Automated Health Assessment System Using 3D Techniques

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Abstract - Pervasive computing has opened doors for a health conscious monitoring system that bridges the gap between the patients and the physicians. This technology involves the use of embedded in-home sensors that monitors the activities of the patients on a periodic pattern so as to aid in the early detection of health anomaly and to upturn the patients' lives. It captures all the activities of the patients under observation using 3D and 5D scale techniques and a periodic analysis is made against a pre-decided set of values. In the case of any abnormal activities being recorded, an alert is send to the physician regarding the fluctuating behavior of the patients over an e-mail. This system falls short in two aspects. While, First it needs to identify the actual patients under monitoring from the rest of the world. This may add the values collected from the visitors too. This creates a chaos situation as the observed values may go abnormally high. The second, is that the delivery of the alert message at the appropriate time. The physicians may not be online every time. This may lead to the lack of support from the physicians. The system challenges to characterize the patient's activity from the visitor's activity using Radio Frequency Identification (RFID) tags. Also the problem of alerts was addressed by sending alert messages to nearby physician who logged in currently, over the Global Positioning System (GPS). This helps in getting immediate first hand suggestion from some general physicians.

Keywords - In-home sensors, RFID, GPS, health anomaly detection, embedded system.

1. INTRODUCTION

The proposed automated health assessment system using 3D techniques are based on the patient's activity in a controlled environment for early health anomaly detection and to boost the patient's quality of living. Analyzing and determining the health anomaly in the early stage will provide opportunity for reducing the problem and also freeze the problem before they become very complex. So, the patients can get help in the initial period before the health anomaly becomes very large. For early detection of health anomaly the embedded system makes use of sensors network for monitoring the activities and 1D algorithm to differentiate the sensor values collected from various activities of the patient in the home environment. However, this sensor network could not differentiate the values sensed from the patients under observation and the rest. This cause a serious chaos. It is found essential that the patients have to be separated or uniquely identified. This could be made possible with the help of RFID technology. RFID readers embedded; in the environment receive radio frequencies from RFID tags that are attached to the patient. RFID tags are used to differentiate the patient from the rest, when the patients are in a collective environment. This helps to differentiate the patients with their RFID tags. The dimensionality technique is used for better observation of the patient in a collective and controlled environment. In RFID the signaling between the reader and the tag is done in different ways, depending on the frequency band used by tags.

RFID tags can be attached to cash, clothing etc. The received signal of the sensor network is compared with the predefined values that are provided by the physician. While contrasting the values, if the system gets any abnormal activities then the system sends an alert message to the physician through email by using the x10 protocol. The alert message contains two links. The first link helps the physician to view the data of the patient collected over a fortnight and the second link helps the physician to reply to the patient through email. If the physician is not available online to respond and react to the alert, then it causes a major problem to the patients and it leads to a critical situation. To avoid this critical situation GPS (Global Positioning System) is used for identifying the physicians are available online at the moment. The GPS system identifies the location of the physicians those who are in the nearest vicinity of the patient. After identifying the nearest physicians' location, the system sends an alert message to the physician. This helps the patient gets quick response from the physician in case of medical emergencies.

2. RELATED WORK

An array of related work shows the activity and importance of health monitoring in old age homes. In wrist actigraphy, the actigraphy devices worn on the wrist, record the movements of the patient and account the sleep parameters by using computer software program algorithms. Wrist

actigraphy accounts, the sleep latency, sleep disorders etc. Actigraphy validates the night time sleep parameters efficiently, while it fails to reach the mark when it comes to monitoring the day time sleep parameters [8]. Video based monitoring systems have been introduced and are used to enhance the monitoring patterns during both day and night time fall detection using fuzzy clustering techniques. The fuzzy set techniques are applied to the input values to detect the states related to fall detection. Machine learning techniques have been added to these techniques to further enhance the fall detection techniques [5]. To further add interactivity to this fall detection domain, smart phone based interactions have been introduced to his model. Smart phones being an intimate part of modern humans, the fall detection system has been coupled with smart phones by sending fall detection alerts to the concerned persons, which makes the system a bit alive. Smart phone integration introduced various problems regarding real time operations, power consumption, usability etc. [4].

More methods are introduced for health detection using daily activity monitoring systems using passive sensors. The health detection pattern is based on detection an interruption in a daily activity and analyzing it based on the patterns. This system will address a wide range of patterns for health detection when compared to the previous system based on fall detection by including multiple user activities. This introduces further challenges to the system like the efficiency in determining the health problem, the range of algorithms to be introduced for monitoring the user daily activities, the monitoring hurdles etc[6]. To enhance the accuracy in early health detection by monitoring the daily user activities, Markov models have been introduced. This will introduce certain methodologies that enhance the accuracy in early health detection by monitoring the daily activities of the user. The Markov model faced difficulties in the health detection methodologies, when the monitored data is not proper which is given as input. An incorrect input value will destabilize the system's ability in guessing the results, because of huge amounts of variations in classifying data [2].

To overcome the discrepancies in collected data from normal day time activities of the user, statistical predictive algorithms are introduces. This will detect the anomalies based on statistics and not direct data collection, which gave predictable results. This model is based on monitoring the indoor room activity times, average number of indoor room movement patterns of the user, etc. The collected data will be monitored by in-home monitoring systems. This system faced certain challenges in data collection such as maintaining accuracy of collecting user data such as body temperatures because of other environmental factors [3]. Ultra wideband radio devices based model to overcome the above problem. This method has been deployed to monitor the health patterns in the case of dementia patients [7]. Automated embedded health assessment tests various features using in home sensors by sensing the patient including the time with visitors and classify the values using 1-D algorithms [1]. There are some challenges in this approach that need to be approached such as health monitoring, comprehend the patients and the visitors and location based health alerts.

3. PROPOSED SYSTEM

This system implements a location based alert system using GPS technology, in the case of a medical emergency. It also addresses the patient specific monitoring using RFID tagging of the patient in a controlled environment using an in-home health monitoring and early detection system. RFID tags are helpful in identifying an object in a collective environment by emitting or responding to an emitted signal based on the type of tag used. GPS is a technology helpful in finding an object location in the face of earth. This enhances the existing methodology for early health alert detection system in a controlled environment. A location based alert system using GPS technology is introduced to help the patients in the case of medical emergency.

This location based alert system is expected to decrease the response time in the case of a medical emergency, i.e., it has the potential for saving a few more extra time in emergent situation. Users are monitored to get data like heart rate, body temperature and also sleep patterns. These are omitted in the collective environments in the existing system. This will enable enhanced data collection in a health monitoring system, which in turn increases the chance of detecting health conditions in an in-home environment. By the use of the above two technologies, the proposed system adds a set of features to the existing health detection and alter systems.

A schematic for location based health alerts for in home sensor based health monitoring, as illustrated in Figure.1. The schematic contains four types of modules; they are monitoring module, analysis module, alert module and location module and remote end module.

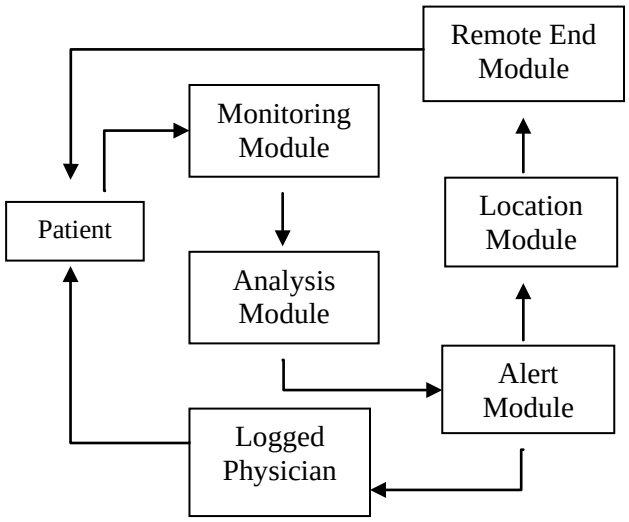

Fig. 1. Schematic for location based alert for in-home sensor based health monitoring.

The monitoring module monitor patient location, temperature and the heart beat of the patient continuously by using the RFID technology and the sensor network and values send to the analysis module continuously. Then the values logged inside the database. The main process of analysis module is contrasting the monitored value with health decline values. While contrasting with the values if the analysis detects any abnormal conditions they create an alert message and send to the alert module. The alert module checks whether the logged physician is present in the hospital or the physician is present in outside of the hospital. The physician present in the hospital then the alert message will send directly to the physician otherwise the alert message will send to the location module. The location module finds the location of the physician using GPS system and sends the location of the physician to the remote end system. The remote end system consists of mobile phones, laptops and pager devices. The alert message will reach the physician through the remote end system and they will response to the patient as soon as possible in case of emergencies.

4. CONCLUSION

An investigation is made on the feature space of the automated health assessment system. 3D and 5D techniques are suggested for, better observation of patents in the controlled environment. This involves RFID (Radio Frequency Identification) technology for achieving patient classification from the guests. The RFID technology enhances the patient monitoring in a collective environment with the help of RFID tags and RFID readers. The health decline collected from the physician is treated as basic decline values. In case of any fluctuating behavior, the system sends an alert message to the physician using GPS (Global Positioning System). Sending alert message with the help of GPS, works as a location based system. The location based health alerts reduce the response time of the physician to higher extend with the help of GPS in case of emergencies. Both RFID and GPS technologies enhance the patient's health and provide better quality of life to the patients. Further improvements in the collection of data can be done using the 7D-scaling technique.

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