A Review of Service Quality in Integrated Networking System at the Hospital Scenarios

Mustafa Almahdi Algaet[1], Zul Azri Bin Muhamad Noh[1], Abd Samad Bin Hasan Basari[1], Abdul Samad Shibghatullah[1], Ali Ahmad Milad[1] and Aouache Mustapha[2]
[1]*Department of Computer System and Communication, Faculty of Information and Communication Technology, Universiti Teknikal Malaysia Melaka, Melaka, Malaysia*
[2]*Department of Electrical, Electronic and System Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Selangor, Malaysia*
elget_765@yahoo.com

Abstract **—Hospital networking system is progressing into a more unified method by connecting technology that utilizes wireless networking technologies into backbone networks. Even though multiple joined circumstances have been acknowledged in the published articles, a common medical facility has not been thoroughly studied and continued to be a difficult subject that is pending. The main challenge faced by networking consultants is the smooth unification of all the components in an all-in-one of healthcare delivery system. A perfect understanding of the functions of the unified networking is essential for effective designing and utilization of such knowledge in the medical backgrounds. This paper denotes the design and review of unified networking system circumstances in a hospital background. The effect of the types of traffic for example the audio and visual, system loads, size and strength of the network line is studied by a test run. Three pilot test studies have been conducted in radiology A&E and ICU conditions. Each condition shows the requirements for a particular type of traffic which then becomes the definite system behaviour. In the case of a radiology requirement, email and FTP traffic are noted to function effectively within the regular-to-big networking systems. In an A&E situation, VoIP circulations create very little jitters and missing data; it is linked with the prerequisites of QoS. In ICU situations, the video conferencing function downgrades the size of the network. Therefore, a QoS enabled gadget is suggested to minimise the packet delay and data losses. This study gives an overall explanation of wireless telemedicine technology and QoS. The findings of this study are summarised and arranged. Besides, the quality of service which has to be studied through the wireless telemedicine technology has been indicated. The findings of this study will provide a useful perspective in the investigation of QoS in wireless telemedicine technology and serve as a foundation for any individuals who are intrigued in the research of "wireless telemedicine technology for e-healthcare services**

***Index Terms*— Quality of Service, wireless telemedicine , Intensive Care Unit (ICU), Accident and Emergency (A & E), Wireless Local Area Network (WLAN) and Wireless Fidelity (WiFi)**

I. INTRODUCTION

Since ten years ago, both wired and wireless networking systems have been attempting to unify, providing efficient and dependable services to healthcare procedures. According to [1],[2] the main feature that is required for applying Wireless Local Area Network (WLAN) technology in medical facilities is precise improvement. [3] suggested the use of fast track wireless technology in the pharmacy tracking and tracing system so as to decrease mistakes related to the delivery of medicinal drugs. Other models that utilize Wireless Fidelity (WiFi) signals have been effectively integrated in [1], [4], [5]. The flexibility of WLAN and user friendliness greatly increases the efficiency of medical care. For example, an individual's medical information related to healthcare observation can be retrieved by authorized individuals by a Personal Digital Assistant (PDA). X-ray films can be acquired as File Transfer Protocol (FTP), Hyper Text Transfer Protocol (HTTP) and Database (DB) enquiry; therefore radiologists can all utilize and share the data efficiently. Finally, it is quite usual for medical personals to conduct a consultation through a video conference or Internet Protocol (IP) telephony on mobile equipment. Although, 3G and Global Packet Radio Service (GPRS) mobile systems are rising in demand in businesses, they have inadequacy in space and would not be able to handle real life connections for huge number of users [4]. However, WLAN technologies can be manipulated to accommodate greater frequency of information transfer compared to mobile networking systems in a comparatively less coverage area to precise healthcare programs in medical facilities. A misunderstanding of the concept of improvement in the medical facility is to substitute the whole wired architecture with a wireless plan. This perspective is not accurate. Since the signal strength of the radio coverage differs according to the background such as distance, interior or exterior interference, and the protocol utilized etc, its performance is not as reliable as the wired systems.

A. Development in the Healthcare Background

The objective of this research is to examine the utilization of stimulation technology in the study of wireless broadcasting channel in healthcare background. In this study, the channel modelling has been done by utilizing a reliable stimulation platform that uses both full-wave Method of Moments and flexible ray locating methods. Based on this, the characteristics of the channel which involve the large-scale and small-scale areas of a wireless networking system practiced inside a medical facility area can be accessed.

Besides, it can also predict the electromagnetic field interference that is emitted by the infrastructure of the network. The test results obtained from the four situations in a healthcare background like the patient's ward, the surgical room, a specific floor or the medical facility, and the cardiac stress test room, with multiple wireless technologies utilized will display the ability of the stimulation method used.

Wireless applications are greatly in favour with healthcare programs because of the convenience and flexible needs, plus, it is more comfortable to use and offers improved services to the patients. Moreover, there are huge cost reductions for the medical facility. In contrast to the old fashioned indoor wireless networking architecture, it is important to guarantee the sturdiness of the radio channel in healthcare backgrounds and also make sure that the medical gadgets in the hospital are not effected by electromagnetic interference as the lives of the patients are at risk. This review investigates the utilization of stimulation technology for the generalization of wireless broadcasting channels in healthcare background. A hybrid stimulation architecture that mixes full-wave MoM and UTD/adaptive ray locating method is suggested to layout the architecture for radio channels of a wireless networking system that is applied in healthcare situations. It can also forecast the stages of EM interference emitted by the infrastructure of the networking system. A study of the broadcasting channels in four different situations in a hospital such as patient's room, surgical room, a specific floor of the medical facility and cardiac stress test room with various wireless technologies has been carried out.

B.Healthcare Applications and Situations

According to [6][14], the ever growing number of users and types of traffic will cause the healthcare programs to depend on more complicated, "interoperable joined systems". The idea of "MedLAN" was first suggested by [7]. It relates to the networking system under study for emergency situations. However, with the improvement in the field of telecommunication technology, "MedLAN" is not limited to the emergency unit only. On the other hand, more situations are anticipated to be combining into the backbone networking system with more dependable technological improvement. As shown in Figure 1, the main applications are about critical life programs, on-demand multimedia programs, office based programs and remote controlled programs. Generic programs like video conferencing, IP telephony and document sharing can be activated on both the wired backbone networking system and with WLAN. This gives flexibility and thus activates smooth interaction and more efficient delivery of medical care [8]. As stated by [9][10]11] the unified medical facility networking system will also bring in new chances for developing programs for instance monitoring patients, alarm systems and remote control gadgets.

Critical life programs: Generic programs contain alarm systems and patient monitoring systems. This kind of programs normally needs little bandwidth but there should be absolutely no interruption and missing data. It requires maximum reliability and flexibility.

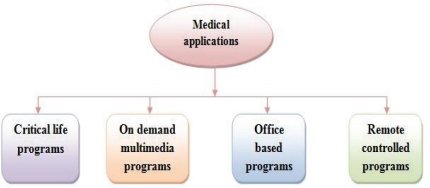

Figure 1: Classification of the major medical applications

On demand multimedia programs: Transferring image, video conferencing and IP telephony are in this list. Compared to the critical life programs, the programs in this list can accommodate small number of missing data but it is very susceptible to interruption and privacy. Effective agility is needed for communication.

Office based programs: Generic programs have internet surfing, data sharing, information searching, and email. Even though, this kind of programs needs significantly high bandwidth, some corrupted information can be retrieved by having backup systems. Privacy is the utmost important. Furthermore, agility is also required to accomplish effective delivery of medical care wherever and whenever needed.

Remote controlled programs: This list relates to the supervision of healthcare equipment mainly alarm systems which are used for monitoring patients from a distance and telemetry that serves physiological abilities.

Figure 2 displays a normal hospital networking system that relates A&E room, radiology and ICU unit. Each situation requires multiple programs which are all connected to the wired networking system architecture that provides high speed connection and centralised control.

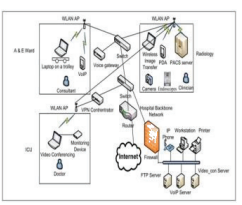

Figure 2: Integrated network scenarios and the core applications in hospital settings.

The A&E room has a laptop on a trolley and a PDA which is able to accommodate WLAN connection. The laptop should record the recurring biomedical information from remote equipment while roaming in the crisis division. In the meantime, it is connected to multiple specialised equipment for example endoscopes and high resolution cameras which accommodates WiFi connection. Thus, excellent images and sound can be retrieved for analysing the situation. On the other hand, the consultant has a choice to retrieve the diagnosis information from the wired terminals or mobile equipment. Besides, IP telephony through a voice gateway can be used to provide call forwarding and voice mail capability. The A&E room in a medical facility is a kaleidoscope which shows various capabilities as written by [12]. E-prescription can be

done by using handheld equipment which are capable of voice recognition when the medical officers or specialists are beside the patient or walking around the hallway. The prescription data can be retrieved by the pharmacist who has a Personal Computer (PC). At the same time, extra data like a patient's background, lab tests results, and physiological information can also be retrieved. The utilization of e-prescription has greatly improved the decision making procedures and reduce the hassle of understanding the doctor's writings by the pharmacist. Basically, there are numerous doubts for the integration of wireless technology;

- Instead of 802.11b, high frequency wireless baselines are needed to transport the healthcare records more effectively;
- Reduce the interruption with other mobile equipment; and
- Strength of the signal has to be thoroughly researched, making sure of the quality of the link established and saturation range.

In the case of radiology, patients' data are managed by programs like database inquiry, file sharing and barcode reading. It also accommodates internet surfing, email and image delivery for analysing the condition of the patient. Generally, Picture Archiving and Communication System (PACS) are utilized to keep X-rays and Computed Tomography (CTs) images electronically and are capable of allowing sharing with other physicians [13][15] had concluded in their findings that the programs which deal with medical database are crucial information which needs backup support and verification processes. Even though, these programs are office based, system overload and ubiquity are heavy.

Another situation that needs attention is ICU unit. This unit is made up of precise mobile equipment such as PDAs and laptops which are compatible with IP telephony, internet surfing and video conferencing. An AP can accommodate transmission of various types of data, audio and videos. The implanted Virtual Private Network (VPN) makes sure that only authorised individuals like medical assistants and doctors can log in and use the applications. Even though similar situations have been researched by [16][17][18] effective broadcasting plan is needed for QoS delivery, whereby improved performance is required. [19] suggested that in future, the healthcare conditions are predicted to have an ideal coverage of the indoor and outdoor area of the hospital. With the utilization of fibre optics, Digital Subscriber Line (DSL) and (WLAN) architecture, medical officers can effectively supervise the effectiveness of healthcare equipment from the comfort of their home. [6] stated that the unified networking systems in medical facility backgrounds are automatically related to the ever-improving telecommunication technology and underlying forces of "organizational". Managing collaboration among organizations is very important for healthcare system layouts. One of the misconceptions directors and project managers is to highlight the mechanical capability of proposed idea, and in a way, ignoring the educational, medical, management and other agendas that they claim it could solve. In view of such misconception, many studies suggest systematic verification techniques [16]. The verification of healthcare networking systems settings can be attained through technological evaluation, benchmark plans for medical pragmatics, and models that start with researching "healthcare facilities, organization and society requirements". [6] also has analysed the added values, possible dangers, and cost of replacement technologies or packages in this context.

II. Special Features

[20] stated that even though the price and technological gains have prompted the study of unified networking systems, concrete knowledge of the features of the hospital equipment is still needed. [21][22][23] have mentioned that healthcare traffic can be categorized into 2 groups, which are (a) regular report information that are shared at a regular interval and (b) urgent signs which have a high arbitrary characteristic. The urgent signs create more difficulties in the planning of the Initial review done by [6] states that bandwidth limitations and data delays are the main cause of concern with medical facility programs. The urgent signs are crucial in saving the patients' lives and therefore resources and QoS plans should be made available to ensure the vital package are transferred in a timely interval. [24][25][26] stated that QoS is specific for each program and thus a full analyses of the requirement of the QoS must be studied [27]. [21] added that a decrease in packet size and other variables need to be considered besides the output and data delays.

III. Explanation Of Present WLAN Technologies

The launch of IEEE 802.11 baselines has activated wireless connection in hospital [28]. WLAN requirements differ significantly in frequency of data, coverage area and other variables because of the Media Access Control (MAC) architecture. IEEE 802.11b resides in 2.4GHz frequency band and uses High Rate/Direct Sequence Spread Spectrum (HR-DSSS) as a MAC mechanism. [29][30][31] stated that big hospitals have a higher probability to invest in wireless technologies then the smaller organizations. The budget, hi-tech communication and medical system requirements determine the investment in the wireless technologies, even though 802.11a and 802.11g infrastructures are considerably more costly and the rate of data transfer is four times faster than 802.11b. As stated by [32], Sydney Adventist Hospital used 802.11a for their patient healthcare systems. The main advantage is justifying the interference with other active equipment using the more well-known 2.4GHz ISM bands. Moreover, 802.11a has more number of channels in contrast to 802.11b and 802.11g, which confronts the problem of concealed connections. As stated by [33], a concealed line links to the connection that cannot interact with the rest. 802.11g has reverse ability, therefore synchronized integration of 802.11b and g can be done. However, [34] realised the coverage area of the concurrent implementation is less than that of independent 802.11b. The total of all is also smaller than 802.11g. Current reviews done by [34] shows that 802.11a backs up multimedia settings with audio, visual and basic IT programs. The main benefits are huge data rate and minimum interruption with other equipment in the 2.4GHz ISM bands, and also remote backups in hospitals [35][36]. However, QoS is not compatible with IEEE 802.11 standard. To study the ideal settings for medical facilities, a comparative

review of 802.11a and g is needed. This exposition studies the effect of traffic load on WLAN capabilities the effect of signal strength on WLAN capabilities.

IV. Unified Networking Architecture

Figure 3 displays a basic networking architecture found in a hospital that can support WLAN technology. Verification system is manipulated to allow admission to the wired backbone networking system. In order to prevent misuse of power, network data is only accessible by individuals who have high accountability. [37][38][39] have stated in their research that such verification, authorisation accountability prototype have been effectively integrated by several medical facilities As WLAN technology depends on radio propagation, a wireless system analyser is needed to detect signal strength (clear channel) and to supervise the quality of radio link. A Wave link's mobile manager is implanted on the server end [40]. It strives to direct the APs more efficiently. The mobile manager is capable of updating the firmware regularly and produces warning whenever the settings have changed based on the predefined guidelines. Besides, all the setting data and verification keys are kept in an impenetrable memory storage system which the system management personals can retrieve when necessary.

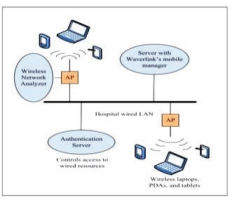

Figure 3: Typical hospital network architecture

V. Performance Metrics

Performance metrics is a set of measures which quantify performance results for visualization and comparison purposes. As explained by [34] throughput, mean packet delay and packet drop are normally utilized in data communication networking system. However, a particular application will require its own set of performance metrics for example email and FTP depends on upload response time and download response time. A detailed explanation of performance metrics which is utilised in this study is described as follows:

- *Throughput*: shows the capacity of traffic received and transmitted to the upper level. It is recorded in kbps.
- *Mean packet delay*: also referred as "end-to-end delay", is vital for sound and image traffic [37]. End to end delay for a voice package is recorded from the moment it is produced to the moment it is received. As stated by [41], minimum end-to-end delay is always known to achieve interactive real time stint. In the real world, basic individual communication is ensured to be 80ms or less delay. More conventionally, 100ms is accepted because of the encoding, decoding, compression and decompression procedure in the course of packet transmission [42][43]. The collective number of end-to-end delay is interpreted as delay in OPNET. Data can be lost in the situation of "buffer overload" or "retransmission failed" [44][45]. It is recorded in kbps.
- *Packet delay variation*: records the end-to-end delay variant of packets whether images or sound designated for one node.
- *Jitter*: is a specific moment that smoothen the movement of packet delay variant among two consecutive packets. It is precisely for sound packets only.
- *Package loss*: records the amount of traffic lost within a certain amount of time. As stated by [46][47], packets can be lost in times of full buffer or retransmission level has been exceeded. Video and sound stream are sensitive to packet drops.
- *Upload response time/download response time*: are utilized to record the quality of email and FTP traffic. Time elapsed between requesting and getting a response packet. It is the time recorded from the moment a sole program sends a request to the server to the period it gets a response packet. Each response packet that is sent from a server to an FTP program is added in this list.

VI. Wireless Healthcare Information Systems

Information technology (IT) is a key factor in the field of e-health [48]. Most of the latest technological advancement in wireless networking has been utilised by the healthcare sector. Wireless networking plays a vital role in the delivery of information in out-of-hospital incident mainly in the healthcare networking operation as well as the allocation of the useable resources and the assurance of Quality of Service (QoS) for a particular medical application. Healthcare services can be enhanced in underserved areas for instance rural health centre, ships, ambulances, airplanes and home environments by using applications such as electronic health records, medical databases and routing photo/text/video/ audio/medical information.[49][50][51][53] have suggested several factors which we should pay attention when discussing data delivery in wireless medical networking system such as data delivery latency, availability, reliability, confidentiality and privacy, QoS requirements and mobility maintenance.

The accessibility of resources is definitely vital in medical networking systems as the generated traffic is highly important for the health and life of the patients. Therefore, maintaining privacy and confidentiality of the customers records need authentication. However, these mechanisms are beyond the scope of this study. Besides, it is an utmost important, especially during emergency situations to deliver a patient's records in a fast and reliable way. Furthermore, the mobility support is another crucial matter for wireless e-health programs. For instance, through the application of various wireless technologies an ambulance that travels along various e-health areas namely mobile or static type of connection during the trials can handle various e-health programs, whereby the connection between the monitoring gadget and the healthcare source of data is maintained throughout.

VII. Handoff Schemes For Quality Of Service Support In Wireless Networking

[52] had investigated the implementation of IEEE 802.11 wireless procedures to support QoS in wireless telemedicine or e-health facilities. The prerequisites for QoS provision in wireless medical networking system is very rigid due to the strict prerequisite and real-time nature of healthcare programs. Fast delivery of patient's data and trust worthiness of data delivered is extremely crucial especially during emergency care. Moreover, mobility support is an important feature for wireless e-health applications. An ambulance travels along various e-health areas carrying various e-health programs. Hence, different wireless technologies are utilised to assure the connection among the monitoring program and the healthcare data source. Moreover, extended researches on the wireless telemedicine systems and e-health technologies are carried out. Some constrains are detected during an open survey. There should be a provision for QoS in wireless e-health, plans for QoS support in wireless networking system and prioritization of e-health services or telemedicine applications for IEEE 802.11 to ensure QoS. Thus, a simple e-health application can function when the user can establish communication on a mobile networking system. The technology used will enable the patients to save on hospital visits and admission, travel to hospitals and receive professional medical at home.

The switch-off of the analog terrestrial network presents the opportunity of delivering high data rates over large coverage areas by means of TV white spaces (TVWS) technology using cognitive radio capabilities. Hence, at the end of 2011 the IEEE Working Group for Wireless Regional Area Networks (WRAN) released the first TVWS standard named 802.22. Within this standard bandwidth, availability depends on the geographical location of the base station (BS) and the customer premise equipment (CPE). Therefore, [53] proposed a model to evaluate the suitability of IEEE 802.22 and WiMAX for the deployment of rural telemedicine networks. The model considers specific traffic profiles based on the telemedicine services that will be offered over the rural wireless telemedicine network. The evaluation presented in this chapter is performed by calculating the number of telemedicine services that IEEE 802.22/WRAN and IEEE 802.16/WiMAX networks can support considering the available bandwidth and the telemedicine traffic profiles requirements. Frame preambles and a MAC/PHY overhead factor per active connection are considered within the analysis. A case study from the State of Chiapas, Mexico, is presented for the deployment of wireless rural telemedicine networks based on the IEEE 802.16/WiMAX and IEEE 802.22/WRAN standards.

VIII. Provision For Qos In Wireless Medical Data Systems

According to [54], the next generation wireless networking systems have been launched to render assistance to multimedia services which have a varied traffic features and distinct QoS guarantees. Recently, a special emphasis has been put on medical broadband applications and the ability of continuously monitoring mobile patients has been introduced because of the development in wireless technologies. The emergency nature of the tele medical programs and the bandwidth requirements justifies the need for offering QoS in wireless broadband healthcare networking system. Wireless networking system may assist several e-health programs with varying traffic necessities and features. Simultaneously, wireless networks guarantees QoS [55]. The distribution of resources in e-health applications differs in many ways for instance the type of services offered, propagation characteristics, traffic requirements and networking structure. This study suggests the use of an adaptive resource distribution plan for QoS provision in wireless medical data systems.

mHealth has a crucial role to play since it can improve communication and enhance the integration of care processes [56][57]. Looking at the internal processes in use at health care organizations, mHealth can increase the productivity of health care providers, and consequently may even improve the productivity of health care systems [58][59] . Focusing on the external relations of health care organizations, mHealth can enhance transparency [60][61] and so increase the accountability of health care providers and systems, but it can also empower patients [62][63]. Finally, the greatest promise of mHealth is to enhance the quality of life and the appropriateness of care [64][65].

Telecommunications and advanced data technologies are mainly utilised for clinical activities and studies have to enhance medical services. Telemedicine services normally depend on multimedia technologies. Multimedia technologies aim to enhance a variety of multiple clinical applications across diverse network topologies. Different applications require different QoS that is relevant with the type of service rendered in different environmental conditions. This paper proposes a new architecture using wireless technology for multi-class provision of QoS in telemedicine. Resource allocation plan for e-health networking system are expected to afford multi QoS classes according to several e-health programs which are expected to provide services that are highly necessary.

Different classes which include the best effort, advanced forwarding and assured forwarding are enhanced with all the resources which are provided to offer optimum results for each e-health programs. In the wireless health information systems, this procedure is carried out based on a logical sequence. First, the existing resources in the networking system are determined. After that, analyse the volume, type and QoS prerequisites for the data to be conveyed and lastly, tune the applications which the network will handle. Hence, a flexible allocation of resources for a wireless networking system with several kinds of services and priorities has to be set. Prioritization is necessary in multi traffic settings for the allocation of an appropriate QoS level for the customers. Besides, in the attempt to reduce the possibilities of calls being blocked because of bandwidth and to augment the performance of the overall system; upgrading and degrading policies are taken into account. The simulation results will validate the desired performance of the suggested plan.

Therefore, the suggested wireless networking system can manage both the normal and life-threatening healthcare plans which are categorised by the nature of their importance. The network will automatically drop or put off the packets so as to fulfil a high level of service in a wireless medical setting corresponding to a particular requirement of the healthcare program and concurring to the importance of the medical care required by assigning different levels of priority.

IX. Quality Of Service In Wireless E-Health And E-Emergency Services

[66] has done a research on the dependable and effective function of e-emergency services or emergency healthcare which requires certain quality control on the networking system and fundamental telecommunication frameworks. Moreover, owing to their unreliable service delivery, most standing wireless body sensor networking systems prove inadequate in fulfilling these requirements. Quality of service (QoS) support which includes an all-encompassing and trustable aid to patients under health risk should be provided by e-emergency systems. This survey examines the necessity for QoS in e-emergency services and wireless e-health. Besides, certain existing and applicable e-health schemes with QoS prerequisites are stated to justify this need. Furthermore, in this evolving subject of application, this paper highlights the high importance of QoS support, and proposes a sum-up describing the e-health proposals herein given.

Patients' lives are priceless and in regard to that emergency healthcare, networking ought to be extremely dependable and efficient. Hence, these networking systems must enhance QoS since it is clear that they require dependability, definite bandwidth, and minimal delays owing to their real-time requirements. Moreover, they have developed numerous healthcare systems, although only few deal with QoS support. Conferring to the numerous wireless e-health schemes that are studied, it is proved that QoS support afforded in every method is alternate and treats diverse stages of QoS for particular uses. They also provide a summary that incorporates their key characteristics and objectives herein to make a better comparison of the QoS techniques that have been studied. Nonetheless, the QoS support and progress levels provided by these systems are not sufficient to satisfy an assumed requirement in the hospital units by providing patients who are suffering from health risks and abnormalities with an all-encompassing, valuable, wireless and extremely dependable assistance.

The works presented in [67] investigated the application of IEEE 802.11 wireless standard to QoS (quality of service) support within wireless e-health/telemedicine services. The stringent requirements and real-time nature of medical application introduce the need for QoS provisioning in wireless medical networks. This paper presents the architecture and novel scenarios for QoS provisioning in emergency telemedicine. Some performance evaluation results are obtained by simulations.

X. Mobile Telemedicine

According to [68], recent researches confirmed the survival of a patient in the course of a health emergency condition relies on the efficiency of the pre-hospital medical care. To tackle this problem, mobile telemedicine utilizes various wireless networking technologies. The characteristics of mobile telemedicine facility provision in a moving means of transportation for example an ambulance are examined in this survey. The distinctive features plus the necessities that are required for it to function are deliberated in terms of merits and demerits to be compared with the existing wireless communication systems that are currently in used. Besides, upcoming wireless broadband communication systems and spectrum access technology are taken into consideration while attempting to enhance the service that is rendered and overcoming the upcoming challenging times.

A mobile telemedicine system (MTS) utilizing mobile communications via cellular phones was developed by [69], making it possible to continuously transmit biological information, including 12-lead electrocardiography data, from an ambulance while the patient is being transported to the destination hospital in real time. In addition, they evaluated whether using an MTS during the transport of acute myocardial infarction patients shortens the interval between arrival at the hospital and balloon inflation to achieve reperfusion (door-to-balloon time). Regarding outcomes, no differences in the peak creatinine kinase and isozyme MB levels or in-hospital mortality were seen between the two groups. However, the door-to-balloon time was 86 minutes (median times) in the MTS group, which was significantly shorter than the 96 minutes observed in the non-MTS group ($P<0.05$). The developed mobile telemedicine system (MTS) has shown its efficacy in pre-hospital medical settings.

Mobile telemedicine is a challenging application that has distinct features. Two way real time audio and video communication, high resolution image and healthcare data transfer, seamless and instantaneous pre-hospital care is required. In an actual scenario involving a moving vehicle which is an ambulance from a rustic to an urban location, the network application needs compilation of procedures and technologies which adhere to the requirements of a particular case.

XI. E-Health Wireless Detector Systems

According to [70], to allow e-health wireless detector networking systems to show significant traffic loads, MAC protocols relying on logical timed algorithms are frequently thought to be more sufficient compared to protocols relying on random access algorithms. TDMA-based MAC protocols can handle the delay besides saving power by avoiding collisions. Nevertheless, these procedures often need some advanced planning to place the super frame time-slots to the networking gadgets which are needed to transport data. As shown in this, study the sick who are involved in the e-health wireless networking system are usually monitored by the same number and kinds of motes, coming from a normal traffic style, and an easy collaborative allocation of time-slot algorithm. The practice of time-slot allocation done by the management of the

networking system can be hindered in this proposed algorithm which may lead to enhance the packet delivery ratio and decrease the power usage in the e-health wireless networking system.

For the benefit of energy conserving and improvement in packet delivery ratio, protocols utilizing small size beacons for example iLPRT is important. A cooperation chain scheduling algorithm can be utilised by the motes of the WSN as allocation of time-slot cannot be stated by a BS transferring short size beacons. Using the normal traffic style used in e-health wireless networking systems, and also the homogeneity relating to the amount and kinds of motes found in the BSNs of an e-health WSN, a simple collaborative time slot algorithm can achieve this objective. As the suggested arrangements are keyed in, it is sufficient if the motes have limited computational resources. Initial test results show a decrease in the packet delivery ratio, but still it is obviously more effective to augment the number of retransmission that needs to be done than to decrease the frame size of the beacon. In comparison to a single retransmission, the two retransmissions revealed an astonishing advancement in the QoS of the e-health WSN based on the packet delivery ratio.

According to [71], the cost effectiveness becomes the main reason behind quality healthcare of the senior citizens. IT can enhance the productivity of health care facilities when applied with care. One instance whereby money can be saved is the nursing of the sick without hospitalization. This review deals with a secured wireless home nursing networking system which can be implemented in diverse health care monitoring tasks.

Additionally, a novel approach is proposed by [72] to detect sensor anomaly by analysing collected physiological data from medical sensors. The objective of this method is to effectively distinguish false alarms from true alarms. It predicts a sensor value from historic values and compares it with the actual sensed value for a particular instance. The difference is compared against a threshold value, which is dynamically adjusted, to ascertain whether the sensor value is anomalous. The proposed approach has been applied to real healthcare datasets and compared with existing approaches. Experimental results demonstrate the effectiveness of the proposed system, providing high Detection Rate (DR) and low False Positive Rate (FPR).

The general cost of receiving medical attention is increasing as the public mainly in western nations are aging. This development helps scholars to discover new technological solutions to enhance the efficiency as well as the quality of care. A reliable and safe technique that allows the sick to be cared from their home is beneficial, as each hospitalized individual highlights the supply of the current shorthanded facilities. This review provides a network for monitoring the sick from home. Hence, it allows freeing hospital space, and at the same time makes the results obtained to be more accountable within specific situations. Besides, to ensure patients' privacy, great attention is paid to develop adequate security measures. Meanwhile, the network offers excellent traceability that is a good measure for legal protection of both the sick and the doctors. Furthermore, it is undeniable that even though technological developments can ensure protection, the individual needs to be given clear instructions on the usage of the networking system in a secured way. To conclude, the hi-tech efficiency for the suggested networking system is excellent and the toll is reasonably priced.

XII. CONCLUSION

This paper has explained the background information and associated networking system layout construction. A basic list of requirements, namely the bandwidth, reliability, delay packet loss, flexibility and safety have been dealt with. This can be a helpful plan for constructing a unified networking system in a hospital. Besides, every networking system cannot be separated from the wired backbone. Therefore, an analysis should be done to ensure the accessibility, scalability and safety of the system architecture. The difficulties involved are bandwidth usage and fairness of interaction. In order to reach the maximum configuration in a hospital networking model, a workable standard has to be planed.

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