

Enhancing the Quality of Medical Services Through the QMS Medical Cloud Platform

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Abstract

The quality of medical services is a critical concern in the healthcare sector. This article addresses the multifaceted challenges that impact the quality of medical services, including medical errors, imperfect medical histories, outdated approaches, and the lack of a professional growth assessment system. Moreover, financial constraints, information incompetence, and communication gaps among healthcare professionals contribute to the issue. Underestimating the patient's role in the treatment process further complicates the situation. This research introduces the QMS (Quality Medical System) as a cloud-based Software as a Service (SaaS) product designed to improve these challenges. The QMS medical cloud platform offers solutions such as a comprehensive educational portfolio for continuing education and self-assessment, quality assurance and compliance with standards, convenient access to up-to-date medical information, improved communication and coordination among healthcare professionals, and active patient involvement in the treatment process. To achieve this, the article provides an in-depth analysis of recent research and publications in the field. The primary goal of this research is to examine the effectiveness of the QMS medical cloud platform in enhancing the quality of medical services. The article also delves into the models governing the relationships between users, companies, roles, and departments within the QMS platform. Furthermore, it explores the Education Portfolio section and the Continuous Education Workflow (CEW). In conclusion, this research underscores the pivotal role of the QMS medical cloud platform in addressing the critical issues surrounding the quality of medical services. It demonstrates that a comprehensive, cloud-based approach can significantly improve patient care and healthcare outcomes. The findings of this study have the potential to revolutionize the healthcare industry and enhance the overall quality of medical services.

Keywords ¹

Quality of medical services, QMS medical cloud platform, healthcare improvement, medical errors, continuous education, patient involvement.

1. Problem statement

1.1 Quality of medical services issue. The field of medicine has always been a crucial component of society, as the health of its citizens is its primary resource. However, despite significant advancements in the field of medicine, issues related to the quality of medical services remain relevant and demand immediate action for resolution. In this section of the article, we will examine the overarching issue of low-quality medical services and explore how the medical cloud platform QMS addresses this problem and contributes to the improvement of healthcare delivery.

1.1.1. Medical errors: thread to life and health. One of the most significant threats to patients is medical errors. These errors can have serious consequences, including a threat to life and a deterioration in the quality of life. Medical errors encompass incorrect diagnoses, improper

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treatments, underestimation of symptoms, or their incorrect interpretation. It is essential to emphasize that these errors are not exceptions but have become a systemic phenomenon in medical practice.

1.1.2. Imperfect medical history: Foundation of incorrect decisions. Another significant issue is the imperfection in collecting and analyzing a patient's medical history. The medical history, which includes the patient's illness history, comorbidities, allergies, and other information, is a fundamental step in diagnosis and decision-making. Imperfections in the medical history can lead to the omission of important details and incorrect assessment of the patient's condition.

1.1.3. Application of outdated approaches and unknown methods. The fast and constant changes in the field of medicine mean that healthcare professionals must continuously update their knowledge and skills. However, some doctors may remain loyal to outdated methods and approaches, disregarding modern standards and clinical recommendations.

1.1.4. Lack of a professional growth assessment and monitoring system. One of the key issues is the absence of an effective system for assessing and monitoring the knowledge and skills of healthcare professionals. Without systematic evaluation and support for professional growth, doctors may remain at the same knowledge level for a long time, overlooking new advancements in medicine.

1.1.5. Financial pressure and limited access to resources. Financial pressure in the medical field can lead to resource-saving measures, affecting the quality of equipment, medications, and the opportunities for research and education for healthcare professionals. This can result in limited access to modern diagnostic and treatment methods.

1.1.6. Dissemination of information incompetence. Information incompetence among healthcare professionals can arise due to a lack of access to up-to-date medical sources and inadequate training in working with modern information technologies. Insufficient levels of information literacy can lead to incorrect diagnoses and improper treatment decisions for patients.

1.1.7. Insufficient communication and coordination among healthcare professionals. The absence of effective communication and coordination among various medical specialists can result in shortcomings in the provision of medical care. For instance, inadequate information exchange among doctors from different specialties can affect the accuracy of diagnosis and treatment.

1.1.8. Underestimation of the patient's role in the treatment process. At times, healthcare professionals may underestimate the role and experience of the patient in the treatment process. Patients often possess vital information about their symptoms and condition that can contribute to accurate diagnosis and treatment.

1.2. The role of the QMS medical cloud platform in addressing the Issue. The QMS medical cloud platform was created with the aim of improving the delivery of medical services and addressing the aforementioned issues. It offers various tools and resources aimed at enhancing the quality of medical services and improving the skills of healthcare professionals.

1.2.1. Educational portfolio: continuing education and self-assessment. The "Educational Portfolio" section allows doctors to keep a detailed record of their activity in courses, online learning, and obtained certificates. Each physician earns points for their activity and skills, deserving recognition. This system incentivizes healthcare professionals to continuously enhance their professional skills and learning, directly impacting the quality of medical services provided. Moreover, they can independently assess their professional growth and improvements.

1.2.2. Quality assurance and compliance with standards. The "Quality Assurance and Compliance with Standards" section allows experts to analyze individual medical cases, evaluate diagnostics, the correctness of medical documentation, and determine the quality of provided medical care. Physicians receive scores reflecting their professional competence and adherence to modern standards. This contributes to the improvement of patient care quality and ensures compliance with professional standards.

1.2.3. Convenient access to up-to-date Information. The QMS medical cloud platform provides access to current medical information and clinical recommendations, helping healthcare professionals maintain their knowledge and skills at a high level. This prevents the use of outdated methods and approaches in medicine.

1.2.4. Improved communication and coordination. The medical cloud platform also contributes to better communication and coordination among healthcare professionals. It enables real-time information exchange among doctors, laboratories, pharmacies, and other medical institutions. This facilitates quicker diagnosis, treatment, and patient care coordination.

1.2.5. Active patient involvement in the treatment process. The medical cloud platform also supports active patient involvement in the treatment process. Patients can access their medical information, record their symptoms, and document test results, which helps doctors make more accurate diagnoses and provide personalized treatment.

1.2.6. Ensuring accessibility and efficiency of medical resources. The medical cloud platform helps optimize the utilization of medical resources, including equipment, medications, and personnel. This allows for improved quality of medical services and reduces financial pressure on healthcare institutions.

General issues related to the quality of medical services remain important challenges for modern medicine. The QMS medical cloud platform addresses these problems by creating innovative tools and resources aimed at improving the skills of healthcare professionals, enhancing the quality of medical services, ensuring information accessibility, and improving coordination within the healthcare system. The implementation of such solutions can contribute to improving the quality of life for patients and ensuring their safety in the context of medical services.

2. Analysis of recent research and publications.

With the growing popularity of cloud computing and related services, many users utilize the cloud on a daily basis for various needs, such as storing images, documents, instant messaging, and accessing information and entertainment on web pages that can be used on the cloud platform. Users expect easy access to services, and the system should consistently provide these services. To assess the effectiveness of the flipped classroom method using the mobile interactive platform UMU in the field of Internal Medicine, 105 students were engaged in 2018, and 93 students were engaged in 2017, all of whom were studying nursing. Students were divided into experimental and control groups, with the 2018 students using the flipped classroom teaching method based on the UMU mobile platform. During the development of the Internal Medicine internship course, they conducted in-depth practical work and analysis.

The paper [1] explores the impact of using the mobile interactive platform UMU on the effectiveness of nursing students' education in the field of Internal Medicine. It is noted that in today's conditions, many users actively utilize cloud resources for various purposes, emphasizing the importance of ensuring stable access to educational services.

Researchers conducted a comparative analysis between the experimental and control groups of students, where the experimental group employed the flipped classroom method based on the UMU mobile platform. The results of this analysis can be valuable for further refining the educational process and developing interactive platforms for teaching in the field of Internal Medicine internships.

The article provides important practical insights and can be beneficial for educators and researchers working in the field of medical education and the development of new technologies in the learning process.

CSSR is a cloud-based smart rehabilitation service that relies on cloud computing and relevant network technologies such as SaaS, Citrix virtual desktop, and Podcast CC. It is designed for professional rehabilitation specialists, special school teachers, college students studying medicine and rehabilitation education, as well as people with disabilities. The service consists of four modules: Cloud Rehabilitation, Professional Education, Cloud Department, and Cloud Community, combining excellent civilian resources in the field of rehabilitation medicine and education. CSSR fully utilizes information technology to provide an effective solution for overcoming challenges in clinical rehabilitation development.

The article [2] describes the development of the CSSR cloud service, designed to facilitate the rehabilitation and learning processes in the field of rehabilitation. CSSR has four main modules, catering to different audiences, including professionals, students, and people with disabilities. The service utilizes cloud and information technologies to ensure effective learning and rehabilitation.

This article can be beneficial for professionals in the field of rehabilitation and education, as well as those interested in the application of cloud technologies in healthcare and education. It offers a new approach to using information resources to improve the accessibility and quality of rehabilitation services.

The analysis of pathogen genomic data can be highly individual and diverse. This article presents our plan and progress in creating the Scalable Pathogen Data Processing Platform (SP³), which provides an efficient and unified process for collecting, analyzing, and comparing genomic data using the advantages of elastic cloud computing. SP³ allows users to launch containerized bioinformatics workflows on personal computers, high-performance computing (HPC) clusters, and cloud platforms. We have implemented and tested SP³ on local HPC, Google Cloud Platform (GCP), Microsoft Azure, and the OpenStack platform. SP³ enables users to retrieve genomic sequence data from the European Nucleotide Archive (ENA) and conduct analysis using open bioinformatics workflows. We believe that SP³ will contribute to establishing common standards for pathogen genomic data quality, data processing, and analysis, helping to address the issues of tool divergence and the utilization of a shared repository of genomic data and cloud resources.

The paper [3] describes the development of the SP³ platform aimed at processing pathogen genomic data using cloud computing resources. The platform allows the use of open bioinformatics workflows and retrieval of genomic data from the European Nucleotide Archive for analysis. The main goal is to establish a unified standard for processing pathogen genomic data and improve the quality of this analysis by leveraging cloud resources and a shared genomic data repository.

In the scientific publication [4] the role of artificial intelligence (AI) in healthcare data management and its implications for the advancement of precision medicine are discussed. The authors provide a substantial body of evidence supporting the necessity of processing and managing extensive healthcare data. This approach is aimed at improving clinical services and the need to enhance the quality of the healthcare system through data-driven approaches.

- The article notes that various private and public organizations actively participate in the creation, storage, and analysis of diverse types of medical data. These include omics data, clinical data, electronic health records, personal health records, and sensor data.
- The primary research findings revolve around aligning these efforts with the broader field of precision medicine, which entails personalizing medical treatment based on individual characteristics and needs

Analyzing the utilization of AI and machine learning systems in healthcare, the article highlights the following points:

- With technological advancements, researchers are increasingly interested in using artificial intelligence and machine learning for processing large volumes of healthcare data.
- The expected outcome is an improvement in patients' quality of life, indicating significant attention to patient-centric care.
- The authors identify challenges in data processing, including the following:
 - Decision-making based on extensive healthcare data.
 - Complexity in handling large healthcare datasets.
- Key topics discussed in the article include:
 - The consequences of working with extensive healthcare data in the context of the role of artificial intelligence in precision medicine.
 - The potential of artificial intelligence in integrating and analyzing large healthcare datasets to provide personalized treatment.
 - The application of artificial intelligence in individualized treatment, with a particular focus on neurological disorders.
 - Addressing issues and limitations related to artificial intelligence in the context of managing and analyzing extensive data that could potentially hinder the development of precision medicine.

The publication by the authors underscores the significance of big data in healthcare, the role of artificial intelligence in precision medicine, and the challenges that need to be overcome for the effective implementation of these technologies.

The paper [5] emphasizes that with the advancement of science and technology and improvements in medical conditions, people have raised their expectations for their health. Chronic diseases are identified as a category of ailments with an exceptionally high mortality rate. The authors of the publication demonstrate that developed medications have a positive impact on the prevention

and treatment of chronic diseases, and smart medicine boxes enable the organized administration of these medications. To enhance the management of smart medicine boxes and establish a platform for remote monitoring, the researchers propose the utilization of Docker technology for the development of a cloud platform. Using Docker container technology, the registration of cloud platform devices, database storage, and server-side applications are implemented in the form of microservices, which effectively enhances the scalability of the platform itself. Experimental trials demonstrate that the platform can efficiently control smart medicine boxes and holds potential for further development.

The article describes the design of a cloud platform for smart medicine boxes using Docker technology. The primary objective of this project is to improve the management and monitoring of smart medicine boxes to ensure effective and scientifically grounded treatments for patients, particularly those with chronic diseases. The use of container technology allows for an expansion of the platform's functionality and an increase in its performance. The results of experimental trials confirm the platform's effectiveness in monitoring smart medicine boxes.

The paper [6] presents the concept of "Values-Based Healthcare" (VBH) as an emerging paradigm within the field of healthcare. VBH is defined as a system that prioritizes the quality of medical services over the cost of treatment. This approach underscores the importance of enhancing patient treatment outcomes while maintaining economic efficiency.

The publication encompasses a comprehensive overview of various facets of the issue, examined through the utilization of bibliometric analysis, including but not limited to:

- **Publication Trends:** Examining the trends in publications related to "Values-Based Healthcare" in the SCOPUS and WoS databases
- **Most Prolific Authors:** Identification and distinction of authors actively contributing to this field.
- **Author Contribution:** Analysis of the individual contributions of authors to sources and research topics.
- **Primary Sources:** Determining the core sources central to the discussion of values-based healthcare.
- **Productivity of Top Authors Over Time:** Tracking the productivity of leading authors in this domain over a specific duration.
- **Globally Cited Documents:** Investigating documents cited by researchers worldwide concerning VBH.
- **Thematic Maps and Word Clouds:** Visual representation of thematic domains within VBH and the most frequently employed terminologies.
- **Network and Collaboration Map Among Countries:** Cartography of collaboration among researchers from various countries in the context of VBH.
- **Author Keyword Network:** Analysis of networks based on author-supplied keywords.
- **Historiography and Spectroscopy:** The study of historical events and the evolution of VBH.

The authors of this publication conclude that values-based healthcare is a relatively novel and evolving concept:

- Researchers emphasize that this concept is most frequently applied in healthcare specialties such as radiology and surgery.
- Collaboration predominantly occurs among researchers from developed countries.
- Current niche topics in values-based healthcare include personalized medicine and responsible care.

This publication offers a comprehensive bibliometric analysis of the values-based component of healthcare, shedding light on its evolution, key participants, thematic domains, and global trends. It provides valuable information about the state of research in this field as of 2023 and identifies new topics and areas of focus for future research.

In the publication [7] an analysis is conducted on the challenges associated with collecting health and care data for residents of care homes in England. The researcher underscores that despite the routine data collection, there currently exists no systematic method for comparing and utilizing these data for comparative analysis and improvement of the situation. To address this gap, the study, known

as the "Development of Research Resources and a Minimal Data Set for Research on Adaptation and Use of Care Homes," has developed a prototype of a Minimal Data Set (MDS) for piloting.

The authors have devised a methodology for a mixed-methods longitudinal pilot study, to be carried out in 60 care homes for older adults across three regions in England, involving approximately 960 residents. Data for the study will be collected from cloud-based digital records of care homes at two time points and linked with resident and care home data at the level of common datasets of the National Health Service and Social Care.

The research comprises focus group interviews with care home staff and interviews with external stakeholders to examine the implementation and perceived utility of the MDS. The researchers have assessed data completeness, timeliness, and performed various statistical analyses to evaluate data quality, construct validity, structural validity, and internal consistency. Longitudinal analysis of pilot data demonstrates the value of the MDS in each region. Qualitative data will be inductively analyzed using thematic analysis to understand the complexities of MDS implementation in care homes for older adults.

The publication emphasizes that the research has obtained ethical approval and underscores the receipt of participant consent. The research results will be disseminated among various stakeholders, including researchers, care sector organizations, policymakers, and committee members.

Furthermore, there is an intention to publish the results in peer-reviewed journals and distribute analytical notes through partnering organizations such as NIHR Applied Research Collaborations, National Care Forum, and the British Geriatrics Society.

This publication presents a detailed research protocol for piloting a Minimal Data Set (MDS) for older adults residing in care homes in England, emphasizing the importance of systematic data collection and utilization to enhance care. It provides a comprehensive plan for conducting this research, including methods, analyses, and ethical considerations.

The publication [8] commences with an acknowledgment of the historical context of infectious diseases with pandemic potential that have affected humanity, including pandemics such as the plague, AIDS (1981), SARS (2003), and various COVID variants. It underscores the persistent challenges associated with these pandemics and highlights the ongoing progress of technological innovations aimed at addressing them. The primary objective of this publication is to conduct a critically comprehensive review of the current state of research in this domain to illustrate the promising role of technological advancements in the healthcare sector. The author aims to illuminate the latent issues faced by healthcare organizations and clinical pathologists worldwide, striving to provide patients with high-quality, life-saving treatment.

The review is divided into two parts, with Part I focused on the discussion of cutting-edge technologies such as artificial intelligence, big data, blockchain technology, open-source technologies, and cloud computing.

The publication emphasizes that these advanced technologies have the potential to address a wide array of healthcare challenges faced by physicians and surgeons across various medical specialties, including cardiology, internal medicine, neurology, orthopedics, pediatrics, gynecology, psychiatry, plastic surgery, and more. It underscores the role of these technologies in curbing the spread of infectious, pathological, and neurological diseases.

The publication examines the boundary conditions and issues related to the application of these technologies in the healthcare sector. Potential ways to address these issues are discussed in the review. Consequently, the publication acquaints readers with the historical context of pandemics and the persistent issues associated with infectious diseases. The authors underscore the importance of technological progress in addressing these problems and improving healthcare. The publication represents a comprehensive exploration of the potential use of these technologies in healthcare with the intent to provide an understanding of how to address healthcare challenges.

In the article [9] it is noted that information and communication technological solutions in the healthcare sector represent a convergence of information technology, advances in medical science, the operations of healthcare institutions, insurance companies, healthcare professionals, and patients. Additionally, there is a notable trend towards personalized medicine, expected to be most effective when coupled with cloud technologies. It is highlighted that healthcare organizations predominantly employ information systems that facilitate the migration of financial, operational, and personnel applications to the cloud. With the emergence of new digital services, there is an increasing demand

for cloud transformation of key medical systems and programs to enhance patient care quality. The article explores the aspects of implementing cloud infrastructure solutions for the automation of various clinical domains, emphasizing the necessity of comprehensive solutions in healthcare, covering medical diagnostics and emergency medical care. The potential for integration of applications, servers, and databases used by different entities (health authorities, medical facilities, research centers, etc.) into a unified network through modern cloud solutions is recognized. The article also discusses the standardization of healthcare information systems and the use of standardized products, including ontologies. On the horizon is the task of developing cloud solutions for intelligent physician support, including the implementation of integrated clinical applications, automated quality control of medical care, and other related aspects. The possibility of developing universal interfaces for integrated clinical applications, particularly relevant in emergency situations, is considered. The article delves into critical aspects of utilizing cloud technologies in the healthcare and information systems sectors. The authors provide a detailed analysis of the needs and opportunities for implementing digital infrastructures and comprehensive solutions to enhance healthcare and access to medical information.

In the [10] it is noted that significant demographic shifts have occurred worldwide in recent decades, characterized by an aging population. These demographic changes have created substantial challenges for healthcare systems. The increasing elderly population, coupled with a shortage of healthcare professionals, has resulted in a complex situation for existing institutions and personnel striving to meet the growing demand. In response to this situation, cloud computing has emerged as a rapidly evolving domain within the digital healthcare sector, enabling the creation of a modern distributed system capable of scaling to tens of thousands of self-regulating tenants for healthcare applications.

Furthermore, the "Native Cloud" architecture has gained popularity as an ideal structure for a multi-node healthcare monitoring system due to its high scalability, low latency, and fast and stable servicing. This research proposes a cloud platform for digital healthcare based on cloud principles, allowing for the management of a large number of patient groups and their care. To confirm the effectiveness of our platform, we conducted modeling of the cloud-based healthcare monitoring platform with real configurations and evaluated its performance in terms of response time, data packet delivery, and overall latency. The authors emphasize that the response time was less than 0.1 ms for at least 92.5% of the 3000 requests. There were no data packet losses, and more than 28% of the total data packets were delivered without delay. Only about 0.6% of them experienced the maximum delay (3 ms) within a 24-hour observation period.

Clinical Significance: This study and the corresponding experiment demonstrate the suitability of the "cloud" platform for monitoring the healthcare system to support service providers and nurses in ensuring regular health monitoring for elderly patients in care facilities for the elderly.

The article discusses the significance of employing cloud technologies within the healthcare sector to enhance the monitoring of the health status of elderly patients. The authors propose a "cloud-based" healthcare monitoring platform that efficiently manages and provides assistance to large patient groups. Experimental results presented in the paper confirm the effectiveness and speed of this medical monitoring platform.

The paper [11] highlights that cloud computing represents an Internet computing model where client PCs gain access to shared resources, software, and data through web/cloud servers. Information technology (IT) in the healthcare sector pertains to computerized IT systems that process electronic medical records based on these records to facilitate the use of cloud computing for individuals, organizations, and companies. The authors emphasize that significant IT companies have already invested millions of dollars in infrastructure, services, tools, and applications. They stress that the healthcare field remains highly diverse, complex, and unique, making it an intriguing subject for investigating the influence of cloud computing.

This scenario presents several challenges, including ensuring the protection of patient medical records in compliance with HIPAA regulations and federal laws. Additionally, concerns arise regarding the increasing cost of healthcare solutions. Consumer expenses are decreasing, and IT will play a crucial role in achieving this goal and improving treatment outcomes and patient care. Cloud computing solutions address these challenges in the healthcare sector and contribute to their resolution. This research aims to explore the current state and recent advancements in cloud

computing in the healthcare domain. The article discusses the importance and potential applications of cloud computing in the healthcare field. The authors examine contemporary trends and challenges associated with the implementation of cloud computing in medicine. The research focuses on how cloud computing can streamline and enhance the organization and delivery of healthcare services.

3. Purpose and objectives.

The goal of this article is to provide a comprehensive analysis of the structure and models used in the medical cloud platform QMS, with a primary focus on their interrelation and impact on improving the quality of medical services. Our research is directed towards the following key aspects:

Architecture and Structure of Models: We will thoroughly examine the architecture of the QMS system and identify the main models and components that constitute it. We will elucidate the purpose and roles of each model within the system.

Interrelationships between Models: Understanding how models interact with each other in the QMS system is crucial. We will analyze how data and information are exchanged among different models and how this contributes to process optimization in medical facilities.

Impact on the Quality of Medical Services: We will determine precisely how these models and their interrelationships influence the quality of medical services. We will explore how the QMS system contributes to error avoidance, enhances medical history records, provides up-to-date medical information, improves the professional competence of healthcare providers, and other aspects that affect the quality of medical services.

Future Prospects and Development Opportunities: In the final stage, we will discuss opportunities for the future development of the QMS system, which will further elevate the quality of medical services in the future.

The overarching objective is to elucidate how the structure and models in the medical cloud platform QMS contribute to the improvement of healthcare services and provide readers with a deeper understanding of the functioning of this system and its positive impact on medical practice.

4. Relationships between User, Company, Role and Department models

In programming and database design, "many-to-many" relationships are critically important and quite common scenarios. This type of relationship exists when many instances of one class can be associated with many instances of another class. In the context of a Queue Management System (QMS), this is especially relevant when modeling the interactions between users and roles.

In the developed system, a user can have one or more roles, and simultaneously, each role can be assigned to one or more users. This is a typical example of a "many-to-many" relationship, usually implemented using an auxiliary "junction" table that includes the respective identifiers of both sides of the relationship.

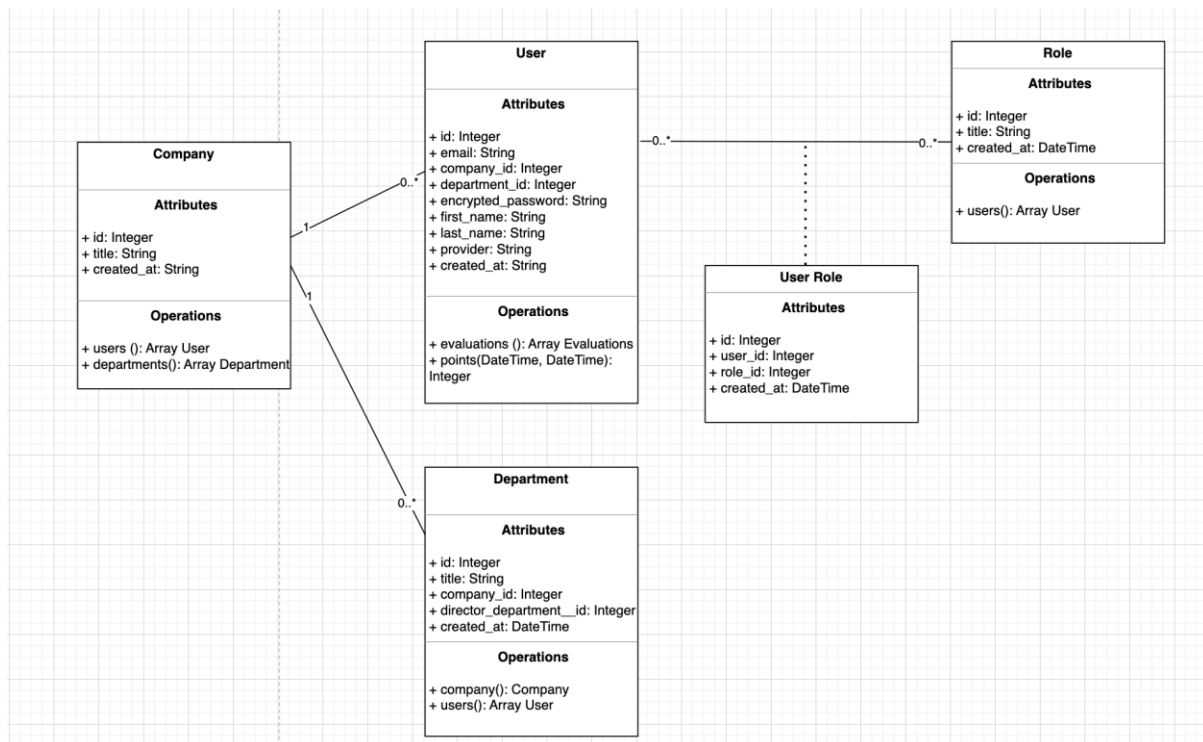


Figure 1: UML Diagram of System Models and Their Relationships

This data structure allows for flexible management of relationships between users and roles, making it easy to assign new roles to users or modify existing ones. It also ensures efficient data storage since information about roles and their corresponding users is stored in one place.

Overall, the many-to-many relationship between users and roles in the queue management system supports a high level of flexibility and scalability, while efficiently utilizing data storage resources.

The user-company relationship enables the segregation of working environments for individual companies.

5. Education portfolio section

The functionality implemented in the system is aimed at improving the quality of patient care, which in turn stimulates their loyalty to the medical institution. This is achieved through the implementation of several key modules of the system, among which the "Education Portfolio" (EP) section plays an important role. This section contributes to the fulfillment of the Ministry of Health's (MOH) order for continuous professional development.

The Education Portfolio provides users with a convenient interface for filling out forms, storing certificates, and submitting reports to the MOH regarding their education. The use of this tool significantly simplifies the process of completing these tasks and enhances data organization. It also saves time and resources that would otherwise be consumed by these processes.

On the other hand, medical institutions, through the EP, have the opportunity to assess the progress and development of their staff. Monitoring the success in professional development and tracking compliance with MOH standards becomes much easier through the digital representation of this data. Additionally, the system helps medical facility managers identify talented employees, pinpoint the need for additional training, and analyze the effectiveness of various training and development programs.

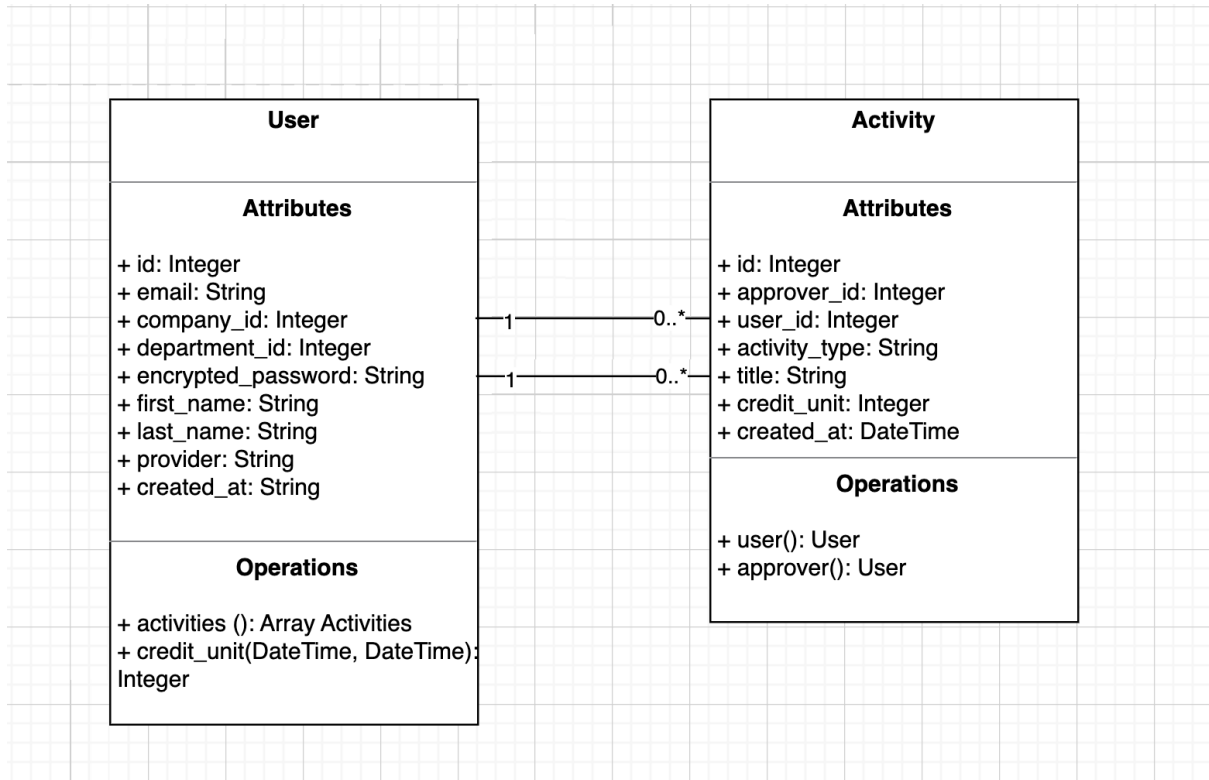


Figure 2: UML Diagram of User, Activity Models, and Their Relationships

The data structure allows for flexible management of the relationships between users and roles, making it easy to assign new roles to users or modify existing ones. It also ensures efficient data storage, as information about roles and their corresponding users is stored in one place.

Overall, the many-to-many relationship between users and roles in the queue management system (QMS) supports a high level of flexibility and scalability for the system while efficiently utilizing data storage resources.

The user-company relationship allows for the segregation of work environments for individual companies. This feature provides a convenient way to separate and manage data for different companies within the system.

According to the model, each activity has an 'approver_id' field, representing the identifier of a user with a manager role who has the authority to approve activities. The approval status of an activity is determined by the presence or absence of 'approver_id.' If the field is not empty, the activity is considered approved; if it's empty, the activity is considered not approved.

This approach streamlines the process of activity approval and enhances data organization. It also introduces a level of automation and reduces the workload on managers, who can simply check the presence of 'approver_id' to determine the status of an activity.

In conclusion, implementing this functionality in the system enhances personnel management efficiency and professional development monitoring, contributing to the improvement of the quality of medical services. As a result, patient satisfaction increases, and their loyalty to the healthcare facility strengthens.

One of the key advantages of this approach is that it not only contributes to improved financial performance through increased patient satisfaction but also enhances the institution's reputation in the eyes of the public.

The application of the "Educational Portfolio" in the QMS can be seen as an innovative approach to managing the professional development of medical staff. It is a tool that allows for effective tracking of the learning process and assessment of each employee's progress. This increases transparency in the staff development process and enables the institution to have confidence in the high qualifications of its employees.

The implementation of QMS with the "Educational Portfolio" section becomes not only an investment in the quality of medical services but also a strategic investment in the development of the institution's intellectual potential. It ensures a stable level of professionalism among the staff while expanding opportunities for further development and service improvement.

6. Section: CEW

The "Control and Expert Work" (CEW) system has been developed with the aim of improving the quality of medical work through continuous monitoring and evaluation of the work of physicians. The key function of the system is to perform expert control over medical cases, which is facilitated by users with the role of "Expert."

These experts review specific medical cases, including documents described and created by physicians for specific patients. Using a special form, they fill in the details of each case. Based on the responses in this form, an Expert Evaluation is generated, which represents an assessment of the quality of the physician's work.

This evaluation mechanism uses a percentage representation for quantitative assessment of the physician's work. This indicator affects the physician's rating, which encourages the physician to provide higher-quality service.

It is important to note that the CEW system has a greater impact on the physician's rating than the "Educational Portfolio" section. This is because while the "Educational Portfolio" evaluates the physician's continuous professional growth, the CEW system assesses the direct work of the physician with patients. Thus, the CEW system emphasizes the direct medical work performed by the physician, which has a direct impact on patient well-being and service quality.

At its core, the "User" and "CEW" (Control and Expert Work) models represent key components of the system. Using a UML (Unified Modeling Language) diagram as an example, we can analyze the structure and interaction of these two models within the system.

First, let's consider the "User" model. This model includes essential attributes such as the user's identifier, their role (which can be a physician, manager, or expert), login, password, and other personal data. This model represents each individual user of the system, allowing them to interact with other parts of the system according to their role.

The "CEW" model, on the other hand, represents the system for controlling and evaluating the quality of a physician's work. It includes attributes such as the CEW identifier, the identifier of the corresponding user, details of a specific medical case, including documents and reports, and the result of the evaluation expressed in percentages.

Within the UML diagram, the connections between the "User" and "Expert Evaluation" models depict the interaction between the user of the system and the CEW process. A user can create or modify an evaluation within the CEW process, and the CEW system, in turn, influences the rating of the physician-user, reflecting their professional effectiveness.

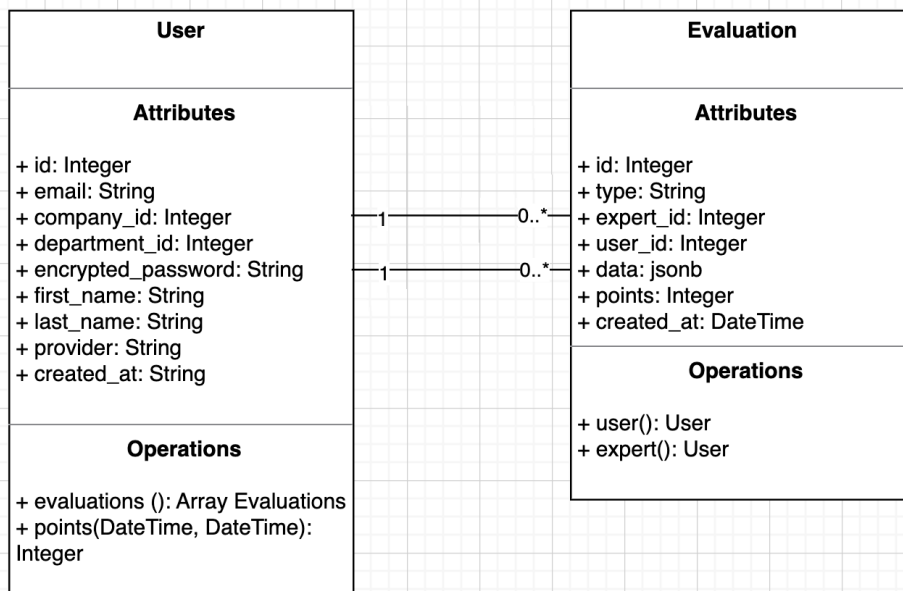


Figure 3: UML Diagram of user, evaluation models, and their relationships

7. Conclusion

The QMS system is based on a highly productive architecture that facilitates fast and reliable data exchange among various models. This architecture allows medical institutions to optimize processes, simplifies the integration of new models, and ensures the availability of medical resources.

We have examined various models, including "Educational Portfolio" and "Control and Expert Work." The first enables doctors to keep track of and evaluate their activity and professional growth, encouraging them to engage in continuous learning. The second provides experts with the ability to assess the work of doctors and ensures independent evaluation of the quality of medical care.

The interrelationships between models in the QMS system define a strong integrated approach to improving medical services. The Educational Portfolio provides data on the skills and activities of doctors, which can be utilized in Control and Expert Work for an independent assessment of the quality of medical care. This interaction helps identify the strengths and weaknesses of medical professionals and enhances their competence.

The QMS system aids in preventing medical errors, improving medical history records, providing up-to-date medical information, and enhancing the professional competence of doctors. This contributes to the improvement of the quality of medical services and patient safety.

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