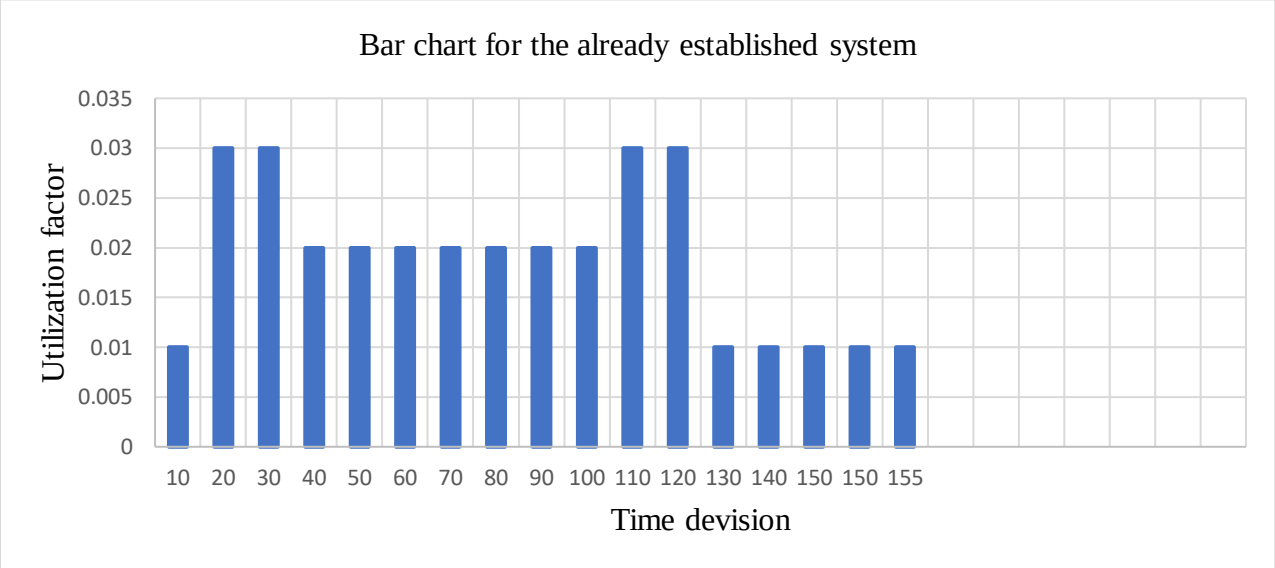

Figure 4.6 Bar chart for the already established system

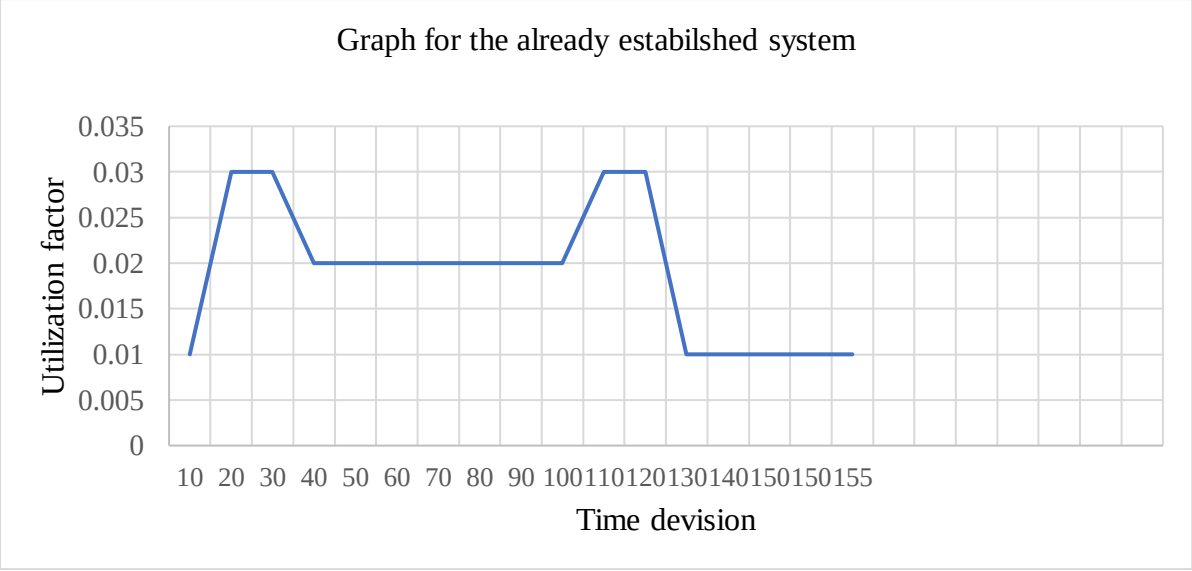

Figure 4.7 Graph of the already established system

The description of the charts below in figure 4.5 and figure 4.6 uses utilization factor against time divisions. The above queue theory analysis shows the already established system is good in terms of speed, and the delays are minimal but only when a crowd willing to enter a shuttle approach i.e. instance 1 and 2. Since the delay is minimal, one could use Poisson distribution process to represent μ and λ with the values 0.3333 and 10. from 7:30AM to 9:30AM, 9:30AM to 4:30PM, 4:30PM to 6:30 PM and 6:30PM to 10PM which are three instances. Hence, the entire hours between these hours are 15hours thirty minutes. Since it takes an average of about 6 minutes to drop a passenger and return, taking chapel as reference point, the 15 hours thirty minutes could be divided by 6 which gives one hundred and fifty-five minutes (155). This divisions are plotted against utilization factors is the three instances

4.6.2 Evaluation on proposed system

A software should satisfy two things. One is customer satisfaction, and another is meeting high profit for the owner or the organization. CUSMS would bring these needs according to analysis below because it does not replace the previous system but adds to what is already in existence to the previous system and hence would overcome the limitation of the previous system. This by the payment and ordering system improvement.

$\lambda = 0.66666$ (1/6) customers per minutes arrive at the shuttle stance

$\mu = 10$ customer per minutes second are served

$L = \lambda / \mu - \lambda$

$L = 0.00840336$ meaning about 0 people in the system

$W = 1 / \mu - \lambda$

W = 1/ (10 – 0.66666)

W = (0.10714) minutes is the average time in the system.

$\rho = \lambda / \mu$

$\rho = 0.006$

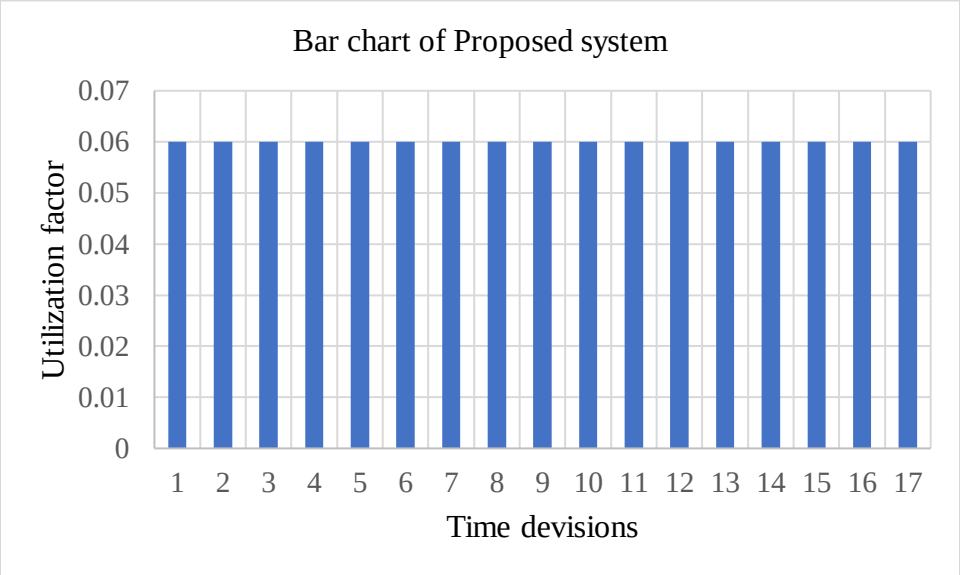

Figure 4.8 Bar chart for the proposed system

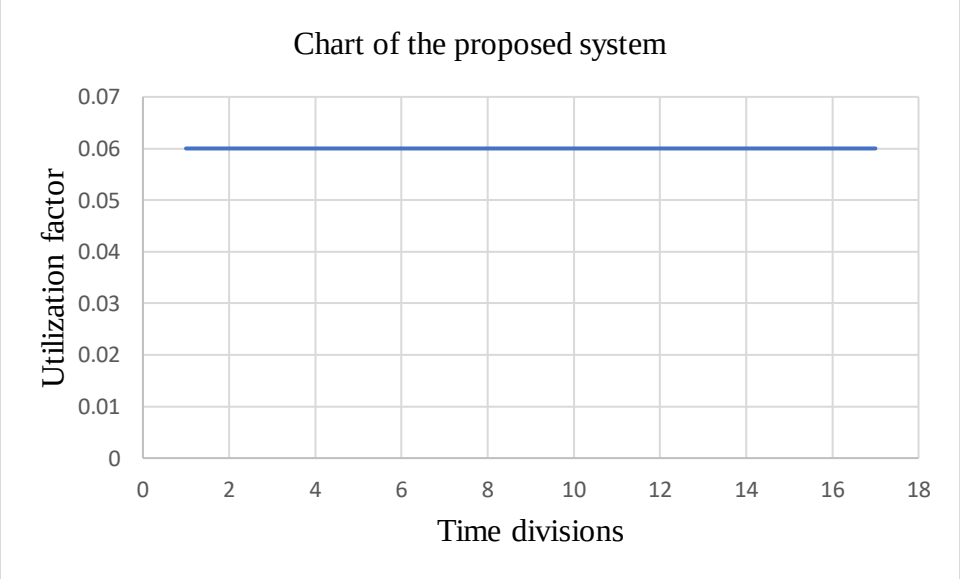

Figure 4.9 Chart of established system.

Figure 4.8 and Figure 4.9 shows that the shuttle RFID payment method would provide a better service rate that the established system in terms of speed. The Chatbot gives the shuttle drivers certainty of where a customer is, and it gives a customer certainty of a shuttle coming. The Covenant University shuttle management system is an addition to the already established system so therefore there is a high pool of request for all the shuttle drivers/admin and the possibility of the pool being empty is very small so therefore there would be no ideal time, and this would even provide a better quality of service for the customers.

The proposed system payment would be better because the normal arrival rate is 0.3333 but due to a new system, arrival rate would double and utilization factor steady because people have multiple options. The OR gate representation shown in table 4.3 below is shows that a user can use a shuttle so long the output is 1and not 0, but this may affect the service rate.

Table 4.3 OR gate representation of CUSMS.

System	Input 1	Input 2	Output
No RFID nor chatbot	0	0	0
RFID	0	1	1
Chatbot	1	0	1
RFID and chatbot	1	1	1

Using the proposed RFID system for payment alone i.e., having 1 for input 2, $\lambda = 0.66666$ (1/6) customers per minutes arrive at the shuttle stance

$\mu = 2$

0 customer per minutes second are served

$P = 1 - \lambda / \mu$

$P = 1 – 0.666/20 = 0.96667$

Since the server's probability of being idle is 0.9667 that means the queue is not being used and that means shuttle drivers are getting more customers so the efficiency could be said to be 0.9667*100.

Efficiency = 96 percent efficiency

Meaning the system is close to being empty because everyone is being served and people are not on the queue system. This is a sign of growth in the shuttle management system.

The efficiency of the proposed system is 96 percent

Profit per Toyota corolla shuttle (₦)

Daily = ((16.5*60)/3 *4*100)) – (100-96.667) = 131,996.667

Weekly = (131,996.667*5) = 659,983.335

Monthly = 659,983.335 * 4 = 2,639,993.34

Per session = 2,639,993.34 * 4 = 10,559,733.36

4.7 Result

The results of this project are measured in the relevance, efficiency, and profit. The relevance is to the customer. The proposed system is very relevant because it doesn't substitute the established system, but it is an addition. The proposed system brings an efficiency of about 96% for shuttle

system in general because it adds to what is already established and hence the profit it goes to an organization is high because its efficiency is about 96%.

4.8 Discussion

This system is very efficient, and it allows people who are not student to be able to use it because it captures both RFID and Chatbot. So, staff can call ride using the Chatbot and pay using their cards or just use the established system. The proposed system is flexible enough to work on days that University is on vacation. Here the Chatbot would be used and majorly order numbers would be used as a payment system.

4.9 Summary

This chapter gives the breakdown of how a shuttle management system works, in terms of the result gotten from using queue theory to evaluate it, which gave a good result, and the discussion from the results obtained

CHAPTER FIVE

CONCLUSION AND FUTURE WORKS.

5.2 Summary

To conclude, Covenant University Shuttle Management System is helpful in calling shuttle at times where there is uncertainty of availability of shuttle, and it ensure electronic payment using an RFID. It makes shuttle accessible to all student because they only need the RFID card to enter a shuttle hence it would be fast entering shuttle would be fast and shuttle would know where and where to go to. Covenant University Shuttle Management System improves efficiency in the workplace by reducing tasks of finding passengers that shuttle drivers and reduce uncertainty of shuttle's availability when passengers need shuttle.

A rule based Chatbot which majorly uses inline keyboard was used for the development and implementation of the booking system. Queue theory was used to evaluate different scenarios of a how a shuttle behaves in Covenant University and the data gotten to construct these scenarios are gotten from a shuttle driver, a staff and a student. A flowchart was used to model the shuttle Chatbot behavior for both Admin and the customer hence an overview of how the system works for a user is documented in this work.

5.3 Recommendation

To improve the current functionalities of the Covenant University shuttle management system, in the future, the scope of the Chatbot can be increased by inputting GPS functionality and making the calling of shuttle automated. The method the RFID authenticates users and then makes payment can be improved by making a program that connects the finical account to not only the Chatbot but also the Chatbot and RFID so either the Chatbot or the RFID could be used and when the money is finished it would not allow such a user to enter the shuttle

5.4 Achievements

From the development of Covenant University shuttle management system (CUSMS) in this project, the achievements that were seen achieved include and limitations are highlighted below

5.4.1 Achievements

1. Employing the Telegram software for the interfacing with the CUSMS Chatbot for calling/ordering a shuttle ride.
2. Creation of an authentication and payment system via the use of an RFID system.
3. This Covenant University Shuttle Management System can be used also in other Universities.

5.4.2 Limitations

1. The RFID has not been tested for cyber-attacks like DDOS which would make the server overloaded.
2. The shuttle drivers can only take orders from the management in handling the Chatbot request. If the people's orders are too much, they would have to wait till it gets to their turn.

5.5 Conclusion

This project is about a system known as Covenant University Shuttle Management System which ensures that customers (student and non-students) registered on telegram can call a shuttle by placing orders, specifying their locations. Also, payment can be done using the RFID system which is also a means to authenticate that such an individual entered the shuttle ride.

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