Software Engineering Methodology for Smart Healthcare Security and its Application in Bangladesh

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Abstract- **In the modern day, producing new software requires utilizing the most cutting-edge tools and techniques. Due to the growing complexity of technology, effective software development increasingly depends on well-managed development processes. A software development project has its own distinctive features. There is no one software process model that can manage all the many types of software development projects because there are so many distinct sorts of them. Whatever paradigm is utilized, there will always be limitations. The goal of the healthcare system security and its application is to provide the best possible clinical treatment and to receive the best possible assistance for patient care and security. The healthcare structures need to support good health, honest economic contribution, and top-notch services. The healthcare business has quickly expanded over the past ten years, especially in developing nations. Implementing medical software programs is one of the most significant future challenging scenarios in the healthcare industry. Utilizing healthcare data structures will expand the availability of fitness services, improve patient satisfaction with care, and reduce clinical errors. We are providing a fresh approach to software engineering for healthcare programs called SDLC as a result. This approach is intended to address the software-improvement issues and challenging circumstances that exist outside the healthcare area. The need to create durable, steady, and high-performing healthcare equipment is the main driver behind the development of a new software engineering methodology for the industry, including SDLC.**

Keywords— Software Development Lifecycle (SDLC), Agile Methodology, Healthcare System, Healthcare Application, Secure Software System, Interact Enhancement

1. INTRODUCTION

The smart healthcare system's aim is to achieve the best possible solution for patients, physicians, any kind of physician's serial, buy medicine, medical translator, same generic different company's medicine, diagnostic center's portal and to provide optimal medical support. The healthcare industry is rapidly grown up. Software engineering is a diverse field that aims to develop high-quality software systems adopting systematic techniques growing project management that are linked to the principles of user-centered design [8]. A set of fundamental aspects used in the design, development, and testing of software applications is named the Software Development Life Cycle (SDLC), which facilitates it. There are some SDLC models such as the waterfall model, spiral model, rapid application model, agile model, Big Bang m,odel etc. Implementing medical healthcare software is one of the major challenges facing Bangladesh's smart healthcare sector in the coming years.

Software engineering practices can be thought of as a group of ideas, techniques, and tools that software engineers use on a regular basis to give the technical and management team a clear picture of how the job is done and to change a disorganized, unfocused approach into one that is more organized and targeted [7].

Currently, devices are found in each home and on every hand. People are using excellent mobile applications as a result to simplify their everyday live.

The creation of a mobile application (app) to aid in the implementation of an efficient healthcare system is the key topic of this paper. People who utilize this app can take advantage of a wide range of advantages, including finding local hospital information, cabin information, booking a cabin with payment, intelligent hospital recommendations, finding a physician, emergency service calls, first aid information, medication alarms, a BMI calculator, medical translation, scheduling as well as reminders, a 24/7 chat system, a photo gallery, push notifications, mental health, and more. By using Agile Methodology, we can use different types of features in the smart healthcare application. An emerging field for Bangladesh's economy is the IT sector. This sector is being given special attention by the government because it is estimated to boost GDP growth by 7.28 percent by the end of 2021 [5].

Applying innovative medical software to healthcare organizations successfully is challenging. A growing industry for software engineers and IT experts is software engineering for healthcare systems. Smart healthcare information systems will boost the availability of healthcare services, enhance the standard of care, and lower medical errors. A growing industry for software engineers and IT professionals is software engineering for medical practices. The following step will cover a systematic examination of applications for smart healthcare security and its application. This research shows us which SDLC model is proper for the healthcare system. This research cover how planning, analysis, design, Implementation, Testing, Deployment and Evaluation properly works in the healthcare system. The research can show us how it can reduce the medical errors

The rest of this paper is organized as follows: Section 2 presents the literature review to know about software engineering-related work, Section 3 presents the methodology of this paper; Section 4 describes the survey of the proposed model-related issues; Section 5 provides a detailed explanation and result of this paper; finally, Section 6 provides conclusions and future work.

2. LITERATURE REVIEW

In the literature review, several articles compare with software engineering methodology for healthcare security and its application in Bangladesh. Next, we present the risk management of the software and different types of software engineering methodology, pros and cons and their limitations:

The tremendous development of technology has resulted in the widespread use of software systems. Smart health systems require a software engineering methodology. Software engineering methods to help achieve smart and consistent healthcare systems[37]. Software Engineering aims to create high-quality software. It is based on the systematic methodologies of the high-quality project. An intelligent healthcare system greatly reduces costs, and many factors cannot be quantified accurately[31]. To understand this superior healthcare technology and system, Model SDLC is applied. It can be done using the SDLC model. This SDLC model can stimulate the development of a software application that also adds a new dimension to the healthcare sector. The healthcare

The System needs to provide the best possible contribution to the patient. The SDLC model can easily provide these services. Implementing smart healthcare is difficult. SDLC Model contains multiple phases of software development and deployment [26].

It is essential to have a thorough understanding of the roles that each stage of the SDLC plays. The SDLC is divided into six phases: requirement analysis and planning, design, implementation, testing, deployment, and maintenance. There are specific security precautions that must be taken at each stage. Throughout the requirements and planning phases, the project team receives all project information from stakeholders or customers [8].These aids determine the level of software security required and also solves the software application bug. The following phase is the design phase, which includes all of the tasks that must be completed prior to any coding.

Modern improvement methodologies such as component-primarily based total improvement and allotted software program environments may bring about insecure merchandise if now no longer monitored and cautiously constructed [21]. As a result, safety functions need to be included at each level of the software program improvement process.

Software risk assessment is a method for locating, evaluating, and prioritizing threats and dangers. In general, there are large, medium, and small software program tasks that each of them may be encouraged via way of means of a threat. In the literature, there is a huge variety of threat evaluation research carried out closer to software program tasks[29]. But there may be at the least view researchers specializing in threat evaluation of small and medium software program tasks[34]. The primary awareness of the paper is to present researchers with a perception of the contemporary stage of threat evaluation for small and medium software program improvement tasks [17].

Risk management and software development classification, we are able to consciousness our paper specifically on the hazard evaluation stage for software program improvement projects. On the alternative hand, the essential goal of this evaluation is to present researchers with a perception of the present-day stage of hazard evaluation for Smart Healthcare Applications in Bangladesh [12]. Additionally, the paper gives facts about the unique forms of hazard evaluation fashions and strategies that are determined in the literature primarily based totally on the context of hazard evaluation for Smart Healthcare Security and its Applications in Bangladesh Using Software Engineering Methodology.

Software security testing is an essential approach to make certain software program protection and trustiness. Identifying vulnerabilities and making sure protection capability via way of means of protection trying out is a broadly implemented degree to assess and raise the software's safety[16]. Due to the openness of modern software-based systems, using appropriate security testing methods is becoming increasingly

A system, piece of software, or online utility is subjected to security testing to search for flaws and different assault routes [13]. It is made of several approaches that make certain the utility's code works as supposed and does now no longer take any accidental actions. There are numerous methods that are offered. If an entry affects a sudden final result even as evaluating preset inputs towards preferred outputs, a hassle is discovered[39].

A developer wishes to be privy to the facts domain's needed functions, actions, and techniques for chance mitigation to be able to draw close the nature of the chance document received withinside the first phase. The evaluation phase's purpose is to decide the probability and length of every chance item's loss.

The system and software design documents are created in the third phase in accordance with the requirement specification document. This clarifies the architecture of the entire system. The model's subsequent phase is informed by the design phase. To implement the risk management plan with the proper priority, it is crucial to make the best decisions possible during the assessment phase. A plan for risk mitigation would minimize or eliminate the hazards with the highest priority.

Building the code and documentation for the solution additives is the primary goal of the growing phase. Throughout the phase, the group continues the song of each chance and offers any new ones as they appear. There are three steps in this procedure. Code reviews: A code evaluation may be a beneficial device for groups to decide whether or not their code complies with local requirements and can even assist them to discover capacity troubles earlier than compiling[35]. Programming in pairs: Pair programming lowers the risk of employee loss [28]. By using unit exams and dynamic evaluation, builders might also additionally test the safety capability of components and make sure that any safety dangers formerly located via threat modeling and supply code evaluation are mitigated with the aid of using any countermeasures now being built.

The final deployment process begins after the software testing phase is complete and there are no bugs or errors still present on the device. The most recent software is launched and examined for deployment issues, if any, based on the comments provided through the use of the project manager.

Many models have been established in the world of software building based on SDLC. The advantages and disadvantages of these models, risk, and security are discussed in the comparative discussion of some models in this paper.

3. METHODOLOGY

The research goal is the final objective that must be attained while the research is being conducted. It might be to fill a knowledge gap, add to the body of current information in the field, develop and test a solution to an issue, or any number of other reasons. In this chapter, we spoke about the methods we use to build up and diversify our knowledge. The thesis work's general look and feel, as well as the methods that were employed to create it. This chapter discusses the research methodology as well as a general overview of the relevant theory. This study's steps include SDLC and model regulation, as well as the current situation and how to solve the problem of smart healthcare Security and its applications in Bangladesh using Software Engineering Methodology. This research is part of a larger project. A review of prior research findings, the development of a survey questionnaire, qualitative and quantitative analysis based on the survey review, survey results, and a recommended best Software Engineering Methodology for Smart Healthcare Security and its Application in the Bangladesh software sector are presented here.

Figure 3.1: Methodology

In problem formulation part in this research, there are different types of problem findings regarding healthcare sector in Bangladesh. There are different types of healthcare applications are available in Bangladesh. But there is no application which are fully designed with proper features. Suppose in telemedicine application in Bangladesh's perspective find that only medicine sales in these types of application. There are many applications of physician's appointment booking. No proper Mobile application for healthcare system with many features. In Bangladesh Healthcare systems follow pluralistic model, for that reason no mobile application doesn't have many features. It is very much useful application for a patient if an application is well designed and add all features in one application. Many Patients lost their previous medical reports, physician's prescription etc. There is no application that can save patients past medical reports and physicians prescriptions. There is no emergency call system to near hospital like uber or Pathao only for patient's emergency. One of the biggest problems is to understand physicians handwriting, many pharmacists can't understand this, and this is one of the main problems. Many medicines have same generic but their companies are different. There are many applications but maximum application doesn't add these features. To ensure proper healthcare system in Bangladesh it is mandatory to add many features in an application that helps patients, physicians, diagnostic centers. However, there are also some issues such as Poor Amenable Survival Rates, Lack of Transparency, and Difficulty Getting a Good Physician.

Security is one of the most important factors for healthcare systems. Healthcare systems data security is very essential. Healthcare systems data and medical entitles are logged by various malicious actor and cyber attackers. Data need to be protected. A large amount of data is stored in the system. As a result, many personal information is stored. Malicious actors attack the system with spam mail, virus, and other worms. They perform identity theft, phishing, and infiltration of networks. These issues are most common in healthcare systems. This security issues can be solved using two factor authentication. Network security can be improved. End to end security can provide and maintain security in the healthcare. Secure software development framework can play a vital role. Encryption system can help to protect this large amount of data. It can easily provide security in the systems. PACS is Picture Archiving and Communication Systems (PACS) which is helpful for transmission and storage of medical records. If healthcare applications security is not properly provided it will be difficult to determine if any attack has performed and what necessary steps need to take. It can lead serious damage and security breach. As a result, Security logging and monitoring is necessary for healthcare application. Broken authentication, Injection flows and session management are threat issues for the healthcare. As a result, security is very obligatory for the healthcare system.

Bangladesh perspective there are no application which is well developed and all service in one application. If in the research follow the agile methodology for smart healthcare application in Bangladesh perspective, this is really very useful application and all the service will find in one application. In this research, different service such as physicians review, medicine sales, one click emergency service, health tracking system, mental health, image processing, EHR, EMR etc. will be added in the system. Physician Review is very important for a patient because which physician's ratings are high that ensures that their treatment is too much better. Medicine Sales system's main goal is to sale medicine by its generic. It will very helpful for all because same medicine different generic different company's prices are different. There are many companies in Bangladesh that their medicine price is too much high. A Patient can easily buy a medicine by its generic and also find the low price of the medicine. Many physicians handwriting can't clear properly so here in this system add a machine learning image processing system so that a patient can easily take a picture of prescription and the system will read it and show the output of the prescription as a clear picture. All of the features can be added possible for Agile Methodology. Adding to many useful features Smart Healthcare Application will be a play a Vital Role in Bangladesh Healthcare System.If agile methodology followed in Bangladesh perspective it will be also helpful for the security of healthcare systems. As a result, data can be secured. These malicious actors cannot log, monitor data and steal data of the system. System becomes more secure. Many unauthorized access and Outdated component cannot perform vulnerabilities to the healthcare systems. Server-side request forgery flaws can break the protocol of the healthcare application. Sensitive data can be unsecure through internal and external servers these problems are resolved by this Agile methodology software system.

Most software applications share certain universal traits while also having some of their own distinctive properties. On the other hand, the developer can make the product using a process model that takes these shared traits into account. The software business uses a variety of models at the moment. The agile methodology stands out among them for smart healthcare security and its application in Bangladesh. Additionally, this research has attempted to develop a model to offer security at each level of the SDLC by evaluating the structure and features of previous models. Accordingly, the model have proposed is user-friendly and has a lot of useful features that leverages other conventional specialized models that are derived through human input, according to the findings of previous studies and survey results. Among the models used to support the agile model. In this study, both qualitative and quantitative methods were employed. Everything is laid out in a way that is simple to understand. Additionally, this research made a lot of effort to include all the data. On the basis of the literature review, the study issue's current state is described, after which the suggested

methodologies and analyses are used. In conclusion, a synthesis of the study's findings is presented.

4. PROPOSED MODEL

A survey of eleven questions were formed in the Google form and forty-four responses were gathered from Software Developers, Software Quality Testers, IT Engineers and Software Engineers of some of the Top Software Companies in Bangladesh. The survey's results are shown and described with the graphs below.

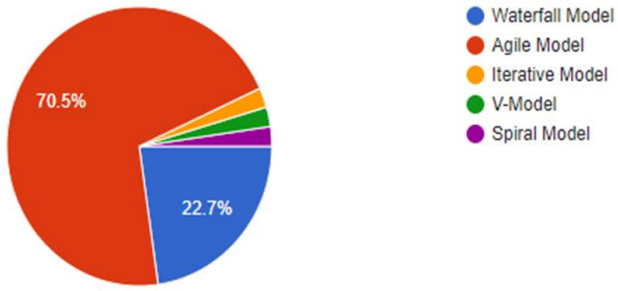

Fig 4.1: Popularity of SDLC Model In Bangladesh

If we see the above pie chart it can be seen that 70.5% engineers agreed Agile model which is most commonly used in Bangladesh.

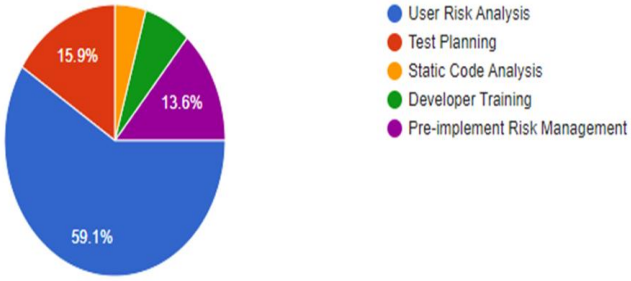

Fig 4.2: Risk Analysis Increasing In Bangladesh Healthcare Sector

For the Security of the healthcare system, 59.1% of engineers think user risk analysis increases more security for healthcare applications.

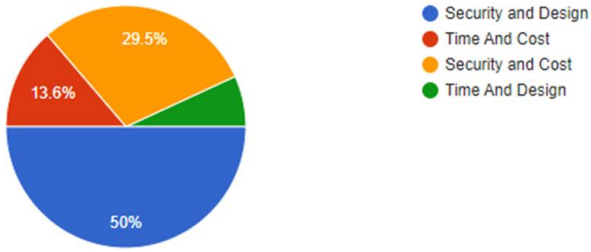

Fig 4.3: Most Important Factor in the Development process in Bangladesh Healthcare Sector

Security and Design is really important and 50% of the engineer think security and design is the most important factor in development process of healthcare system.

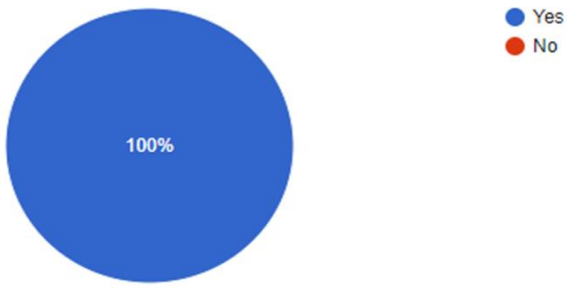

Fig 4.4: Importance of more security Testing

100% of Engineers think that this system needs more security testing in the SDLC process.

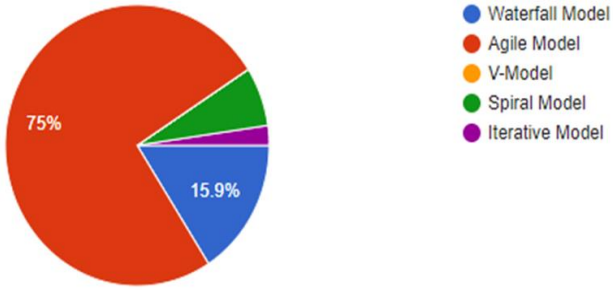

Fig 4.5: Ensuring for more security in healthcare system

Agile Model ensures more security in healthcare system and 75% of engineers agreed with it.

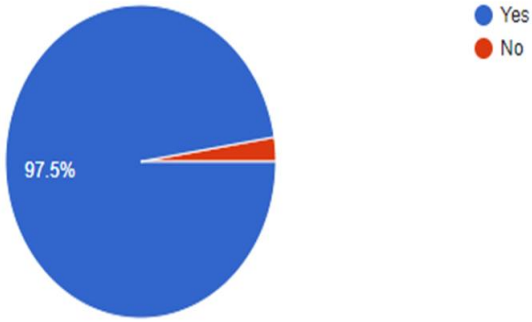

Fig 4.6: Security enhance design phase

"Security will enhance from the creation of a primary product prototype during the design phase of the SDLC" 97.5% of engineers agreed with it.

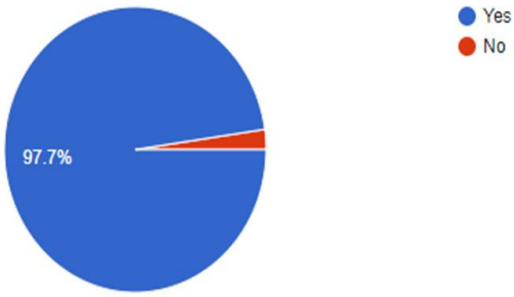

Fig 4.7: Detecting Error save time

97.7% Engineers are agreed that detecting errors in the early stage can save time, energy and cost in the software development process.

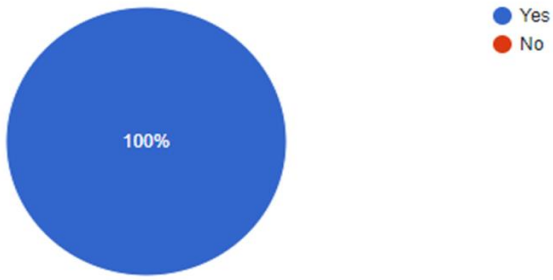

Fig 4.8: Development of Secure Software

100% of engineers agreed that detecting errors in the early stage of software development could be a significant turning point in the development of secure software.

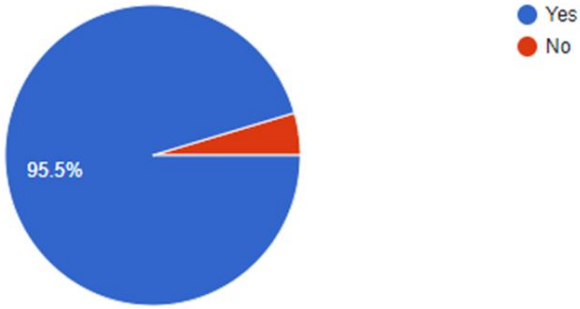

Fig 4.9: Hybrid Model ensures system's security

95.5% of engineers agreed to use a hybrid model in the business if it ensures your system's security.

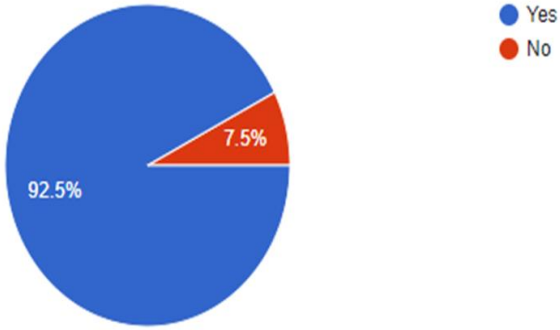

Fig 4.10: PACS Service improve healthcare sector of Bangladesh

92.5 % of engineers agreed that PACS (Picture Archiving and Communication System) service can improve healthcare sector of Bangladesh.

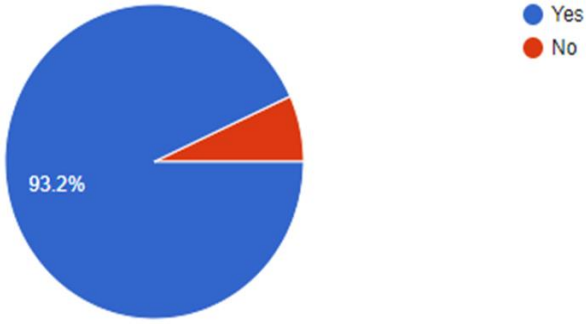

Fig 4.11: Electronic Prescription software's effectiveness in the Healthcare sector in Bangladesh

93.2% of engineers agreed that third-party integration with electronic prescription software will offer effective security for the healthcare sector of Bangladesh.

4.1 Proposed SDLC Model:

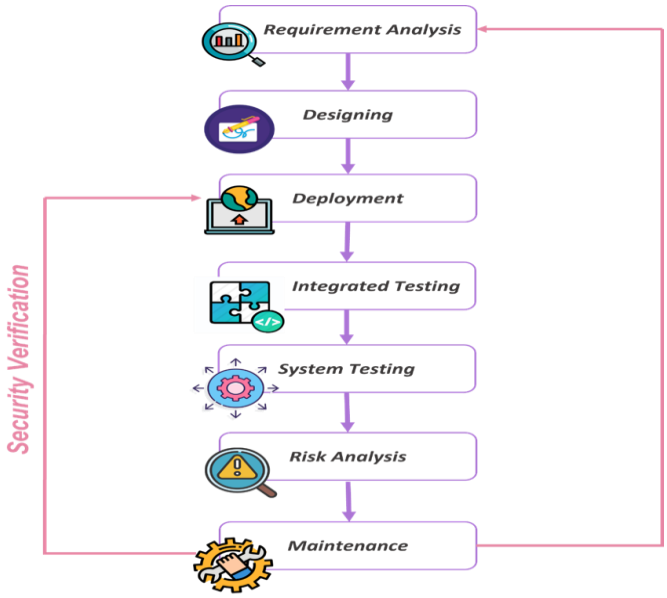

Fig 4.12: Proposed SDLC Model Architecture

Project managers and developers can make sure that security protocols are applied consistently throughout the development process in line with the set of rules by using systematic techniques like frameworks and procedures in Healthcare Applications in Bangladesh. Proposed SDLC Model Architecture there is a flowchart. All the programs work in a systemically way. By using this Model, software engineering methodology in the healthcare system in Bangladesh is properly secured and all the development processes in line.

In Healthcare security and its application in Bangladesh, there must be a security issue for all users, so that the proposed model is used here properly. Another thing is for the telemedicine issue it is important for all patient to give their medical prescription to the system.

The idea of tackling security vulnerabilities and security early in the software development life cycle is now stressed by the majority of studies. The design phase entails distilling all of the analysis and requirement knowledge necessary for software design. For designing, a variety of tools can be used, including data dictionaries, entity-relationship diagrams, and flow diagrams. There are numerous designs available, including functional and object-oriented designs. Software design guidelines exist that can be applied to creating secure frameworks, enhancing the security of programming frameworks, and dealing with problems that impede the development and security . In the healthcare security and its application in Bangladesh the most important issue is security. Because the data of patients, physicians and hospitals are here. So that the hacker or others tries to break the security of the system. Therefore, the recognition of different security risks at the design phase will help avoid the loopholes that may pose a threat to the security of the system in the future. Our system is not only having security issue another part of our system is telemedicine and other types of healthcare related issue solving. But the main thing is the security of healthcare system is the main design phase of our proposed Model.

In Healthcare security and its Application in Bangladesh, now-a-days, software maintenance is a generally accepted component of the SDLC. It refers to all updates and adjustments made after a software product is delivered. Deployment and maintenance of software are the final stages

of the software development lifecycle process. The actual installation of the software product, along with all of its components and database, in the production environment, may also fall under this phase. This typically leads to a variety of complications that are associated with this type of integration. According to Payer, an update and patching strategy establish how to address security problems, create patches, and provide users with updated software. In order to often check for new updates while taking into account the demand on the update servers, the component in charge of security updates must be created. We can go back and look at previous requirements studies or system testing stages if necessary. The Healthcare Application in Bangladesh is further enhanced and new features and functionalities are gradually added during the operation and maintenance period.

5. DISCUSSION:

A new Secured Agile Software Engineering Methodology has been proposed in this paper. As the data of the Healthcare Industry is considered the most valuable asset on planet earth, the security of Healthcare Software Solutions should be more secure and interactive. To ensure the integrity of data and source, extra security layers have been introduced into the proposed agile method. The main focus of the newly proposed Agile method was on design and preventive threat modeling. In the design phase of the proposed Secured Agile Model, four sequential subphases have been introduced and those are Security Requirements Analysis, Forming Secure Coding Structure, Threat Modeling, and Developing Security Architecture. The reason behind the sequential approach is to ensure effectiveness in providing protection in each and every phase from cyber criminals, attackers, phishing, threats, and malware.

For implementing or upgradation using sprint system of Agile model, a whole new Maintenance system has been introduced in the proposed agile methodology. The maintenance system will work as a pathway of creating a re-engineered and a better Healthcare System than before. It is believed that, the freshly proposed Agile Method for Healthcare System will bring an evolutionary change on Healthcare Industry that will be more flexible, reliable and secure.

Almost all software system has some limitations. Building a secure Healthcare Software Solution is a challenging task since it has to be reliable, user-friendly, stable, and safe for its users. Since the proposed agile-based healthcare system emphasizes security and data integrity, poor implementation may bring a great hamper. As mentioned earlier in this paper that, the system will be an interactive approach among the patients, physicians, and hospitals. So, miscommunication between the user and the system site may break down the entire system, as it relies on a network that is compact. Additionally, the mis interaction of patients with technology instead of face-to-face customer care might cause a misleading treatment or service. Also, poor data collection and misleading data analysis can create a disaster to the patient care process in the proposed Secure Agile Method. Since agile cares about building a better product in a short period of time, a lack of proper documentation may hamper the structure of the system.

6. CONCLUSION AND PERSPECTIVES:

Since the Agile method heavily depends on user interaction, maintenance of that system can be critical and may be driven in the wrong direction due to a lack of interaction and communication between the system and the user. A poor testing strategy may lead the system at risk of data breach and can cause a great catastrophe as Healthcare System holds the confidential data of patients, hospitals, and physicians. In conclusion, the proposed Healthcare Agile Method should be handled carefully with professional hands and advanced technology.

This paper discussed what helped improve the modern healthcare system. The models used here help to improve the various sectors of healthcare. These models can be developed in the future and used to help develop other fields, including healthcare. These models can be developed depending on the uses and product. Here the algorithm can be implemented so that it can be used in large complex systems. As a result, many complex systems can be used very easily. This model can be improved in such a way that everyone can use the model perfectly in business and enterprise software also. Automation of software models can be done to ease future development by developers. AI systems can also be used as a result whole software system will be improved which can be very useful in every business. In the healthcare system, huge data should be stored in different sectors and all the information of a patient is stored. Sometimes it is difficult to maintain all the data by humans. So, it will be better if the AI system is used in healthcare. So, in the future AI system can be improved for developing the healthcare system. So that it may be easier to use in every sector and it will also be helpful to reduce maintaining the big data of the healthcare system. This system can be improved in such a way that every class of people can use it easily and receive modern health care.

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