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Software Applications to Health Sector: A Systematic Review of Literature

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Abstract: Technology has become a strategic ally for the automation and improvement of processes in the health sector. Many of the current developments have supported the automatic, efficient and efficient detection of different pathologies which results in quality of life and treatment of patients. This study proposes a systematic review of the literature which compiles different developments that have contributed to the solution of different problems in the sector and the advances that have contributed to the processes of continuous improvement of detection and treatment.

Key words: Health application, m-Health application, telemedicine, tele-surveillance, tele-assistance, remote monitoring

INTRODUCTION

Based on the great demand that exists today in health services, technology has been implemented as a support by creating information systems in which its main objectives are to automate the routine tasks of the sector through the design and implementation of applications that use terrestrial and mobile communication networks to provide the necessary medical care to users (Zhang *et al*., 2013).

The relationship between technology and the science of life is leading medicine to a change that seeks to improve techniques that help people to detect and treat diseases more quickly and effectively through sensors, portable devices among others using innovative concepts that link to microtechnology, photonics, nanochemistry and biotechnology, this is expected to be the future of medical changes.

Telemedicine understood as the use of information technologies and communications with the area of medicine allows the connection of doctors and patients more quickly. Likewise, in the pharmaceutical sector, the use of new technologies in the creation of new medicines and the implementation of the clinical history of a patient have been evidenced using a registry system and a database that monitors the decisions and treatments of the patient. Patient (Dey and Barbhuiya, 2005; Khwairakpam and Mazumdar, 2009). It is for this reason that different solutions have been developed that contribute to the dynamics of technological advances in the productive sector which will be addressed in this literary review.

Context: Technology has come a long way in recent times spanning key sectors of society and the health sector is no exception, facilitating the management of patient's medical records using cloud technology to the cloud and doing, so, the more flexible the exchange of data through the different health providers that manage the patient, besides also reduce expenses in the management of the infrastructure and in the maintenance that requires such records, taking into account the definition of criteria associated with integrity, confidentiality, authenticity.

In addition, the health system is in constant change taking advantage of the technology to contribute to the improvement of the provision of health services in the improvement of communication between the patient and the doctor through telemedicine m-Health understood as the use of mobile devices for health care. Kothyari and Kumar (2010) with the developments that have been

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advanced use is made of applications that can help the elderly through a remote monitoring of patients called televigilance or teleassistance that support to the early identification of diagnoses and follow-up to treatments of patients located in areas of difficult access.

MATERIALS AND METHODS

Based on the systematic review of the state of the art it was possible to filter according to the search in specialized databases such as ACM, science direct and IEEE which served as a basis for the retrieval of information from scientific study that were taken as base for the analysis of the literature.

Subsequent to the process of identification of the specialized databases, we proceed to the construction of the key word search information. Among these were identified the following. Health application, m-Health application, telemedicine, telesurveillance, tele-assistance, remote monitoring.

Table 1-3 show the results of the bibliographic review can be shown taking into account the key words health application and m-Health application.

Most study reviewed and analyzed come from IEEE and science direct in the first part of the recovery. After filtering the results, 45% of them are discarded as they are not related to the objectives of the review and another 40% because they are book chapters or case reports that are not included in our analysis.

Finally, 60 papers were obtained that are related to the objectives of this review in terms of software application trends in the health sector.

Table 1: Number of articles collected with key words heatth application and m-Health application

Database	Health application	m-Health application
IEEE explorer	138.000	228.000
Science direct	947.312	691.524
ACM library	155.952	159.087

Table 2: Number of articles collected with keywords, tele-medicine and tele-surveillance

Database	Health application	m-Health application
IEEE explorer	6.211	11
Science direct	10.948	290
ACM library	156.000	0

Table 3: Number of aticles collected with key words, tele-asssitance and remote monitoring

Database	Health application	m-Health application
IEEE explorer	145.000	235.000
Science direct	950.325	652.698
ACM library	152.235	157369.000

RESULTS AND DISCUSSION

The boom that has generated wireless technology in health and its evolution in telemedicine and teleassistance is shocking as they mix telecommunications, mobile technology and medicine to create an area in health that can provide support to patients without the need to be transported to a health center, this is why there are more and more mobile communication devices that allow to have at hand a series of applications that contribute to be aware of the health of the user as there are special mobile devices alone for medical use that can connect with other technological devices and share medical information (Coleman *et al*., 2003) (Table 1-3).

In recent years has been implemented the sensor networks of the body to monitor the health status of people carrying this type of devices, using the WBAN and BSN networks, different devices have been developed that help remote monitoring of patients both by their physicians as well as by their caregivers or family members using wireless networks (Zhang *et al*., 2013).

In some countries, grid technology has started to be used in the health sector in such a way that through a network, data can be stored that are most interesting for people, so that, health institutions have faster and more timely access of these, through telemedicine that allows users to access information stored in a database in an easier way without having the need for an operator to manage their information and in case of emergency when providing the necessary medical care can obtain with greater (Chase and Holnbeck, 2004).

Other developments are focused on facilitating communication through real-time videoconferencing to make inquiries about a health problem presented to patients, especially focused on doctors who are distant. These prototypes have been tested in London with good acceptance due to the characteristics of portability and effectiveness in communication.

Making use of remote sensing and GIS geographic information systems, it is sought to identify viruses and diseases based on previously collected information, taking as a pilot information on dengue, the GIS system was first used to have the incidence levels of the disease and then extracted all data from the results obtained with the remote sensing to know what the indicators of the disease in the environment.

Hardware devices can be very useful in the health sector, one of the most recent developments was carried out in Germany where hardware was developed that contains the main ones in the event that it suffers an accident or a situation that relates to health, information such as name, type of blood, allergy to person,

medications you can use, instructions in case of emergency which health provider you are affiliated with and family numbers.

Different WSN wireless sensor networks have developed different solutions for the health sector in order to be able to analyze the behavior of diseases in patients and signs that can generate alarms as they develop their daily activities. This type of data is usually sent to the healthcare providers of the patients in order to have a more effective care of pathologies (Kothyari *et al*., 1992).

In the same way, it is used image processing algorithms to analyze X-ray images for the remote analysis of CT scans to support the detection of different pathologies in patients who were in difficult access areas. As a basis for a reconstruction system in computed tomography in which the process was divided into several parts, the processing of X-ray images in 2D, the filtering of the frequency domain of the projection of said images, the processing of each image to transfer them to a network or a hard disk, the intersection of each element with a detector to calculate the current voxel intensity (Ghorbani, 2008).

In this line of ideas, software solutions have been developed that allow the analysis of remote oxygen saturation measurement to support patients with pathologies associated with respiratory failure, through a development platform that performs a series of calculations in order to display results on an LCD screen to a user. The development platform is based on the AT89S8252 which has an 8051 architecture with integrated chips. The software is made up of devices such as screen, key boards, sensors among others that allows the developer through a code to access the stored data and provide the information required by the platform.

Using the implementation of network sensors have been used to have motorized vital signs of the patient through medical communication MICS and WMTS, this system works with network sensors used with 402-4 MHz band which uses sensors and a unit These remote sensors can measure up to 4 signals or 4 channels, the system is integrated by softwares and firmwares for the transfer of data through the internet.

Additionally, in this sector robots have been developed in surgeries. These surgeries require the integration of devices such as medical imaging systems, trackers, mechanical auxiliaries or robots which support the study of different surgical treatments that are generated in this type of procedures (Kothyari and Kumar, 2010; Vittal *et al*., 1994).

At the University of Oxford in the United Kingdom, an investigation was carried out which consists of the processing of medical signals by means of monitoring software that is capable of analyzing and processing a person's vital signs in real time. An intelligent monitor and a source of information that makes it possible to monitor constant conditions, this software monitors the heart, blood pressure, oxygen saturation among others and the results are measured with those stored in a source to shed which is the state of the person each take of the data have a specific time all this is done through a sensor connected to the monitoring software.

Among other developments is MD-Adapt an architecture that aims to enable communication in medical devices, encouraging the use of open source, so that, the community can make an effort and create a reusable, modular and shared interface, device code will be portable to several platforms like Linux, windows among others and the codes will be executed in native code, c, java, so that, the developers who are interested in helping to improve these devices have no problem.

In Saudi, Health System Software (CPHS) was implemented which comprises two large subsystems, Computerized Patient Registration System (CPRS) and Mobile Computing System (MCC). Thanks to these, medical services in hospitals in Saudi Arabia have been improved and thus have contributed to the improvement of patient's health.

The 3D slicer application is a project aimed at providing an applicable platform in medical and basic environments, this software is based on a series of components among which stands out in 3D image analysis. The 3D slicer is created by the need for a product applicable in medical research that allows the computation of 3D images in various formats. Pieper *et al*. to provide security in the exchange of data of the images, the RSA protocol was developed to encrypt and decrypt the images through a series of tools, this protocol was implemented in a FPGA circuit, the system allows to generate keys to encrypt and to decrypt the data of medical images at a specific time depending on the size of the file.

Other applications have focused on web-based teleradiology which allows a distribution of radiological images to radiologists located else where these images are of high quality and allow for an improvement in patient service.

Other developments such as osirix is open source software under the GNU license which allows seamless integration of different work stations and servers where medical files are found with a technology that makes it possible to share data from the network without the need for a base data, the way data is exchanged is comfortable, allows high performance and advanced processing of images, this system is suitable to work with him in large health institutions, conferences and academic/clinical environments.

Different software solutions have also been developed that allow physicians to provide better patient

care, provide patient diagnosis information, reduce critical intervention time and provide health information tools for patients and provide telecommunications for remote consultation.

The boom that has generated wireless technology in health and its evolution in telemedicine and teleassistance is shocking as they mix telecommunications, mobile technology and medicine to create an area in health that can provide support to patients without the need to be transported to a health center, this is why there are more and more mobile communication devices that allow to have at hand a series of applications that contribute to be aware of the health of the user as there are special mobile devices alone for medical use that can connect with other technological devices and share medical information (Coleman *et al*., 2003). MedMon is a security monitoring software that analyzes all radiofrequency wireless networks that go and leave medical devices and detects whether there is security or not if there is no protocol, depending on the danger can only give a notification to the user or if it is very malicious is activated some packages that eliminate the danger directly (Zhang *et al*., 2013).

Since, the beginning of the use of the technology there are malicious agents who try to damage the systems of the different devices that is why you must have software developments that are not vulnerable, since, it exposes all the information that can manage that is why it is so important to have protocols and software that support the integrity of the information. As a result of research was developed MedMon is a security monitoring software that analyzes all radio frequency wireless networks going and leaving medical devices and detects whether there is security or not, if there is no protocol depending on the danger, it can only give a notification to the user or if it is very malicious it activates some packages that eliminate of direct way the danger.

In Malaysia, the DICOM (Digital and Medical Communications) system was developed which is used in the healthcare sector to store, print and transfer information in medical images through a TCP/IP protocol. This system connects scanners, work stations, servers, printers and other types of devices. DICOM supports X-ray images in digital format and is also capable of keeping a record of the patient, type of image, size in pixels of the image among others.

Other devices have also been developed as pendant bracelets that can contain the medical information of each patient to facilitate in the event of an accident to act more quickly having at hand relevant information from the medical record for immediate intervention of doctors, bracelet is made of silicone material which has the SIM card inside.

In the health sector has also identified the need to send patients information from home for this has been developed ZigBee wireless technology to have control of the sending of data in real time and monitoring of vital signs of the person through a sensor (Zhang *et al*., 2013).

Other developments are focused on monitoring types of bacterial resistance to antibiotics and in order to discover new infections or epidemics that can be spread in a hospital. Some applications have focused on the implementation of wireless sensors that are used to monitor the status of patients such as temperature, heart rate and pressure is automatically controlled using a bio-medical kit that connects patient. Different applications of software for detection of pediatric diseases and to detect affections in infants have been developed in a reliable way. This application allows pediatricians to provide us with a better service.

Telemedicine has also focused on the treatment of real-time sleep monitoring that allows the analysis and detection of signals obtained from multiple sensors. This allows showing the results of heart rate estimation, respiratory rate, obstructive sleep apnea and the diagnosis of stroke.

Among other types of devices developed can be located applications that contribute to monitoring, control, treatment and assistance. As for example the ambulatory electrocardiographic monitoring based on android and the IOS (iPhone Operating System) which contributes to proceed with precision in the daily activities of connection in different zones (Elsaeed *et al*., 2015).

In addition to the process of obtaining data, they must be managed efficiently and effectively. There are many research in the literary review that contributes to the process of data exchange that focuses on the electronic medical record in a safe way. By Akib *et al*. (2014) other developments such as Diabcard which is a system based on chip cards containing information on the medical history of patients with diabetes, this software is made through an object-oriented language for the high performance of the application in this card are found the patient's primary data, so that, when required it is possible to access them quickly.

Data mining techniques have also been integrated in order to allow the physician through a Web interface to have the patient's diagnosis in a relevant way for the decision making of the diagnoses and the user through a key can obtain his diagnosis entering the website, this system is based on Bayesian theorem and tree system an advantage is that users can enter the system from any operating system such as windows, machiston, Linux or any other.

For medical students it is also important to use the technology to acquire the necessary knowledge in an orderly manner for this is very important that this information is truthful and accessible easily for this is

using social software using semantic technology, Web services can be of great benefit to this, since, you can access the information from anywhere. AMON is an advanced telemedicine monitoring and care system in which medical follow-up is performed on patients with high-risk cardiac and respiratory problems, the system evaluates the patient's vital signs and measures them with values stored in the system if the patient surpasses the values the system sends an alert to the medical center, this system has a sensor that is a handle that is worn on the wrist and inside it is a box that allows monitoring, this system has been tested in 33 people as part of a medical study to validate it.

By means of algorithms we will perform a review of medical images to analyze the data and analyze them used MeVisLab, this medicine imaging was given from the discovery of X-rays in 1895 and from that time the analysis of the data by means of image monitoring software has become paramount in health centers for examinations such as computed tomography or magnetic resonance imaging.

As a result of the appearance of telemedicine in health centers, it has been necessary to implement wireless networks, so that, the communication between the patient and the doctor is of good quality and also to allow physicians to access the data of the different devices connected to these networks for this several platforms are used that facilitates the communication in real time with the patient and with the vital signs of this for this a specialized software is necessary.

CONCLUSION

Refine the search criteria by including a greater number of key words focusing on other types of technologies that have been developed for the health sector. The vast majority of study found define the wide usability of different developments in both hardware and software for the health sector. For future reviews on this subject, it is advisable to include other key factors in the development of applications for the health sector to improve the search results. From the review of the literature we can conclude the following. The inclusion of different hardware and software developments in the health sector has supported advances in the detection and treatment of different pathologies. The automation of the processes in the health sector has allowed to improve the quality of life and care of patients with different pathologies that have been intervened with this type of applications. The safety, reliability and comprehensiveness of patient data have been strengthened as a basis for efficient and efficient treatment of patients. The treatment of information remotely supports decision making with greater precision and agility. Many hardware devices can support the treatment of more than one pathology thus strengthening the comprehensive treatment of patients.

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