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Elevating healthcare excellence: A comprehensive exploration of total quality management in modern healthcare systems

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Abstract
This study explores the crucial relationship between total quality management (TQM) and healthcare, looking at how TQM techniques and concepts can improve operational effectiveness, patient care quality, and healthcare results as a whole. TQM provides a formal framework for attaining these goals in a time when healthcare systems around the world are dealing with growing expectations for better patient experiences, safety, and cost-effectiveness. This essay explores the history, tenets, and ways in which TQM in the healthcare industry has been modified to fit the particular challenges of the industry. This study outlines the essential TQM elements that could improve healthcare delivery through a thorough analysis of pertinent literature and case studies. In order to enable healthcare personnel at all levels to uncover inefficiencies, minimize errors, and improve patient care through evidence-based practices, this study looks at techniques for establishing a culture of continuous improvement. The study also explores how technology and data analytics are used to execute TQM in the healthcare industry. It exemplifies how data-driven insights can support early intervention to avert negative outcomes, performance monitoring, and decision-making. The report also tackles the difficulties and hindrances that healthcare companies could experience while adopting TQM, such as resistance to change and the requirement for cultural transformation. Healthcare executives may create plans to overcome these obstacles and promote a long-lasting culture of quality improvement by being aware of these challenges. Finally, "Elevating Healthcare Excellence" emphasizes how crucial it is to incorporate TQM ideas into contemporary healthcare systems. This paper provides a thorough review of how TQM might raise healthcare standards by examining its methods, advantages, and potential drawbacks. Adopting TQM principles becomes an essential strategy for achieving healthcare quality in a quickly changing environment as healthcare institutions work to provide safer, more effective and patient-centric services.

Keywords: Total quality management, TQM, healthcare industry, patient care, quality in healthcare

Introduction

Despite the challenges posed by the intricacy of human biology and the complexity of scientific research in the field of medicine, the rate of progress in healthcare is remarkably rapid. Affirmations and news consistently astonish individuals, regardless of their exposure to science fiction literature and media during their formative years (Zuhra *et al*., 2017) [23]. Organizations have successfully fabricated liver and kidney tissues with 3D printing techniques, as well as developed prosthetic devices and pharmaceuticals that have received approval from the Food and Drug Administration (FDA). IBM Watson's cognitive computing system gathers vast amounts of data and generates the optimal treatment option for patients by analyzing crucial medical evaluations. Furthermore, advanced machine learning algorithms have the potential to perform even more sophisticated tasks. According to Lomotey *et al*. (2017) [12], tattoo-based devices have the capability to monitor essential health indicators and vital signs, thereby alerting individuals via their mobile phones when there is a need for immediate attention. Advanced reality gadgets, such as Microsoft's Holocene, have the capability to enhance our visual perception and equip professionals with the necessary skills to tackle challenging techniques. The progress in the field of medical advancements continues to astound us. In the year 2013, there was speculation on novel initiatives aimed at revolutionizing medication adherence monitoring. These initiatives involved the implementation of microchips within medication containers, enabling healthcare professionals to ascertain the timing and consumption of prescribed doses by patients. There has been a prolonged anticipation for the development of devices capable of facilitating holographic data input. However, the available options thus far have been limited to simplistic and toy-like contraptions, lacking the desired sophistication and functionality (Qiu *et al*., 2015) [16]. Without substantial investments being made in them, they will have significant challenges in achieving widespread adoption. One noteworthy example is L'Oréal, a company specializing in high-quality personal care products, which has developed a wearable sensor capable of informing the user of potentially harmful levels of sun exposure.

Literature Review

In recent times, there has been a gradual increase in the utilization of electronic health monitoring services. This is mostly due to the significant rise in the number of prevalent medical devices that are interconnected with diagnostic systems through various network technologies. Versatile health mind is a specific subset within the e-health domain, aiming to enhance conventional healthcare practices by the utilization of PDAs, wearable devices, specific sensors integrated with body area networks, and the latest advancements in distant communication technologies. Mobile technologies have played a crucial role in healthcare systems, particularly in the context of video chat telemedicine and mobile patient monitoring (Li *et al*., 2007) [10]. In general, the provision of convenient prosperity services necessitates the implementation of stringent quality of service (QoS) and quality of experience (QoE) protocols. The consistent utilization of convenient prosperity services, such as remote adaptive patient checking, telecare, and remotely directed surgical intervention, necessitates significantly enhanced performance metrics (e.g., minimal delay and jitter, rapid response time, and low package incident). Several small prosperity scenarios are dependent on wearable body sensors, such as electrocardiogram (ECG), heart rate monitors, and ultrasound devices. Additionally, inherent sensors found in smartphones, including as high-resolution cameras and gyroscopes, also play a crucial role in monitoring and assessing health conditions. The advancement of various flexible prosperous applications necessitates the exploration of cutting-edge and network management systems due to their highly impactful features on the necessary system resources, as well as the need to meet QoS/QoE requirements. Based on the presented evidence, we were persuaded to design and implement a system that facilitates remote access to a structured security framework for m-health (mobile health) services. This system incorporates a multi-criteria decision engine to determine the most suitable available access option. The flexible health system relies on the Distributed Decision Engine and the Network Information Service to fulfill several inquiry duties. These duties involve providing both static and dynamic parameters of the accessible healthcare communication networks (Adame *et al*., 2018) [1]. Several approaches exist for implementing the game plan in Wi-Fi networks. E-health thinking systems provide a robust platform for the effective delivery of quality healthcare information in diverse mobile health contexts. The current progress and advancements in the realm of Internet of Things (IoT) have significant implications for the emerging era of healthcare. The healthcare vision is widely endorsed as it advances the enhancement of individuals' quality of life and well-being, encompassing many health measures. The ongoing growth of diverse Internet of Things (IoT) devices in the field of healthcare is being extensively examined due to challenges associated with managing the IoT terminal hubs used for health monitoring, real-time data processing, and intelligent decision and event management. In the field of literature, Din and Paul (2018) [2] have put up a healthcare design that relies on the analysis of crucial data obtained from health monitoring sensors and the utilization of big data analytics in the healthcare sector.

Over the past decade, there has been a growing interest in big data, particularly in the context of health services applications. The integration of distributed computing and the Internet of Things (IoT) paradigm in the healthcare sector presents several opportunities for medical information technology (IT). Experts believe that this integration has the potential to significantly enhance healthcare services and contribute to their continuous and systematic improvement in a big data environment, such as Industry 4.0 applications. However, effectively managing data in a cloud-based Internet of Things (IoT) environment remains a significant challenge. Similarly, Khalifa and Zabani (2016) [8] put out an alternative approach aimed at optimizing the selection of virtual machines in cloud-based Internet of Things (IoT) healthcare applications. The objective of this model is to effectively manage the substantial volume of data integrated within the context of Industry 4.0.

The utilization of Internet of Things (IoT) and big data in intelligent electronic health (e-health) care applications.

The rise in popularity of universal frameworks can be attributed to the improvements and dynamic adoption of IoT devices and their enabling technologies. The Internet of Things (IoT) has demonstrated significant potential in the field of high-risk environments, particularly in the context of organizations focused on health and safety (EHS). In the context of these industries, the safety, reliability, and efficiency of IoT-based applications are crucial since they possess the capability to operate at a detailed level and provide comprehensive low-level data, thereby addressing the concerns surrounding human lives. This paper examines the current body of distributed research on the applications of Internet of Things (IoT) in high-risk environmental, health, and safety (EHS) industries, with a specific focus on the healthcare industry, food supply chain (FSC), mining and energy sectors (oil and gas and nuclear), intelligent transportation (such as connected vehicles), and building and infrastructure management for emergency response operations up until the year 2016.

The Web of Things (IoT) provides a cohesive platform for connecting humans and objects, with the aim of enhancing and simplifying our daily lives. This concept represents a shift from centralized, figure-based planning to a more decentralized state, enabling a wide range of applications such as wearable technology, home automation, efficient transportation, and intelligent urban environments. In their study, Farahani *et al*. (2018) [3] discussed the significance of IoT in the healthcare industry, specifically in relation to healthcare and prescription services. They presented a comprehensive framework for the IoT e-health ecosystem. The management of healthcare is increasingly challenging due to the insufficient and less effective healthcare services available to satisfy the growing demands of an aging population with chronic illnesses. It is proposed that a transition from a center-driven approach to a patient-centered healthcare model is necessary, wherein all stakeholders, such as healthcare providers, patients, and administrative bodies, are seamlessly interconnected. The implementation of a patient-driven Internet of Things (IoT) e-health ecosystem necessitates a multi-layered architecture comprising device, fog computing, and cloud infrastructure. This architecture is essential for effectively managing and processing complex healthcare data, considering factors such as data variety, velocity, and latency. The mist-driven Internet of Things (IoT) design is accompanied by various instances of services and applications that are implemented on those layers. The aforementioned illustrations encompass a range of topics, including varied health, assisted living, e-drug, inserts, and early warning systems, as well as population monitoring in smart cities.

In recent years, there has been a significant development in the utilization of m-healthcare apps based on the Internet of Things (IoT), which offer a wide range of features and real-time services. These applications provide a platform for a large number of individuals to receive regular health updates in order to promote a more wholesome lifestyle. The use of Internet of Things (IoT) devices in healthcare settings has revitalized various aspects of these applications. The vast amount of data generated by Internet of Things (IoT) devices in the healthcare sector is processed in the cloud instead of relying solely on the limited capacity and computational resources of mobile devices. In light of this distinctive circumstance, a proposed healthcare system is presented that utilizes cloud computing and Internet of Things (IoT) technology to diagnose illnesses. This system is capable of predicting potential ailments and assessing their severity. This study aims to examine the concept of computational sciences in order to generate client-oriented health assessments through the utilization of specific terminologies. The structural model for exceptional healthcare among understudies is designed for practical implementation scenarios. The results are recorded following the completion of health measurements in a specific environment. The topic of the understudy point of view has been examined in the field of literature (Verma and Sood, 2018) [20]. In this work, health information was generated using the UCI dataset and medical sensors. The objective was to predict the severity of various illnesses in students. The process of identifying patterns is accomplished by employing several state-of-the-art classification algorithms, and the results are evaluated based on metrics such as accuracy, sensitivity, specificity, and F-measure. The results of exploratory analysis indicate that the suggested methodology outperforms the benchmark approaches in predicting diseases.

The field of wireless body sensor networks (WBSNs) has seen significant advancements in therapeutic methodologies.

The advancements in wireless sensor technology, specifically in wireless body area networks and sensor networks, have progressed beyond the stage of detailed and continuous monitoring. These innovations have become a significant driving force in various fields, including both medical and non-medical applications (Zuhra *et al*., 2017) [23]. Physiological monitoring systems have been developed to monitor human health conditions and are responsible for transmitting collected data (such as glucose levels, electromyography, ECG, electroencephalography, temperature, etc.) from biosensor nodes to medical or non-medical servers for analysis. Numerous steering and information dissemination protocols have been specifically designed for Wireless Body Sensor Networks (WBSNs). The directing conventions in wireless body sensor networks (WBSNs) may vary depending on the specific application and network design (Timothy and Kong, 2017) [19].

The utilization of wearable devices in the remote care movement is being facilitated by many health care service providers, in response to the growing growth of IoT (Lomotey *et al*., 2017) [12]. These devices are utilized to systematically input individual health-related information (such as vital signs, medications, allergies, etc.) into healthcare information systems for the objectives of health monitoring and professional diagnosis. The present examination highlights the challenges faced by healthcare facilities in managing various clientele with varying insurance coverage, resulting in heterogeneity of data sources and complexity in the billing process. The issue at hand has been addressed in numerous research studies through the proposal of wearable Internet of Things (IoT) data streaming frameworks. These frameworks aim to ensure the traceability of data flow from its original source to the health information system.

The advent of Internet of Things (IoT) technology in the human services sector and its applications in medicine have had a significant impact on the testing of healthcare issues. Character management is an essential system within the Internet of Things (IoT), which has been employed within a highly promising domain of medical science. Within this particular identity management system, each individual client or device is inherently assigned a distinct identity, hence enabling the collection of comprehensive information pertaining to that device through its designated identity. Several studies have been conducted on the utilization of Internet of Things (IoT) in real-time frameworks. The purpose of these exams is to ensure prompt awareness of any activity occurring in the device environment. This enables immediate action to be taken upon receiving a notification about the event (Sun *et al*., 2012) [18]. The problem of Internet of Things (IoT) in mining areas is comparable to a significant issue that is being addressed here, including crucial operations conducted in mining regions, resulting in the creation of tailings. In light of subsequent dam disillusionments and significant accidents, there has been a notable increase in the occurrence of severe damage and fatalities.

The communication protocol utilized in Internet of Things (IoT) for e-health systems.

The Internet of Things (IoT) facilitates a consistent and structured means of connecting individuals and patients, thereby enhancing and simplifying several aspects of our life. The aforementioned perspective signifies a shift from process-oriented focused strategies to a more decentralized environment that presents numerous opportunities, such as smart wearables, intelligent homes, advanced mobility, and smart urban areas (Farahani *et al*., 2018) [3]. Two articles examine the compatibility of the Internet of Things (IoT) in healthcare and medicine by presenting a complete framework for the integration of IoT in e-health ecosystems.

The management of human services is becoming increasingly challenging due to inadequate and less efficient social healthcare services that are unable to fulfill the increasing demands of a growing population afflicted with chronic illnesses. In a few introductory statements, the inspectors suggest that the e-social protection framework necessitates a shift from an internally focused approach to a patient-centered healthcare model, where all stakeholders, such as healthcare facilities, patients, and services, are consistently interconnected. The implementation of a patient-centered Internet of Things (IoT) e-health system requires a multi-layered design approach. This design encompasses the device layer, fog processing layer, and cloud layer, which collectively enable the efficient handling of complex data in terms of its volume, velocity, and latency.

The IoT configuration driven by haze is accompanied by numerous instances of services and applications that are implemented on those layers. These depictions encompass a range of topics, including mobile health, assisted living, e-medication, implants, early warning systems, and population monitoring in smart cities. The issues associated with IoT e-health encompass information association, flexibility, terminology, interoperability, device network human interfaces, security, and privacy. Currently, telemedicine is widely recognized for its capacity to deliver high-quality healthcare treatments to geographically distant regions. In order to achieve its objectives, telemedicine employs a range of remote technologies, including the Internet of Things (Hossain, Rahman, & Muhammad, 2017; Hossain, Islam, Ali, Kwak, & Hasan, 2017) [6, 5]. The Internet of Things (IoT) is challenging the boundaries of telemedicine by revolutionizing the delivery of improved and reliable healthcare services. The highlights of telemedicine have been organized by providing a model known as an IoT-based well-being medicine companion, which facilitates the appropriate adherence of patients to the recommendations provided by healthcare professionals. This paper presents a security framework that aims to assure user authentication and safeguard access to resources and services. The security framework authenticates a user based on the OpenID standard. An access control system is implemented in order to prevent unauthorized access to medical devices. Upon the successful confirmation, the client generates an approval ticket, referred to in this article as a security access token (SAT). The SAT encompasses a range of advantages that provide the user access to medical Internet of Things (IoT) devices and their associated services and resources. The SAT is designed with cryptographic measures to mitigate the risk of counterfeiting. A medical Internet of Things (IoT) device verifies the SAT (Self-Assessment Test) prior to fulfilling a request, thereby ensuring secure access. The suggested framework has been implemented to preliminarily assess the asset effectiveness of several SAT verification methodologies across multiple performance metrics, such as computation and communication overhead.

The utilization of software-defined networks (SDNs) in the context of Internet of Things (IoT) within the health care sector.

Wireless body sensor systems are designed to facilitate communication between sensor nodes attached to the human body for the purpose of monitoring essential metrics and conditions of the body. The design and development of wireless body sensor network (WBSN) structures for health monitoring have received significant attention in recent years, as evidenced by the research studies conducted in the industry (Harbouche *et al*., 2017) [4]. This notion is commonly advocated by expensive healthcare systems and recent advancements in the development of miniature health monitoring devices, as well as emerging technologies such as the Internet of Things (IoT) (Patel *et al*., 2017) [14], which contribute to the primary problems of 5G (Harbouche *et al*., 2017) [4]. The presence of a definitive approach to handle the necessary programming design and verification is of utmost importance for the development and maintenance of such systems. This article introduces a flexible preventive human services framework. The proposed framework is predicated on a structure that incorporates diverse centers and offers both systematic and comprehensive monitoring, as well as specific guidelines. We presented a conceptual framework to illustrate the primary direction of the Wireless Body Sensor Network (WBSN). This study presents a fundamental aspect wherein a model-driven construction strategy is proposed to effectively address the assurance of each core behavior in the Wireless Body Sensor Network (WBSN) from the perspective of the overall WBSN conduct. This approach enables experts to derive a system design based on a comprehensive understanding of its requirements. In order to assure the adherence of this layout to its intended standards, it is necessary to validate and verify the presumed practices prior to their implementation.

In essence, formal processes serve as effective tools for software professionals to verify the consistent accuracy of concurrent programming across all stages of its life cycle. Formal verification is widely recognized as a highly effective method for ensuring the dependable accuracy of concurrent systems. In this study, we employ a model checking methodology that utilizes a model modification technique to validate the conclusively determined advantage of a Wireless Body Sensor Network (WBSN) for health monitoring. The proposed model-driven technique aims to verify the adherence of the determined structure to its overall specification, with the objective of enhancing the system's performance and quality of service (QoS). This methodology enables the planner to engage in logical thinking on a conceptual representation of the entire system, rather of focusing solely on its physical form.

The utilization of big data and Internet of Things (IoT) technologies in the service system for elderly individuals.

The provision of adequate care for elderly individuals is of paramount importance due to their susceptibility to various ailments and their consequent need for consistent healthcare services and interventions. Developing a comprehensive understanding of the future trajectory of older persons in the near future is a crucial undertaking, considering the diverse characteristics and experiences of this population. The primary focus of Wendy and Mitzner's (2017) [21] article was on the domains of housing, financial well-being, and social engagement among individuals aged 65 and above. The article explored the role of information, communication, and technological advancements in facilitating increased mobility, self-management, and overall improvement in quality of life. In their study, Wendy and Mitzner (2017) [21] put forth a suggestion that aimed to delineate the multifaceted nature of environments, well-being, and living conditions for older persons in the future. This discourse examines the potential adverse consequences that may arise from the expansion of development, encompassing prolonged social isolation and the widening of socioeconomic disparities. The research primarily centers on envisioning the necessary conditions in which older adults possess self-determination and autonomy, are sufficiently equipped to address their health and well-being requirements, have abundant and fulfilling opportunities for social connectedness, mindfulness, sustained life purpose, and overall high quality of life (Shah *et al*., 2016) [17]. In order to achieve this in the future, it is necessary to organize the development with the involvement of the current, more experienced adults who cater to the needs and skills of the future, older adults. This entails establishing a strong foundation to facilitate widespread access and integration of these technologies. Additionally, it is important to support the integration of technology into individuals' lives at younger ages, providing flexible functionality to accommodate changing needs and preferences. Table I presents a comprehensive overview of significant technological advancements in the healthcare industry.

Mature individuals consistently exhibit a preference for establishing structures, a process that necessitates a high level of organizational support and currently lacks the necessary connections. The current structure for providing assistance to seniors is inadequate in meeting their physical and emotional well-being demands, given the rapidly growing population of elderly adults. A shift in focus from individual-level interventions to more proactive and collective-based approaches will become increasingly prominent as the situation changes. Jeste *et al*. (2016) [7] have put out the proposition of implementing physical activities later in life as a means to promote healthy lifestyles and preventative healthcare, with the aim of encouraging older adults to remain in their own homes as they age.

The implementation of a secure healthcare system

This section elucidates the safety mechanism employed in an intelligent and secure SHCH system, as proposed in the aforementioned research study. The graphic illustrates the deployment of SHCH controllers at key healthcare facilities within the vicinity of the city. The SHCH controller unit is comprised of a consolidated assembly of the subsequent components:

In this study, we aim to investigate the effects of climate change on biodiversity in a tropical The smart reader is capable of receiving input signals from several sources, including the hospital, RSU, and ambulance.

The present study employs a swarm intelligence strategy inside the framework of soft computing methodology to develop a security module that utilizes nano robots. The aforementioned logic is capable of detecting and responding to the four fundamental security alarm messages transmitted by ambulance services, hence providing necessary medical assistance to patients during emergency situations. The study conducted by Qiu *et al*. (2015) [16] focuses on the implementation of secure and efficient operations within smart registered ambulances while traveling in a smart VANET (Vehicle Ad-Hoc Network) within the SHCH (Smart Healthcare City) zone. The SAFE approach encompasses several safety and security mechanisms included in a smart ambulance. One such mechanism is the SOS feature, which is utilized to activate the "Save Our Soul" option. The activation of this mechanism can be initiated by either the intelligent operator of the vehicle or one of its occupants in response to a significant issue. The roadside device autonomously detects alerts and triggers a signal at the human-assistance center in order to monitor the car and deliver emergency services. Additionally, the term "attack" is employed to denote the action of engaging a button in response to an external assault on the vehicle, such as instances of robbery or theft. Furthermore, with regards to fuel management, in the event of an unforeseen gasoline shortage, the smart vehicle possesses the capability to be monitored and prompt help can be promptly dispatched upon detection of the activation of the designated button. The fourth feature is an emergency button that serves multiple purposes. It can be utilized in situations where there is a significant health risk to either the driver or passenger during travel. Additionally, it can be activated in response to any sudden criminal activity occurring within the vehicle. In the event of a sudden accident, pressing this button will transmit an emergency signal to the SHCH controller, enabling prompt assistance to be dispatched after notifying the appropriate local authorities. By employing advanced nanorobot technology, both the controller and ambulance units within the system are equipped with cognitive capabilities. Consequently, the ambulance is consistently provided with up-to-date information regarding the congestion status of nearby traffic. The present communication is conducted based on the Vehicle to Vehicle Communication (V2V) concept in VANET, as proposed by Qiu *et al*. (2015) [16]. This enables the system to detect high traffic conditions in the current traffic scenario and efficiently redirect the route of an ambulance to an alternative way, thereby reducing the waiting time significantly.

One potential limitation of the proposed system is its reliance on a single data source. This could introduce a risk of incomplete or inaccurate information, as well as potential biases inherent in the data. Additionally, the system may not be able to effectively handle unexpected or

The management of dynamic topology changes in the VANET system has not been adequately addressed. In the event of a rapid increase in mobility among mobile stations, it is anticipated that the proposed system may have difficulties in effectively managing the resulting surge in traffic. Furthermore, the system's throughput will not exhibit considerable performance if there is a high occurrence of connection failure. Under such circumstances, the presence of additional packets containing control information will lead to an excessive amount of data and thus cause significant delays, resulting in a substantial decrease in overall throughput.

The social ramifications

The project work has garnered significant recognition from individuals within the social sphere due to its provision of an enhanced service management framework within the medical domain. The safety of patients and their relatives is ensured within the system due to the utilization of a smart ambulance. This model incorporates a microcontroller chip embedded in the vehicle's PCB, which carries self-personal information. Consequently, once the ambulance enters the VANET (Qiu *et al*., 2015) [16] zone of SHCH, it is effectively controlled and monitored by its controller. When the SHCH controller detects the presence of a traffic jam in a certain traffic area, it initiates a process to aid ambulances upon their arrival by redirecting their route. In addition to many identifying details, the ambulance is equipped with four fundamental security domains that provide communication with the SHES controller. In the event of an emergency, the activation of one or more buttons on the ambulance will occur, either by the driver or by a patient attendant, depending on their presence at the time. The monitoring of this phenomenon is consistently conducted by the SHCH controller located at various city sites or roadside areas, employing the V2R (Vehicle to Roadside Unit) concept as proposed by Wu and Horng (2017) [22]. The controller promptly responds to any alert message, providing rapid support and taking appropriate action to aid the patients.

The findings/results of the study

In order to evaluate the efficacy of our suggested methodology, we conducted experiments employing two simulation tools, specifically NetSim and Ns2. In both instances, we obtained findings that exhibit a high degree of similarity. This prompted us to deliberate on the matter of determining the optimal allocation of SHCH (Standard Health Care Hours) to ambulances for processing within a single round of service. In addition, we conducted a comprehensive performance analysis by comparing our methodology with other similar methodologies. The simulation parameters that were taken into account during the implementation of the proposed approach are displayed. NetSim is a highly commendable tool for the programming of simulations, system design, research and development, automation, and applications related to barriers. The software possesses notable features that contribute to the measurement of performance. The library possesses a comprehensive collection of records pertaining to both wired and wireless protocols. Additionally, it offers access to C source code and provides enhanced features during simulation. Furthermore, it facilitates troubleshooting and coding processes, ensuring ease of use. The road topology is established by the utilization of the map editor, while the vehicle movement editor is employed to generate the vehicle motions. The editor also assists users in specifying vehicle route information, specifically for ambulances, in the simulation scenario. This includes details such as the total number of ambulances to be included in a specific route, the departure time of the vehicles, the origin and destination points, the transit period, the speed, and other relevant configurations that are set during the simulation process. Additionally, the processing time required by the SHCH controller in the proposed SHCH system is also demonstrated. The term "processing time" pertains to the duration of system execution during simulation. In this study, we are assessing the efficacy of the proposed system. In order to verify the accuracy of the simulation outcomes, two simulators, namely Ns2 and NetSim, were employed. In both simulations, it was observed that the processing time exhibited a negligible change, with the values being almost equal. The performance of the proposed scheme for the delay caused by the SHCH controller in smart healthcare services is demonstrated. In this context, the term "delay" pertains to the time difference between data transmission from the source to the destination when utilizing the SHCH scheme, as compared to the duration it takes for an ambulance to travel without employing the SHCH function. Considering that the delay is rather modest and SHCH has implemented numerous security measures, it may be argued that the delay is within acceptable limits and can be effectively managed. When subjected to simulation in both Ns2 and NetSim, it was shown that they demonstrate a similar length with slight fluctuation.

Additionally, this research paper presents a comparative analysis of the average delay of the suggested scheme by the SHCH controller and two other similar approaches, namely IoT-based and EPSSHIC, as stated in the study. The comparison also takes into account the baseline circumstance in which the proposed system is not implemented. The suggested methodology exhibits an average end-to-end delay in data transmission ranging from 5 to 10 minutes, which is quite moderate when compared to alternative methodologies. It is not said by our research that the way we suggest guarantees the attainment of minimum delay. However, our observations prompt a conversation over the substantial amount of time required for the intelligent execution of our system, which involves the processing of intricate logic within the smart sensors of the smart vehicles, specifically ambulances. Additionally, this research study presents an evaluation of the performance of the suggested scheme for security service time, comparing it with two other approaches: an IoT-based system and EPSSHIC. The comparison also takes into account the baseline circumstance in which the proposed system is not implemented. The proposed system exhibits a range of security service time durations, specifically between 20 and 30 seconds. This duration falls within the middle range when compared to alternative systems. We do not assert that our suggested technique achieves the shortest time requirement. However, our observation prompts a discussion on the substantial time required for the intelligent execution of the security service in our system. This is due to the extensive logic executed by the smart sensors integrated into the smart vehicles.

Conclusion

In metropolitan regions, particularly in smart cities, there is a growing prevalence of novel health threats and challenges arising from the complex lifestyle characteristic of the local environment. Concurrently, there exist developing technologies aimed at streamlining health-related challenges. Specifically, smart applications leveraging big data and data analytics have been developed to effectively manage, monitor, and evaluate a range of health threats and their corresponding enhanced remedies. In the aforementioned research study, an innovative healthcare system has been devised to address the challenges pertaining to health care in smart cities. This intelligent and advanced system aims to guarantee the well-being, protection, and prompt medical attention for patients within an urban VANET (Vehicular Ad-Hoc Network) area. The ambulances utilized within the system are equipped with advanced technology, including intelligent sensor devices that are strategically positioned at the Printed Circuit Board (PCB). These sensor devices possess the capability to communicate with the Roadside Unit (RSU). The proposed technique has been deliberated upon, with the inclusion of a flow chart that illustrates the implementation of the safety mechanism within the system. The study involved conducting simulations using both Ns2 and NetSim software. The results indicate that the system under investigation exhibits enhanced levels of secure service and improved security solutions for healthcare. These improvements are attributed to the utilization of sophisticated technologies such as automated vehicles, big data analytics, and vehicle-to-roadside (V2R) communication within the context of vehicular ad hoc networks (VANETs).

Conflict of Interest
Not available

Financial Support
Not available

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