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Research paper

A Composite Web Design Structure for Online Tennis Court Payment System

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Abstract

This paper presents the development of composite web design structure for online booking tennis court system. Problems identified that IR 4.0 for sports facilities is needed where less of sports owner implemented to facilitated effective management. Customer navigation has been a challenge to design well-structured websites to manage their facilities. The different understanding of the web developer and the user is considerably different that caused for poor website design. The objective for this research is to provide a simple online reservation system for a tennis court where customers are easy to access to the tennis court facilities. Analysis of the customer satisfaction is retrieved based on the designed system. The system was designed with functions that follow specific requirement, including user's registration and login, online booking, online payment, QR code, composite web design structure and database construction. The system was developed using CMS (Content Management System) with Joomla applications and XAMPP web software. XAMPP is free open source added with a combination of Apache, PHP and MySQL. The Google spreadsheet was used to create QR code. Informational databases like time booking, court available and online payment are designed. Data collection on the web page on the running composite webpage has been analyzed and results on rates of the portal, the player's booked, time booking, customers by ages and genders, Indoor and Outdoor booking are presented. Data shows an increase in booking daily from 7 am to 10 pm compared to last year based on the easy booking system with a composite web design structure of online payment prototype system that has been developed. This research presents an impact on IR 4.0 development towards managing sports facilities with recent trends and human health activities.

Keywords: *Online booking system, QR code, Composite web design structure, Joomla Web Application*

1. Introduction

According to European Commission, "Internet of Things (IoT) represents the next step towards the digitization of our society and economy, where objects and people are interconnected through communication networks and report about their status and/or the surrounding environment"[1][2]. IoT has become the next evolution of the Internet; since it is allowing us to gather analyses and share data from which knowledge is being extracted that it helped them simplify different day-to-day tasks. Hence it is weaving itself into our lives and gaining lots of attention[3][4]. Since IoT is a network connectivity and computing capability extends to a constellation of objects, devices, sensors, and everyday items that are not ordinarily considered to be "computers"; this allows the devices to generate, exchange, and consume data, often with minimal human intervention. In the context of integrated location-based, "smart homes" or "smart cities" have even been implementations for these devices[5], [6].

In the past few years, more and more daily tasks and operation are done online using computers and mobile devices since the rapid growth of the internet. Web-based application development also has grown to an outstanding level. As we can see nowadays, almost all organization has to work in paperless technology. The developed happen from manual system to a computerized system among many organizations and agencies[7]. One of these tasks is making a reservation or booking online for a web-based application. Booking systems are used in more and more places all the time. Even when buying something online the item is booked for the prospective buyer but booking systems could be limited to systems and not too generalizing. Using a booking system should be logical and easy to satisfy all the users on both sides of the system [8]. Booking systems can be quite simple or on the other hand, very complex when looking at their functionalities [9]. Most of the booking systems functions do not become visible to the user or the administrator. These functions could be, for example, automated reminders to users and calculations to avoid overlapping bookings. The more resources and other changing factors a system has, the more processing needs to be done.

User's experiences with website page online presence face problems related to web usability issue. In general, how user-friendly is the website described its complicated declaring for a website. In effect, the present visitors with the most useful platform of ever website become the main to finding and using information, entertainment, product, etc. Easy to use and offer something to the user should behave for the website like online booing, authenticate with RFID, adaptive monitoring [10, 11, 12]. This theory might sound quite easy but in reality, in order to achieve measurable success, it requires several necessary and important steps to complete it. In terms of web usability, the decisive factor above all is website navigation that can then complement the web design and content in a meaningful way [13, 14].

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In this system, the user is able to book tennis court by using web application. For this system, it concludes special application for security in the tennis court. The user is provided a QR code after the payment process to access the tennis court.

2. Literature Review

E-commerce (electronic commerce) is for any type of business, or commercial transaction, which involves the transfer of information across the Internet. Several trillion dollars are been exchanged annually over the web has been expanding rapidly for the global e-commerce[15]. So the key element for the organization is the website design. The user may leave a website if having difficulty in locating the information even though its information was a high-quality information [16]. The difference in understanding of developers view and the user's view become a primary cause for a poor website design. The desired information in a website simply is not being able to locate due to this dissimilarity in many times users.

This problem cannot be easily avoided since, at the time of creation of a website, web developers may not have a prediction of users' likings and can only arrange pages based on their own decision. But, the satisfaction of the users rather than the satisfaction of the developers can be measured by the success of a website. So, how pages should be organized by structured web pages in a way that generally matches the user's model [17]. The various issues on a website have been focused by previous studies, such as knowing the web structure, discovering relevant pages of a given web page and extracting the template from web pages.

Navigation structure means by the users can move from page to page within a website to have a pleasurable experience [18]. This shows a user-friendly website where people will gain interest and easy interacts with the website.

2.1 Web Design Structure

Web design structures consist of 4 types which are linear, Hierarchical, non-linear and Composite structure. Details explained the most used design web structure.

2.2.1 Linear

Linear navigation is the simplest website structure. Figure 1 shows linear structure where each page is simply linked to the one before the node. This only really works if the website has very few pages.

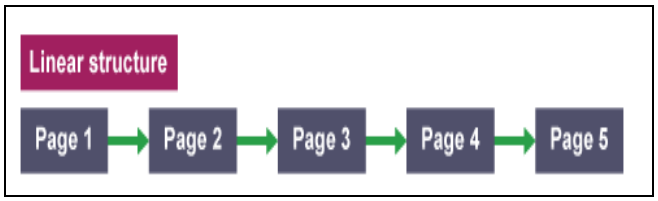


Figure 1: Linear web design structure

2.2.2 Hierarchical

Tree-like in its nature was defined for a hierarchical navigation structure. At the top, the home page was created and underneath it breaks into categories as shown in Figure 2 [19]. The domination in usability studies suit for this conceptualization of website hierarchy, where the speed and accuracy with which users perform a pre-defined information retrieval or other tasks in a website are frequently measured by the number of hyperlinks users need to follow or web pages they need to visit in order to complete the task [20].

a. Web Design Structure

The web navigation structure allows users to follow their own information flow. It may be unique to each user who used the application. To facilitate this, there needs to be a large number of links between individual pages. This limits its usefulness with larger sites containing more pages as shown in Figure 3.

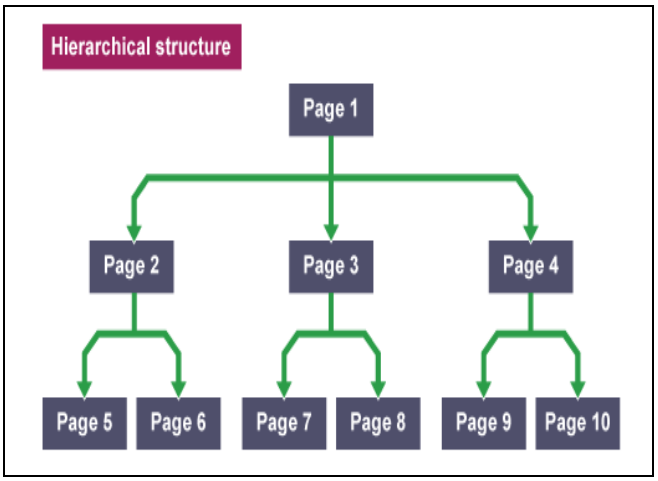


Figure 2: Hierarchy web design structure

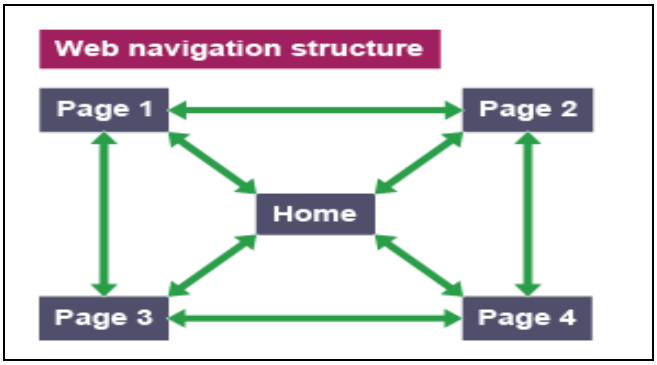


Figure 3: Web design structure

2.2.3 Composite

A composite navigation structure integrates various aspects of other structures and is the least limiting [21][22]. It can be part linear and part hierarchical and is particularly useful where the multimedia product has a lot of topics and sub-topics as shown in Figure 4.

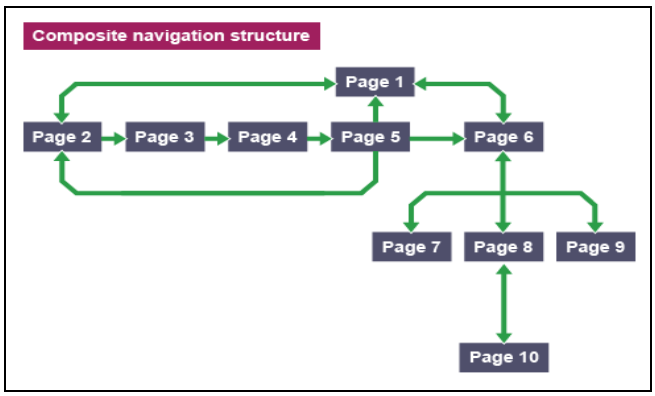


Figure 4: Composite web design structure

a. QR code

The Quick Response (QR) code is used to store user information and ticket purchasing details in encoded form with black and white and have no restriction of QR size[23]. This QR code can be used to transfer from one mobile to another and can be shown ticket detail to the booking checker for validation [24].

b. Online Payment

As for micropayment, it will involve a very small monetary amount which is mainly used in Business to Consumer/B2C business via internet for the transaction. Micropayment provides offer various payment modules. Merchants need to sign up for an account with the chosen provider and decide for a module that will suit the needs for the system and the user. The customer gets an option how to pay for desired content or goods. The most common micropayment applications such as PayPal call2pay, hand pay, credit card, direct card, etc. Once the user has an account with some balance in it, they can generate a QR code.

c. Gap Analysis for Existing Booking System

The existing system is an example of a functional online system which has its feature and has a specific function with the related field such as business field, campus field or extra. In this project, the structure used a composite structure by using Joomla! Version 3.8.0. This project also is implemented online payment and after the payment process complete, QR code is generated to make this project more special that other website.

Table 1: Research Gap Analysis

Feature	Structure Design	Model Web	Payment Method
Tennis Town	Linear structure	Wordpress	Not Provide-need to contact first
TPC Kuala Lumpur	Linear structure	XiMnet	Not Provide-need to contact first
iBookCourt	Composite structure	GOGOSCORE	Online payment
Bookcourt88	Composite structure	Wordpress	Online payment
This research [2018]	Composite structure	Joomla!	Online payment

3. Methodology

The project methodology framework is divided into six phases starting from gathering information, design, implementation, testing, result, and documentation. Figure 5 shows the flowchart of the overall system.

3.1 Flowchart and Research Structure

Figure 5 shows the flow for the general booking process. Firstly, a user needs to login to the web application to booking the tennis court.

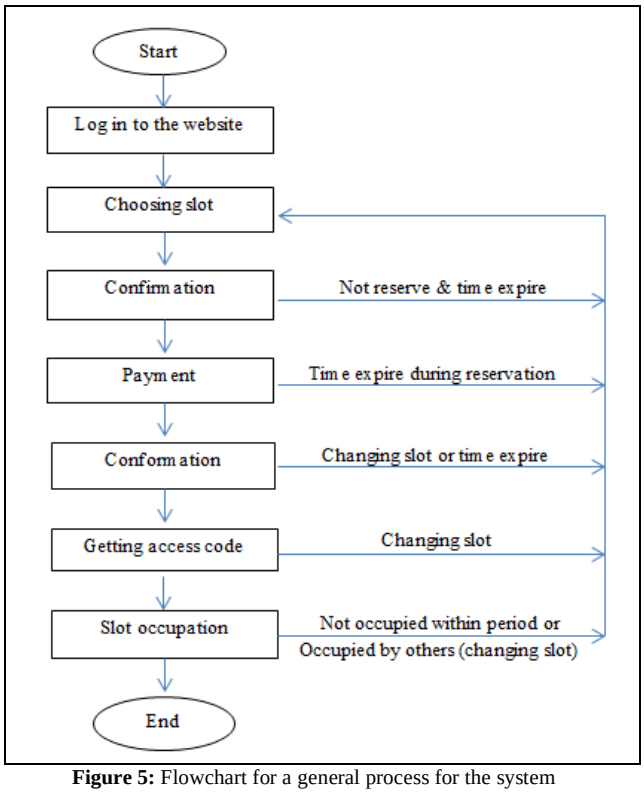


Figure 5: Flowchart for a general process for the system

After login to the web application, users need to choose the slot for a tennis court and make some payment with the online payment. After settling all the process including the payment, users will get the QR code for booking court. Lastly, the data is captured. This system involved the implementation of the various elements to build a system. This system also has a front end device that is connected to a server. All the data has been submitted to the database and the database will responded to the server for data collected. After the user booking the system and make the online payment, data is confirmed by the server and invoice and the QR code is generated as shown in Figure 6.

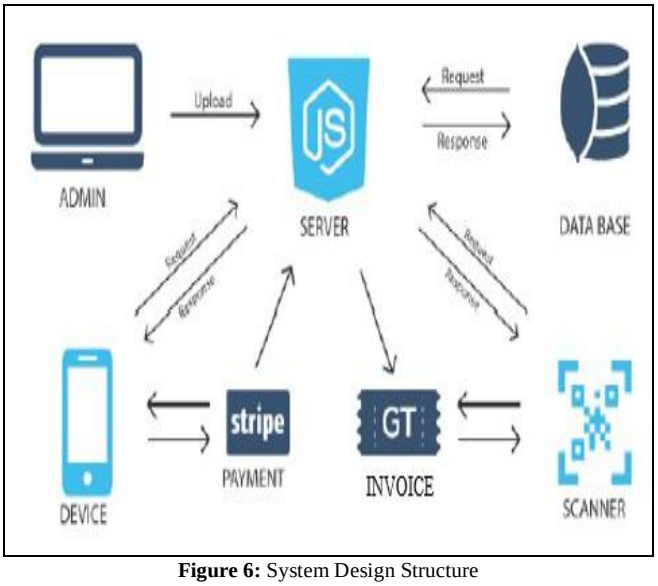


Figure 6: System Design Structure

3.2 Table Parameters

Important parameters are analyzed based on literature and technology-enhanced for the newly developed system.

3.2.1 Design Structure

This project system, the composite web design structure has been used as shown in Figure 7.

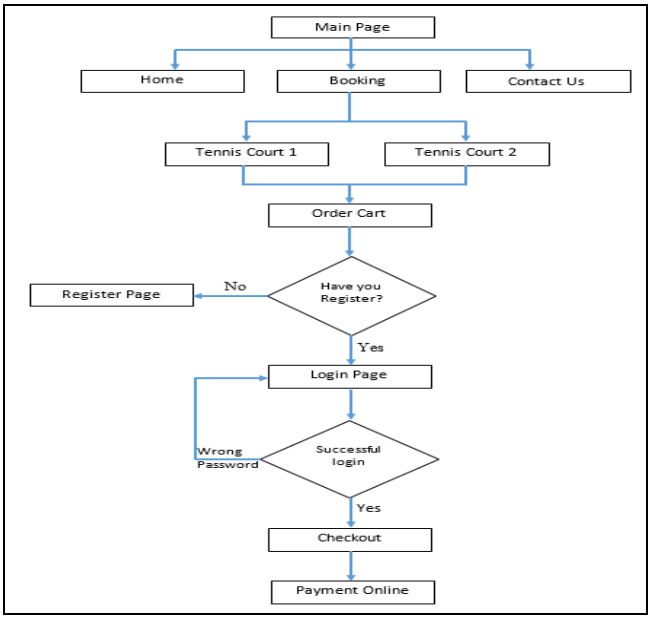


Figure 7: Website design structure

The "home page" includes a short description of the tennis booking system. The "booking" page contains the tennis court 1 and tennis court 2 and this page will hold the database for the system. This page also with be connected to the online payment. The last page is "contact us", where customers can find ways to contact the association.

3.2.2 Parameters Design

Web Development on hardware and software is identified to design the web composite structure and its prototype. Table 2 shows the parameters design to develop this project.

Table 2: Parameters Design

No	Descriptions	Parameters
1	Laptop	• Processor: Intel Pentium 987, Speed 1.5GHz • Chipset: Intel HM70 • Graphics: Intel HD Graphics • Display: 14-inch WXGA, LED-backlit display, 1366x768 pixel • RAM: 2GB DDR3 • Hard Disk: 500GB • Window: Window 7 64-bit Operating System
2	Connection	• Bluetooth 4.0 • Wi-Fi 802.11 b / g / n
3	Joomla!	Version 3.8.0
4	PHP Built on	Window NT user-PC 6.1 Build 7601 (Windows 7 Ultimate Edition Service Pack) i586
5	Database	Version 5.5.5-10.1.32-MariaDB
6	PHP	Version 7.2.5
7	Web server	Apache 12.4.33(Win32) OpenSSL/1.1.0h PHP/7.2.5
8	WebServer to PHP interface	apache2handler
9	Server Root	C:/xampp/apache
10	Security	• Core - LDAP Information Disclosure
11	Dynamic	Respond by Admin

3.3 Hardware and Software Development

3.3.1 Hardware

The hardware comprises of Computer that store web server and website's component files. A Domain Name is rented to monitor the web and a configuration is set accordingly to the required hosting. Management of Hosting has been set that allows posting a website or web page onto the Internet

3.3.2 Software

The current system was developed using CMS (Content Management System) by using Joomla, the web server software is XAMPP as shown in Figure 8. It is widely used nowadays, mainly because it is a powerful, free and open source. XAMPP is mainly a combination of Apache, PHP, and MySQL as shown in Figure 9 and Figure 10. Apache is an HTTP server application to run dynamic websites such

as the ones made with PHP [25][26]. Apache also includes a MySQL database and a phpMyAdmin browser-based application for database management [27][28].

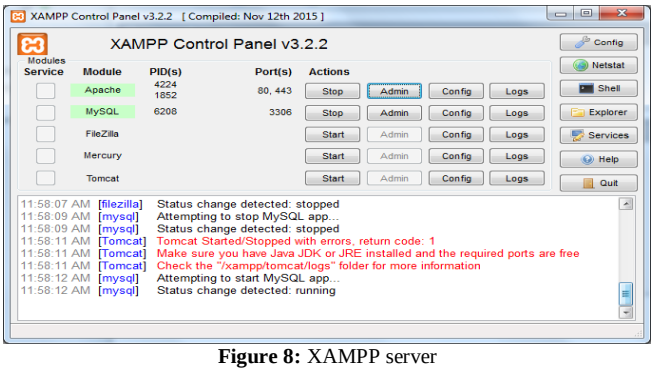


Figure 8: XAMPP server



Figure 9: web server

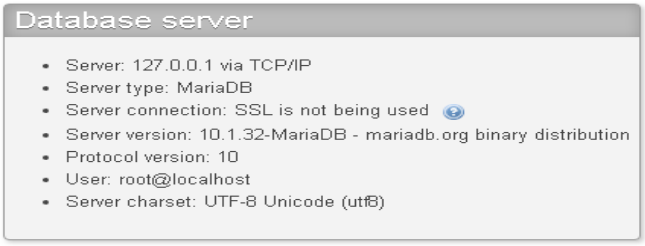


Figure 10: Database server

4. Result and Analysis

Figure 11 shows the home page for the booking system website. On clicking Booking, the tennis court booking is displayed. The user needs to select between tennis court 1 or tennis court 2. After selecting the option that has on that webpage, the user needs to click on the button "ADD CHART" to proceed for booking. The user needs to double the information before click "CONTINUE SHOPPING" as shown in Figure 12.

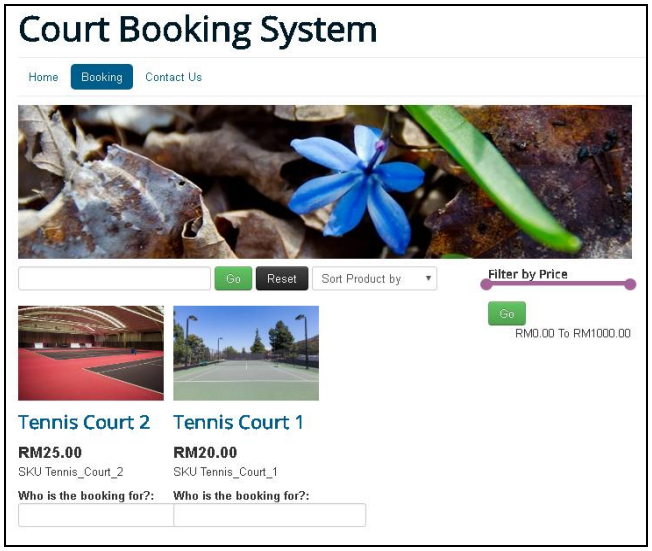


Figure 11: Homepage

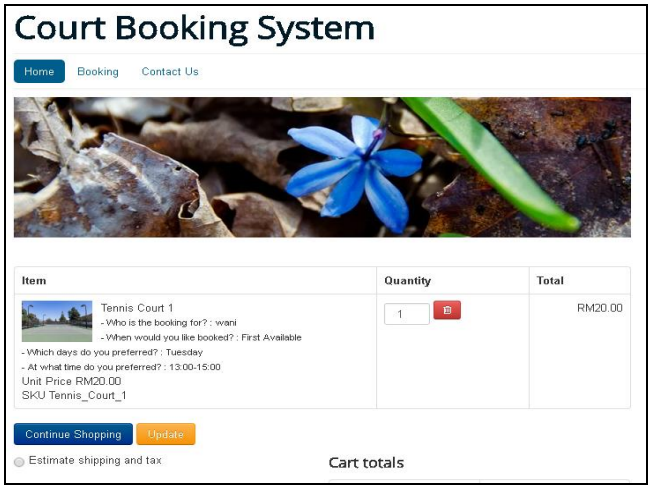


Figure 12: Cart tool for checkout

Figure 13 shows user page if the user already has the account where a user just click on the button "Login" as shown in figure. Before continuing to the checkout, a user needs to create an account if the user booking for the first time. The information will be stored in the database.

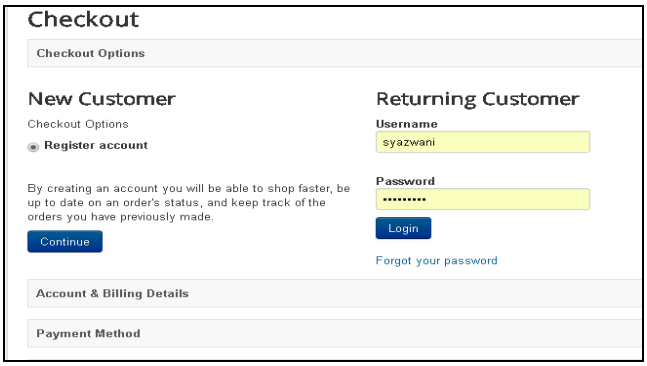


Figure 13: Login page

Figure 14 shows users that proceed to enter Billing Details before the Payment Method. A user need to complete the payment by using online payment after complete the billing details.



Figure 14: online payment

Figure 15 shows the QR code for the booking system. After all the process complete, QR code is received to the user for entering the tennis court.



Figure 15: QR code

Figure 16 shows the web admin that able to check all the bookings. All data for this booking system has been collected by using Google form. After the booking complete, the user needs to click the link to the Google form because the QR code will be generated by using Google spreadsheet.



Figure 16: Data collection on a web page

Figure 17 shows the gender that booked the tennis court in two distinct of gender rules for male and female. Male reached the highest group that represented about 14 people out from 25 people. Female shows least preference out of all people. It also confirms the male is more interested to play tennis than female. Figure 18 shows the player booked the tennis in a one week which consists of seven days of Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. It is interesting to note that Saturday has the highest booking then the other days with the total booking 9 slot and Sunday got the second highest for the total booking for 8 slots. In contrast, the other day for Monday, Thursday and Friday have been booked only for 2 slots per day. Tuesday and Wednesday reach the lowest booking slot at 1 slot booking only. It can be seen from the chart that overall, Saturday and Sunday was the best day for slot booking in all seven days.

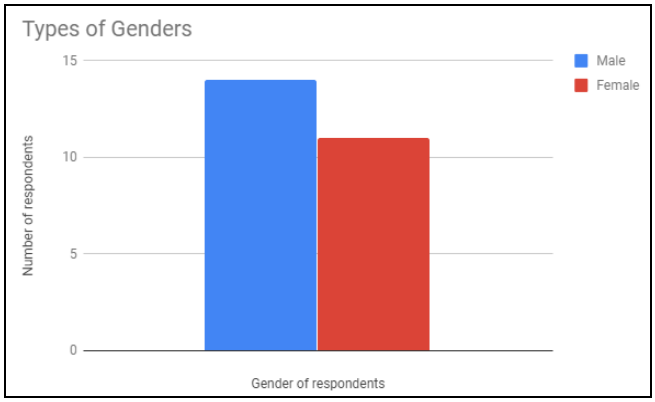


Figure 17: Respondents who have rated the Online Tennis Court Booking System web portal for Genders

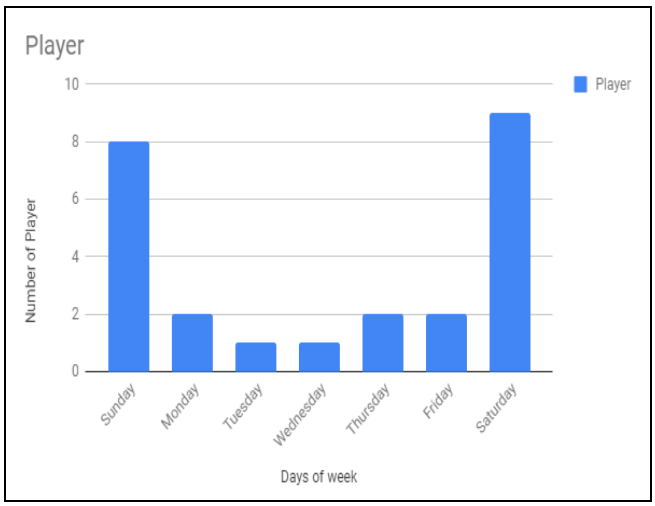


Figure 18: Analysis on Rated Online Tennis Court Booking System

Figure 19 shows the time that player booked the tennis in a one week which consists of seven days of Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. It is interesting to note that the time at 7.00-9.00, 10.00-12.00 and 20.00-22.00 has the full slot booking for Saturday and Sunday with the total booking is for 2 slots. At time 13.00-15.00 got the lowest booking slot for 2 slots in 2 days out of seven days. In contrast, the other day for Monday, Thursday and Friday mostly have a booking time at 7.00-9.00 and 20.00-22.00. Tuesday and Wednesday reach the lowest booking slot at 1 slot booking only at 7.00-9.00 and 20.00-22.00. It can be seen from the chart that overall, 7.00-9.00, 10.00-12.00 and 20.00-22.00 was the best time for slot booking in all seven days.

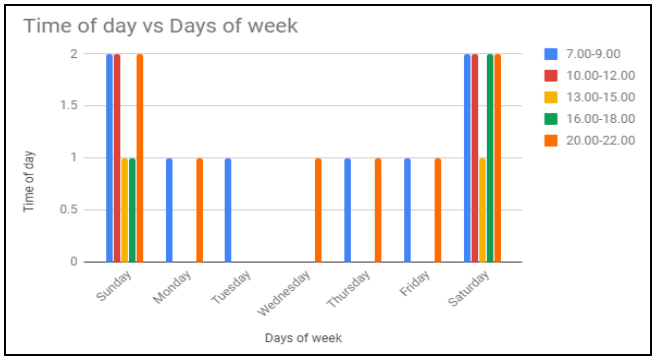


Figure 19: Respondents who have rated the Online Tennis Court Booking System web portal for time booking system vs days

Figure 20 shows five distinct age groups of 0-12, 13-20, 21-30, 31-40 and over 41 years old. The 21-30 age group was the highest slot that has been booked for 8 slots. In the next age group for 13-20 and 31-40 reached 6 slots respectively. The 0-12 group shows the lowest marked preference out of all the group. Overall, it is clear each age group has shown the interest to play a sport.

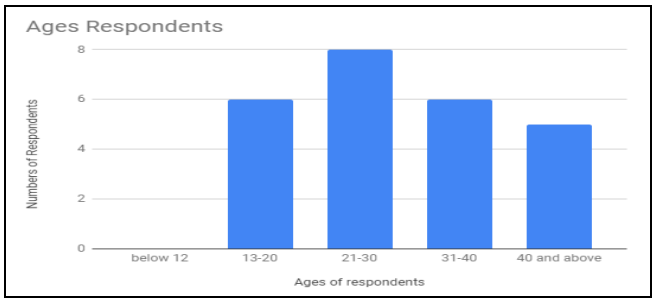


Figure 20: Analysis on Rated Online Tennis Court Booking System for Ages of users in Booking System

Figure 21 shows analysis on the court for outdoor and indoor that has been booked in one week which consists of seven days of Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. It is interesting to note that the most favorite court that has been booked is the indoor court that reached 5 slots booking for Saturday. As for Sunday slot booking, it shows that the outdoor and indoor court reach the same booking slot by 4 slots for each court. In contrast, the other day for Monday, Thursday and Friday mostly have one slot booking each for outdoor and indoor court. Tuesday and Wednesday reach the lowest booking slot at 1 slot booking only for outdoor court only. It can be seen from the chart that overall, the most booking slot is the indoor court in all seven days.
Figure 22 shows the data collected for genders in shows five distinct age groups of 0-12, 13-20, 21-30, 31-40 and over 41 years old. The 21-30 age of group was the highest slot booking that has been booked by male and female for 4 slots. In the next age group for 13-20, male has the highest booking slot for 4 slot and female reach only 2 slots for the age group. It can be seen from the chart that overall, the most genders that booked tennis court is male in all seven days.

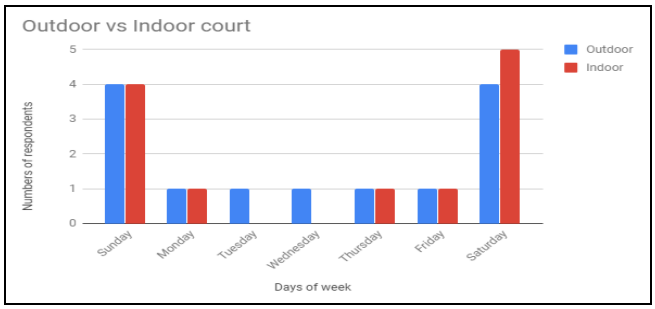


Figure 21: Respondents who have rated the Online Tennis Court Booking System web portal for court outdoor vs court indoor

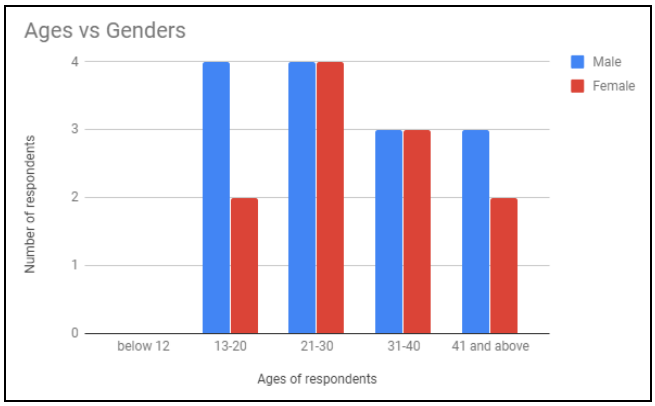


Figure 22: Respondents who have rated the Online Tennis Court Booking System web portal for genders vs age.

Figure 23 shows the court for outdoor and indoor that has book the tennis at time 7.00-9.00, 10.00-12.00, 13.00-15.00, 16.00-18.00 and 20.00-22.00. For time 7.00-9.00, it shows that the outdoor court has the most booking slot that indoor slot for 6 slot booking. As for 20.00-22.00, outdoor and indoor got the same booking slot at that time which is 4 booking slot for each. It is interesting to note that the time at 13.00-15.00 show that the only court that has been booked is an indoor court. It can be seen from the chart that overall, 7.00-9.00, 10.00-12.00 and 20.00-22.00 was the best time for an outdoor court in all seven days.

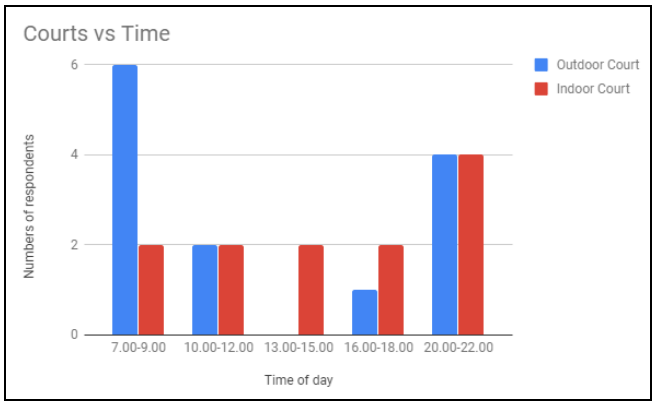


Figure 23: Analysis on Respondents rated on Online Tennis Court Booking System web portal for Court Outdoor and Indoor vs Time

Figure 24 shows analysis for additional players that the person how has booked the tennis court will bring allow to play the tennis together. Three additional players reach the highest number for the total is 11 that consist 6 for outdoor court and 5 for the indoor court. It follows by the adding 1 additional player that reach 5 for outdoor court and 4 for the indoor court. The lowest number for the additional player is 2 that reach 2 for outdoor court and 3 for the indoor court.

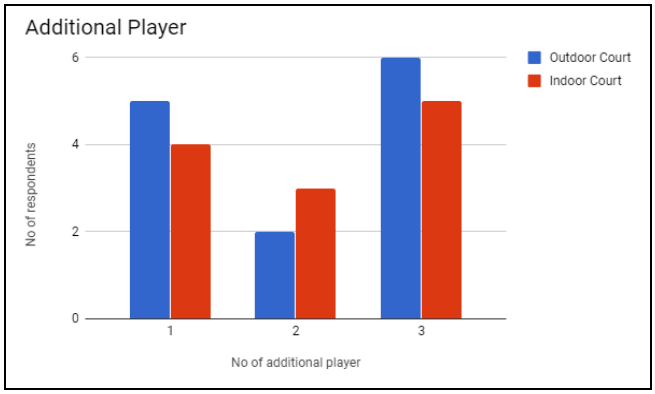


Figure 24: Analysis on Rated Respondents outdoor and indoor Court vs additional player

5. Conclusion

As for the conclusion, the development process for this project fulfilled the end of user requirement. The system has been tested and the required functionalities are worked. This system is user-friendly so that everyone can use this application easily. The user has to give the proper documentation. The end user is able to easily understand how this overall application. The system is evaluated, implemented and its performance is found to be satisfactory to the end users. The required result for the user's requirements is generated. The future development for the project has a wide scope for web design depended on user's requirement in time which adapt to new web development technology. A mobile application will be the enhanced for this research in efficiently and effectively, More latest technology with nibbling website will be extended and can be developed with more advanced feature at any time.

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References

[1] C. Li, J. Li, H. Cao, and Z. Meng, "Design and Implementation of Online Booking System of University Sports Venues," MATEC Web of Conferences, vol. 24, no. 20, pp. 2–8, 2017.
[2] C. Perera, S. Member, A. Zaslavsky, P. Christen, and D. Georgakopoulos, "Context Aware Computing for The Internet of Things : A Survey," IEEE COMMUNICATIONS SURVEYS & TUTORIALS, vol. 16, no. 1, pp. 414–454, 2014.
[3] S. Vashi, J. Ram, J. Modi, S. Verma, and C. Prakash, "Internet of Things (IoT)," International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2017) Internet, vol. 3, no. 17, pp. 492–496, 2017.
[4] A. Sahadevan, D. Mathew, J. Mookatana, and B. A. Jose, "An Offline Online Strategy for IoT using MQTT," IEEE 4th International Conference on Cyber Security and Cloud Computing., vol. 5, no. 34, pp. 369–373, 2017.
[5] M. Cook, T. Myres, and J. Trevathan, "A Prototype Home-Based Environmental Monitoring System," International Journal of smart Home, vol.

vol.7, no. no.6(2013), pp. 393–408, 2013.
[6] K. Bing, L. Fu, Y. Zhuo, and L. Yanlei, “Design of an Internet of Things-based Smart Home System,” 2nd International Conference on Intelligent Control and Information Processing (ICICIP)., pp. 3–6, 2011.
[7] B. Walek, R. Farana, and O. Hosek, “Proposal of Expert System for Hotel Booking System,” 17th International Carpathian Control Conference., vol. 7, no. 16, pp. 804–807, 2016.
[8] S. Singla, M. Yadav, and P. S, “Parking slot booking system,” International Journal of Advance Research, Ideas and Innovations in Technology., vol. 4, no. 2, pp. 1332–1337, 2018.
[9] A. Nath, A. Khandelwal, A. Kanojia, I. Minocha, and R. Niyogi, “Design and Implementation of an Intelligent Cab Service System,” Tenth International Conference on Contemporary Computing., no. August, pp. 10–12, 2017.
[10] N. Kurmashov and K. Latuta, “Online Book Recommendation System,” Electronics Computer and Computation (ICECCO), 2015 Twelve International Conference., pp. 3–6, 2015.
[11] M. Kassim, H. Mazlan, N. Zaini, and M. K. Salleh, "Web-based student attendance system using RFID technology," in 2012 IEEE Control and System Graduate Research Colloquium, 2012, pp. 213-218.
[12] M. Kassim, C. K. Haroswati, C. K. Yahaya, and M. N. Ismail, "A prototype of Web Based Temperature Monitoring system," in ICETC 2010 - 2010 2nd International Conference on Education Technology and Computer, 2010, pp. V5266-V5270.
[13] B. Singh and H. K. Singh, “An Efficient Approach for Improving Website Design,” Fifth International Conference on Communication Systems and Network Technologies (CSNT)., vol. 6, no. 14, pp. 945--949, 2015.
[14] A. Jaafar, M. Kassim, C. K. Haroswati, and C. K. Yahya, "Dynamic home automation security (DyHAS) alert system with laser interfaces on webpages and windows mobile using rasberry PI," in Control and System Graduate Research Colloquium (ICSGRC), 2016 7th IEEE, 2016, pp. 153-158.
[15] K. Lin, C. Shen, T. Chang, and T. Chang, “A Consumer Review-Driven Recommender Service for Web E-Commerce,” IEEE 10th International Conference on Service-Oriented Computing and Applications, vol. 9, no. 17, pp. 206–210, 2017.
[16] P. R. Kumar, “Efficient Methodologies to Optimize Website for Link Structure based Search Engines,” Green Computing, Communication and Conservation of Energy (ICGCE), 2013 International Conference., pp. 719–724, 2013.
[17] F. Roberto and C. Sandra, “A Framework of Automated Data Collection of Usability in Web Applications,” Computer Science Society (SCCC), 2016 35th International Conference of the Chilean, pp. 1-9 2016.
[18] A. Dickinger and B. Stangl, “Website performance and behavioral consequences: A formative measurement approach,” Journal of Business Research., vol. 66, no. 6, pp. 771–777, 2013.
[19] E. Djonov, “Website hierarchy and the interaction between content organization, webpage and navigation design: A systemic functional hypermedia discourse analysis perspective,” Information Design Journal 15., vol. 15, no. 2, pp. 144–162, 2007.
[20] S. Renuka and P. Jayanthi, “An enhanced model for effective navigation of a website using clustering technique,” Information Communication and Embedded Systems (ICICES), 2014 International Conference on, no. 978, 2015.
[21] K. Lau and C. Tran, “Composite web services,” Emerging Web Services Technology. Vol. II, 2008.
[22] A. Ajouli, “Transformations between Composite and Visitor implementations in Java,” 39th Euromicro Conference Series on Software Engineering and Advanced Applications Transformations., pp. 25–32, 2013.
[23] Mrs. Omprakash Yadav, Ryan Fernandes, Rohit Tiwari, and Sheenam Kaul, “Online Reservation System Using QR Code based Android Application System” International Journal of Scientific and Research Publications., Volume 4, Issue 12, December 2014
[24] A. Gupta, B. Iram, B. Samrit, M. Dhage, and P. N. Khan, “Online Facility of Ticket Booking and Generating Buspass Using QR Code,” International Research Journal of Engineering and Technology., vol. 5, no. 3, pp. 1544–1548, 2018.
[25] E. P. Nugroho and R. Cahyana, “A Development of Cloud-Based PHP Learning System,” 3rd International Conference on Science in Information Technology (ICSITech)., pp. 674–680, 2017.
[26] S. Agamah, “A PHP Application Library for Web-Based Power Systems Analysis,” 2015 IEEE European Modelling Symposium., vol. 1, no. 52, pp. 353–358, 2015.
[27] D. Alam, A. Kabir, T. Bhuiyan, and T. Farah, “A Case Study of SQL Injection Vulnerabilities Assessment of . bd Domain Web Applications,” 2015 Fourth International Conference on Cyber Security, Cyber Warfare, and Digital Forensic, pp. 73–77, 2015.
[28] D. A. Kindy and A. K. Pathan, "A Survey On SQL Injection : Vulnerabilities , Attacks , And Prevention Techniques," 2011 IEEE 15th International Symposium on Consumer Electronics., pp. 468–471, 2011.