

# Smart environment with post processing health and social care essay



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This chapter presents aims at presenting a brief overview about the topic of the research and also highlights the basic purpose and aim of the current research. The chapter starts with the background of the topic of study that familiarizes the reader about the basis upon which the research is based. The chapter moves further by describing the rationale and significance of the study in which the principal investigator illustrates that why the research developed interest to the principal investigator and why there was a need for such study. Finally, the chapter concludes by providing the structure of the remaining thesis, with a brief outline of the thesis flow and the headings included in those chapters. The purpose of this chapter is to provide the reader a brief overview about the research topic and provides the main purpose and aim behind this research study. It comprises of the background of the problem, which provides a brief overview of the topic of the research and the problem.

## **Background**

As technology and medicine combine and techno-medical functions turn out to be technically and economically viable, recognizing the factors that control end user acceptance will become more critical to strategic planning and technological design in healthcare organizations (Krein et al. 2007). Due to current developments in pervasive and ubiquitous technology, the exposure and quality of healthcare have increased noticeably (Varshney, 2009). Union of cellular and broadband communication with pervasive technology devices has resulted in the development of pervasive healthcare. Pervasive healthcare provides healthcare services to anyone at anytime, entertaining the restrictions of place, time and quality. Though, pervasive

healthcare does not develop from technology progression alone (Katz & Rice, 2009). The growing attention in pervasive healthcare is also resulted from technology dispersion and increasingly accepted technology imposition. With sustaining networks and wireless communication becoming conventional more pervasive healthcare function is apparent in hospitals, emergency departments, battlefields, as well as home care for persistent circumstances (Munnelly & Clarke, 2007). Pervasive healthcare is a reaction to the requirement for personalized and nonhospital trouble. Pervasive healthcare removes the physical limits of hospitals and provides each individual a chance to contribute personally in their own healthcare (Pai & Huang, 2011). Pervasive healthcare has the ability for unhindered data link as well as real-time synchronous interaction in a practical space. Data link is critical in high-risk conditions where a misplaced episodic symbol can result in a severe outcome. Using pervasive technology, healthcare, often faulted for its remote and mechanical feel, can offer the in-person touch recommended by customary medicine (Olguin, Gloor & Pentland, 2009). Pervasive healthcare technology is in quick development and it is becoming more technically refined and more persistent to privacy due to current pervasive advancement. With the advance in technology, attention on pervasive healthcare technology has considerably increased in the technology examining society (Pai & Huang, 2011). Having the prospective of healthcare without limits of time and space, pervasive healthcare technology not only answers the requirement for patient self supervision in disease recovery and other long-term care arrangements, but also the vital requirement for intensive observations in sensitive, high-risk conditions.

## **Motivation and Goals**

Aged population and the massive increase in chronic diseases spurred the need for pervasive healthcare systems. Age-related illness dominates future health care trends. The objective of this paper is to discuss research challenges in pervasive healthcare to pave the way for a pervasive, user-Centred model in the context of home-based aged population as a preventive healthcare approach.

## **Research Questions**

The research questions for the study are as follows: RQ1: Are there any benefits of implementing pervasive healthcare? RQ2: What are the main problems with the current system of pervasive healthcare? RQ3: What are the main concerns with existing solutions of pervasive healthcare?

## **Aims and Objectives**

The aims and objectives of a research summarize what is to be achieved by the study. These should be closely related to the statement of the problem and cover the different aspects of the problem and its contributing factors in coherent way and in logical sequence. Following are the aims and objectives for this study: To study pervasive healthcare To determine the main problems of pervasive healthcare To evaluate the main concerns of the existing solutions which are provided through pervasive healthcare To find methods for improving existing solutions which are provided through pervasive healthcare

## **Time Scale**

### **TASKS**

### **WEEKS**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**10**

Proposal Construction Pertinent literature reviewing

Analyzing and redefining the problem(s)

Implementation of the findings

Preparation of the draft report

Beginning of full data analysis

Writing the complete Thesis

Time is an important factor when considering project work. A considerable amount of time will be required to complete this project, as it will require the gathering of a good amount of secondary data. Moreover, the research will

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make progress according to the university rules so as to collect extensive data for the research study to make it an effective one. The time adjustment of daily hours will be accumulated according to the submission date given by the instructor. Furthermore, the final submission date of the thesis may get negotiable with the instructor keeping in view the current scenario of the research work at that moment of time.

## **Gantt chart for Time Distribution**

The following time management chart illustrates the amount of time required on the tasks set aside for the completion of the project.

## **Thesis Organization**

The remaining chapters of thesis are structured as follows: The second chapter provides the appropriate and significant literature review for the selected research topic that signifies the past study in this field. The literature will help to develop an understanding concepts and perceptions about various terminologies that are important keeping in view the topic of the research. The content for the chapter was gathered through online libraries, scholarly journals and peer reviewed articles to maintain authenticity of the provided information. The third chapter provides a general idea about the research methodology that has been selected for this research. The methodology mainly includes; the research design, questionnaire design and framework, sampling technique, data collection method, ethical considerations for the research. In addition, reliability and validity of the survey is also defined in this chapter. The fourth chapter provides the analysis of findings in a detailed manner so that a conclusive outcome can be obtained. The chapter provides complete analysis of <https://assignbuster.com/smart-environment-with-post-processing-health-and-social-care-essay/>

secondary data that is collected in the second chapter. The fifth chapter summarizes the complete study with flair of personal views on the topic of the research. The chapter moves forward and provides implications of the current research and then ends up by providing future recommendations of the study. These recommendations can help researchers and concerned individuals to pile on the current level of provided information.

## **CHAPTER 02: LITERATURE REVIEW**

This chapter examines all the past literature that it is relevant to the research topic and that has been published up till now. The main purpose of this chapter is to identify and obtain various scholarly and non-scholarly sources that can prove beneficial in obtaining positive results during the course of the study. The literature review is to identify, obtain and check various sources and other materials that may be useful for research purpose and to extract and compile relevant information necessary to the research problem. Majority of this data is collected through secondary sources on online and public libraries. The literature review section builds upon the concept of pervasive healthcare in smart environment with post-processing of data.

### **Complexities of Healthcare System**

Healthcare system is a complex one where outcomes are difficult to predict and the market as a whole does not behave in linear ways (Garson, 2008; Munnelly & Clarke, 2007). This complexity comes from several sources both human and environmental with differing goals and behaviors. These differences can be seen in the many layers that make up the entirety of the healthcare system. The healthcare system or environment is comprised at a <https://assignbuster.com/smart-environment-with-post-processing-health-and-social-care-essay/>

high level of at least three interacting markets, healthcare delivery (patient-provider), health insurance (patient-provider-payer), and healthcare research (education-provider-funder) (Pai & Huang, 2011). Each market maintains its own goals and is comprised of different sets of agents that interact in their own unique ways. These agent interactions are non-linear and often uncertain. If we examine the basic patient-provider relationship, we can see many of these complexities and uncertainties. Illness itself is uncertain. Who becomes ill, the illnesses effect on any single individual and the individual treatment prescribed appears random and uncertain. Not everyone becomes sick and not everyone reacts in the same way to treatment (Appari & Johnson, 2010; Ziefle & Rocker, 2010). Providers vary in their recommendations and the cost of care is often not considered when seeking treatment. Patients desire the " best" care, not the cheapest or most efficient care. Decisions on where to seek care are frequently based on word of mouth or appearance of the provider's office. High cost is regularly associated with high quality where this is frequently not the case (Anderson & Wittwer, 2011). Treatments themselves are becoming complex. New technologies are generating better diagnostic tools, improving treatment options, and increasing the expectation of cure. Decisions about whether to pay for these treatments and what to pay for these treatments are complicating the insurance and pay or portion of the market (Varshney, 2009). The complexities of treatment and high price of care often result in attempts to manage treatment decisions. The goal of insurers to control costs and the goal of the providers to increase revenue and maintain control over treatment decisions regularly conflict, creating a complex relationship between providers and insurers. The normal economic patterns of supply

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and demand do not seem to apply within the healthcare system (Doukas & Maglogiannis, 2008; Lankton & Wilson, 2007). These uncertainties and conflicting goals contribute to the complexity of the healthcare system and healthcare policy decisions. The current goals of healthcare policy to increase access, control costs and improve quality do not easily complement each other. Attempts to control cost directly impact treatment decisions and employment levels (jobs). Attempts to increase access to care increase healthcare costs (Nachman et al. 2010; Pai & Huang, 2011). Attempts to improve quality often increase costs and/or limit treatment options. Because of these complexities and the non-traditional economic behaviors of the healthcare market, policies must be designed to promote value from both a provider and patient perspective (De Moraes et al. 2010; Anderson & Wittwer, 2011). Many of the current policies do not address value, but rather focus on the lowest acceptable costs for a particular service. Medicare and Medicaid are prime examples of this cost control focus (Olguin, Gloor & Pentland, 2009). Examining the value added of policies to each agent in healthcare and other markets will be important to future healthcare policy discussions.

## **Overview of Healthcare Technology**

Healthcare Technology existed long before it was recognized for its critical role in healthcare. The origin of modern Healthcare Technology can be traced back to 1905 when Willem Einthoven transmitted an electrocardiogram (ECG) from the hospital to his laboratory through standard telephone lines (Thuemmler et al. 2009). Tele-consultation came into practice in 1920 when a Norwegian Hospital was connected with ships at sea

via Bergen Radio. In April 1924, the Radio News in the United States presented the emergence of the same tele-consultation concept in a news article (Krein et al. 2007). Thereafter, significant events occurred with the creation of the International Radio Medical Centre in Italy in 1935 and with the Centre of Maritime Health Care in France in 1945, in order to provide medical support to the ship crews and remote islands. In the late 1940s, A. G. Cooley and J. G. Cohen experimented in X-ray transmission over telephone wires and the term telognosis was coined in 1950 (Thuemmler et al. 2009). In the late 1950s, Jutras transmitted video-recordings and radiogram through coaxial cable, and resulted in the term of tele-fluoroscopy. Tele-education started in the late 1950s and early 1960s as medical instructional programs on the television (Sneha & Varshney, 2007; Varshney, 2009). The first televised medical conferencing occurred in 1965 on an open heart surgery between the hospitals in Houston, TX and Geneva that were linked through an international communication satellite. In 1959, Wittson used a two-way closed circuit television as a teaching and diagnostic tool focused on neuro-anatomy at Nebraska Psychiatric Institute. The service was intended for group therapy through television supervision and monitoring (Munnelly & Clarke, 2007). The result was improved patient consultation and rehabilitation and reduced hospitalization. Medical instruments have played an integral role in surgery, dissection, diagnosis, treatment, and other forms of medical investigation and intervention. Sets of surgical instruments have been found that date back to 50 AD that closely resemble surgeons' tools used today (Sneha & Varshney, 2007; Varshney, 2009). These instruments would be an example of a form of medical technology, in the form of tools, assisting the medical practitioner. Another <https://assignbuster.com/smart-environment-with-post-processing-health-and-social-care-essay/>

form of technology used in medicine for many millennia is information technology (Munnely & Clarke, 2007). Medical information technology is often thought of in the modern context of computers, but the careful collection and analysis of information related to observation of patient condition, effectiveness of different treatments, and design of new treatments dates back to the time of Hippocrates (ca. 460 BC - ca. 370 Be) (Washburn & Hornberger, 2008). Hippocrates took meticulous notes that enabled him to make numerous breakthroughs both in the understanding of the workings of the human body and in the ethics and approach to thinking that are essential to modern medical practice and investigation (Olguin, Gloor & Pentland, 2009). Comparatively little innovation took place in furthering, the practice of medicine from the time of Hippocrates until the early 20th century, with developments such as the smallpox vaccine in 1901. During the 20th century, the growth of medical technology has increased continuously, with innovations such as penicillin, X-ray, PET/MRI scanning, computers, robotic surgery, radiation therapy, chemo-therapy, and many other forms of technology and treatments (Garson, 2008; Munnely & Clarke, 2007). While the use of medical hardware and information technology has been essential to healthcare for thousands of years, these same tools can create difficult problems (Appari & Johnson, 2010; Ziefle & Rocker, 2010). For example, the over-use of antibiotics has caused a new form of pathogen commonly called super-bugs, such as methicillin-resistant staphylococcus aureus (MRSA) and other antibiotic resistance strains that are extremely difficult and expensive to treat. Healthcare facilities (buildings) can also be considered to be a form of technology. As with other forms of technology, physical facilities involve a mutual interaction between users of the <https://assignbuster.com/smart-environment-with-post-processing-health-and-social-care-essay/>

technology and the technology Anderson & Wittwer, 2011). In healthcare contexts, the physical facilities are often intimately interrelated with the staff and other technology that the building contains (Munnely & Clarke, 2007). Often, technology is integrated into the building itself. As with other forms of technology in healthcare, organizations spend significant sums of money on their facilities. If these funds are not spent wisely, they contribute to the rising cost of healthcare and can affect the financial or operational viability of the organization (Aziz et al. 2006; Washburn & Hornberger, 2008). Among the pioneers of Healthcare Technology, the National Aeronautics and Space Administration (NASA) has been one of the most supportive. Concerned with the wellness of the astronauts during space missions, NASA scientists developed technological devices for the measurement and transmission of physiological and medical data between space and earth stations in the 1960s (Lankton & Wilson, 2007). This effort was later applied in the 1970s to support medical services to the rural Papago Native American Reservation in Arizona using a manned mobile medical unit linked to local hospitals. The first full service Healthcare Technology operation appeared in 1968 between Logan Airport Health station and the Massachusetts General Hospital (MGH) of Harvard Medical School (Garson, 2008; Munnely & Clarke, 2007). The service included 10 remote sites linked through the New Hampshire-Vermont Medical Interactive Television Network with a central hub stationed at Dartmouth. The service supported medical education and specialty medical services including psychiatry, cancer, and dermatology (Pai & Huang, 2011). Another significant Healthcare Technology event occurred in the 1990s when NASA launched the first large scale international Healthcare Technology project, Spacebridge. Spacebridge currently supplies a variety of medical

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specialist consultations and medical educational opportunities to the Eastern European region (Sneha & Varshney, 2007; Varshney, 2009). Modern Healthcare Technology in the last century evolved from basic telephone consultations as experimental projects. Propelled by emerging technologies and the information superhighway, Healthcare Technology has resurfaced with new content and meaning. Healthcare Technology experiments that are currently used in pilot form will prove to be routine in the future.

## **Impact of Technology on Healthcare**

The purpose of this section is to review the literature on the impacts of technology in healthcare. Evidence on the impact of technology in healthcare is mixed. Literature on technology impacts in healthcare have looked at both final outcome measures, such as productivity or output or mortality, as well as intermediate performance measures such as error rates, cycle times, utilization, and complications (Pai & Huang, 2011). A recurring theme among studies on technology and healthcare is the role of time lags; the empirical evidence generally supports the notion that technology investments require a substantial time period for users to learn how to use the technology (Ziefle & Rucker, 2010). Studies drawing from technology literature base, consistent with the literature on technology investment, appeared more likely to include complementary investment factors such as business process reengineering (BPR) and training (Varshney, 2009). These studies find positive impacts to technology and often included (Varshney, 2009). Studies based in the medical literature painted a more mixed view of outcomes technology investment (Bardram, 2008; Coronato & Pietro, 2010). These studies generally did not include complementary

investments and generally took a "tool view" of technology investments. The studies based in the medical literature used a more nuanced choice of outcomes; consistent with the idea that healthcare is a unique context, including outcome measures such as error rate, differential mortality, utilization rates, and complication rates (Sneha & Varshney, 2007; Varshney, 2009). What is missing from this literature is a study that takes into account the unique nature of technology investment, as well as the unique context of healthcare. Theory and evidence about the impacts of technology investment suggest that technology: a) is a general-purpose technology which often requires complementary investments to yield positive returns, b) lowers search costs, which lower the variance of outcomes, c) facilitates the accumulation of "memory capital" over time, d) lowers monitoring costs, e) speeds information diffusion, and f) exhibits network effects (Ziefle & Rocker, 2010). While many of the potential impact of technology would seem to result in positive returns in healthcare, findings on the impact of technology in healthcare to date are mixed. Most studies on the impacts of technology in healthcare have either: a) used a rich understanding of technology investments focused upon the impact of technology on traditional outcome measures such as profitability or response time, or b) used a simplified view of technology investment with a rich understand of the particular phenomena which arise out of the unique context of healthcare (Coronato & Pietro, 2010). What is needed in this literature is a study which takes into account the particular impacts of technology investments on phenomena which are unique to healthcare, such as treatment inconsistency.

## **Research Conceptual Framework and Theoretical Background**

Present research examines the factors that influence patient Healthcare Technology adoption drawing support from the following theory. Theory of Reasoned Action The Theory of Reasoned Action asserts that beliefs influence attitudes. Attitudes, in turn, influence the intentions that guide behaviour, and acceptance of technology is then demonstrated through behaviour. TRA is well-tested and has been proven valid in predicting and explaining behaviours in general human behaviours. The concept of Theory of Reasoned Action was founded on Fishbein and Ajzen's social psychology research. TRA suggested that significant relations exist between beliefs, attitudes, intentions, and behaviours (Aziz et al. 2006; Washburn & Hornberger, 2008). According to TRA, most social behaviours are not automatic actions; instead, they are under volitional controls. TRA asserts that people consider the implications of their action based on the information available to them before they decide to perform behaviour (Aziz et al. 2006; Washburn & Hornberger, 2008). Since behaviour is a result of cognitive reasoning, behaviour is predictable. Theory of Reasoned Action is built on three constructs: attitude (AT), subjective norm (SN), and behavioural intention (BI). TRA has been examined and tested through numerous research studies. In TRA, attitude reflects personal behavioural beliefs and subjective norm refers to social influences. TRA suggests that behaviour intention is a function of two determinants, a person's attitude and the subjective norm. A person's behavioural intention, in turn, is the immediate determinant of the actual action (Aziz et al. 2006; Washburn & Hornberger, 2008). Based on the pictorial presentation of TRA by Ajzen and Fishbein, TRA may be expressed

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as:  $BI = AT + SN$  and actual behaviour = BI. A person holds different beliefs from past experience about objects, actions, and events. Beliefs serve as the immediate determining factors of a person's attitude (Aziz et al. 2006; Washburn & Hornberger, 2008). Positive belief means stronger conviction and acceptance toward the behaviour in question. With positive beliefs, a person tends to gather positive attitudinal intention to behaviour, which in turn leads to more potential realization of the behaviour. Attitude is a person's evaluation of the entity in question (Lankton & Wilson, 2007). Attitude arises as a function of beliefs. Beliefs may change due to time and circumstances or be replaced by new beliefs; these changes in turn affect a person's attitude. Social scientists have long established that attitude is a critical behavioural disposition (Lankton & Wilson, 2007). However, a person's favourable or unfavourable perception to behaviour in consideration alone does not always produce the behavioural outcome. To accurately predict attitude, an additional variable must be taken into account of the attitude-behaviour relationship. This additional variable in TRA is the subjective norm (Aziz et al. 2006; Washburn & Hornberger, 2008). Subjective norm refers to a person's perceived expectations from relevant individuals or groups on whether or not to perform the behaviour in question (Varshney, 2009). Subjective norm is a function of normative beliefs, the resulting influence of the social environment. Social pressure can force an individual to perform or avoid behaviour in consideration regardless of the person's existing intention. Since it has the potential of overriding a person's own intention, subjective norm is an independent construct to attitude in the TRA model.



## **Concept of Pervasive Healthcare Technology**

Many Pervasive Healthcare Technology devices have undergone experimental trials in hospitals as well as in patients' homes. Infrared technology, motion sensors (infra-red detection or acoustical detection), video cameras, and so on, that use wireless, Internet, ISDN, and telephone lines have been installed in healthcare facilities (Snyder, 2007). Traditional non-invasive Pervasive Healthcare Technology often requires patient engagement with devices at a set time and location. For at risk cases, such as post-stroke and postoperative wound-related complications where a close un-obstructive monitor is crucial in the recovery process, periodic monitoring may not catch episodic signs at the critical time (Washburn & Hornberger, 2008). Recent development of pervasive monitoring systems focuses on automated and un-obstructive Pervasive Healthcare Technology without the restrictions of time and place. Pervasive healthcare requires wireless technologies and the matching infrastructure capabilities. Pervasive services are supported through wireless LANs, cellular GSM/3G networks, satellite-based systems, and so forth (Varshney, 2007). Pervasive healthcare applications include "pervasive health monitoring, intelligent emergency management system, pervasive healthcare data access, and ubiquitous mobile Healthcare Technology" (Varshney, 2007). Research on pervasive Healthcare Technology started in the early 2000s using the then budding pervasive computing technologies. The goal was to utilize ubiquitous communication technologies to improve patient autonomy and healthcare mobility through continuous monitoring. In cases such as myocardial ischemia and post abdominal operations, continuous physiological data for timely detection of deterioration can change the entire care outcome.

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Extended from Varshney's definition for pervasive healthcare (2007), present research defines pervasive Healthcare Technology as a Pervasive Healthcare Technology for anyone, anytime, and anywhere without location, time, and other restraints. Earlier pervasive Healthcare Technology experimented with video-telephony installations (Thuemmler et al. 2009). These devices provide live video interactive communication through plain old POTS for its wide availability and relatively low costs (Lankton & Wilson, 2007). Using video-telephony, the healthcare professional can review the therapies and provide support in real-time. More importantly, these devices alleviate the gap of distance, allowing care providers to monitor the patient's emotional and mental states and not simply physiological information (Olguin, Gloor & Pentland, 2009). Other types of pervasive Healthcare Technology are enabled by portable topical sensors that integrate wireless technology with clinical devices. Tele-devices such as tele-ECG and ring-sensors are worn by the patients for Pervasive Healthcare Technology. Data, such as ECG, pulse rate, respiration rate, and oxygen saturation levels, is collected and forwarded to the healthcare providers automatically (Tu, Zhou, & Piramuthu, 2009; Varshney, 2007). This continuously monitored data can provide important clinical insight for timely and accurate diagnosis. Advanced pervasive devices for automatically collecting multiple clinical parameters have shown success in a body sensor network system (Nachman et al. 2010). This Pervasive Healthcare Technology system equipped with multiple sensors is able to collect, process, and wirelessly transmit the received data via a secured link to a laptop for further diagnosis. Pervasive Healthcare Technology devices that do not require patients to wear the tele-devices also have been developed in the past years. For example, mattresses, toilets,

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kitchen appliances, and clothing embedded with monitors can sense sleep pattern, body weight, body temperature, pulse rate, and so forth (Bardram, 2008; Coronato & Pietro, 2010). Further experiments on advanced tele-sensing systems utilize the Doppler radar technique to gather scattered vital signs from throughout the body (Ziefle & Rucker, 2010). These systems can gather multiple clinical parameters and are able to operate autonomously without disturbing the lives of the patients. Pervasive Healthcare Technology is built on widely deployed wireless networks and advanced computing technologies. Pervasive Healthcare Technology solutions have focused mainly on at risk disease management (Anderson & Wittwer, 2011). However, a growing market in a wide range of the healthcare field is ready to propel the development and consumption of pervasive Healthcare Technology. This practice has had profound influences on healthcare, catering to the elder, the disabled, the underserved, and the critically ill (Washburn & Hornberger, 2008).

## **Pervasive Healthcare Technology in Primary Care**

One area that can be a compelling reason for technology is healthcare.

Healthcare is one area where people do want to be more engaged, and not just more connected. A group of researchers at Partners Healthcare in Boston has done several studies looking at using technology to conduct "virtual visits" between patients and primary care providers. In two studies, they showed that both patients and primary care providers felt that a "virtual visit" was indeed a useful alternative to the traditional in-person visit for many different situations (Lankton & Wilson, 2007). However, because patients are not interested in using technology with each other, pervasive

healthcare will pose many unique challenges to healthcare that previous communication technologies did not. When one looks at the telephone and email, healthcare was very slow to adopt both of these technologies. By the time it finally happened (or in the case of email, is still happening), both technologies were already wide spread (Doukas & Maglogiannis, 2008; Lankton & Wilson, 2007). This may not be the case with technology. It is not enough for healthcare to simply adopt technology; healthcare must take "the first step" and offer this service to our patients, and hope that patients will indeed follow (Anderson & Wittwer, 2011). This is a very daunting prospect for many people in the healthcare field. Fortunately, many devices, including laptops and smart phones, have technology embedded in them. So the number of people with the needed hardware is at least growing over time. Indeed, of the five virtual visits that were in 2011, three of those patients were using a web cam that was built into a laptop computer (Pai & Huang, 2011). For these patients, the challenge is to get people to think about using hardware when interacting with their healthcare provider. However, the large majority of people in this country still do not have a web cam of some type in their house. For these patients, you also have the added task of getting them to buy the needed hardware in the first place (Ziefle & Rucker, 2010). While the hardware is not expensive, many patients are perfectly comfortable simply using the telephone and the traditional in person office visit to interact with their healthcare providers. Overcoming this inertia will be a new challenge for healthcare providers who want to introduce this modality to their patients (Pai & Huang, 2011). There is growing evidence that the benefits of pervasive healthcare are worth the effort. One obvious benefit is that pervasive healthcare can often replace an

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office visit, which is a tremendous convenience for the patient (Pai & Huang, 2011). There are three main patient complaints where this can happen – skin, movement, and psychiatry. This last area has been a particularly active area at many academic medical centers. This is largely due to the fact that psychiatry does not rely on an in-person physical exam (De Moraes et al. 2010; Anderson & Wittwer, 2011). A virtual visit allows the psychiatrist to still see the patient's non-verbal communication cues, which are critical in this field. In an article from 2010, a group of researchers from UC Davis used 5 case studies to suggest that tele-psychiatry may actually be superior to traditional in-person consultations for treating some pediatric patients (Nachman et al. 2010). But on top of these benefits, pervasive healthcare can also be a great replacement to regular telephone visits. In these situations, they may not offer much in the way of clinical benefit to the provider, but it allows for a much higher level of engagement between the patient and provider, something that both sides often find beneficial. In a recent survey of 2000 doctors, 7% of physicians report that they are using online conferencing to communicate with patients (Munnely & Clarke, 2007). In an article from InformationWeek about this survey, it was postulated that one reason for such a high number is that physicians may actually prefer this higher level engagement as opposed to using email to communicate with patients (De Moraes et al. 2010; Anderson & Wittwer, 2011).

## **Technological Components in Pervasive Healthcare Technology**

A Pervasive Healthcare Technology system is comprised of healthcare service providers, healthcare application service providers, and

communication service providers. Pervasive Healthcare Technology is a system that connects primary care physicians, providers, specialists and patients (Garson, 2008; Munnely & Clarke, 2007). The fundamental platform of Pervasive Healthcare Technology consists of a user interface, some clinical devices, a transmission medium, and supporting software and hardware. The Pervasive Healthcare Technology user interface is achieved through a Pervasive Healthcare Technology workstation (Coronato & Pietro, 2010). The Pervasive Healthcare Technology workstation may be a simple personal computer (PC) or personal digital assistant (PDA). The user can interface through a telephone pad, mouse, touch screen, remote control, joystick, voice recognition system, and so on (Pai & Huang, 2011). Clinical devices are connected to the Pervasive Healthcare Technology workstation for local healthcare providers to capture patient vital signs or other clinical data, such as images and sounds. Depending on the type and use of Pervasive Healthcare Technology, different clinical devices have been incorporated with Pervasive Healthcare Technology applications: digital electrocardiogram (ECG), tele-otoscope, electronic stethoscope, tele-pathology microscope, x-ray digitizer, high resolution digital camera, and pulmonary function test device (PFT) (Washburn & Hornberger, 2008). Acquired clinical data is then transmitted to distant remote site for examination and analysis. Pervasive Healthcare Technology data is presented in the form of text, voice, still images, and full motion video (Appari & Johnson, 2010; Ziefle & Rucker, 2010). Pervasive Healthcare Technology software systems facilitate data entry, data storage, data transmission, and data processing. A typical Pervasive Healthcare Technology software system has the following components: 1. User interface software for the user to interact with the <https://assignbuster.com/smart-environment-with-post-processing-health-and-social-care-essay/>

Pervasive Healthcare Technology system2. Data acquisition system and sensors for acquiring images and vital signs from the medical devices3. Software to store and retrieve patient record and medical database4. Software to ensure secure and successful data transmission5. Network protocols for data transmission6. Processing software to manipulate the acquired data

The selection of electronic links depends on the required bandwidth, the available telecommunication infrastructure, cost, and expansion potential. Transmitted data can be analog or digital as text, sound, and images (Bardram, 2008; Coronato & Pietro, 2010). The data can be formatted according to the digital Imaging and Communications in Medicine standard (DICOM) or in non-DICOM formats (Bardram, 2008; Coronato & Pietro, 2010). Transmission can be made through point-to-point connections or multiple point connections that link multiple sites over terrestrial or cellular mobile links. Tele-medical data transfer can be achieved via terrestrial media, cellular mobile media, and satellite (Coronato & Pietro, 2010). A variety of terrestrial services are currently used: (a) voice telephone networks including the Public Switched Telephone Network (PSTN) and the plain old telephone systems (POTS), (b) switched digital dial-up telephone services such as Integrated Services Digital Network (ISDN), (c) Frame Relay Services (FRS), (d) Local Area Networks (LAN) and WAN Area Networks (WAN), and (e) Virtual Private Networks (VPN). Cellular mobile services currently used in Pervasive Healthcare Technology are Global System for Mobile (GSM) Communications (digital cellular phone technology), Code Division Multiple Access (CDMA), high-speed digital wireless General Packet Radio Service (GPRS), or 3G mobile technologies (De Moraes et al. 2010; Anderson & Wittwer, 2011). Satellite services generally utilize

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geosynchronous and low earth orbit (LEO) satellite, and very Small Aperture Satellite Terminal (VSAT). Although more costly, satellite services enable large amounts of data to be transmitted regardless of geographic boundaries (Pai & Huang, 2011). Transmissions of Pervasive Healthcare Technology are conducted in either real-time interactive synchronous mode or store and forward asynchronous mode. Real-time synchronous operation requires that the patient and the care providers meet at the virtual space at the same time. It is used when immediate feedback is critical in situations such as emergent interactive treatments (Doukas & Maglogiannis, 2008; Lankton & Wilson, 2007). Real-time telemedicine allows remote healthcare providers to examine and consult the patients with little time delay. Conversely, if immediate feedback is not required, store and forward mode is used. Store and forward telemedicine acquires and stores medical data and then transmit the data to healthcare providers at a scheduled or convenient time for offline assessment (Lankton & Wilson, 2007). Rapid breakthroughs in computing and telecommunication technologies have brought about advances in telemedicine; however, fast evolution of technology means existing telemedicine systems may quickly become obsolete (Anderson & Wittwer, 2011). Although performance and cost-effectiveness are important factors, programmability, upgradability, and flexibility are even more crucial in designing or selecting a telemedicine system (Pai & Huang, 2011). A successful telemedicine system builds on reliable hardware, software and network architectures. The criteria for a telemedicine system design should follow the same rigorous guidelines as those for information systems (Doukas & Maglogiannis, 2008; Lankton & Wilson, 2007). Moreover, with the fast pace of technology, telemedicine system design must take a futuristic

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approach, emphasizing scalable and plug-and-play architectural frameworks and conforming to widely accepted industry standards.

## **Pervasive Healthcare Approach for Aged Patients**

Among Healthcare Technology developments, tele-monitoring is the fastest growing category that highly suits aged patients for home based treatment.

In 2004, research studies reported that the total healthcare technology market was about \$380 million (OTP, 2004). In 2007, it was predicted that the tele-home care market alone would grow to be in the billions by 2010 ("Home ehealth", 2007). Uptill now, the prediction has come true (Pai & Huang, 2011). In-home tele-monitoring for aged patients currently focuses on two chronic, high mortality diseases: diabetes and congestive heart failure. However, tele-pulmonary monitoring has also been prevalent in elderly patients. Healthcare Technology in these cases provides remote consultation and helps manage the episodic needs of high-risk illness for elder patients, provide education, schedule care, reduce hospital stay, and improve overall patient and clinician satisfaction. Research studies suggest that even though not all aged patients are willing to be monitored 24/7/365, most homebound aged patients who have difficulties accessing to medical care are comfortable with the arrangement (Sneha & Varshney, 2007).

According to research, demographic trends would likely require increasing future home healthcare ("Home e-health", 2007). Research studies assert that an aging population and increasing rates of obesity and cancer indicate a significantly larger population of chronically ill elders that require rehabilitation and long-term care management (Ziefle & Rocker, 2010). This scenario translates into significantly increasing demands upon the relatively

small group of healthcare providers and inevitable cost inflation.

Compounded with the increasing shortage of healthcare professionals and facilities, healthcare provision is becoming an acute problem; Healthcare Technology will most likely be the only solution (Sneha & Varshney, 2007; Varshney, 2009). The use of Healthcare Technology allows patients to access to the best clinical providers, despite differences of time and distance, and frees up the small group of highly specialized experts for the most critical cases (De Moraes et al. 2010; Anderson & Wittwer, 2011). From the aspect of a hospital, healthcare technology technologies enable the efficient use of resources, improved quality, decreased medical errors, and enhanced medical care experiences. From a patient's perspective, healthcare technology allows aged patient to stay at their residence, to cut the cost of long-term healthcare, and to decrease the frequency of hospital visits (Thuemmler et al. 2009). Timely data entry and immediate access to patient electronic records help reduce the latency issues of patient care. Moreover, recent wireless technology further promotes the mobility of both healthcare professionals and patients. Researchers predict that the future of inpatient care is digital, wireless, and interactive (Washburn & Hornberger, 2008). With the help of Healthcare Technology, patient care can be achieved in the patient's room at hospital or at home with the CAD-CAM assurance of safety and quality.

### **Relative Advantages for Home Based Aged Patients**

Healthcare Technology enables specialists to attend to aged community that otherwise could not be served (Doukas & Maglogiannis, 2008; Lankton & Wilson, 2007). It eliminates possible travelling time and cost for aged

patients and healthcare providers. Healthcare Technology allows quick access to specialized care in rural communities. It reduces economic strain as well as alleviates a patient's emotional strain of travelling far from home (Aziz et al. 2006; Washburn & Hornberger, 2008). In rural areas, treating local aged patients with Healthcare Technology means more than to provide access to otherwise impossible treatments. It also increases the financial viability of rural medical facilities and strengthens the rural economy.

Networked healthcare also brings balance to the distribution of aged patients and care providers among urban and rural facilities (Thuemmler et al. 2009).

Tele-monitoring aged patients inside hospitals may potentially reduce the cost of intensive care and post intervention observation and increase the administration's effectiveness. Tele-monitoring aged patients at their homes can lead to improved, continuous, and highly effective disease management (Lankton & Wilson, 2007). Healthcare Technology makes personalized pre- and post-treatment integration possible through continuous consulting and monitoring. To conclude, general agreements on fundamental benefits of Healthcare Technology are as follows: 1. Increase aged patients' accessibility to medical care in their own community. 2. Effective use of healthcare resources. 3. Enhanced continuum of patient care. 4. Access to specialty care when either geographically or physically impossible. 5. Timely institution of healthcare at emergencies or otherwise. 6. Increase productivity of practitioners and improve healthcare service quality. 7. Cost-effectiveness for the entire healthcare system. 8. Support of healthcare maintenance needs such as education, training, and informatics.

Traditionally, Healthcare Technology is supported for its benefits to the otherwise inaccessible rural populations (Thuemmler et al. 2009). Today's <https://assignbuster.com/smart-environment-with-post-processing-health-and-social-care-essay/>

Healthcare Technology also reaches out to the medically underserved urban populations in inner cities, senior facilities, prisons, and so forth. Global availability of the Internet and highly sophisticated computing technologies has propelled the growth of Healthcare Technology (Pai & Huang, 2011). Healthcare Technology is becoming an integral part of healthcare throughout the world.

## **Current State and Challenges for Pervasive Healthcare Technology**

Research studies have long concluded that Healthcare Technology is useful for aged or adult aged patients. Nevertheless, Healthcare Technology adoption is still in its infancy (De Moraes et al. 2010; Anderson & Wittwer, 2011). Mainstream UK healthcare organizations have been hesitant about Healthcare Technology adoption until recently. There had been considerable amount of scepticism from practitioners, due to a lack of face-to-face, reach-and-touch intimacy (Coronato & Pietro, 2010). Hence, Healthcare Technology was often limited to rural settings and was applied to aged patients without critical needs. The return on investment (ROI) was difficult to justify due to often refused reimbursements, huge initial start-up costs, and high maintenance costs. In addition to these considerations, legal issues regarding physician licensing, legal liability, and patient confidentiality concerns also deterred Healthcare Technology adoption (Pai & Huang, 2011). Patient care favours personal touch. Research studies agree that in certain cases, medicine can only be fully exercised through one-on-one interaction between the physician and the patient (Sneha & Varshney, 2007). With higher speed communications and more advanced computing technologies,

recent Healthcare Technology has allowed healthcare providers and aged patients to meet in virtual spaces synchronously in ways that such personal attendance can be achieved (Olguin, Gloor & Pentland, 2009). Live communication, aided by audiovisual devices and high speed Internet, has been rendered accessible due to such devices as tele-presence robotics and pervasive tele-monitoring used in current healthcare technology practices. As computers and telecommunication become increasingly prevalent and familiarity to the technologies grows, pervasive healthcare technology has become acceptable from the perspectives of healthcare providers and healthcare recipients (Washburn & Hornberger, 2008). Healthcare technology used in critical patient interventions has been proved successful in the past. In those cases, remote medical specialists were linked to the actual examination or operating room through real-time interactive communications (Ziefle & Rucker, 2010). Healthcare Technology for use in neonatal intensive care units (NICU) has been proven feasible as early as in the 1990s (Pai & Huang, 2011). Tele-ICU provides innovative remote care for centrally monitored ICU aged patients in an effort to improve ICU critical care as well as leverage scarce intensive care doctors. Tele-surgery requires more technical skills and costs, but tele-robotic surgical systems used with laparoscopic techniques have also demonstrated the capability and effectiveness of remote tele-surgery (Munnelly & Clarke, 2007). Regarding fee structures, the ATA (2009) emphasizes that services provided on site are not different than services provided remotely through Healthcare Technology (Sneha & Varshney, 2007). Nonetheless, the Healthcare Technology reimbursement issue has persistently been identified as a critical obstacle to Healthcare Technology adoption and expansion. Healthcare insurers

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(Medicare, Medicaid, and private insurers) have argued that the access and cost of healthcare technology cannot be adequately addressed (Appari & Johnson, 2010; Ziefle & Rocker, 2010). This is possibly due to difficulty to build a chain of traceability for treatment and is vulnerable for fraud and abuse. Moreover, although the costs of high-speed networks and IT devices have decreased in recent years, tele-digital versions of medical devices are certainly more expensive than traditional versions (Sneha & Varshney, 2007; Varshney, 2009). Costs for Healthcare Technology provision are difficult to recoup since reimbursement policies are nonexistent or limited. The integration of Healthcare Technology is seriously challenged by the lack of consistent and comprehensive reimbursement policies and regulations (Doukas & Maglogiannis, 2008; Lankton & Wilson, 2007). Legal and licensing issues are also big hurdles to healthcare technology adoption ((Munnelly & Clarke, 2007; OTP, 2004). The transmission of medical records across state lines, different state licensure and accreditation requirements, and dispersion of liability in cases of cross-state practices are all pending on Federal regulation. Moreover, by elevating the care provision, healthcare technology also affects the standard of healthcare (De Moraes et al. 2010; Anderson & Wittwer, 2011). With new standards, healthcare providers may have increased liability for failing to implement up-to-date technologies in addition to liability for inadequate maintenance or use of technologies, resulting in patient dissatisfaction (Lankton & Wilson, 2007). Efforts have been put forth for interstate compact and licenses for healthcare technology practices. Various organizations such as Federation of State Licensing Boards and the Centre for Healthcare technology Law (CTL) have initiated policies and regulating models on aspects of licensing and litigation ((Varshney, <https://assignbuster.com/smart-environment-with-post-processing-health-and-social-care-essay/>

2009; OTP, 2004). However, state licensure and liability issues continue to be unresolved obstacles to healthcare technology marketing and user acceptance (OTP, 2004). For healthcare technology to be successful, patients require confidentiality, reliable and available connectivity, and consistent data transmission. Real-time data transmission can be especially problematic in remote areas, which is a critical concern when human lives are involved. The issues of data security and patient confidentiality raise critical concerns that demand the development of secure, reliable, and capable connectivity and transmission infrastructure. Current infrastructure and patient data systems, such as electronic healthcare records (EHR), require financial and regulatory encouragement from policy setting organizations in order to meet the standards and compatibilities of healthcare technology. Healthcare technology is a marriage between technology and healthcare. It thus inherits the complexities of both disciplines. Healthcare is a context and culture specific industry. Unique healthcare needs and individualized approaches often demand special considerations. The decision making process and workflow patterns require adaptation to specific healthcare provisions and providers. Conversely, to keep pace with the constant evolution of new technologies, IT must address usability, connectivity, scalability, maintainability, and so forth. IT practices follow standard development cycle with multiple iterations of prototyping, developing, and testing that are not usually applied in the healthcare. By merging the two disciplines, healthcare technology expansion must seriously focus on inter-disciplinary practices, blended expertise and partnership (De Moraes et al. 2010; Anderson & Wittwer, 2011). Challenges have persisted in healthcare technology adoption and expansion despite its evident effectiveness. However, with techno-

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centric development in almost every business area, the demand for healthcare technology applications will drive the market (Sneha & Varshney, 2007; Varshney, 2009). Using healthcare technology is not only critical to the healthcare systems, but also important to the healthcare delivery model and to the entire economy. Conversely, regardless of the tele-part of healthcare technology, healthcare providers must abide by the rules of quality healthcare practices and patients need to accept the advance of medical technologies while understanding their limits (Nachman et al. 2010; Pai & Huang, 2011). Furthermore, research asserts that there is an existing wide "digital divide" between those who, including both healthcare providers and recipients, have access and those who do not have access to healthcare technology (Coronato & Pietro, 2010). If not properly addressed soon, this differentiation may continuously widen and result in serious problems in healthcare delivery in the future. To sum up, continuing patient education and practitioner training is absolutely critical to healthcare technology progress.

## **Present Research Intention**

Present research concentrates on pervasive healthcare technology based on the following facts. First, pervasive healthcare technology has a potential for virtual face-to-face communication regardless of the distance. Distance can be created through geographic location, transportation imparity, and other social issues (Nachman et al. 2010; Pai & Huang, 2011). Pervasive healthcare technology can help bridge the distances. Second, pervasive healthcare technology has a potential for unrestricted data continuity when data collection and transmission can both be automated without time



constraints (Pai & Huang, 2011). Third, broad band and cellular communications are more economically feasible currently. The advanced technology has translated technological intrusiveness into virtual closeness. The demands for pervasive healthcare technology has consistently presented through market forecasts. In order to sustain market position and patient pool, it is necessary for healthcare organization to leverage this up-to-date Healthcare Technology application (Ziefle & Rucker, 2010). However, Healthcare Technology adoption requires organizational strategic effort and healthcare professional's recognition and contribution. Moreover, with the diffusion of information technology, the attitude and expectation to tele-medical innovation from patients will also be crucial to the adoption of healthcare innovation (Olguin, Gloor & Pentland, 2009). Healthcare Technology is a distributed cooperative care. The cooperation and communication among clinicians as well as patients, their relatives and peer patients are critical (Lankton & Wilson, 2007). Applied in chronic disease management, such as diabetes and heart failure, successful implementation of pervasive healthcare technology relies heavily on patients' ability and willingness to use the technology. A tele-medical technology would not be useful unless patients use it (Tu, Zhou, & Piramuthu, 2009). In response to this understanding, present research focuses on the determinant factors for patients' technology acceptance.