Analyzing and Implementing an Online Metro Reservation System

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Abstract

In most nations, the old transport system has been replaced with the evolutionary development of the new one to satisfy the socio economic necessity of the people. As Saudi Arabia’s capital city, Riyadh is witnessing rapidly shifting microcosm of global trends in transportation, making this city an exceptional case study. This study examines the need and the development of computerized system of passenger reservation for Riyadh metro, with the aim of designing and implementing an online Metro Reservation System called Riyadh Metro Reservation System (RMRS). RMRS enables and assists passengers in managing reservation and modifying cancellation/refunds while overcoming excessive human interference in ticket’s issuance process and efficiently managing their ticketing transaction, without having to face delay by the usual procedure of manual ticket issuing or obstacles from metro counter staff. The proposed system was designed and implemented utilizing the Unified Modeling Language (UML), Microsoft Access 2010 and ASP.NET programming languages.

Keywords: Information System; Reservation System and Unified Modeling Language.

INTRODUCTION

Electronic Commerce (EC) is rapidly growing and this has led to considerable demands for business to efficiently and promptly satisfy customer needs. EC comprises the sale of goods as well as services using electronic methods. EC falls into three categories namely, Business to Consumer E-commerce (B2C), Business to Business E-commerce (B2B), and Consumer to Consumer E-commerce. In general, B2C associates with retailing that consists of direct purchase made on the Internet. The most common service of B2C E-commerce is online ticketing. In fact, online ticketing is becoming popular for train or bus users. Various countries, people prefer travelling on buses and train, from one place to another. At present time, the use of electronic ticketing is becoming popular for train or bus users.

Accordingly, there are roughly 370, 000 mobile phone applications that consumers can use while for Apple users, there are 425, 000 Android platform applications to choose from [10]. As mentioned by Meeker in [11], people have begun to allocate more time for mobile device use as opposed to desktop and laptops. Mobile devices including tablet PC and smartphone are now an integral part in the life of people in Saudi Arabia; these devices are the most effective and convenient tools of communication unconstrained by place and time [7].

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In today’s era, the public transportation has become a crucial travelling method. Comparatively, back in the days, the travelling of man from one location to the next would take months or even years, and there was very little assistance from technology or tools of communication [6, 7]. At present time however, within only a fraction of time like hours or days, man could travel thousands of miles with the assistance of effective and efficient transportation method and communication device. In many countries, particularly the third world countries, people prefer travelling on buses and train, from one place to another. At present time, the use of electronic ticketing is becoming popular for train or bus users. As explained by Ferreira et al., in [8] electronic ticketing comprises the system of ticketing that utilizes technology of self-service as application base to assist users in booking a ticket on their own.

The recent introduction and evolution of applications on smartphones have changed the behavioral habits of consumers in terms of goods and services buying power [7]. The online purchases made by consumers via mobile application have increased on a global level, with no limits. Now, using simple mobile phone app and online pay method, consumers or the public can book, purchase, validate and retrieve their transport ticket [9]. The application and use of mobile phones among consumers have greatly expanded from just to communicate to various other tasks including music, gaming, navigating and so forth.

It is not common for Saudi people to be seen with their PC beyond their office boundary. On the other hand, they are always with their mobile phones. Mobile phones as well as smartphones are currently very popular among vast amount of users [12]. It is very convenient and simple to just use a mobile phone to make a reservation. In general, online booking imparts customer with additional information pertaining to the company, prices, service availability, procedure of ticketing and booking, online payment as well as other available services. In addition, mobile communication may bring the company closer to its customers with the establishment of relationship between both parties [7].

The technological revolution influenced everything [13-22], even the methods of scheduling and booking for the real world reservations and booking issues. Nowadays, Artificial Intelligence (AI) algorithms is widely used, mainly in solving challenging problems including retrieval of information and patterns recognition [23-34], nurse rostering problem [35].
analysis of medical image [36-40], Learning Management System (LMS) [41], prediction of river flow [42-44], image segmentation [45-53], as well as Healthcare Monitoring [54, 55]. Consequently, utilizing the web technology and AI algorithms, there are numerous scholars have created and implemented scheduling and booking web systems to solve the real world reservations and booking issues [56-59].

In the work of Mezghani in [60], electronic ticket (e-ticket) is a system of transport payment grounded upon the utilization of technologies of information and communication. On the other hand, Vives-Guasch et al. [61] describe e-ticket as a contract in digital format, between user and service provider which could also offer commuters’ authentication and verification. E-ticket is a ticketless system comprising coding and delivery of a considerable amount of information over a small area, enabling commuters to travel without having to carry a printout ticket [62].

The paper is organize as the following; system analysis will be described in section 2, database implementation of the proposed work will be illustrated in section 3, the system design of the proposed work will be illustrated in section 4. Results discussion of the proposed work will be illustrated in section 5. Finally, the conclusion is presented in section 6.

SYSTEMS ANALYSIS

The proposed system should have the ability to fulfill the requirement of making available the fitting functionality to the user, enabling user should to understand the obtainability of ticket reservation. The system should enable user to reserve, manage, modify, and cancel the ticket, and request for refund wherever and whenever he or she is. Thus, the first step would be to analyze the requirement of the proposed system. This is followed by the development and designing of the strategy, which is the second step. The interface design dictates the manner in which users will be relocated using this proposed system. The construction of database determines the type of developed and stored data. In this study, Unified Modeling Language (UML) will be employed for describing the rudimentary structure of the proposed system. In this regard, activity diagram, use case diagram and class diagram will be utilized in this work.

Unified Modeling Language (UML) Models of the Proposed System

UML is a standardized general-purpose modeling language that is related to the object-oriented software engineering domain. Object Management Group (OMG) is the responsible body in managing and generating the standard. The addition of UML to OMG adopted technologies list was done in 1997. Since this time, it has become the industry standard for the modeling of software-intensive systems [6, 63]. UML contains a group of graphic notation and techniques for generating visual models belonging to object-oriented software-intensive systems. UML denotes a set of engineering practices that have successfully modeled large and intricate software systems [64], and mainly, UML employs graphical notations in representing the design of software systems, resulting in visual aids in project design communication.

UML offers diverse diagrams groups utilized to model a system. Nonetheless, use case, sequence, class and activity diagrams were employed in this system. The use of UML includes the combination of techniques obtained from the modeling of data (entity relationship diagrams), of business (work flows), of object, and of component. Furthermore, this system is employable using all processes all through the life cycle of software development, and across diverse technologies of implementation [6]. Accordingly, use case diagrams are used in the beginning phase of a software development project. These diagrams provide recommendation on how the final system can possibly be employed. Owing to their intuitiveness and simplicity, use cases have the capacity to effectively express the functional requirements of a software system. Designed to explicitly capture and portray the interactions and functionality between the system and its users, use cases are also usable in negotiations with non-programmers [6]. For the proposed system, the use case diagram can be referred in Figure 1.

Figure 1: Use case diagram of the proposed system
Activity Diagram
Activity diagram presents the detail workflows of business and operational components in a system, particularly the general control flow of the task sequence from the beginning to the end. Here, many decision paths that are present in event development in the activity are illustrated. Activity diagram may detail the situations where parallel processing may take place during the performance of certain activities [6, 65-67]. Figure 2 shows the proposed system’s activity diagram. Prior to gaining access to the system, user is required to present valid user credentials such as username and password to the system. After the authentication process, authorized user could access the appropriate resources while the unauthorized user will be taken to the login interface again, and again, will be asked by the system to present the valid credentials.

Use Case Diagram
Figure 1 presents the use case diagram that illustrates the management system of metro proposed for Riyadh metro. As can be viewed, the system comprises two actors. The first actor is employee who shoulders the accountability of documenting the metro trips management and reviewing the trip schedule. The second actor is traveller who will perform the following tasks: manage reservations, make new reservation, review trip schedule and manage the ticket.

Class Diagram
In object-oriented analysis and design, the class diagram is regarded as the most essential component. This diagram illustrates the types of objects existing within the system and demonstrates the static associations among the system’s internal classes. It can also be employed in revealing the attributes and the operations of a class, as well as the restrictions which impact the manner in which the objects are connected [68-71]. The class diagram for the proposed system can be viewed in Figure 3.

DATABASE IMPLEMENTATION
For the proposed application, the database was implemented using Microsoft Access 2010, which is a database application that allows one to produce database files with the application of the relational model. The model allows the creation of tables, and storing and manipulation of data inside the tables as necessitated. Furthermore, relationship can be developed in order to generate communication among them. The tables below are examples of the created tables:
SYSTEM DESIGN

The issue of usability of the system proposed in this paper from the viewpoint of administrator will be highlighted in this section. As the flexibility of software increases, the availability of choices also increases, particularly in terms of the reservation that can be utilized. In turn, the task to be carried out by customer to specify the complete set of rules for a reservation becomes more challenging. The interface designs below are examples of the implemented interfaces design.
RESULTS DISCUSSION

This section illustrates the proposed system usability. Throughout this section, the system is evaluated while user satisfaction is ascertained. Evaluation was achieved on the proposed system by operating it on Internet Explorer and Mozilla Firefox with the local host server. For the purpose of evaluation, 20 students from College of Applied Studies and Community Service at Imam Abdurrahman Bin Faisal University (IAU) were requested to use the proposed system. First, the students were instructed on the use of system and the user interface. After that, the system was tested by the students, and the survey questionnaire was answered, it consists of 10 items constructed to measure the user satisfaction level. The proposed system usability was also measured. The result and the system usability level based on the 20 students feedback is represented in table 4. As can be elucidated from the result, a high percentage of the users consents that system is useful, practical, and fulfills the main objective of the project.

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Table 4: Collected data results from the 20 students.
CONCLUSION
This study presented the design and establishment of the Riyadh Metro Reservation System (RMRS). This system will enable and assist passengers in handling reservation, making modifications and cancellation, requesting refunds, eliminating the tremendous human interference to the present process of ticket issuance, managing ticketing transaction in an efficient manner, and resolving the delay problems related to the current manual procedure of ticket issuance, and challenges in monitoring the metro counter staff's performance. RMRS was fabricated and implemented utilizing Unified Modeling Language (UML), Microsoft Access 2010 and ASP.NET programming languages.

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