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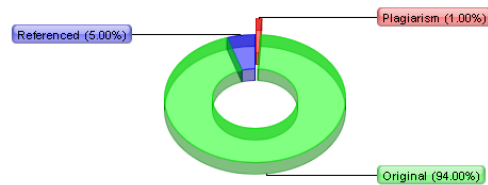
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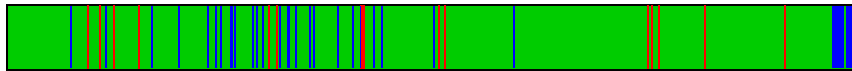
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AUTOMATED RENTAL SYSTEM FOR INTERNET CAFE

Cabangan,
Felmae
Bernaline S.

Dejelo, Jeanmuelle G.

Southern Luzon State University

College of Engineering

June 2020

BIOGRAPHICAL SKETCH

Name: Felmae Bernaline S. Cabangan Birthdate: March 24, 1999 Birthplace: Dasmariñas,
Cavite Permanent Address: Brgy, Poblacion, San Antonio, Quezon Contact Number:
+639092109691 Email Address: cfelmaebernaline24@gmail.com Educational Background:

School University

Inclusive Years

Honor/Award

San Antonio Central School

2005

- 2011

N/A

Manuel S. Enverga Institute Foundation Inc. 2011

- 2015

N/A

Southern Luzon State University

2015

- 2020 N/A

Academic Affiliations:

Institute of Computer Engineers of the Philippines

Member

2019-2020

Future Engineers League

Member

2015-2020

Institute of Computer Engineering Students

Member

2017-2020

Society of Computer Engineering Students Member

2017-2020

SLSU's Department of Science and Technology - Scholars Organization Member

2017-

2020 BIOGRAPHICAL SKETCH

Name: Jeanmuelle G. Dejelo Birthdate: June 15, 1998 Birthplace: Lucena City Permanent Address:
Quezon Avenue, Sampaloc, Quezon Contact Number: +639778104193 Email Address:
jeanmuelledejelo.g@gmail.com Educational Background:

School University

Inclusive Years

Honor/Award

Sampaloc Elementary School

2005

- 2011

N/A

Manuel S. Enverga Academy Foundation Inc. 2011

- 2015

N/A

Southern Luzon State University

2015

- 2020 N/A

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Member

2019-2020

Future Engineers League

Member

2015-2020

Institute of Computer Engineering Students

Member

2017-2020

Society of Computer Engineering Students Member

2017-2020

CERTIFICATE OF ORIGINALITY

We hereby declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material to which to a substantial extent has been accepted for award of any other degree or diploma of a university or other institute of higher learning, except where due acknowledgement is made in the text.

We also declare that the intellectual content of this thesis is the product of our work, even though we may have received assistance from others on style, presentation and language expression.

FELMAE BERNALINE S. CABANGAN

Researcher

JEANMUELLE G. DEJELO

Researcher

Noted by:

Engr. RENATO R. MAALIWR Research Adviser June 4, 2020

APPROVAL SHEET

In partial fulfillment of the requirements for the Degree Bachelor of Science in Computer Engineering, this research paper entitled, Automated Rental System for Internet Cafe, has been prepared and submitted by Felmae Bernaline S. Cabangan and Jeanmuelle G. Dejelo, who is

hereby recommended for oral examination. RENATO R. MAALIW III, CPE
 Research Adviser
 Approved in partial fulfillment of the requirements for the degree, Bachelor of Science in
 Electronics Engineering, by the oral examination committee.
 MADONNA D. CASTRO, ICDLSC LEONARD ALLEN R. PAVINO, CPE Member MemberJERWIN V.
 OBMERGA, CPE
 Chairperson
 Accepted in partial fulfillment of the requirements for the Degree Bachelor of Science in
 Computer Engineering.
 June 4, 2020
 RENATO R. MAALIW, DITDate DeanDEDICATION
 To our parents, we dedicate you this research study as our token of gratitude for all your undying
 support
 . This piece of hardwork is also dedicated
 to the teachers who help and guide us in conducting and realizing this final output. Thank you!
 FBSC
 JGD
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 possible. TABLE OF CONTENTS
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	ABSTRACT
	Title: Automated Rental System for Internet Cafe
	Authors: Cabingan, Felmae Bernaline S.
	Dejelo, Jeanmuelle G.
	Advi
	ser: Engr. Renato R. Maaliw IIIThis study entitled
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"Automated Rental System for Internet Cafe"	
<p>was conducted to design and develop a system that will automate the work of a cashier. Components such as sensors, microcontroller, server computer and touch screen display are used in the construction of the said system. Specifically, it aimed to design the physique and graphical user interface of the system, and to determine the appropriate materials needed in the construction of the said system. Likewise, it aimed to create a program for the proper operation of the device. An experimental type of research was used as they will automate the traditional transactions for internet café and they want to compare the manual operation from the automated system. This study intends to handle every retail service transaction in an internet café with less human intervention. The system automates the work of a cashier by using a kiosk that will accept and validate payments through a bill acceptor or through an RFID reader using cards. This system also enables customers to use their smartphones in paying their rental time. The researchers have developed the existing Piso-net which is an internet gaming vending machine by accepting paper bills instead of coins. Also, the individual PCs are networked in the kiosks unlike in Piso-net that have an individual machine for every PCs. With this system, the said business has been able to reduce its labor cost on operation and boosted their sales as people got fond of the said innovative system.Keywords: bill acceptor, internet café, kiosk, microcontroller, RFIDChapter I</p>	

INTRODUCTION

Starting and running a business is considerably tough. Business owners are expected to devote their maximum time, energy, and effort in maintaining it. They need to work and stay up from day until night just to accommodate all the customers needing their services unless they employ someone to work aside for them. But hiring someone attaches additional operating cost and expenses that understandably reduces the net income of any business. Modern technology continues to grow, innovate, and evolve which really made a significant difference in our society. From the onset, technology brought us convenience and has opened a lot of doors to many opportunities that looked unlikely to be imaginable, attainable, and achievable before. It benefits mankind

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mostly from the use of techn

ology from its numerous and diverse uses especially to businesses both small and large in scale. A cashier-less shop is one of those products of technologies that business enterprises are implementing at present. This kind of technology helps not only the proprietors of a business in general but also the customers who experiences convenience and ease with an alternative and yet innovative way of payment service.

https://www.insight.com/en_US/learn/content/2017/02232017-these-small-business-technology-statistics-are-surprising.html

As for

https://www.insight.com/en_US/learn/content/2017/02232017-these-small-business-technology-statistics-are-surprising.html

Josh

Wandisin (2017), Vice President for marketing of Brother Corporation, implicates that their survey shows that a majority of small businesses see a light at the end of the tunnel and are willing to invest in technology solutions to increase productivity and capitalized on new technology trends. Moreover, forty one percent (41%) have plans to increase technology spending on mobile payment systems. https://www.insight.com/en_US/learn/content/2017/02232017-these-small-business-technology-statistics-are-surprising.html

(Lazar, 2017)<https://blogs.constantcontact.com/small-business-mobile-data/>

According to the statement of <https://blogs.constantcontact.com/small-business-mobile-data/>

Ryan Pinkham, sixty six percent (66%) of small business owners rely on mobile devices to manage operations. Like

Plagiarism detected: 0.05% <https://www.fashionedits.com/blog/amazon-opens...> + 2

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in Amazon's Go, the first cashier-less convenience store,

It uses hundreds of cameras and sensors to account what people are buying then the customers' mode of payment is by using their proprietary app. Given these set of examples of modern technological innovation for business applications, customers are now more engaged in businesses implementing this alternative ways of payment which results in additional profits. They are interested not just because it is new and innovative but because of the convenience the technology and innovation that it brings to them.

Background of the Study

<https://psa.gov.ph/content/2012-census-philippine-business-and-industry-information-and-communication-all>

According to the study conducted by Philippine Statistics Authority (PSA) entitled

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"2012 Census of Philippine Business and Industry - Information and Communication for All Establishments"

released last 2015, two-thousand seven-hundred ten (2710) of other telecommunications activities are mostly Internet Cafés (Philippine Statistics Authority, 2015). Presently, Internet Café is not just a business that gives a simple computer rental services to the customers but it also offers variety of services such as scanning, printing, e-loading, game, and other non-computer related services such as food and drinks. These kinds of businesses even provide temporary shelters in some aspects as extra services. Managing an internet café requires a lot of management skills and additional manpower due to the varieties of services that it can cater. Based on the study conducted by Progress,

eighty six percent (

<https://www.healthdatamanagement.com/opinion/digital-transformation-success-depends-on-data-governance>

86%)

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of business decision-makers believe that they have at a minimum a two year period to integrate digital initiatives before falling out behind their competitor

ors (Cooper, 2018).

Since there is already a lot of Internet cafés popping out for its known profitability as a business, it therefore requires business owners to act fast, transcend and be unique so that they can gain competitive edge with similar businesses.

The problems associated with having a cashier in stores are well-known and documented. From the perspective of business owners, hiring someone implies an additional operating cost that reduces the net income of a business and the trust for someone is also at stake.

A cashier-less shop is one of the technologies that business owners are interested in as it brings convenience and innovation to both owners and customers.

Objectives of the Study

The main objective of the study is to design and develop a automated rental system that will automate the work of a cashier. Specifically, the study aims to attain the following: To design the physical and graphical interface of the device. To determine the appropriate materials needed in the construction of the

Automated Rental System for Internet Cafe.

To create a program for the proper operation of the device.

To

test and evaluate

the system.

Significance of the Study

The following stakeholders will benefit from this study.

Business owners of an Internet Café

. Internet Café owners will benefit from the study as it will make receiving and handling rental payments with less human effort.

Customers

. The customers will benefit from this study as it will introduce innovation through the use of their smartphones as they can now use their smartphones for payments for additional convenience.

Researchers

. The main researchers of this study will benefit from the study from the experience and knowledge they will earn after the conduction and fulfillment of the research. This will also serve as their opportunity in showcasing their knowledge and skills about the research.

Students and Future Researchers

. Researchers who will conduct a study similar or connected to this study will benefit from it as this will provide information that can be used as a reference to their future researches. Also, this will supply them additional knowledge about the cashier-less style management system.Scope and Limitation

The study is intended limited solely for Internet Café type of business.

It is limited only to aid the business owners in managing the computer rentals for Internet Café and building a more convenient payment method for the customers at the same time. In this study, all computer rental payments will be made with the aid of the device as it integrates both timer and payment system in one single package. This study will reduce the human effort of handling and receiving payments.The prototype of this study will be using a bill acceptor. It will only be accepting twenty and fifty-peso bills. Also, issuance of receipt will not be covered.


D

efinition of TermsThis contains the definitions of the terms used throughout the study.

Bill Acceptor

is used in accepting and validating paperbills in order to accurately register customers' payments.Client

is a computer or computer program that is capable of obtaining information and applications from

 **Plagiarism detected: 0.15%** <https://kullabs.com/class-miscellaneous/caomputer...> + 8 id: 6

a server.

Computer

is an electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program.

Graphical User Interface

(GUI) is a form of user interface that allows users to interact with the system. It shows the information and set of commands within the system. Kiosk

is a stand-alone device placed in a public area for business purposes. It provides information and services of the system.Internet

cafe

is

a simple cafe in which customers pay to use computer terminals to access the Internet.

Local Area Network (LAN)

is a network of computers and associated devices that share a common communications line or wireless link to a server.

Microcontroller

is used to allow the sensor and bill acceptor to be read by the server computerRadio-

frequency Identification (RFID) is used in gathering information from an RFID tag.Server

is a computer or computer program which manages access to a centralized resource or service in a network.

Chapter II

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter exhibits the literature and studies that are relevant to the present study which were obtained from several sources such as thesis, books and the internet to support the study. These explain the different ideas that are related to the study Automated Rental System for Internet Cafe from the past up to the present which serves as a basis for the construction of the conceptual framework.

Related Literature

Building Materials

These are any materials that are used for building or construction purposes. Material selection is important after you have determined the purpose of the design. It may be difficult to maintain a retail kiosk as customers, or even employees can steal or vandalize the kiosk.

According to Stephanie Kropkowski Schaeffer's

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"Kiosks: How to Create a Successful Self-Service Kiosk Project"

, the materials needed for the kiosk can range from metal, wood and injection molded plastic. She added that the function of the kiosks will determine the best material. For the most part metal kiosks are more solid and secure, wood kiosks can give an increasingly refined look, while injection-molded plastic kiosks are preferable for eye-catching design as they can be made in almost any color.Choosing a rugged material for the exterior of a kiosk is a crucial part because they are always available to the public and more vulnerable to theft and general abuse. (Building Outdoor Kiosks to Last, 2016)

Metal/Steel

https://www.designingbuildings.co.uk/wiki/Metal_in_construction

Metals are a solid material that have a good electrical and thermal conductivity and are generally hard, shiny, malleable, fusible and ductile. These are commonly used in the construction industry because of their durability and strength to form structural components, pipework, cladding materials, and other components.<https://www.metalsupermarkets.com/galvanizing-important/> Steels will rust due to atmospheric conditions over time and the degree of the rust will depend on the environment that the product is in. There are protective methods to avoid this such as painting or plastic coating, but these methods have downsides. When damaged, the part of the steel will become rusty and the protective coating will be removed. These protective methods are non-lasting and unreliable because it needs continuous maintenance. A better method for protecting steel materials against corrosion is through hot-dip galvanization or the process of applying a protective zinc coating on metal or steel to prevent it from rusting. According to

<https://www.wenzelmetalsspining.com/galvanized-steel-vs-stainless.html>

Adam Hornbacher of Wenzel Metal Spinning, Galvanized steel is a regular steel sheets that have been coated in zinc to make them corrosion resistant. Wood

Wood is said to be one of the most used natural building materials in the world according to Sadanandam Anupuju. Because of its number of valuable properties such as low heat conductivity, small bulk density, relatively high strength, and amenability to mechanical working makes it as a famous building material. Plastic

Plastics are suitable materials for point-of-purchase (POP) due to their ease of fabrication, outstanding aesthetic properties, and its cost. Kiosks provide customers with access to information in public places such as mall and airports. Plastics are seeing wider use in kiosks where superior aesthetic properties and durability are desired.

As mentioned by James Gregorie (2015), kiosks made from plastics are generally a bad idea because the sun can bleach colors out of it or dry it out which can lead to cracking and breaking. It can be difficult to determine the best materials for the project you are going to build. That is why, when choosing a building material, there are factors to consider such as cost, aesthetics, durability, availability, and maintenance. (Construction: Factors to consider when choosing building materials, 2015)

Cashier-less Store

A cashier-less shopping store is a product of new technology that eliminates the human effort. The store does not need any cashier since it allows customers to pay for their purchased goods with a mobile application or radio frequency identification (RFID) cards.

<https://risnews.com/cashierless-stores-futuristic-experience-can-have-big-impact>

Sahir

Anand (2018), in his online article named

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"Cashier-less
Stores & Futuristic
Experience
Can Have a Big Impact But..."

stated that fresh store concepts are more effective when it is targeted towards particular customer sector and

cashier-less

stores could save customers time if executed properly.

<https://www.forbes.com/sites/lanabandoim/2018/09/26/cashierless-shopping-with-tap-to-go-technology-is-coming-to-more-grocery-stores/>

According to Lara

Bandoim

(2018), the tap-to-go experience for customers and users makes shopping seamless and fast. The payment will work by just tapping their smartphones or cards on the tag under the item they want. It was further discussed that the store uses an electronic tag that beeps and lights up in a green color around the edges once it is tapped. If the customer has changed their mind in purchasing some items, they can put them back and refund the charges by tapping on the electronic tag again. But this time, instead of green color, it will light up in a red color around the edges.

In Chris Albrecht's (2019) article, he made a list of cashierless tech companies gunning for Amazon Go. Different companies have their different approaches that can be advanced than others. Microsoft is one of the companies that want to achieve a cashierless technology. Sam's Club which is owned by Walmart have opened an experimental store last year which uses the Walmart's Scan & Go app to pay for items. Similar to Sam's Club approach, Skip takes part of the competition in the cashierless technology that are targeting the convenience stores. Customers are required to download the Skip app to scan and purchase items in the store. Graphical User Interface

GUI or Graphical User Interface was first developed in 1981 at Xerox PARC by Alan Kay, Douglas Engelbart, and a group of researchers. It is a system of interactive visual components for computer software. It displays objects that convey information, and represent actions that can be taken by the user. User interface design is one of the most important factors to consider when building a mobile app. That is why the mobile designer must go for a comprehensive approach and look beyond the common principles of user flow, feedback, structure, and visibility

.Internet Café

Internet café also known as computer rental is an establishment that allows the public to rent computers to access the internet. The payment is based on the time they have used.

[https://www.google.com/url?q=https://franchisemanila.com/2015/09/internet-cafe-still-a-profitable-business-in-the-](https://www.google.com/url?q=https://franchisemanila.com/2015/09/internet-cafe-still-a-profitable-business-in-the-philippines/&sa=D&ust=1553058817010000&usg=AFQjCNFqzqQQ27c3Nt6l_kLv515Cg4Nrkw)

[philippines/&sa=D&ust=1553058817010000&usg=AFQjCNFqzqQQ27c3Nt6l_kLv515Cg4Nrkw](https://www.google.com/url?q=https://franchisemanila.com/2015/09/internet-cafe-still-a-profitable-business-in-the-philippines/&sa=D&ust=1553058817010000&usg=AFQjCNFqzqQQ27c3Nt6l_kLv515Cg4Nrkw)
According to TJ Fuguroa (2015), Internet Cafés are still a profitable business in the Philippines although the demand for internet browsing using computers has declined because there are a lot of establishments that offers free Wi-Fi, and the mobile internet usage is increasing. He stated that the demand for internet café are still there because there are services that it can provide that cannot be provided by only using the mobile internet such as printing, scanning, and e-gaming. He also stated that internet cafés are the best place to stream movies, videos and live since they have a much stronger connection compared to the use of Wi-Fi wherein the bandwidth is limited. He added that the most of the customer's time and money are spent on gaming, and that the rent for computers of today ranges from 15 pesos per hour in provincial rate up to 25 per hour in Manila. Fuguroa also mentioned that Internet Cafés are still considered to be a good business in the Philippines and to never be hesitant to invest on increasing customer service and satisfaction. <https://businesstips.ph/internet-cafes-2-0-7-reasons-why-there-is-still-a-market/>
The article of BusinessTips (2017) entitled

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"Internet Cafes 2.0 - 7 Reasons Why There Is Still a Market"

stated how internet cafés have provided the equipment and connection for a small fee and also explained why business owners still consider Internet Cafés as a profitable business. One of the reasons of the profitability of the said business is that the demand is there. The major customers of an internet café are said to be the student population. Students uses the internet because of research and study. Also, it can be a place where patrons can play computer games for an hourly fee. Kiosks

<https://fitsmallbusiness.com/what-is-a-kiosk-examples/>

A kiosk is a small, free-standing booth placed in a public area for business purposes. It provides information and services on commerce, entertainment, education, etc. Usually, it is found in large areas with numerous people like malls and theme parks that provide useful details about the area. These are also used in restaurants and fast food industries.

<https://hbr.org/2015/03/how-self-service-kiosks-are-changing-customer-behavior>

In Gretchen

Gavett's

online article (2015)

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"How Self-Service Kiosks Are Changing Customer Behavior"

, she pointed out that

self-service technologies can dramatically change what people do and how they act.

Cited from the study of four researchers at the Rotman School of Management, Duke's Fuqua School of Business, and the National University of Singapore, a store changed from face-to-face to self-service boosted the market share of difficult-to-pronounce items by eight and four tenths percent (8.4 %). The researchers concluded that consumers might fear being misunderstood or appearing unsophisticated in front of the clerks. Thus, changing to self-service removed the social friction.

Stated in Lindsay Frost's (2018) online article named

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"Principles of Ergonomic and Anthropometric Design"

, When one is designing a product to provide self-service, they can't pre-determine the physical attributes of the user and they don't have an opportunity to train the user. Also, a Good anthropometric design guarantees a good fit between the user, the equipment and the environment. In the case of kiosk's, it is concerned with designing the best fit for the widest range of users.

Henry Dreyfuss, a 20th century industrial designer, greatly advanced the understanding of, and standards for, good ergonomic design. He created his own anthropometric standards which are still extensively used.

Having a point of reference is the Dreyfuss approach to ergonomic design. A set of guidelines rather than rules is what it offers. Since kiosks are intended for general purposes, Dreyfuss' anthropometric guides helps to address the extremities of factors such as the maximum and minimum user heights, in order to set appropriate mid-points. Some specific design points that can be engineered includes screen angling, speaker positions, printer positions, input devices' positions, and the haptic feedbacks (

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"Principles of Ergonomic and Anthropometric Design"

, 2019).When installing a touchscreen kiosk, the angle of the screen is a major consideration based on the article entitled

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"Touch Gesture Success and Screen Angle for an Interactive Kiosk"

by Dorothy Shamonsky, Ph.D (2014). She also stated that kiosk are most often installed with a fixed-screen position. An approximate 45-degree angle is the most commonly used hand-held position. The decision of screen angle needs to be based on a combination of issues, such as usability, security, stability, and visibility of the device.<https://www.iso.org/obp/ui/> According to

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"Ergonomics of human-system interaction -- Part 210: Human-centred design for interactive systems"

(ISO 9241-210:2010) by International Organization for Standardization (ISO) (2010) reviewed and confirmed last 2015, Human-centred design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, and usability knowledge and techniques. This approach enhances effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance.

Microcontroller A

<https://internetofthingsagenda.techtarget.com/definition/microcontroller>

Microcontroller is a microcomputer in a compact integrated circuit designed to perform specific operations in an embedded system. It has a processor, memory, programmable input/output peripherals on a single chip.

<https://en.wikipedia.org/wiki/Microcontroller>

It is commonly used in automatically controlled products and devices such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems.

The utilization of Microcontrollers has developed rapidly for it is used in multiple industries and applications such as vehicles, robots, office machines, medical devices, mobile radio transceivers, vending machines, and home appliances, among other devices. One example of a microcontroller is the <https://www.teachmicro.com/intro-nodemcu-arduino/>

Arduino NodeMCU that helps in prototyping or building the Internet of Things (IoT) product. Also, this microcontroller can readily be connected to the internet via Wi-Fi.QR Code

QR Code, also known as Quick Response code is mainly used for embedding messages for users to use their mobile devices to capture the QR code and to get the information with the use of QR code reader or scanner. This technology was developed by Masahiro Hara from Denso wave. These codes use four standardized encoding modes - numeric, alphanumeric, byte/binary and kanji- making it efficient in storing data.

Based on the article

<https://scanova.io/blog/blog/2016/07/26/qr-code-history/>

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"QR Code History: Evolution of the popular 2D Barcode"

of Zara Rizwan (2016), she stated that

<https://scanova.io/blog/blog/2016/07/26/qr-code-history/>

QR code was first applied in automobile, pharmaceutical, and retail industries in tracking

inventories. In the present time, it is being used for marketing and social media. She discussed that in 2016, apps like Snapchat and Messenger use QR codes as a feature in searching and adding friends. Also, she added that to attract new customers, brands such as Coca-cola are using these codes as a marketing tool.
<https://technode.com/2018/02/16/photo-chinas-obsession-qr-codes/>
 As for Timmy Shen (2018) on his article entitled

 **Quotes detected: 0.03% in quotes:** id: 16

"China's Obsession with QR Codes"

, the transaction volume of mobile payments has reached \$5.61 trillion and is expected to reach \$47 trillion in 2019.

<https://technode.com/2018/02/16/photo-chinas-obsession-qr-codes/>
 He stated that the reason why China is obsessed with this technology is because of the convenience it gives to the users. By just simply scanning QR codes, smartphone users can pay bills and purchased good using their mobile payment applications. The payment goes directly to the vendors' virtual wallet.

<https://pia.gov.ph/news/articles/1015376>


According to the article of Jerome Carlo Paunan (2018) entitled

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"<https://pia.gov.ph/news/articles/1015376>
 Unveiling the 1<https://pia.gov.ph/news/articles/1015376>
 st
<https://pia.gov.ph/news/articles/1015376>
 Cashless
 Marulas
 Public 'DigiPalengke'<https://pia.gov.ph/news/articles/1015376>
 "

<https://pia.gov.ph/news/articles/1015376>

has revealed that the new Marulas public market in Valenzuela City is the first 'DigiPalengke' in Northern Metro Manila where an entire marketplace is equipped with cashless payment transactions. This technology has allowed the residents to experience cashless convenience via QR payments courtesy of PayMaya, Primetech Solutions, Inc., and the City Government of Valenzuela. It further discussed the PayMaya application that gives the user a virtual prepaid card for shopping online, booking flights, and more. The users of this technology will also be entitled to receive cash back and promos being offered by PayMaya to its users. Radio Frequency Identification Reader
 An RFID reader is used in gathering information from an RFID tag. To transfer data from the tag to a reader, radio

 **Plagiarism detected: 0.03%** <https://www.slideshare.net/musicnippon/bcon-slide> id: 18

waves are used. For the

RFID tag to be read by the RFID reader, it must be within the range of the reader. This technology enables fast identification of a particular object.

The RFID technology is now being used in a variety of applications such as passports, smartcards, toll booth passes. According to <https://www.shopify.com/retail/5-examples-of-innovative-uses-for-rfid-technology-in-retail>

Jessica Bianchi's (2017), retailers are always on the lookout for ways to operate more efficiently by implementing technology to improving customer's shopping experience, and to set themselves apart from the competition. In 2016, research showed 73% of business retailers had implemented RFID and that number nearly doubled from 2014. She stated that the reason why the use of RFID is on the rise is that the majority of business retailers consider technology as a way to have more accurate inventory counts. Vending Machine

A vending machine

<https://www.thoughtco.com/the-history-of-vending-machines-1992599>

 **Plagiarism detected: 0.14%** <https://www.jnec.org/industry-institute-interaction-cell.php> id: 19

is an automated machine that renders items such as snacks, beverages, and tickets to consumers with the payment is inserted into the

machine. <https://www.thoughtco.com/the-history-of-vending-machines-1992599>

<https://www.thoughtco.com/the-history-of-vending-machines-1992599>

According to Mary Bellis'

 **Quotes detected: 0.03% in quotes:** id: 20

"The History of Vending Machines"

<https://www.thoughtco.com/the-history-of-vending-machines-1992599>

During 1883, Percival Everitt

invented and introduces the first commercial coin-operated vending machines in London, England. It was used as a convenient way of purchasing envelopes, postcards, and notepaper. Many other coin-operated vending machines were introduced that it offered almost everything, including postcards, stamps, and cigars.

<http://edition.cnn.com/style/article/japan-vending-machines-eiji-ohashi/index.html>

In Japan, vending machines are a common sight. According to Jacopo

Prisco

(2017), there are over 5.5 million vending machines in the

<http://edition.cnn.com/style/article/japan-vending-machines-eiji-ohashi/index.html>
 country. <https://www.thoughtco.com/the-history-of-vending-machines-1992599>

Related Studies

Foreign Studies

[https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-](https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N)

[BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N](https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N)
The study entitled

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"[https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-](https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N)

[BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N](https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N)
Application Design of Toll Payment using QR Code: A Case Study of PT.

JasaMarga[https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-](https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N)

[BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N](https://www.google.com/url?q=https://www.semanticscholar.org/paper/Application-Design-of-Toll-Payment-using-QR-Code-a-BagusPriambodo/bdd2387767642c88fe7467f4eae1f886ae29a3&sa=D&ust=1552968887093000&usg=AFQjCNFn3kxQlsqhcu_N)
"

conducted by

Kristanto

and

Priambodo

(2016) uses electronic transactions that intends to improve the time efficiency at the toll gates with the help of QR code and Android platform as access so that the transaction does not need to be served manually.

<http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-18/Coursework/zhangpu.pdf>

The findings from the study of Pu Zhang

(2017)[http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-](http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-18/Coursework/zhangpu.pdf)

[18/Coursework/zhangpu.pdf](http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-18/Coursework/zhangpu.pdf)

<http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-18/Coursework/zhangpu.pdf>

entitled

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"<http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-18/Coursework/zhangpu.pdf>

Why QR code payment develop well in

China[http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-](http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-18/Coursework/zhangpu.pdf)

[18/Coursework/zhangpu.pdf](http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2017-18/Coursework/zhangpu.pdf)

"

have talked about the advantages of QR code payment and also analyzes the promotion of QR Code payment for the improvement of the user experience in China.

The researchers noticed the reasons why QR code payment develops well in China. It requires no special equipment,

It

is more convenient and safer as it is able to securely store the payment details in a mobile phone

and carrying it around than bringing your entire wallet full of cash. Also, it has been discussed

about China's Alipay and WeChat Pay that dominates China's mobile payment sector.

The study has also revealed the features of QR code such as being able to store a large amount of information, reliability, confidentiality and strong security. Whilst, it has revealed that it has an error correction function that makes the QR code still readable despite the local damage due to perforation, fouling.

The researcher has identified the three main payment methods for QR code payment such as paying a merchant with QR Scanners, paying a merchant without QR scanners and Paying Individuals. As for paying a merchant with scanners, the merchant will use the mobile payment application to scan the QR code to identify the customer and make the transaction from their mobile wallet. In the case of paying merchant without scanners, the QR codes are displayed and the customer will scan it by using their QR scanning application to send their payment.

Local Studies

<https://www.ijraset.com/files/serve.php?FID=16766>

Sagapsan, Aurelius, and

Saguin

(2018) on their study entitled

Quotes detected: 0.11% in quotes:

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"<https://www.ijraset.com/files/serve.php?FID=16766>

Coin Operated Students' Grade Inquiry through Coin Slot

Machine<https://www.ijraset.com/files/serve.php?FID=16766>

"

<https://www.ijraset.com/files/serve.php?FID=16766>

have developed an application software to retrieve and print students' grades, class schedule,

and account balance by inserting a five peso coin in a slot machine. The software output was

evaluated by 30 evaluators to determine its reliability, functionality, and usability.

<https://www.ijraset.com/files/serve.php?FID=16766>

The study was conceptualized from the

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"PisoNet"

computer rental systems that promote affordability in terms of rental payment. It is a vending machine-like custom personal computer (PC) boxed in an enclosed-type cubicle containing electronic circuitry that controls the timing usage of customers. They have mentioned that the coin-operated students' grade inquiry through a coin slot machine is an application system with a hardware interface that provides students' information with the use of touch screen technology by inserting 5-peso coin for it to operate and in order to minimize and avoid delay in getting all required students' related information queuing at the registrar's office.

The researchers have observed that the overall level of usability of the designed software in very high in view of the fact that almost all of the system features and functions are evident with the best quality characteristics in architectural design, very simple and usable. They have mentioned the system provides efficient delivery of students' grade reports with a higher level of accuracy.

In the study of Adia, J.H.L et al entitled https://www.academia.edu/33582541/BenteNet_An_Efficient_and_Convenient_Automated_Personal_Computer_Rental_System_The_I BenteNet: An Efficient and Convenient Automated Personal Computer Rental System, the researchers developed a device that upgraded the features of the Piso-net currently has. Their prototype has an individual PC rent that can be used by inserting either coins or bills and able to give change once the user decides to stop the remaining credit.The study focuses on providing improvement to the existing operation of renting a Piso-net PC to the users or customers by enabling them to use either bills or coins as a mode of payment. To be able to test and evaluate the created prototype, the researchers have conducted a total of nine experiments about how reliable the device is in terms of accepting payments, time, and returning balance.The researcher s have concluded that the prototype of their study is reliable and accurate based on the series of experiments conducted having a percentage error not exceeding by 30% in terms of accepting authentic peso coins/bills and rejecting fake/outdated bills. Moreover, it consistently converts the payment received into minutes which is displayed in the LCD. They have mentioned that the use of the prototype greatly helped the owner as well as the customers in terms of convenience.

Conceptual Framework

The figure below presents the flow of the research that the researcher have used in creating the prototype of the study. It consists of three main parts including the input, process, and output.

Determining the appropriate theories, principles and concepts
s for the prototype design

Determining the best possible programming language to use for the software construction

Planning and DesigningMaterials AcquisitionProgrammingAssemblyTesting and Evaluation
Planning and DesigningMaterials AcquisitionProgrammingAssemblyTesting and Evaluation
Automated Rental System for Internet CaféDocumentation PapersINPUT PROCESS
OUTPUTFig
ure 1. IPO Model of the Automated Rental System for Internet CafeFigure 1 shows the concepts of how the researchers conducted the research about the

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"Automated Rental System for Internet Cafe"

. The researchers first determined the appropriate theories, principles, and concepts that has helped in making the prototype design. Then, the researchers determined the best possible programming language that can be used for the construction of software. This is to have as much theoretical knowledge of the product creation.After the gathering of these data, the researchers proceeded with the process. Here they did the planning and design which includes how the researchers designed the kiosk and its GUI, materials acquisition to determine the appropriate materials needed in the construction of the prototype, programming for the proper operation of the device, assembly of the hardware parts, and the testing and evaluation to assure the functionality of the prototype. Each part was critically studied and planned before proceeding to the next step.The aforementioned steps and processes have resulted to the production of the Prototype Hardware and Software design of the Automated Rental System for Internet Cafe.

Chapter III
METHODOLOGY

This section introduces and discusses the methods and procedures that were used by the researchers in gathering the data with regards to the study. This includes the research locale, respondents, research design, research instrument, interview, procedures, data collection and the statistical treatment that were useful in making the study a success.

Research Locale

The study was conducted at a CBJ Internet Café which is situated at Sampaloc, Quezon Province. The locale was chosen for the reason that this particular internet cafe is owned by one of the researchers. For this reason, there is a chance for a much more efficient data gathering which was beneficial for the entire research conduct.

Respondents

The grantees of the

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"Automated Rental System for Internet Café"

was composed of the owners and fifty (50) customers of CBJ Internet Café. The prototype was demonstrated to the selected respondents. Afterwards, they were given a questionnaire to determine the acceptability of the Graphical User Interface (GUI) to the end-user and the functionality of the system.

Research Design





In conducting this research study, the researchers used an experimental type of research as they have integrated both hardware and software components as part of the research which is the study's main output, the one that will automate the traditional transactions for Internet Café rentals. The researchers compared the manual operation from the automated system. This study intended to handle every rental service transaction in an Internet café with less human intervention. The purpose of this is to lessen the operational cost of the said business and for the convenience of their customers.

Figure 2. Project Development Process

Research Instruments

The researchers made use of the following facilities and instrumentation in order to gather data and information

Ⓢ Plagiarism detected: 0.03% <https://www.slideshare.net/aayush30/macro-factors-> id: 27

that are relevant to the study	
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"Automated Rental System for Internet Cafe"	
 Plagiarism detected: 0.05% https://www.slideshare.net/aayush30/macro-factors-affecting-b...	id: 29
in affecting-b... which may help them to fulfill the objectives of the said study. Library	
Undergraduate thesis, journals, and books from the library of Southern Luzon State University	
 Plagiarism detected: 0.09% About">https://www.cgsecurity.org/wiki/CGSecurity>About	id: 30
will be used by the researchers in conducting and documenting the study. The information that will be gathered from these materials will give them additional knowledge related to the researcher's study.	
Internet	
With today's advancement of technology, the researchers have found another method of collecting data and information, the use of the Internet. The internet resources as a reference tool will provide rapid access to information needed by the researchers. The theories and components that they have gathered from articles and forums online on the internet were necessary in constructing the device.	
Consultations The consultations that were held with the instructors and engineers with regards to the operations, development, and principles of the design were conducted in order to expand their knowledge relevant to the study.	
Questionnaires	
In the construction of the questionnaire, the researchers used the English Language as the main dialect of the questions. The researchers submitted a draft to their research adviser for any suggestions and was revised until it arrived to a good final questionnaire paper.	
These questionnaires helped the researchers in extracting and gathering information from the respondents. These are essential in assessing the opinions and thoughts of the respondents with regards to their experience from prototype of the	
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"Automated Rental System for Internet Cafe"	
.	
These questionnaires were used to determine the functionality and efficiency of the system as well as the acceptability of its GUI and case design.. It is conducted upon the customers of the Internet Café having them rate the system from the scale as shown below:Scale Interpretation	
5	

Excellent

4

Very Good

3

Good

2

Fair but needs improvement

1

Poor

Procedures

These are the procedures that the researchers must followed in order to make the system:

1.

Planning and designing

First, the researchers gathered information from various reading materials such as online articles, books, and theses that are found in the library. These phase helped the researchers to what materials they should use and how they should create the design of the system's user interface. With the gathered information, principles, concepts and ideas that could be used for the construction of the prototype, the researchers planned and designed the prototype based on how a user can easily interact with the device. 2

.

Materials Acquisition

After

planning

and designing, the researchers then gathered the

right

materials needed for the construction of the prototype

of

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id: **32**

"Automated Rental System for Internet Cafe"

. The components and materials

that were used

should be available and enough in the market to avoid the shortage and unavailability of the materials

listed. In

the

case

of

unattainability,

seeking

for its

viable

replacement

was considered.

Correspondingly, the researchers

deliberated the cost and quality of such materials they used.

After canvassing, the researchers then purchased the materials to construct the said prototype

3

.

Programming

The

researcher

s programmed the software

in such a way that they were compatible with all the hardware

incorporated in the circuit

design. The

software

user interface and experience

design was based on the design principles gathered during the research process.

4.

Assembly

The researchers created a design for the chassis of the kiosk where the height of the users, and the size of the components that were placed inside were considered. One of the considerations that the researchers used is knowing the most suitable building material for the kiosk to complete the prototype of the said study. 5

.

Testing

the functionality of the research

To

assess

the functionality of

the

system's prototype, the researchers conducted a series of testing

and evaluation

to assure the functionality of the

said

research

prototype. The researchers ran series of test to check the functionality of the touch display, the bill acceptor, the RFID reader and the software implementations of each hardware which turned out all functional. Chapter IV

RESULTS AND DISCUSSION

This chapter presents the results of the creation of Automated Rental System for Internet Café. It discusses the development of the system from its System overview which explains how the system works. The technical description of the system presents the information gathered by the

researchers, block diagram of the system, the flowchart of the program, circuit planning and chassis design. Also, this chapter exhibited the software and hardware implementation needed in the construction of the system. The results of the tests and evaluation for the said system are also presented on this chapter.

System Overview

This system provides an automated payment service that is designed primarily for an Internet café. It functions as an alternative in managing the computer rental payments for it automates the work of a cashier in an Internet Café. Components such as sensors, microcontroller, server computer and touch screen display are used in the construction of the said system. It has a process of login, logout and checking balance. The use of microcontroller is needed for it is used to interface different devices that are essential in making the said system. Devices that are needed for the system to work were distinguished. The system would operate as follows: The device would be equipped with a tablet monitor that will display its graphical user interface. This is where the user communicates with the system. The machine would have a sensor that will accept and validate payments in exchange for the service of the system. It is programmed in a way that when a customer inserts a bill in a slot, it would either accept or deny the payment that will depend on the bill inserted. The system will automatically compute the time depending on the given payment. Lastly, the device includes a server computer that will process all the data that will be inputted in the device. This system has an application programming interface (API) that allows other system to connect and interact with its existing features or other additional functionalities to the system.

The software is designed to run on a Microsoft windows operating system. Technical Description In this part of the chapter, both hardware and software are discussed technically. It contains the information gathering, planning and design, list of materials used in building the machine including its specifications and functions.

Planning and Designing

Since the type of research used in this study is experimental, the researchers compared the manual operation in an internet café from the automated system. The table below shows the manual operation of receiving payments and how it should satisfy the customer's rental time.

Table 1. Manual Operation in an Internet Café

No. of Transactions

Payment Received

Rental Time

Time Started

Time Ended

Total Time Spent

1
20
8:25 am
9:45 am
1 hr. & 20 min.
2
20
8:25 am
9:45 am
1 hr. & 20 min.
3
20
8:25 am
9:45 am
1 hr. & 20 min.
4
20
8:25 am
9:45 am
1 hr. & 20 min.
5
20
8:25 am
9:45 am
1 hr. & 20 min.
6
50
9:50 am
1:10 pm
3 hrs. & 20 min.
7
50
9:50 am
1:10 pm
3 hrs. & 20 min.
8
50
9:50 am
1:10 pm
3 hrs. & 20 min.
9
50
9:50 am
1:10 pm
3 hrs. & 20 min.
10
50
9:50 am
1:10 pm
3 hrs. & 20 min.

The table above displays how the rental time should be satisfied by how much bill is inserted in the kiosk. For an instance, if the customer gives a 20-peso bill, then the rental time should be 1 hour and 20 minutes. However, if the customer gives a 50-peso bill, then the rental time the customer should have is 3 hours and 20 minutes.

The researchers collected data and information from various articles and studies that are related in the designing of the system. This phase will include how the researchers designed the kiosk and its GUI. Since the kiosk display is only for payment, reloading, checking balances, and logging-in, large screen displays will not be needed so the researchers decided to use a 10-inches tablet. The

table is mounted into kiosks in a portrait or vertical format because information can be presented in a manner that is more pleasing to the eye.
The Table 2 below presents the considerations the researchers made in designing the Graphical User Interface of the system. Table 2
. GUI Design ConsiderationElements
Description
Color
The researchers chose a color that will make the contents readable to the user.
The researchers used a dark color for the background to emphasize the buttons along with its contents that has an orange color.Fonts
The font used in the system is Arial. The researchers ensured that the texts are visible so people of all ages could read the text used in the interface.Interface
The researchers kept the interface simple since it is only used for the payment operation.
Unnecessary visual elements are omitted to prevent confusion and to provide simplicity to the user interface.
Icons
The researchers used icons to enhance usability, be easily remembered, and improve the design of the interface.
The icons are accompanied by text labels for the user to easily identify what the icon means.
Next, in order to choose the right microcontroller, the researchers gathered information about the microcontrollers that can be used for the kiosk, such as the Arduino uno, Raspberry Pi and NodeMCU. In the study entitled
<div>🔍 Quotes detected: 0.08% in quotes: id: 33</div>
"A Comparative Study of Arduino, Raspberry Pi and ESP8266 as IoT Development Board"
by Dinkar R. Patnaik, it summarizes the capabilities of the available hardware development platforms for IoT. The table below shows the comparison of three development boards.PARAMETERS
ARDUINO UNO
RASPBERRY PI
ESP-8266
Processor
ATMega328P
Quad-core ARM Cortex A53
-
GPU
-
Broadcom VideoCore IV with 400 MHz-
OPERATING VOLTAGE
5V
5V
3.3V
CLOCK SPEED
16 MHz
1.2GHz
26 MHz - 52 MHz
SYSTEM MEMORY
2kB
1 GB
45kB
FLASH MEMORY
32 Kb
-
up to 128MB
EEPROM
1 Kb
-
-
COMMUNICATION
SUPPORTED
<div>🚫 Plagiarism detected: 0.17% id: 34</div>
https://www.researchgate.net/publication/317433743_IoT_Development_Board_Comparison_of_Arduino_ESP8266_and_Raspberry_Pi
IEEE 802.11 b/g/n IEEE 802.15.4 433RF BLE 4.0 via shield
IEEE 802.11 b/g/n IEEE 802.15.4 433RF BLE 4.0Ethernet Serial
IEEE 802.11
b/g/n
ENVIRONMENTS
Arduino IDE
Any linux compatible IDEArduino IDE, Lua Loader
PROGRAMMING LANGUAGE
Wiring
Python C C++ Java Scratch RubyWiring, C, C++
I/O CONNECTIVITY
SPI I2C UART GPIO
SPI DSI UART SDIOCSI GPIO
UART, GPIO
Table 3. Comparison of Arduino, Raspberry Pi-3 and ESP 8266-01 wifi moduleTable 3 presents the capabilities of each development boards. In terms of storage and computing speed, the table shows how Raspberry Pi-3 has a higher performance compared with the Arduino and ESP8266. Raspberry Pi-3 is equipped with inbuilt Wi-Fi and Bluetooth which means that it can be connected to the internet and push the data to the cloud servers if required for further processing. Based on the table above, Raspberry Pi offers the most advantage,
<div>🚫 Plagiarism detected: 0.12% https://www.mageplaza.com/blog/micro-and-macro-factors-of id: 35</div>
but on the other hand, it is said to be that ESP-8266 stands out strongly when it comes to
device level sensor networking abilities due to its small form factor and wireless connectivity, ESP-8266 being a low-cost device is a first choice for implementing sensor networks in an IoT scenario. For the kiosk's building material, the researchers considered different factors in selecting the right material. Table 2 presents the comparison between metal, plastic, and wood, which are all discussed in chapter II, along with the factors that needs to be considered.Table 4.
Comparison of Building MaterialFACTORS TO CONSIDER
METAL
PLASTIC

WOOD
COST
AESTHETICS
DURABILITY
AVAILABILITY
MAINTENANCE

Table 4

shows that the plastic is the cheapest among the three materials mentioned, but in terms of durability, it is better to use metal/steel for it is more durable and secured compared to wood and plastic kiosks considering that it will be located in a public space. The materials mentioned are all available in the market. In terms of maintenance, it is better to use metals as a building material. The best materials are said to be those that are easy to maintain. Good quality of the building materials is important as it requires less maintenance than cheaper materials. With the result from the table, the researchers concluded that the building material that is suitable for the system's kiosk is metal. This also ensures that the physical and internal components of the kiosk are protected from tampering.

Block Diagram
The Figure 3 represents the components that are associated with the system. It shows the input, process and output of the system wherein the components are represented by blocks connected by lines which shows the relationship between each component to make the system to operate. Figure 3. Block Diagram
Based on the diagram, the inputs are sensor and the bill acceptor. The sensor will gather the information from the user's card. On the other hand, the bill acceptor will accept and validate the inserted bill. The input gives signal to the microcontroller. The microcontroller then allows the sensor and bill acceptor to be read by the server computer. Hence, it allows the server computer to count the payments received by the bill acceptor and to read the card represented by the user. Then, the touchscreen display allows the main interaction between the user and the system by providing set of commands and information that is specified with the end user.

In order to get a simple visual representation of the user's interaction with the system, a use case diagram is used. Figure 4. Use Case Diagram of the Automated Rental System for Internet café: Client PC App

Figure 4

shows the representation of the relationship between a user and the client application. The user can login, create an account, change workstation, pause/resume timer, change account password by using the Client Application. Figure 5

. Use Case Diagram of the Automated Rental System for Internet café: Kiosk App

Figure 5 shows the interaction between user and the kiosk application. The user can also login, recharge, change workstation, check account, and register card by using the kiosk application. **Flow Chart Diagram**
The flow chart shows how the special designed system software processes the data. The researcher illustrates the flowchart to know how the data will flow in the system after knowing the relationship between the components of the system. This was used to know the construction of the program. Figure 6. Flow Chart Diagram of the Server Computer Program
Figure 6 shows the system flow of the program of Server Computer. If there are ongoing sessions, the program loops first on processing the sessions time to check if there are sessions that has already ended to logout and lock the client workstation. After that, it begins looping for user commands such as user login and user logout. However, if there are none, it will directly jump to the waiting loop of the incoming user command. If login command is received, it will check the received user credentials and user balance if both are valid. On the other hand, if logout command received, it will log out and lock the client workstation. After the completion of either commands, it will return to the main program loop. Figure 7. Flow Chart Diagram of the Kiosk's Program

Figure 7 above shows the system flow of the Kiosk's Program. The program loops first on processing the server connection. If the process of connecting to the server is successful, the system will jump to the next event, otherwise it will repeat the process. After that, the user will have three options: login, recharging account and checking of balance. Figure 8: Flow Chart Diagram of the Arduino Bill Acceptor Program

Lastly, Figure 8 shows the system flow of the Arduino Bill Acceptor program. Since the bill acceptor is connected to the server, the server connection must be successful first.

The bill acceptor will wait for the instruction from the server command. With the server command's instruction, it will count the cash inserted and will process the payment. **Circuit Planning**
The researchers planned a schematic diagram that will be used in creating a circuit of the system. The figure below shows the schematic diagram of the system. It shows the components of the circuit and the interconnections between them. Figure 9. Overall Schematic Diagram of the Automated Rental System for Internet Café

The Figure 9 shows the overall electronic schematic diagram of the system. The researchers used NodeMCU as their microcontroller unit for their system. The BV 20 bill acceptor is connected to the ground and the other pin is connected to the Digital Pin 8 to receive the analog pulses from the acceptor. The RFID Reader MFRC522 is connected to MOSI (Digital Pin 7), MISO (Digital Pin 6), SDA (Digital Pin 4), SCK (Digital Pin 5) to Communicate with the Microcontroller Unit. Then the power line 3.3V and GND from the RFID module is also connected to the same pin in the Microcontroller Unit.

Materials
After knowing the components needed in the construction of the system, the researchers gathered the right materials that are suitable to the system. Software applications that are used in the system were also identified. The materials are separated into two tables: the hardware and software components. It includes its name, specification and its function. Table 5

. Hardware Implementation

Component Specification

Function

Tablet

10 inches screen
Android Operating System
16 GB of memory
Wi-Fi enabled

The tablet serves as display of the system.

Arduino Node MCU

Wi-Fi enabled
128kB of memory
4Mbytes of storage
3V, 5V power voltage

It allows the sensor and bill acceptor to be read by the server computer.

BV20 Bill Acceptor
Requirements: 12 V
Standby: 150 mA
Running: 540 mA

It will accept and validate payments in exchange for the service of the system.

RFID-RC522
13.56MHz Operating Frequency
3.3 Voltage Supply
13-26 mA
10Mbit/s Max data transfer rate
SPI interface
Read range: Approx 3cm with supplied card and fob.It is used to gather information from the user's card.
Table 5 shows the hardware implementation of the system. These are the hardware components that represents the components used in the block diagram. It includes its name, specification and its function.

The table above lists the hardware components that was gathered by the researchers in order to construct the system. The components listed above was used to make an interaction and to have a communication between each components.

Table 6.: Software Implementation Table 6 shows all the software applications that was used by the researchers throughout the construction of the system. The table contains the names of the components and its functions.

Component	Function
Node.js	It is used to write the code that will run the main software
Visual Studio	It is used to write the codes for the client software needed in the system.
Visual Studio Code	It is used to write the codes needed for the server software.
Arduino IDE	It is used to write the codes needed for the microcontroller software.

The software applications listed above was used as a platform by the researchers in order to write the program needed in the component's software and the software that are needed in the construction of the system.

Chassis Design
For the chassis of the kiosk, the researchers created a plan for the interior and exterior design. The figure below presents the interior and the exterior design of the machine from different views.

Figure 10: Design of the Kiosk
Figure 10 shows the outer measurement such as the height, the width of the base, and the screen holder size of the machine measured in millimeter. The researchers gathered 50 customers of CBJ Internet Cafe (42 male and 8 female) to determine the preferred viewing angle for the kiosk. Their height ranges from 152.4 cm (5 ft.) to 182.88cm (6 ft.).

Figure 11: Users' Height
With the data above, it shows that among the fifty chosen respondents, most of them are 167.64 cm (5'6

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"). The height of the kiosk which is 44 inches was based on the maximum range of user's elbow height. According to Jeffrey Kelly's "

<https://notsitting.com/proper-height/>
Proper Height For Standing Desks", it is essential to determine the correct height of your standing desk in order to maintain the best posture possible. For the proper height of a standing desk, it should be built by the measure of the distance from the floor to the bottom of your elbow when it is positioned at a 90-degree angle from the floor. As stated in chapter II
, the decision of screen angle needs to be made based on the visibility of the users. Since there is no appropriate angle for all people especially in scenarios that involves only one height, the researchers then asked the selected customers to choose their preferred angle (30-degree, 45-degree, and 55-degree angle).

Figure 12
: Frequency of Preferred Angles
Figure 12 shows a wide variation of the selected customers in the angle preferences for the tablet display. As can be seen on the figure, 56% of the selected customers preferred the display to be in 45-degree angle. The cash acceptor and RFID reader is placed in front where users can easily access. Black is the chosen color for the system's kiosk

Structural Organization
This section shows the developmental process of the system. It presents the structure of the system and how it is made. It includes the activities that are made by the researchers such as the circuit construction, programming, assembly of the components, casing, testing and evaluation.

Circuit Construction
This section presents the development process of the circuit necessary in the system. The construction of the circuit is based on the schematic diagram that shows the interconnections and arrangement of the wires.

Figure 13. PCB Lay-out
Figure 13 illustrates the lay-out of the PCB that shows the connection of the components. This is printed in a sticker paper and attached it to the PCB for etching.

Figure 14
: Etching
In Figure 14, it shows the etching of the PCB. The PCB was placed into the etching solution for 25-30 minutes until all the copper has dissolved around the design.

Figure 15
: Soldering Layout
Figure 15 shows the soldering of the circuits. This will help in ensuring the stable connection between the components.

Figure 16
. Drilling
The next step is to drill the holes for the pins of the electronic components as shown in Figure 16. The holes serve as the permanent place for the components. The components are then soldered in the PCB to avoid removal of components as shown in Figure 17.

Figure 17
. Soldering Components
Programming
This section present the codes used in developing the system. The discussion on how the code works is also shown in this part.

Graphical User Interface (GUI)
Figure 18
: Sample Code of Lock Screen for the Client Application
As shown in the Figure 18, it specifies the style for the username and password and the background and contents of the lock screen. It also demonstrates how the change in the foreground color and opacity is when the username box or password box is clicked. Also, it shows how the QR code scanner take actions when the mouse is focused in it. The researchers create the interface for the lock screen in the client application. This is where the clients will log-in into their account. The figure below shows the lock screen page for the client lock scree

n as shown in the figure 19. Figure 19

: Lock Screen for the Client Application The figure above shows the output of the code in the figure 18. This is the interface for the lock screen in the client application. The right side of the lock screen is intended for the advertisement or promotional strategy of the internet café. The interface also includes a QR code that the client will scan for them to log-in into their account. Figure

20. Sample Code for Change Account Password Form Figure 20 shows how the User Interface for changing the account password is made from the code. Figure

21. Change Account Password Form Figure

21 shows the result of the written code in figure 19 for the Changing Password in the Client Side. Figure

22. Sample Code for the Create Account Form Figure 22

shows the sample Code for the User Interface for the Form for basic User Information required in creating an account from the client side. Figure 2

3: Create Account Form Figure 2

3 shows the output of the given code in Account Creation Form for the client side. Figure 2

4. Sample Code for Change PC Select Box Figure 2

4 shows the sample code for the Change PC Select Box User Interface for the client side. Figure 2

5. Change PC Select Box The figure shows the output of the given code in Change PC Select Box for the client side. Figure 2

6. Sample Code for the Sidebar The figure shows the sample code for the sidebar for the current session information which includes the time start, session time, bonus time, amount paid, and current session price Figure 27. Sidebar The figure shows the screenshot of the output of the written code for the client Session Information Sidebar. It will display the time the session information and the price. Users can also change their PC in this side bar. Figure

28. Sample Code for the Home Page of the Kiosk As shown in the Figure 28, the code defines the UI components and its specific methods of the Kiosk Main Page. It includes five functional buttons which are member login, non-member login, recharge session, members' area, and shop QR. Figure 29

. Equivalent Home Page Figure 29

shows the output of the code shown in the figure 28 for Kiosk Main Page. Same as what the code specifies, five buttons are present in this page. If member login button is selected, the user will be required to present their own card to the reader for user authentication and verification. In non-member login and recharge buttons, users will be required to insert cash first before further operation. Figure 30. Sample Code for the ScanQR or Tap ID page As shown in Figure 30

, here lies the written codes for the ScanQR and TapID. This part includes how the QR Code will be displayed in the screen, and it also displays a button that when user clicks will return to its homepage. Figure 31. Equivalent ScanQR or Tap ID page Figure 31 shows the output of the written code in the figure 30 for the Equivalent Scan QR or Tap ID page. This will be displayed in the screen when the user login, recharge, check account, and register their card. Figure 32

. Sample Code for Insert Cash Page Figure 32 shows a part of insert cash sample code. This part of the code shows that when the user clicks the back button at the top, it will cancel the request of inserting money, otherwise it will just display the amount of cash inserted by the user. Figure

33. Equivalent Insert Cash Page Figure 33 shows the equivalent cash counting page from the code in figure 32. This will be displayed when the user insert money in the kiosk. The exact amount of the inserted cash of the customer will also be displayed. Figure 34

. Sample Code for the Choose Workstation Page As shown in Figure 34, a part of choose workstation sample code. This part includes how the user can see the available workstations in the screen. Figure 35

: Equivalent Workstation Page Figure 3

5 shows the equivalent workstation page for the code in figure 34 In this page, the user will pick their desired PC. Red Labeled PC means that the workstation is already occupied and not available for logging in. Orange labeled PC's are workstations that are occupied and are available for recharging. Green colored PC means that the workstation is available. Figure 36

: Sample Code for the Members' Area Page As shown in Figure 36, a part of the members' area sample code. The page consists of four buttons, the check account, register card, add cash, and reset password respectively. Those buttons will bring the user to different page if the user click one. Figure 37

: Equivalent Members Area page Figure

37 shows the equivalent members area page for the code in figure 36. Four buttons are present in this page: the check account, register card, add cash, and reset password buttons respectively. The member customers have the liberty to choose their desired operation. Figure 38

: Sample Code for the Account Information Page As shown in Figure 38, a part of the account information sample code. The page displays the account information of the user such as User ID, Username, Owner name, cash balance, and if their card is registered or not. Figure 39

: Equivalent Account Information Page Figure 39 shows the equivalent account information page from the code in Figure 38. This will be displayed after the account authentication. The kiosk will retrieve the account information and show it to the user which will automatically hide after 7 seconds. Figure 40. Sample Code for the Non-member Login Page As shown in Figure 40, shows a part of the non-member login page sample code. This part includes how the display will show the exact amount of the cash the customer has inserted. Figure 41

. Equivalent Non-Member Login Page Figure 41

shows the equivalent account information page from the code in Figure 40. This is for the non-member customers. The page displays the amount of cash the customers has inserted and their selected workstation. Figure 42. Program used for the RFID The figure above shows the screenshot of the program used to request RFID reading from the reader. The counter is calibrated from the function runtime. 1 count is approximate 28 milliseconds. The preset 250 is approximately 7 seconds. Figure

43. Program for Cash counting Figure 43 shows the program used to start the cash counting. If the module has already started the counting money, it will throw an error. Then, it will start counting and will send a counting status. Figure 44. Another program for Cash counting Figure 44 shows the program that will stop the cash counting and will send the result. If the module is not counting money, it will throw an error. Afterwards, it will send a success status and count the total result. Interfacing

The connection of the component with other components is presented in this section. The discussion on how the components communicate with each other in the development of the system is also present here.

Microcontroller Configuration

The researchers programmed the Arduino Node MCU ESP8266 to be able to read the RFID tags

system is presented in this part as shown in Figure 47. Figure 47. Assembling Components All of the external modules such as the bill acceptor, RFID Reader, Router, and Tablet are all interconnected on the designed motherboard operated by the NodeMCU microcontroller. The Tablet is powered by the DC Transformer that is connected to the motherboard's 12V rail. Its switches are connected to the digital pins so that it can be controlled by the microcontroller. The RFID reader is connected directly to its designated IO pins in the microcontroller. The Bill Acceptor power lines are connected to the Relay switch and its signal lines are routed directly to the microcontroller and which both are controlled by it. The router's power lines are connected to the motherboard using a DC Transformer and the data connection between the router and the NodeMCU happens wirelessly. Figure 48: Kiosk of the Automated Rental System for Internet Café Figure 48

To assess the functionality, effectivity, efficiency, reliability, and accuracy of the system's prototype, the researchers conducted a series of testing and evaluation. Table 7 shows the different tests for the functionality of the android application. The researchers tried to test if a user will be able to login and logout using the application. Also, they test the login, recharge, and checking account using the QR Scan if it will work with the android application. Table 7: Functionality Testing Result of Android ApplicationAction

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QR Scan Check Account	
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The results from	
Table 7 shows that the android application is functional with the actions stated in the table. With	
a success rate of 100%, it is therefore concluded that the operations in the Android applications	
are working well.Table 8 presents the tests conducted by the researchers to assure the	
functionality of the Kiosk Application. It will determine if the operations in the application are	
working well.Table 8: Functionality Testing Result of Kiosk ApplicationAction	
Trials	
Score	
Success Rate	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Member Login	
/	
/	
/	
/	
/	
/	
/	
/	
/	
10	
100.00%	
Non-Member Login	
/	
/	
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/	
/	
/	
/	
10	
100.00%	
Member Recharge	
/	
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/	
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/	
/	
/	
10	
100.00%	
Non-Member Recharge	
/	
/	
/	
/	
/	
/	
/	
/	
10	
100.00%	
QR Account Request	
/	

10	100.00%	RFID Tap Request
10	100.00%	
The results from the Table 8 shows that the kiosk application is functional with the actions stated in the table. With a success rate of 100%, it is therefore concluded that the operations in the Kiosk applications are working well.Table 9 presents the tests conducted by the researchers to assure the functionality of the Client PC application. It will determine if the operations in the application are working well.Table 9. Functionality Testing Result of Client PC Application		
Trials		Action
Score		
Success Rate		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Member Login		
10		
100.00%		
Logout		
10		
100.00%		
QR Login		
10		
100.00%		
Pause		

10	
100.00%	
Resume	
/	
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/	
/	
/	
/	
10	
100.00%	
Change Account Password	
/	
/	
/	
/	
/	
/	
/	
/	
/	
10	
100.00%	
Lock screen	
/	
/	
/	
/	
/	
/	
/	
/	
10	
100.00%	
The results obtained from the Table 9 shows that the Client PC application is functional with the actions stated in the table. With a success rate of 100%, it is therefore concluded that the operations in the Client PC applications are working well.Table 10 shows the testing of functionality of the bill acceptor in terms of accepting 20-peso bill with the different paper bill conditions.Table 10. Functionality Testing Result of Bill Acceptor using a 20-peso BillPaper Bill	
Condition	
Trials	
Score	
Remarks	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Dirty	
/	
/	
X	
/	
/	
X	
/	
/	
/	
8	
80%	
Wet	
X	
X	
X	
X	
X	
X	
X	
X	
X	
X	
0	
0%	
Less Folded	
/	
/	
/	
/	
/	


/	
/	
/	
/	
/	
10	
100%	
Fully Folded	
X	
X	
X	
X	
X	
X	
X	
X	
X	
X	
X	
0	
0%	
Crispy	
/	
/	
/	
/	
/	
/	
/	
/	
/	
10	
100%	
The table shows that the bill acceptor does not accept bill that are wet and fully folded. Also, bills that are dirty have an 80% success rate of being accepted by the bill acceptor. However, bills that are crispy and less folded are accepted by the bill acceptor. Table 11 shows the testing of functionality of the bill acceptor in terms of accepting 50-peso bill with the different paper bill conditions.	
Table 1	
1. Functionality Testing Result of Bill Acceptor using a 50-peso Bill	
Paper Bill Condition	
Trials	
Score	
Success Rate	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Dirty	
X	
/	
/	
/	
/	
X	
/	
/	
/	
/	
8	
80%	
Wet	
X	
X	
X	
X	
X	
X	
X	
X	
X	
X	
0	
0%	
Less Folded	
/	
/	
/	
/	
/	
/	
/	
/	
/	
10	
100%	
Fully Folded	

X	
X	
X	
X	
X	
X	
X	
X	
X	
X	
0	
0%	
Crispy	
/	
/	
/	
/	
/	
/	
/	
/	
10	
100%	
Much like with the 20-peso bill, t	
able 11 shows that the bill acceptor does not accept 50-peso bill that are wet and fully folded.	
Also, just like the previous test with the different bill, the bill acceptor also accepted eight (8) out	
of ten (10) dirty 50-peso bill inserted. The crispy and the less folded bill had a 100% success rate	
of being accepted by the bill acceptor.	
Table 12. Testing the Reliability and Accuracy of the	
Devicve in terms of Inserted Bill to Rental TimeNo. of Trials	
Bill Inserted	
Credited Amount	
Rental Time	
Remarks	
(Accuracy)	
Expected Value	
Actual Value	
1	
PHP 20	
PHP 20	
80 minutes	
80 minutes	
100%	
2	
PHP 20	
PHP 40	
160 minutes	
160 minutes	
100%	
3	
PHP 50	
PHP 90	
360 minutes	
360 minutes	
100%	
4	
PHP 50	
PHP 140	
560 minutes	
560 minutes	
100%	
5	
PHP 20	
PHP 160	
640 minutes	
640 minutes	
100%	
6	
PHP 50	
PHP 210	
840 minutes	
840 minutes	
100%	
7	
PHP 50	
PHP 260	
1,040 minutes	
1,040 minutes	
100%	
8	
PHP 50	
PHP 310	
1,240 minutes	
1,240 minutes	
100%	
9	
PHP 20	
PHP 330	
1,320 minutes	
1,320 minutes	
100%	

10
PHP 20
PHP 350
1,400 minutes
1,400 minutes
100%
Table
12 presents the testing of the reliability and accuracy of the device in terms of the inserted bills to time spent ratio. It
<div>  Plagiarism detected: 0.04% id: 37 </div> http://math.ucdenver.edu/~ssankar/MATH2830SP13/Math283...
shows that there is no difference between
the expected and actual value of the rental time based on the cash inserted. This means that, the expected value of rental time was achieved during the testing. Also, it shows that as the credited amount increments when the device continuously receive paper bills, the rental time also adjusted to the increments. This shows that the rental time has a high accuracy in relation with the inserted bill and value of rental time. Table 13 shows the different tests for effectiveness of
<div>  Plagiarism detected: 0.04% id: 38 </div> https://proteusmaster.ucsf.drexel.edu/UGE/installation_guide.ht...
the system on different operating systems.
The researchers tested if the system was able to run with the latest and other version of Windows OS. Table 13
. Testing the Effectivity of the Kiosk based on the bill inserted
No. of Trials
Bill Inserted
Expected Value
Actual Value
1
PHP 20
PHP 20
PHP 20
2
PHP 20
PHP 40
PHP 40
3
PHP 50
PHP 90
PHP 90
4
PHP 50
PHP 140
PHP 140
5
PHP 20
PHP 160
PHP 160
6
PHP 50
PHP 210
PHP 210
7
PHP 50
PHP 260
PHP 260
8
PHP 50
PHP 310
PHP 310
9
PHP 20
PHP 330
PHP 330
10
PHP 20
PHP 350
PHP 350
Table 13
shows the result on how the expected value to be displayed should be satisfied based on the bill inserted. For instance, if a customer inserted a cash, the display should show the exact amount of the cash that the customer has inserted. Also, the value should increment if the customer continuously inserts bill on the kiosk. The result on the table
<div>  Plagiarism detected: 0.04% id: 39 </div> http://math.ucdenver.edu/~ssankar/MATH2830SP13/Math283...
shows that there is no difference between
the expected and actual value of the amount that was displayed on the screen, therefore it shows the effectivity of the kiosk in presenting the bill inserted. Table 14. Testing the Effectiveness of the system on Different Operating System
WINDOWS OS
TRIALS
REMARKS
1
2
3
4
5
7
/
/
/
/
/
Effective
8
/

/
/
/
/
Effective
10
/
/
/
/
/
Effective
Table 14 presents the results when the system was tested using the different versions of Windows. Here, it is seen that the system effectively runs on Windows 7, Windows 8, and Windows 10. Table 15. Testing the Effectiveness of the system on Different RAM capacityRAM
TRIALS
REMARKS
1
2
3
4
5
1GB
/
/
/
/
/
Effective
2GB
/
/
/
/
/
Effective
4GB
/
/
/
/
/
Effective
8GB
/
/
/
/
Effective
Table 15
shows the different tests for the effectiveness of the system on computers with different RAM capacity. In the five trials that were made with each RAM capacity, all of them were successful and is therefore concluded that the system is functional on computers with RAM capacity of 1GB-8GB.The researchers compared the manual operation from the automated system to determine the accuracy of the device. For an instance, if the customer gives a 20-peso bill in manual operation then the payment that will be displayed in the kiosk should be the same. Also, in terms of rental time, the result in manual operation should be the same as the result in the automated system.Table 16. Comparison between Manual Operation and the Automated Rental System for Internet Café
No. of Trials
Payment Received
Rental Time
Remarks
(Accuracy)
Manual Operation
Automated
Manual Operation
Automated
Time Started
Time Ended
Total Hour Spent
Expected Time
Actual Time
1
PHP 20
PHP 20
9:22 am
10:42 am
1 hr & 20 mins1 hr & 20 mins1 hr & 20 mins100%
2
PHP 20
PHP 20
9:22 am
10:42 am
1 hr & 20 mins1 hr & 20 mins1 hr & 20 mins100%
3
PHP 20
PHP 20
9:22 am
10:42 am
1 hr & 20 mins1 hr & 20 mins1 hr & 20 mins100%

4	
PHP 20	
PHP 20	
9:22 am	
10:42 am	
1 hr & 20 mins	1 hr & 20 mins1 hr & 20 mins100%
5	
PHP 20	
PHP 20	
9:22 am	
10:42 am	
1 hr & 20 mins	1 hr & 20 mins1 hr & 20 mins100%
6	
PHP 50	
PHP 50	
11:15 am	
2:35 pm	
3 hrs & 20 min	3 hrs & 20 min3 hrs & 20 min100%
7	
PHP 50	
PHP 50	
11:15 am	
2:35 pm	
3 hrs & 20 min	3 hrs & 20 min3 hrs & 20 min100%
8	
PHP 50	
PHP 50	
11:15 am	
2:35 pm	
3 hrs & 20 min	3 hrs & 20 min3 hrs & 20 min100%
9	
PHP 50	
PHP 50	
11:15 am	
2:35 pm	
3 hrs & 20 min	3 hrs & 20 min3 hrs & 20 min100%
10	
PHP 50	
PHP 50	
11:15 am	
2:35 pm	
3 hrs & 20 min	3 hrs & 20 min3 hrs & 20 min100%
Table 16	
shows the evaluation of comparison between manual operation and the operation from the automated system in terms of receiving of payments and rental time. The researchers did the manual operation simultaneous to the automated system and the results were the same. It is therefore concluded that the system is 100% accurate in receiving payments and converting it to customer's rental time.After conducting extensive testing, the system is evaluated. The researchers	
evaluated the hardware reliability and durability through continuous device operation. The Functionality, GUI, Efficiency, and Design of the system is evaluated through questionnaires. The researchers evaluated the hardware reliability and durability of the system by making it operational continuously for over a week. The device remained plugged and open even after shop operating hours. Results are collected before the shop closes and another one before open the next day.	
Table	
17: Durability Test	Duration
Status	
Before Open	
ing Time	Before Clos
ing Time	First
Day	Working
Working	
Second	
Day	Working
Working	
Third	
Day	Working
Working	
Fourth	
Day	Working
Working	
Fifth	
Day	Working
Working	
Six	
th Day	Working
Working	
Seven	
th Day	Working
Working	
The researchers evaluated the system by giving questionnaires to the respondents.	
The questions are all about the core design and functionality of the system. The goal of it is to determine its acceptability	
and to determine whether the system is acceptable to the end user.	
Table 18	
: Evaluation of GUI the system	
Statements	
Rating - Average	
The interface is simple but attractive	
4.67	
It has appropriate background color and design	
4.21	
The font used in the system is readable	

4.73
Menus are organized
4.71
The features are clearly stated
4.65
It requires less technical skills to operate. 4.73
The functions can be easily determined by the users.
4.73
The process is interactive4.5
Table 18 shows the results of the Graphical User Interface part of evaluations taken from the respondents. The total average of the acceptance of the GUI is 4.62 out of 5. The total average score is equivalent to Very Good based on the qualifications listed by the researchers which has an exact numerical equivalent percentage grade of 92.325% in user acceptability. This means that the Graphical User Interface is acceptable for the users and that users get to easily use the system. Table 19
. Evaluation of the Functionality of the systemStatements
Rating - Average
The bill acceptor accepts payments
4.57
The timer is accurate depending on the payment received.
5
The card receives the money loaded from the kiosk
5
The touch input shows right display output
5
Table 19 shows the results of the Functionality part of evaluations taken from the respondents. The total average of the acceptance of the GUI is 4.89 out of 5. The total average score is equivalent to Very Good based on the qualifications listed by the researchers which has an exact numerical equivalent grade of 97.85% in user acceptability Statements
Rating - Average
The kiosk responds to the user commands
4.7
The kiosk saves time for some customer needs
4.11
when it comes to the system's functionality.Table 20
. Evaluation of the Efficiency of the systemTable
20 shows the results of the Efficiency part of evaluations taken from the respondents. The total average of the acceptance of the GUI is 4.41 out of 5. The total average score is equivalent to Very Good based on the qualifications listed by the researchers which has an exact numerical equivalent grade of 88.1% in user acceptability when it comes to the system's efficiency.Statements
Rating - Average
The kiosk design is comfortable to the user
.4.4
Table 21. Evaluation
 **Plagiarism detected: 0.08%** id: 40
https://www.researchgate.net/publication/234076792_Narratin...
of the Case Design of the systemTable
21 shows the results of t
he Case Design part of evaluations taken from the respondents. The total average of the acceptance of the GUI is 4.4 out of 5. The total average score is equivalent to Very Good based on the qualifications listed by the researchers which has an exact numerical equivalent grade of 88% in user acceptability when it comes to the system's efficiency.Limitations and Capabilities
As much as researchers desire to make a best possible system, there will always be a flaw in the system that makes it perform and function limitedly.
After carefully evaluating the system by deploying it to the real situation, the researchers were able to identify the boundaries and capabilities of the system. For the Kiosk, the built-in bill acceptor was not able to accept bills that are in wet, crumpled and/ or folded condition but it was able to cater countless crispy and less folded 50 and 20 peso bills until it fully occupied the space provided for the bills inside the chassis. The device itself is capable of running continuously and accepting countless bills without unexpected problems during the span of the evaluation. However, the system will only run continuously if provided with uninterrupted supply of power and if operated properly resulting in a good wear-tear condition. The system was able to handle 13 client workstations for the evaluation flawlessly. But theoretically, basing on the program resources usage while running on the specific device used, it will be able to handle up to 100+ clients whereas it can be improved by replacing the server with a higher specification.Chapter V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS
This chapter presents the final observations of the entire research process. This includes the summary of the research carried out by the researchers during the development. All data was based on the results and analysis of the data collected and the results of the machine testing. The findings were defined upon conducting the operation of the system.
This chapter contains the summary, conclusions and recommendations drawn from the analysis and interpretation of the results of the study.
Summary
In owning a business, one must consider the cost without sacrificing much in the quality in all aspects of the business, especially the operational cost as it occurs as the business operates. In today's world to make one business excel and succeed, owners must understand the importance of merging technology in every part of their business. Technology sets the standards in businesses that if one fails to comply, slowly, their business will be losing their advantage. With an idea of business technological modernization and knowledge of a Computer Engineering student, the researchers came up with an idea of the possibility of utilizing and applying their knowledge in designing and developing a system that will not only make an advantage to an existing internet café business but also reduce its current operation cost and improve its existing service. The objective of this research is to design the whole system with the use of determined appropriate materials. To create a program specially designed for proper operation of the device, the main output of the Automated Rental System for Internet Cafe, and to test and evaluate it to ensure the compatibility and effectiveness of each part to the software. With this system, the said business has been able to reduce its labor cost on operation and boosted their sales as people got fond of the said innovative system.
Findings
With the researchers

in depth analysis of the problem, they were able to identify and provide appropriate answers and solutions to the project's given objectives. For the device's physique, the researchers considered the users' age group and their possible height to give the best experience to the maximum number of users. After substantial probing for the best possible display angle and base height, it has been finalized and decided to give a 45 degree display tilt and a 102 cm stand. These two measurements turned out to be the best angle and height to accommodate a large range of different user heights.

In designing the graphical user interface of the system, the researchers considered factors such as color, fonts, and icons to determine whether the system is acceptable to the end users. The researchers kept the system's interface simple for it is only used in payment operations. Unnecessary visual elements were omitted to prevent confusion and to provide simplicity to the user interface. The researchers were able to design the system with the use of extensive research done to determine the appropriate components, software solutions, and materials best fit to the project's system's minimum specifications. With the researcher's on-hand observation and thorough analysis, it is proved that NodeMCU is the best fit for the system's microcontroller needs over the inferior Arduino Compatibles and the overkill Raspberry Pi. It offers Wi-Fi connectivity that makes it able to accommodate the wireless connection needs of the other parts of the system.

Whilst for the physical build of the system, with enough research done, the researchers were still not appeased so they went hands-on on identifying the best material for the chassis. They considered the environment

where the system will be placed and the behavior of its users. They were able to identify that since the system is standalone and must withstand different users, it must not be fragile and cannot be easily tampered as the system will store and handle cash. So, with that findings and further research, the researchers decided to use steel as it is sturdy and tamper-proof. Having the said material's heavy property, the device cannot easily be stolen in its placement. They aided it by a set of wheels so it can easily be placed from one place to another even with its heavy construction.

To create a program for the proper operation of the device, the researchers ended up using C# Programming Language for the client application as it provides low-level access to the system running on Windows. For the mobile and kiosk application, they used web technologies for it to be able to run on different devices without any compatibility issues.

For the system's function's versatility and usability, the researcher studied and determined the best software to be used to operate the system. Finally, after a series of system tests and evaluations, the researchers are able to determine that the overall system is able to perform and carry out the job on which it was originally designed for. The evaluation of the individual system applications went as what the researchers expected and the system was marked ready for production use.

Conclusions

The researchers achieved their objectives in making the research study and had finished making a prototype which have given satisfaction to the problem stated in Chapter I. They have developed a prototype stationed at CBJ Internet Café

to have a system that offers a convenient and efficient way for Internet owners in managing the customer's payments. The researchers designed and developed a system with appropriate materials that automates the work of a cashier by creating a kiosk that will accept and validate payments through a bill acceptor or through an RFID reader using cards. They are able to equip a custom made program for the device's operation. This system also enables customers to use their smartphones in paying their rental time. The researchers have developed and improved the existing Piso-net, an internet gaming vending machine, by accepting paper bills instead of coins and making the individual PCs are networked in a single kiosk unlike in Piso-net that have an individual machine for every PCs. After conducting several tests trials and evaluation on how the Automated Rental System for Internet Café performed, they discovered some flaws that can be improved in the future, limitations of the system operation, and things that the prototype system can actually do. It can handle small to medium internet café businesses with the number of clients the system can handle. It cannot handle and accept bills that are not in good condition which is partly good because the bills that are not in condition will be filtered. With all these said, it can be concluded that a fully functional machine was developed, proven by the results obtained.

Recommendations
The researchers recommended the following to enhance the capability and utility of Automated Rental System for Internet Cafe.

The system should be able to issue receipts to the customers for every transaction.

The system for membership accounts should be accessible online.

The hardware's display angle must be adjustable to accommodate different user viewing needs.

The server should be upgraded to cater more clients.

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<https://www.forbes.com/sites/lanabandoim/2018/09/26/cashierless-shopping-with-tap-to-go-technology-is-coming-to-more-grocery-stores/APPENDIX>
 A(PROTOTYPE USER MANUAL)
 OPERATION MANUAL
 Plug the Kiosk into the power outlet.
 Plug the Kiosk into the central network switch.
 Run the Server Application in the existing Server Computer.
 NOTE:
 THE KIOSK OPERATES ON VOLTAGES 110V ~ 220V.
 DHCP MUST BE SETTED UP ON THE EXISTING NETWORK OR SPECIAL STATIC ASSIGNMENT MUST BE ASSIGNED FOR THE KIOSK
 KIOSK MANUAL
 Select the operation if logging in or doing member account specific operations.
 For Logging In:
 Select if Member Login, Non-Member Login or Recharge for adding money to the current session.
 For Non-Member Login and Recharge, They are required to Insert Money first before any further operations. Once a money is accepted the user will be unable to cancel the Login or Recharge Operation. The display will show the exact amount of the current cash count the customer has inserted. For the Member Login, the user is required to present their own card to the card reader for user authentication and verification.
 The customer will pick their desired PC. Green Colored PC Icons means the workstation is available. Red Labeled PC means the workstation is already occupied and not available for logging in. Yellow Labeled PC's are workstations that are occupied are available for recharging.
 The Kiosk will
 return to the Homepage after a successful operation. FOR MEMBER ACCOUNT
 The Member Customer will choose their desired operation: Check Account to Check their Account Balance
 Register Card to Register New Account Card
 Add Cash to Recharge Account
 Check Member Account
 To Check Account. The user must present their card to the reader first.
 After Account Authentication, The Kiosk will retrieve the account information and show to the user. The information will automatically hide after 7 seconds
 Register Card
 After Creating an Account and buying their own card or registering a replacement card. The user must scan the barcode shown in the kiosk to identify the user.
 After Authentication, the user must present their newly bought card to the card reader.
 A confirmation message will show after a successful registration. Add Cash
 To add cash to the account. The user must present their card to the reader first.
 The User can now insert cash in this stage. Once a money is accepted the user will be unable to cancel the Login or Recharge Operation. The display will show the exact amount of the current cash count the customer has inserted.
 After inserting money and finalizing the transaction, it will show you the current balance and return to the kiosk homepage showing a successful transaction.
 Client Application
 In the client lockscreen, You are able to create your own account, make kiosk account request using username and password, or Login your own account Account Creation
 Click the Sign Up button below the Login Form
 Fill up the necessary basic user information.
 A confirmation message will show after a successful registration.
 Kiosk Account Request
 Enter your account Login Username and Password First
 Instead of Clicking Login, Click the Submit button under the Kiosk Request.
 After the Request and account authentication, it will automatically push the request to the Kiosk and will acknowledge the account.
 Account Login
 Enter your account Login Username and Password First
 After entering the right credentials. Press enter or click the Login Button
 After authentication and checking account validity and credits, the server will unlock the workstation and show the session information. Changing Workstation
 In an ongoing session click the Change PC button in the client application sidebar
 Choose Between the available workstation in the List
 Click Change PC after the selection
 After that, the old workstation will automatically lock and the session will be moved to the selected workstation.
 Pausing Workstation
 Click the Pause Button in the sidebar. The button is only present for member users
 It will lock the workstation and return you the login page

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```
import { BrowserRouter, Route, Switch, Redirect } from "
```

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[illegible]

Redirect
from={ prop.redirect} to ={layout + path + prop.path + (prop.params " ")}
Quotes detected: 0.07% in quotes: id: 55
key={key} /); } return (Route path ={layout + path + prop.path + (prop.params " ")}
exact={ prop.exact} render ={props = prop.component {...props} / } key={key} /); }); }; xiv x 36