

ECO QR Car Park System

Siew JX, Ng CH, ChrisFoo XJ, EdwinCheong LT, JoviLee JT

School of Computing & Creative Media, KDU University College,

Jalan Kontraktor U1/14, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia

dmx.xiang@gmail.com, chuan_hang@hotmail.com, chrisfoo1212@gmail.com, edwin4v@gmail.com,
jovilee18@gmail.com

ABSTRACT- *This paper talks about a new environmental friendly parking system that is able to reduce the pollution on earth compared to other generic parking systems. The three main concern for our parking system is the about the impacts towards the environment, the cost of this system and the overall satisfaction that users will get from using this newly designed system. The research methodology used in this project is sequential mix mode to collect data by using online survey and experiment to validate the result. It also addresses the current problem of pollution.*

KEYWORDS: shopping mall; car park; wireless; sensor; network; Arduino; barcode; QR code; Bluetooth; smart card

1. INTRODUCTION

In recent years, pollution is becoming worse than ever before. In the past two years, the database – now covering 3000 cities in 103 countries – has nearly doubled, with more cities measuring air pollution levels and recognizing the associated health impacts [1]. Air pollution has a high impact on health, some examples are like lung cancer, chronic and acute respiratory disease, the risk of stroke and much more. Ambient air pollution, made of high concentrations of small and fine particulate matter, is the greatest environmental risk to health—causing more than 3.3 million premature deaths worldwide every year [2]. Pollution is getting worse and worse by each passing day. It is our duty to do our best to maintain and protect the environment. So we decided to help our mother earth by implementing an eco-friendly and simplified car park system. An example of eco- friendly car park system that exist is the automated parking system or APS for short. This car park system is a mechanical system that is automated. It stacks cars vertically and multiple levels to help reduce the square footage usage. This system is found in Paris, France since 1905 at Garage Rue de Ponthieu. The Automatic parking systems are space efficient, the reason for this is that since it has an absence of passengers, it does not require to have a wide parking space as normal car parks. It also reduces the space by not having any pedestrian footpaths, staircases, walkways, and ramps. Automated Parking System is also simplified, once driven into the transfer area, the passenger exit the vehicle, a ticket is given and will be used to retrieve the car. Research aims to deliver the following objectives as shown in Table 1.

Table 1: Research Objective

RO1: To minimize the cost for parking system
RO2: To reduce the environment's pollution
RO3: To improve the customer's overall satisfaction.

R01: To reduce the cost. The reason for this is that is costly to print a lot of car park ticket. We would also need to purchase a lot of Autopay machines along with a few car park ticket machines which would further increase the total cost. The Autopay machines would also need to have maintenance often to ensure that it is running smoothly and properly or else customers would not be able to pay their carpark ticket and cost inconvenience. The inconvenience that it would cost is that the customers would have to walk to another Autopay machine which is located further away. This will create a domino effect, all the customers will have to go to another Autopay machine creating a longer queue than usual. This will waste time to get to another Autopay machine and waste time queueing up.

R02: To save the environment. Printing carpark tickets on a daily basis in a large scale consumes a lot of materials. This contributes to the desecration of the environment. Car park tickets are not only made up of paper but also other materials like plastic, ink and etc. The process of making papers to car park tickets is long, it goes through a lot of procedures to come out as a car park ticket. This wastes a lot of resources and time to actually produce a single ticket. If we are able to change the material that we use to something more eco-friendly, it will benefit both the company and the environment at the same time.

R03: To improve customer's satisfaction. A lot of customers are not satisfied with the way the current system works. They find it to be quite troublesome compared to the other systems that already exist. One of the examples is like the RFID system or SmartTag. It saves more time and is more practical compared to the car park ticket system. Users will have a better experience and will be far more content or satisfied if the car park systems are improved. If we are able to improve the customer's satisfaction, it is more likely that they will come back because they enjoy the service that they experience, this will help improve not only the building's reputation but also its income if it is a shopping complex. This paper aims to answer the research objective via the research question in Table 2.

Table 2: Research Questions

RQ1: How to build an efficient system that is low cost?
RQ2: To what extent able to improve the current system and incorporate eco-friendliness to it?
RQ3: How can our system be efficient and eco-friendly enough to set our system apart and also please the public?

	<ul style="list-style-type: none"> distance -Convenient when scanning -Fast -Secured -Can stored big amount of data -Reusable 	<ul style="list-style-type: none"> -Picking up information problem -Tag collision problem
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RQ1: The main component of our system would be the QR code scanner, server, and Bluetooth devices. The price of a QR code scanner can cost as low as \$40 to a few hundred USD. The price, of course, depends on the quality, build and etc. Renting a server cost as low as \$5 a month. Bluetooth devices cost around 25 ringgit.

RQ2: Can further improve the current system by implementing new technologies such as QR code, RFID and etc. The way to be eco-friendly is to use green. There are a lot of green products nowadays, products made up of recycling or reusable materials or energy. Like by using solar energy. We would have to put up solar panels near the exit of the car park where it can get solar energy and then use that energy to power our QR scanner, Bluetooth and etc. This method will definitely be more eco-friendly as the energy is renewable it would also save cost replacing electric.

RQ3: In our prototype, we use Bluetooth module to transmit data is because the energy consumption for Bluetooth is very low. Bluetooth only needs few months to finish using a standard battery life iv. Furthermore, bluetooth.com had announced they are developing a Bluetooth that has ultra-low energy consumption that can run few months by using standard coin cell battery. Moreover, our parking system is using QR code, therefore, it does not require so many RFID cards which are made of plastic for a user. In the long term, if every parking is using this system they may give a bigger impact on our environment.

2. LITERATURE REVIEW

Table 3: Driver ID Method Comparison

	Advantages	Disadvantages
QR Code	<ul style="list-style-type: none"> -Distinct -Cheap -Does not require special equipment -Flexible/ Practical/ Versatile? -Can contain a lot of data 	<ul style="list-style-type: none"> -Lack of Familiarity -Slower -Security issues
Bar Code	<ul style="list-style-type: none"> -Small -Inexpensive -Universal -Accurate -Widely used 	<ul style="list-style-type: none"> -Slightly more difficult to read or scan -Needs to be near the scanner -Can't add additional information -Not very secure -Vulnerable
RFID	<ul style="list-style-type: none"> -Can be read from a 	<ul style="list-style-type: none"> -More expensive

The advantages of QR codes is that it is distinct. It is very easy to be spotted, people can easily recognize a QR code based on its square shape filled with black boxes within it. No one can ever complain that they were unable to find a QR code [5]. QR codes are also very cheap. Costing as low as free. You can make your own QR code online, there are many websites which provide this service for free with a wide range of functions to choose from. QR codes can also be printed on things, for example, paper, boxes, plastic and etc. The cost of this would only be the amount of ink you use. QR codes are very easy to generate, all you need is the correct website or company and that's why you do not require any special equipment. For example, 3D printers require the 3D printer, Poly Lactic Acid (PLA) and Acrylonitrile Butadiene Styrene (ABS) which are basically the materials that need to print, a 3D model, STL files, and a slicing software.

QR codes are also versatile. They can be used for basically anything. QR codes benefits both businesses and customers. Business owners can put QR codes everywhere, on websites, road advertisement signs, products and etc. Customers will just have to scan the QR code and will get all the information regarding the product or business. This helps business owners with advertisement while also help customers to store information quickly. QR codes can also contain a lot of data. The amount of data able to be stored in a QR code depends on a number of squares boxes there is in a QR code. The maximum rows and column a QR code can have are one hundred and seventy-seven each. This would be a total thirty-one thousand three hundred and twenty-nine squares. For numeric only, the maximum it can store is as much as seven thousand and eighty-nine characters. For alphanumeric, it is four thousand two hundred and ninety-six characters. And for binary, it is two thousand nine hundred and fifty-three bytes.

The disadvantages of QR code is that it lacks familiarity or awareness. I'm seeing more and more QR codes being used (I saw one on the BBC's Good Cook program for instance), but only a minority of people are using them [6]. QR code may be very popular nowadays in social media and among younger aged people. However, if you would ask an elderly man or woman what is QR code or to show them one, they would not know what it is. This is the main drawback of QR code, although it is easy to be identified it lacks its identity. A lot of people would see a QR code and think that it is some crazy silly design of boxes and would not know that it contains information if scanned. Another group of people might know it is a QR code but do not know how to properly scan it. They might not have a QR code reader installed on their phones or might not know what that application is on their phones. Another disadvantage of using QR code is that it might be a little slower. To scan a QR

code, you would have to go through a few procedures. The first would be open a QR code scanner application. The next step would then align your camera with the QR code, making sure it is not too far or too near to be able to read by the application. After scanning, the application would mostly ask you what you want to do next, whether it is to open the link or app. Then you would only get the information you are looking for.

QR codes might also be a concern to some people because of security issues. A hacker or unethical computer user can generate their own QR code stating that by scanning the QR code you would win a new free phone or car, unaware users might eat the bait and scan it, leading them to a website which contains harmful viruses, spyware and etc. This will allow hackers to target a new audience and create a new way obtaining information instead of just targeting computer users.

Barcode has a lot of advantages, the first advantage is that it is small. Barcodes have an average size of only twenty-five point nine three millimeters in height and thirty-seven point two nine millimeters wide. The symbol size should not be reduced below 80 percent. Barcodes also have a very low cost. Barcodes can be printed directly on the product like cardboards but can also be printed on a sticker to be placed on products with a more irregular shape like for example bottles, Tupperware, fruits and etc. Another great advantage of using barcodes is that it is a universal technology [7]. Almost every part of the world has used or is using the barcode for their inventory or stock that they have. Meaning this technology can be found anywhere and so retailers or business owners would not have to worry that this technology make not be available overseas so they don't have worry about whether or not their business can be expanded overseas or like how they do not need to worry about stock and inventory when importing large amounts of products. Barcodes are very accurate when scanning. It is normally very fast and precise when scanning a barcode, it would not take up to more than 3 seconds to scan a barcode. Barcodes are also very accurate, it is said to have the same accuracy as good as RFID tags or even better. Barcodes are also widely used. Barcodes can normally be found in retailing shops and products to any other shop that has a barcode reader, this includes mechanical shops, retailing shops, boutiques, cafes and so on, the list goes on.

The first disadvantage of a barcode is that it is slight more difficult or troublesome to use? Barcode needs a line of sight, meaning the barcode scanner needs to be aligned with the barcode when RFID do not require such effort [7]. Another disadvantage of a barcode is that it needs to be near the scanner. Some barcode scanner has a short detection range compared to other identification methods. However, with new technology, barcode scanners can be scanned up to barcodes fifty feet away. This is called long range barcode scanner, these scanners are very useful for when trying to scan products that are placed on the top shelves. But for normal barcode scanners, the furthest it can scan is no more than fifteen feet. Besides that, barcodes do not have the ability to read/ write capabilities. This means that they can't be added with new information once confirmed. Moreover, barcodes are also easy to forge and reproduce, making it exposed to threats. Barcodes are vulnerable. They are easily damaged because they need to be placed in an area that

can be scanned by the line of sight. So the barcodes have to be exposed and placed on the outside of the product. If the barcode is damaged, scratched, ripped and etc. it would be impossible to scan the barcode.

RFID advantage is that it can be read from a distance. A simple example would be SmartTag, RFID in cars coming from a distance can be detected by the machine allowing cars to pass through faster. RFID are also easier or more convenient to scan or detect. You just have to make sure that it is not blocked and is exposed enough to be able to scan. When compared to barcodes where you have to line the sight up and put it closely, you will see how much more convenient RFID are. RFID are also much faster. RFID tags are readable at a faster speed compared to the other identification methods. It is said that you can read around forty RFID tags simultaneously. RFID tags can be read from as far as three hundred feet away in distance [7]. RFID are also more secured. This is because the data within the RFID tags can be password protected, encrypted, or to even include a kill feature to remove the data inside the tags permanently. Also, RFID tags can carry a much larger amount of data compare to other identification methods like barcodes for example/ RFID tags also have read/ write ability. Meaning the data within the tag can be changed multiple times and saved. Besides SmartTag to store information like user data, account balance and etc. RFID can be programmed to store information like shipping histories, product maintenance, expiry dates and etc. RFID are also reusable which means eco-friendly. The reason for this is because RFID tags are made to last longer as they are covered by a plastic cover to make them more rugged.

The disadvantages of RFID is that it is more costly. RFID needs to assemble, inserting computer chips and etc. which made it cost more. The next disadvantage is that RFID signals might be blocked. RFID readers will face a problem if the RFID tag is placed under metal or liquid that might interfere with the signal to be picked up. Another disadvantage is that signal collision or tag collision might occur when using RFID. How this happens is when two signals from different readers overlap each other causing the tag to not be able to respond to both readers. RFID contains two different chips which are read-only and read/write chip which cannot be read by the same machine.

3. RESEARCH METHODOLOGY

The research methodology that uses in this Quantitative Generalization. The method for doing data collection is The amount of respondent for this survey is a total of eleven people. It is because the advantage of doing questionnaire is able to get answers from many people in a short amount of time. Furthermore, the target audience for this research is easy to reach. It is because our target audience for this research is only Malaysia driver. Furthermore, the advantage of the questionnaire is that the more respondent, the better the analysis and results. Therefore, the questionnaire is the suitable data gathering method for this research. The data is to be collected via the following methodology as summarized in Table 4 below.

Table 4 : Research Methodology **Ошибка! Источник ссылки не найден.**

Research Dimension	Explanatory Sequential Design
Research Methodology	Quantitative Generalization
Data Collection	Online Survey
Result Validation	Experimental Simulation

The research dimension for this project is using explanatory sequential design-xii. The data collection method that used is an online survey. The online survey is very convenient compared to the traditional paper survey. Online survey allows people to be able to do in a smartphone, laptop, and tablet in any place. Furthermore, it is also able to auto generate results to us by using the collected data. In the questionnaire, it divides into five sections. In the first section, ask about personal details of the respondent. From these personal details able to know that the respondent is the target audience that our research needs. Moreover, in the second section, the questionnaire ask about the respondent to see if he or she is a smartphone user. This is because the new parking system that is designed require using a smartphone. From this section, we are also able to get data about either phone or RFID card is more convenient to people. Furthermore. In section three it asks about the new car park system if the feature is necessary or not. So from this sections, we able to get data to know which feature is it useful for the user. Moreover, in section four it asks the respondent to provide any new idea that can improve the current car park system. The last section asks about which ID method people like, from here we are able to know which type of ID methods people prefer.

4. FINDINGS & DISCUSSION

The identification method uses QR code. The reason for this is because it is considerable one of the cheapest identification method out there. Compared to the other identification methods, it cost almost the same as the barcode and it's cheaper than RFID. QR Code is might be slower to be detected compared to the other methods, but it is not too long, QR code makes it up when it does not require any special equipment. It fits with the whole eco-friendly theme. The QR code method is more pollution free as it can be reusable or regenerated, it does not use any material like plastic for cards or paper for tickets. Going with the whole reusable concept, QR code can be rewritable. Meaning the data can be changed and do not have to get a new barcode or etc. QR code scanning distance is also considerable good because it does not require too near of a distance. Furthermore, by using QR code user might not have to roll down the windows of their vehicle to scan the QR code. Besides that, most people have a lower chance of forgetting their smartphones than RFID card, therefore it is also able to help solve the problem of forgetting to bring RFID card.

Current car park system is convenient ? (11 responses)

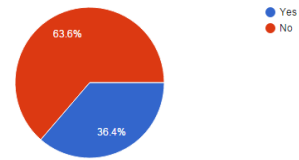


Figure 1: Convenient System?

Would you try out a new car park system? (11 responses)

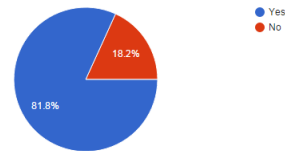


Figure 2: Try new car park?

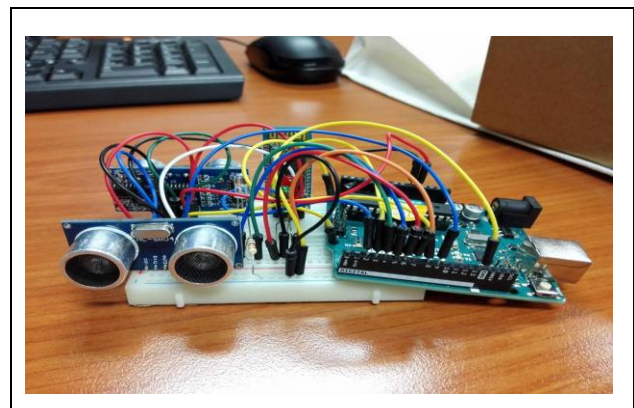


Figure 3: Arduino Devices

In figure 1 shown that 63.6% of people said that the current car park system is not convenient enough. From figure 2 shown that a total of more than 80% of the respondent would not mind trying out a new parking system. This means that our parking system which uses a different technology might be a popular choice among users. In Figure 2, we are able to know that the majority of people do not mind to try out a new car park system. Since from figure 1 there is a large amount of people who agree that current car park system is not convenient enough means that it does not meet their satisfaction and know there is room for improvement. Therefore, this QR Car Park system prototype is built to help improve the existing system. Other than that, some inconvenient issues caused by the current RFID carpark system is analyzed and improved in QR Parking System. QR Parking system does not need to roll down the window to scan the card like RFID if the distance is right and the window is clear.

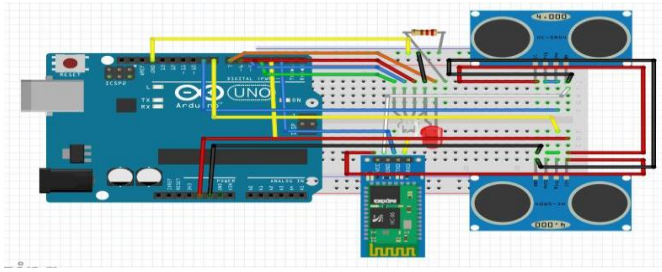


Figure 4: Arduino Circuit



Figure 5: Network Topology

Result validation is done by using experiment simulation technique in Figure 3. It shows the prototype that is built by using Arduino. From the Figure 3, we are able to see that there are 2 ultrasonic sensors and is connected to a single circuit. This is to prove it is able to detect multiple parking lots, so one sensor for one parking lot. Figure 4 shows the connection and component of the device. From Figure 4 we are able to know that there are 4 main components for our circuit. The first component is the main circuit which is the Arduino board. For this project, the Arduino model we are using is Arduino UNO. There are a lot of other Arduino board like Arduino Pro, Arduino Mini, Arduino Pro Mini and etc. Arduino Uno was used for this project because it is the easiest to learn how to configure. Figure 5 shows the topology of mobile phone and the parking system. The left-hand side smartphone acts as a camera and it will use Bluetooth to communicate with the Arduino and show the correct QR for the user to scan using the right-hand side smartphone.

5. Conclusion

“This ITconomic paradox has been long debated over its tangible and intangible contributions” especially on the need for simplified and eco-friendly long term solution for both the driver and shopping mall plus environments [13]-[15]. With the current technology, there are many ways to go green, including electric cars, solar energy panel and etc. For the future, we can incorporate these great findings to our system. A new technology is being researched to use friction to convert to electricity. Researchers at Georgia Tech have been developing an alternative method of harnessing our movement that relies on static electricity and friction while increasing the potential for energy harvesting significantly [16]. This would also be a great way to harness energy in a green way.

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