**Online Ticket System**

**BSc (Hons) Computer science**

**Module 3: SOFTWARE DESIGN**

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**Due Date: 01/03/2021 at 9am**

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**Introduction:**

This report will outline a system project for local trains that allows users to book local train tickets and get ticket receipt online.

**Formal Requirements Analysis**

Requirements analysis is important as it is used to meet the demands and expectations of the smart ticketing app. It involves communication with the stakeholders to define expectations, document all the key requirements for the product end user such as consumers and aims to recognise the user requirements, system requirements and functional and non-functional requirements for the app.

**Methodologies:**

There were various strategies for software development to choose from and implement. From these, the agile methodology and the traditional ‘waterfall’ methodology were considered.

Given that the online ticketing app is a reasonably simple system in its design and implementation, but, will need to be improved with changing user requirements, it was decided that a partial implementation of the agile approach methodology would be best. This is due to the agile approach focusing namely on iterative development and it would reduce large costs that may incur if later changes were made using the traditional ‘waterfall’ model. Agile is responsive to change in customer requirements and allows for return to previous stages throughout the development process (McCormick, 2012). Agile is well suited for small groups and thus suitable as the development team for this project consists of less than 5 members.

The agile approach will be implemented as follows. The stakeholders (the end users and customers) are provided demonstrations of the program at the end of each iteration and their feedback and response is used and implemented for changes in the following iteration. This process is repeated/iterative cycle continues till the product delivered meets user/customer expectations. It was found that agile to be more efficient than waterfall for this due to its adaptability to the real world. With agile development it is easier to make last minute amendments to the requirements or design (McCormick, 2012).

The traditional waterfall methodology would be inconvenient for prototyping as it follows a ‘one phase’ and ‘set-in-stone’ approach which means that once decisions have been made in the initial stage, there is no turning back or else the organisation will incur high costs to do so (McCormick, 2012). This approach would require the development team to spend a considerable amount on each stage before moving on and that bugs are corrected in advance which would be unnecessary and inconvenient. Meanwhile, with the agile methodology, this issue is not prevalent and there is less focus on documentation and more on ensuring the deliverability of working software. (Somerville, 2016).

Nevertheless, once the agile prototyping is completed and the software requirements are fixed, changes in rest of the project will be unlikely and, thus, the waterfall methodology will be employed as it is more suitable to follow.

**User Requirements:**

Secure login function: this ensures that only authorised users can log in to make a reservation and will include the admin access to train officials.

Train reservation: this allows authorised users to make a reservation on a train journey. Reservations can normally be made well in advance, and remain available until two hours before the train starts its journey,

Pay function: this allows users to pay with various payment method which includes credit/debit cards, PayPal and CashApp and will also accept checks or cash by setting up offline payment options in addition to online payment.

Admin access function: this allows only admin users to make changes in trains destination etc and will also include extra function called Role-based access control (RBAC).

**System Requirements:**

* A workstation which includes CPU, monitors and secure internet connection and a secure database is required.

Non-functional: These are the system attributes such as usability, security etc.

* Use of encryption to avoid bots from booking tickets.
* Should accept different payment methods.
* Should include security feature in form of username and password to protect user data.
* This system will have quick response rate alongside user friendly interface.

Functional: functions/feature that a product must have for users to be able to accomplish their task / work.

* Booking system needs to be associated with a single account.
* Booking confirmation and receipt should be sent to user for them to show it to staff member.
* Booking system should only allow users to book trains when they are available.

The second phase for online ticketing system is analysis phase. Software engineers work with a range of system stakeholders which include managers and any end users of the product to find out about the application domain, the services that the system should provide, and the performance of the system. This process is mainly divided into 4 important points which are discovery, classification and organisation negotiation and specification. One main problem with software elicitation is that most stakeholders do not know what they want, or they may have conflicting requirements which makes it impossible for developers to understand the user requirements. Therefore, the requirements gathering method is used to make sure end users’ requirements are met. These include group interviews and questionnaires/surveys.

Group interviews: for requirements gathering of project, it was found that group interviews are better than one-to-one interviews as it saves a lot of time and, therefore, allows for collection of more stakeholders’ opinions in a short amount of time. These can also be used to add new concept/ideas for the online train ticketing system. The discussions in focus groups are relaxed, and often participants enjoy sharing their ideas and perceptions, (Krueger and Casey, 2009) suggesting that stakeholders will be more willing to give their opinions and, therefore, means less conflicts between stakeholders.

Online Questionnaires/Surveys: for our requirements gathering, the group decided to use online questionnaires to collect information from many stakeholders in relatively short amount of time or for the people who were unavailable to do group interviews, as a railway organisation is likely to have thousands of stakeholders. It will be easier and cost effective to get their input using questionnaires/surveys for system requirements. Furthermore, according to BBP Learning Media (2009, p.76), “The questionnaire is the primary tool of marketing research, a device for delivering questions to respondents and recording their answers”.

**Possible risks:**

Ethical/social issues with gathering: one main ethical issue with focus group that doesn’t exist in one-to-one interviews is that some participants may not be able to voice their opinion freely. This applies to people with introverted personality types. They may not feel comfortable giving their opinion in group setting and, therefore, the information that is obtained is not representative and the investment may get wasted. However, one way to overcome this is to do anonymous an online questionnaire, therefore, creating a space for people to be comfortable to give their opinion. Furthermore, moderator bias also exist in focus group. They may, intentionally, inject their personal biases into the participants' exchange of ideas which may, consequently, affect the requirements gathering of a system, thus, leading to invalid results and waste of investment.

Ethical/social issues with questionnaire: One issue with using online questionnaire is that it may not be representative as someone with disability may not be able to fill in the online questionnaire due to various reasons which may lead to inaccurate gathering. Also, the elderly may find it difficult to navigate technology used to fill in the questionnaire which may mean it is unrepresentative of organisation as elderly people aren’t included which may lead to waste of investment. One way to overcome this is to offer one-to-one interviews with people who are disable or elderly to get the requirements gathering therefore making the sample more representative.

**Legal Requirements for Smart Tickets:**

The mart ticketing app is required to comply with laws and regulation. These include organisation policy, protecting personal data, accessibility and right of users to grant consent for using their personal data which may include name address etc.

Accessibility: this means that website should be accessible to everyone who wants to use it and is included in equality act 2010. It is an online website app and, therefore, complies with Web Content Accessibility Guidelines (known as WCAG) which ensures that the web page app is accessible to people who are blind and have any mobility issue or have any problem relating to thinking and understanding.

Right of users: this includes General Data Protection Regulation (GDPR) which means that organisation is only collecting data that is required furthermore, making it easier for users to withdraw their consent. This also includes notifying user that the app uses cookies.

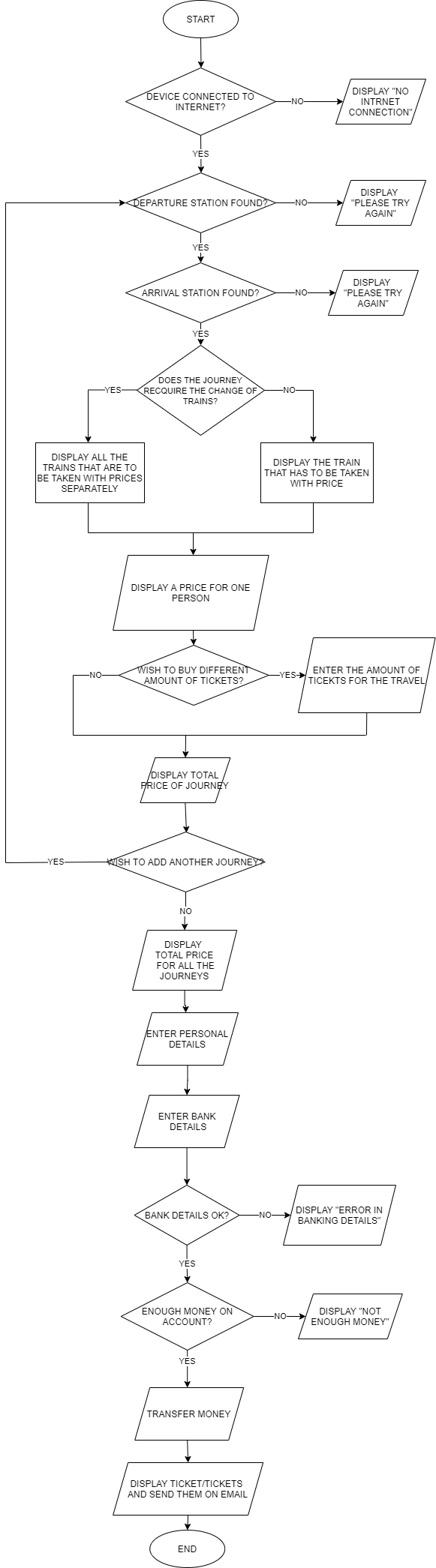
Protecting personal data: this comes under GDPR which means the smart ticketing app takes necessary action to prevent data from being stolen, therefore, organisations will use SSL certificate for encryption of personal data and software will be updated regularly to make sure data is not stolen.

**User Acceptance Testing**

This is the last phase of software life development cycle which verifies if the product is fit for the intended purpose. In this phase stakeholders or end users will use the product, check if it works as expected and try to detect any errors or bugs that were not identified by the developers. This is also known as beta testing.

Security testing: as ticketing system will use internal and external database, it is essential that information is protected at all times, therefore, different methodologies will be employed to ensure data is protected which include security scanning which will provide system weakness and later provide solutions to reduce these security risks. Another way data could be protected is by using Penetration testing which simulates an attack from a malicious hacker and ensures the database is protected from external attacks.

Access control: as for our user requirements, it is required that admins are able to log in and make changes, therefore, access control test would be required. This identifies users by verifying various login credentials and includes different testing methods such as different pins, passwords and username. This will be done to make sure that unauthorised users do not have access to main database. Furthermore, role-based access control (RBAC) will be included which will mean users will access data that is been deemed necessary for their role within the organisations e.g. staff member will not have access to the stored data of customers such as their bank details etc.

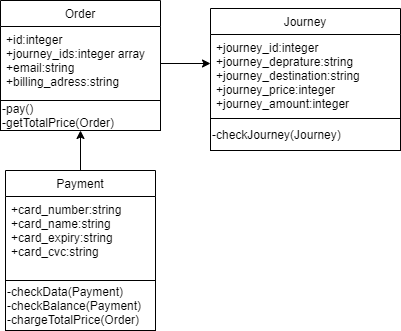
**Formal Systems Design**

**Flowchart Explanation:**

* Check whether the device is connected to the internet, if not then message “NO INTERNET CONNECTION” is displayed
* Once departure station was entered check whether this station exists, if not user is asked to try again
* Once arrival station is entered, check whether is exists and if not, user is asked to try again
* If the journey requires change of trains every train that has to be taken is displayed with all the prices and if it doesn`t then the cost of one train is displayed
* If user wants to buy tickets for more than one person then he should enter the amount of people he is buying tickets for
* The total price of the journey for all the people is then displayed
* If another journey is to be added then user goes back to entering departure and arrival stations and everything starts over
* The total price of all the journeys for all the people is displayed
* Personal details, such as email that the tickets will be sent to and billing address are to be entered
* Bank details are entered
* If bank details aren`t OK, the message “ERROR IN BANK DETAILS” is displayed and if they are then the balance is checked
* IF user has enough money on balance, he is getting charged the cost of all the tickets
* The tickets are displayed on screen and sent on user`s email

**UML explanation:**

* Journey is a bit that consists of its own id, the departure and destination, the price and the number of tickets needed. Departure and destination are strings and user inputs them himself then with check Journey method they are checked and if these stations exist, journey price is being set. When the user is asked to enter the amount of people, he is buying the tickets to, journey amount is updated, and the price is multiplied by it.
* Order consists of its id that might be needed in future for billing, array of journey id`s an email and billing address. It also has got Total Price method that sums the prices based on all the journey id`s.
* Payment takes card information, checks it and then charges the card and sends all the tickets on email that is kept in Order using charge Total Price method.

**The Team Working Strategy**

**Potential Risks/Issues:**

It is crucial that development projects ensure a successful strategy for team working is devised early on as many issues can arise from not prioritising this, such as a lack of engagement between team members, lack of communication, poor management, not working in the same direction or towards the same vision and, worse, tension and conflict (Flint, 2016). This can lead to projects taking longer than necessary. Team members are the projects greatest asset and the organisation of the group directly affects the decisions that are made by the group with regards to the interactions and exchange of information between the stakeholders and the group (Why Are Employees The Most Valuable Intangible Assets?, 2020).

**Our Approach:**

For this reason, it was important to ensure that at the start of the project, the strengths and weaknesses of the members were highlighted so that the suitable tasks were delegated to the them based on their skills. The team acted as more of an informal group where, despite there being an assigned team leader for tasks such as making sure the members are on track, and dealing with the external interface, the group acted mainly as a whole when it came to a consensus on the decisions affecting the project and everyone’s opinion was taken into consideration. The group was small, with few individuals working together throughout the development process and so members introduced themselves to each other and built trust by voicing their concerns and fears early on making them able to communicate easily throughout the project and understand one another.

**Regular Communication and Goal Setting:**

Throughout the development process, regular one-to-ones were scheduled between the team leader and team members to ensure everyone understood what they were doing correctly or if there were any concerns. Group members had regular meetings to give feedback on each stage, to keep one another updated so that they are working in the same direction and to ensure regular communication. Each day, clear goals were outline for what required from members to do that day and deadlines were set. This helped ensure the project was done in time and that deadlines were met. Overall project goals were also set in a similar manner. By doing this, the group was able to avoid issues throughout the project and was well managed and orderly.

**Conclusion:**

Overall, the aims and objectives were achieved. This was done through consistence team efforts and consistence approach was taken to design and implement the smart ticketing system, therefore, allowing users to book local train tickets easily via app, which is implemented with secure payments system to build trust between organisation and consumers. To conclude we believe that we have achieved all the requirements which were required by the user and therefore we believe we have produced a successful system.

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