Smart Health Monitoring System (SHMS) An Enabling Technology for patient Care

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Abstract

Health Monitoring System is a sophisticating technology and another way to the normal/regular management of the health of the patient. This Health Monitoring Mobile Application is a contribution from our side to the public and to the overall health industry in Pakistan. With the help of Health mobile application, the users will be able to store their medical records, prescriptions and retrieve them later. The users can store and keep track of their vital readings (heart rate, blood pressure, fasting glucose, random glucose). The mobile application also shows hospitals that are nearby in case the user wants to avail of any medical help. An important feature of the application is the symptoms-based disease prediction, the user selects the symptoms which he has and then the application will name certain diseases that match those symptoms based on relevant algorithms. The major advances and issues have been discussed, and as well as potential tasks to health monitoring will be identified and evaluated.

Keywords: SHMS, health monitoring, disease diagnosis, mobile application, biomedical monitoring, remote monitoring.
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1. Introduction

Population increasing is unavoidable, and with the development of civilization and medicine, the initial cause of death has changed from transmissible to cureless diseases author in [5]. Thus, rescuing aged patients in the circumstance of accidents and illness are very important. So, improvement for care of health at hospital and in home, has now become more crucial for patients. Health monitoring information systems have now become very important, particularly intelligent systems used to provide high-quality healthcare monitoring [1], which save on medical and manpower cost.

Paper medical records are easily lost and are hard to keep track off especially when someone is already concerned about their health. Patients who are hypertensive or diabetic need a constant track of their vital parameters for all their medical appointments [8], but such readings are hard to keep track off if not saved or recalled properly. In a society like us where people are not well educated and don't understand their health concerns, they end up wasting their time and money on going from doctor to doctor instead of finding the right consultant for their specific problem, the Mobile health application will provide a digital platform to

users where they will be able to store their medical records and doctor's prescriptions in image format [4]. They will be able to enter vital health readings (heart rate, blood pressure, fasting sugar, random sugar) and keep track of them [6][3]. The application also provides users with certain diseases which the user might have, by matching the symptoms the user entered. So, the user gets a rough idea of what diseases could have caused the symptoms which he has and consults the specific doctor or specialist. In local market there are several web-based solutions through which people can book online appointments with doctors, and see which hospitals are nearby but that's it author in [10]. Our solution has one short coming that it doesn't have an online booking platform. The other features which our application has, and the existing solutions don't have are online storage of user medical record and prescriptions, storing user vital readings and finding nearby hospitals and pharmacies city wise.
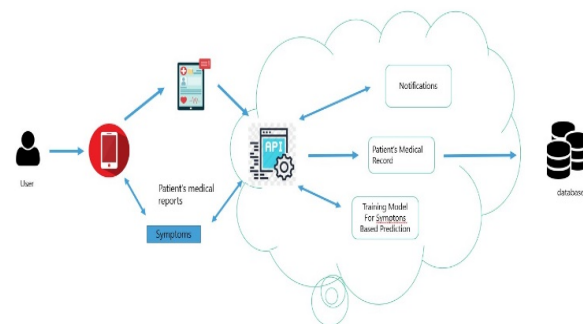
System Design

Fig. 1. System architecture of SHMS.

In this picture the user sign in the application the interface will be appear this will ask the user which service He/she wants to use the desire service will then coonect with the api and send signals tto the database throught notification the doctors and medical concern are able to know patients medical record. By the help of this patient can also see his medical report and doctor can also aware of the symptoms and conditions of the patient if he/she will be need any kind of further assistance it will notify them .

2. Literature view

The truth of advance medicine is that the number of patients is way more than the doctors who are there for their treatment e.g CARDIO [8]. The recent epidemic has proven that the nations are not equipped for the emergencies of that kind of problems and there is a world-wide need for qualified doctors for such issues [10]. The health monitoring system can help the concerned for available and lighten the burden at the hospital [7]. We have now two options to make doctors more efficient than before, one is technology. Through SHMS we will shorten the urge of keeping large amount of data manually. [5], there is no need to make a loaded file for the patient and refer different tests for the diagnosis's it will also help for the patients family which are collecting and saving patient history for future help the system will save all the readings which is provided by the patient to the system and doctors will also aware of this so they will know the progress of each and every patient and able to mentioned the burden. Authors in [10] [11]all of it will be done through indicators. This system will save your time and effort. This system will get a bed in hospitals for needy patients. After thoroughly checking up and analysing health indicators, the system will suggest whether to stay or discharge or recover from home under doctor's supervision. This system will notify doctors to care more for those patients who are endanger. SHMS will help patients to recover after surgery or heart attacks remotely under doctor's guidance [16][31][32][33].

1.1 Requirement Analysis

The system consists of a mobile application with several modules: Storage module: to store user medical record and prescriptions Vital Readings Module: where the user stores his or her heart rate, blood pressure (bp), random blood sugar, fasting blood sugar [6]. Hospitals & Pharmacies: pharmacies will be shown on city wise basis while hospitals are shown based on nearby locations with distances. Disease Prediction: here user will enter his or her symptoms and the system will tell based on rebalance algorithms to which diseases the symptoms match.

The system is fast, reliable, and highly scalable because of the use of database. It can concurrently handle multiple users. The system only requires a stable internet connection for effective usage [2]. Several critical reviews have been published since 1960, including those by Roine et al. [38], Lau et al. [39], and Brownsell et al. [40]. We chose peer-reviewed articles relating to remote HMS, mobile HMS, and wireless SHMS for this review, which were published between 2005 and 2011. We identified 300 studies from 400 research publications, shortlisted 80, and chose 50 that best fit our search parameters. Studies that lacked practical implementation/testing, validation/evaluation results, or did not meet the above criteria were removed. The research was separated into two sections: smart systems (WHMS, MHMS, RHMS, and GHMS) and traditional or wired systems (WHMS, MHMS, RHMS, and GHMS [12][13][14][15][16]. The classification of the HMS and its subsections is shown in Figure 2, The Table 1 summarizes the studies that were chosen based on the classifications in and the year of publication. the shows how these papers are classified depending on their medicinal applicability. The system uses database, which requires SSL technology to encrypt the data. Only authorized users can access the data and enter new data. The data is secured from unauthorized disclosure and manipulation.
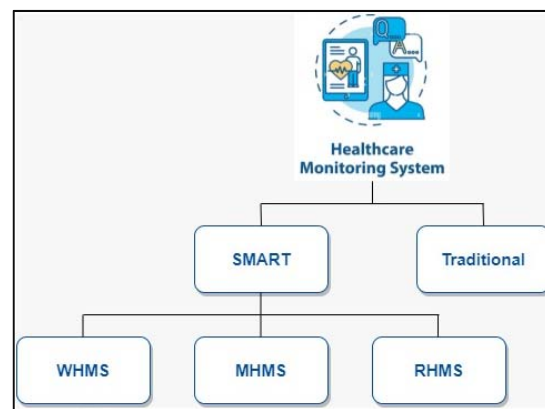

Figure 2. Classification of HMS

Table 1: Compare of the Health Monitoring System with previous work

Reference	Techniques	Transmission System	Design	Application Scenario	Focuses
17	The LNet	Connectivity with PDA	Unified	HMS Epilepsy Seizure and Symptom	EMG, ECG and Galvanic
18	AMON System	GSM and Wrist Bracelet	Operator Based	The PH Estimates conditions	Blood Pressure, Blood Saturation, Skin Temperature, ECG
19	Lifeguard	Used Base Station and Blue Tooth	Unified	Wearable Monitoring System and Multipara meter	Heart Rate, Blood Pressure, ECG, Respiration Rate, Body temperature and Oxygen saturation
21	Real Time Wireless Physiological Monitoring System	impotent Cordless Phone to main Station	Consolidate	System assistance in Nursing Hospitals and labs	Pulse rate. Blood Pressure, ecg, Heart Rate, nerves and Temperature
26	Brain Injury Monitoring System	Bluetooth to Home PC	Unified	Monitoring of Brain Injured Infants	Blood Saturation, Heart Rate, Respiration, Body Movement
20	MyHeart	Communication to Data Logger	Off-line	Wearable System for Heart Disease Monitoring, Sensors Knitted or Embedded in Garment	ECG, Activity Sensor
22	clothing Health-care System (WEALTHY)	Bluetooth or GPRS	Central or Data Acquisition	Application to Clinical Patients through Rehabilitation, old-age People, Patients with Chronic Illness	ECG, EMG, Thoracic and Abdominal Respiratory Rate, Body Positioning and Movement
23	MagIC	Bluetooth / GPRS	Central	Woven Textile Sensors in a Heated Vest Washable	ECG, Respiratory Rate, Motion Level Sensors
24	Medical Remote Monitoring of Garments (MERMOTH)	RF connection to PDA	Data Acquisition	Wearable and Stretchable Sensing Clothes	ECG, Respiratory Inductance Plethysmography, Temperature of skin, Activity
25	NASISTIC	Bluetooth/ 2G-4G Linking	Nearby Distributed/ Central	Social Sensor of Node Deployments	Mixture of Biophysical Signals (ECG) with User Habbits

Users will be provided user manual, online help along with the mobile application for support since people are not used to these kinds of application especially in Pakistan [4][27][28].

Healthcare systems such as mobile health applications are becoming the fastest solution for the huge problem of healthcare system issues [16][19][35][37]. Furthermore, become easier for the management and continuous access to the historical records of the patient, the global technology has the strength to boost the users to take an active role and manage their role according to the requirement. This is very important for the management of long-term conditions. E-medical records allow users to personalization the services and manage the collection of the records. This customizable system can be helpful in data extraction, also for the decision making and software systems supports, and a predicted system to support the diagnosis, treatment, and care based on each. [39]. In this paper, we show the ability of the ongoing era of smartphones technology and possible apps for

omnipresent health monitoring and management system. We have to define the planning and structure of the system and organize the global health monitoring systems, and also need to take the step for the iPhone application and more for it

Smartphones combine the processing and communication capabilities of today's workstations into a small, wearable package, resulting in a revolution in the number of sectors and applications. Health monitoring and wellness management are two of the most promising smartphone applications. Remote and networked sensors and actuators, mobile platforms, novel interactive displays, and developments in computer and networking infrastructure will increasingly be used to provide continuous monitoring and real-time, tailored feedback on health and behavior. For community-wide health awareness and maintenance, data acquired by sensors at point of care or labs must be anonymized and pooled [34][35][36]. Inferences about best practices and cost reductions in providing health care can be drawn from such data, especially when collected over large populations. The potential of smart-phone technology for ubiquitous health monitoring, typical applications, and the development of our new ubiquitous health monitoring system, which includes the most common functionalities for ubiquitous health [29][30][37]. monitoring and wellness management, are presented in this paper. This is a tremendously promising field with an exponentially growing number of sensors and business prospects that can drastically transform and improve the healthcare system.

3. Methodology

A Health monitoring system is a group of activities that are used to tackle the issues of wellness management and maintain a system in operatable condition and may not be restricted to an inspection of current system states [5], but also helps with maintenance and repairing which is being cause by these observations.
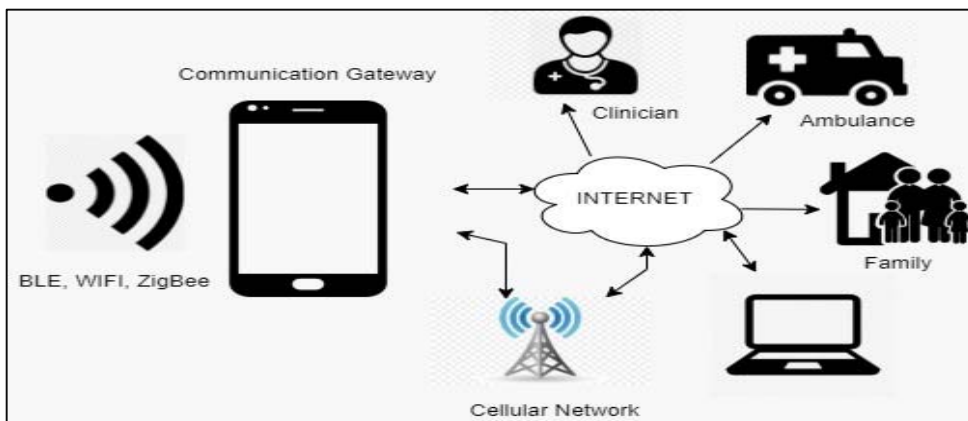

Figure 2. This is a method which is showing how communication is take place.

The figure 2 shows that, the Wi-Fi availability is necessary and then communication gateway (Mobile phone) then all the Ambulance clinician family are connected by the patient and have all the information about it.

3.1 User Authentication

Firstly, when the patient opens the application, he has to login his or her account then the app wants an authentication to prove after that the system runs.

3.2 Disease Prediction using Symptoms

When the system completely run after that the patient tell the symptoms and then system tell the possible disease that detected the system in patients' body [9].

3.3 Enter Vital Readings

The most important step for the user and the system is when the patient enters the reading of glucose, blood sugar, heart rate [6], blood pressure based on the reading system stores them and tell the disease.

3.4 Show Vital Readings

The system shows up all the vital readings like sugar heart rate [6] and blood pressure if the condition of patient is changing or the situation gets critical.

3.5 Medical Reports

All the reports of patients that has been saved in the database. But patient must submit the reports. And after that the system generates its own report author in [20].

3.6 Hospital Recommendation Based on Location

If the users give command of show hospital list first system, ask for the permission and live location of patient after that the system give hospitals list based on current location of the user.[25]

3.7 System Notification

System gives notification based on current location and shows up all the activities of patient like all the readings of users and the report's author in [17].

4 Result and Discussion

In this section we have discuss all the possible result which we have get from the initial steps of the application and all the discussion which we have taken from the project and the results will be exactly like this.
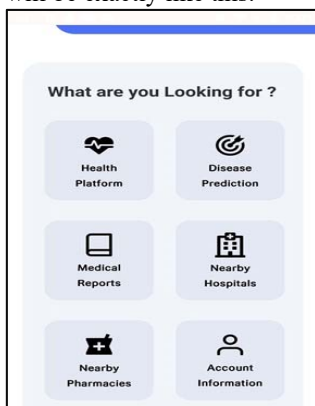

Figure 3. Interface of SHMS Application.

Figure 3 shows the interface of SHMS application and it consisted of Health platform where all the readings are taken and save into the medical records. In the disease prediction section, all the predicted disease are store which can be useful for the doctors and patients both to recognize the issue by the symptoms [9]. In Medical Report section all the reports are available. In Nearby Hospitals section all the information of the Hospital is available like contact no address. In Nearby Pharmacies all the available pharmacy locations are given. The Account Information in which all information related to patient are given.
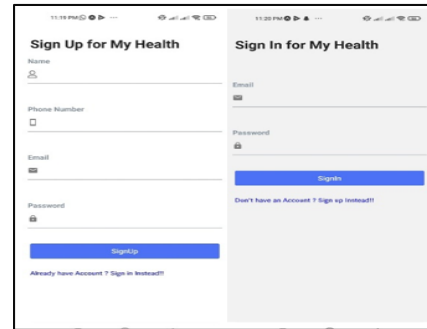

Figure 4. Layout of Sign in and sign up

First the user needs to sign up in the application so that the database will be created of his name and all the data will be stored in it. Then the sign in page is used for the daily use and records as shown in figure 4. The sign in page can take the patient to the interface where he/she will be using the desire section.
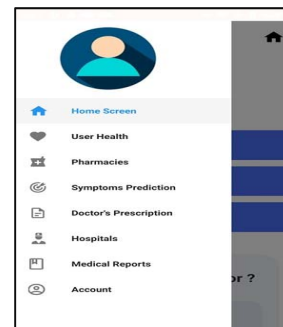

Figure 5. Navigation Pane of HMS.

It may include home screen section User health section pharmacies section symptoms prediction doctor's prescription Hospitals medical report and account. In figure 5 pane allows a user to select one of the categories provided by menu and guide users towards to screen for choice.
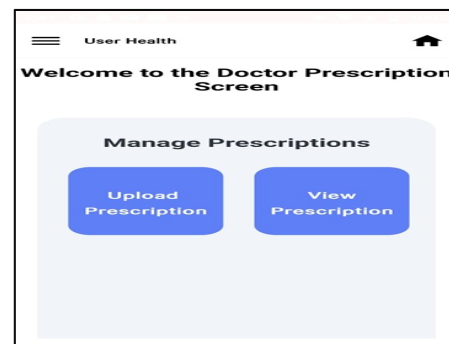

Figure 6. Prescription Screen for Doctor

The figure 6 showed prescription section, where system allows to add or view your prescription. The doctor can also be prescribing the medicine through the app by posting picture. There is also take image feature which will make a user to take a picture and send it to desire person. The system can ask the user to take a picture or take it from anywhere e.g. gallery. This will make the patient easier to view or save his/her prescription and send it to concern for further check-up.

Figure 7. Close location hospitals

In figure 7 shows the list of pharmacies which are available nearby with the location and addresses. The best thing of system is that it will show all the hospital and pharmacies which are nearer to your location, and this is not only bound only for Karachi, but it will cover almost all the cities.
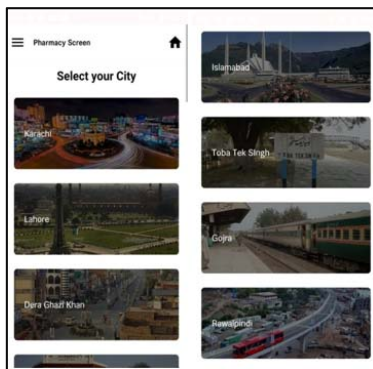

Figure. 8: Nearby Cities

This is the list of the city where the services of our health Monitoring system are operational. The figure 8 illustrated the system tried to cover some of the biggest cities and some of the under populated cities. The cities include Karachi, Lahore, Islamabad, Khanewal, and Peshawar, Toba tek Singh, Gujrat, Mardan, Chaman, Faisalabad, Gujrawala, Quetta, Multan, Gojra, and Rawalpindi. These are the cities which we

have highlighted because the big cities have a lot of problems of hospitals and medical services they are not ready to overcome an excessive load of patients in pandemic and same as for the small cities have limited resources of medication and they are also not well trained for the any of the special case. If it happen they will sent it to the other cities and they will then treat them.
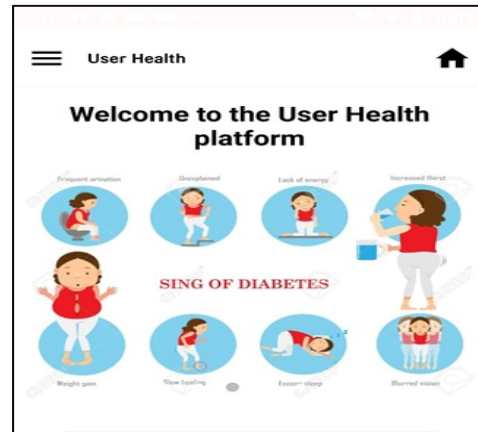

Figure 9: The Gird view of HMS Application

This one is the user health platform where he/she can excess and came to know or predict different symptoms of different disease [9]. As shown in the figure 9 you can see that the picture is showing different symptoms /sign of diabetes:

- Urinate Multiple times, often at night.
- Patient is very thirsty.
- Lose weight rapidly.
- Are very hungry.
- Having a vision blur.
- Have numb or tingling hands or feet.
- Feel tired every time.
- Have dry skin.
-

4.1 Medical Reports

Type 1 diabetes symptoms can appear suddenly, in as little as a few weeks. Type 2 diabetes symptoms often appear gradually over several years and are so minor that you may not even notice them. Type 2 diabetes affects many persons who have no symptoms. Some people don't realize they have diabetes until they start experiencing symptoms like blurred vision or heart problems.

Figure 10: The Gird view of HMS Application

The figure 10 represents the interface of HMS, and it shows the details of application and control and manage the records. Through this patient can be able to manage the reading and feed the reading into the database. The first box is blood pressure by entering into this patient can feed the reading into the daily recorder and in the background the graph of the daily reading is form. The second box is heart rate [6] by using this a cardiac patient can be able to maintain his/her pulse rate and if the condition is getting worse an alert message will be generated and the doctor will prepare for the treatment of patient [9]. In the third box a random blood sugar section is available in this patient can add his/her random blood sugar reading so that the graph will be form and it will show the increase and decrease rate of sugar. In the fourth box the fasting sugar section is available in this patient can add his/her random blood sugar reading so that the graph will be form and it will show the increase and decrease rate of sugar.

4.2 Symptoms of High blood pressure

Most diabetics with high blood pressure show no signs or symptoms Very high blood pressure or fast rising blood pressure, on the other hand, can lead to:

- Headaches
- Vision problems
- Nose bleeds
- Trouble breathing
- Fits
- Black outs

4.3 Symptoms of low blood pressure

Low blood pressure symptoms, like high blood pressure, aren't usually obvious. If you do experience symptoms, they could be any of the following:

- Feeling dizzy, lightheaded, or fainting

- Blurred vision
- A rapid or irregular heartbeat
- Feeling nauseous
- Confusion

High blood pressure affects about 3 out of 10 persons with type 1 diabetes and about 8 out of 10 people with type 2 diabetes at some point in their lives. People of African-Caribbean or Indian ancestry have a higher risk of high blood pressure. Furthermore, those who are overweight, consume a low number of fruits and vegetables, do not get enough exercise, or consume alcohol on a regular basis are at a higher risk. regular

Figure 11: Blood Pressure of HMS

This is graph which shows the reading of blood pressure which is saving on a daily basis and each reading is saving with date and date through these readings the graph is form and showing the progress or variation in the reading.
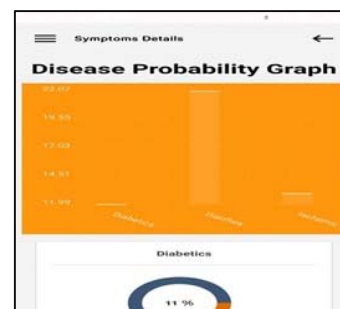

Figure 12: Blood Pressure of HMS

This Figure 12 show the disease probability by taking readings which is given by patients. It will show two types of graph a bar graph and ring graph.
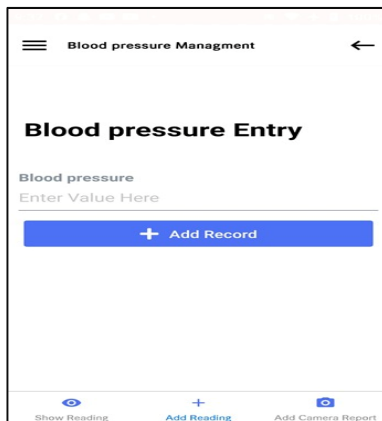
Figure 13: Blood Pressure of HMS

The blood pressure entry column is shown in figure 13 this is how it will take the reading and store it into the database.
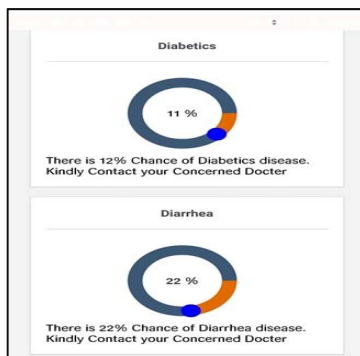

Figure 13: Blood Pressure of HMS

Figure .13 In this figure the causes or symptoms of diarrhoea are discuss and showing the ratio of severity. This is the predictions of the disease which system predict This prediction is not authentic that's why graph show the ratios of the predication and suggest contacting with doctor if the condition is critical.
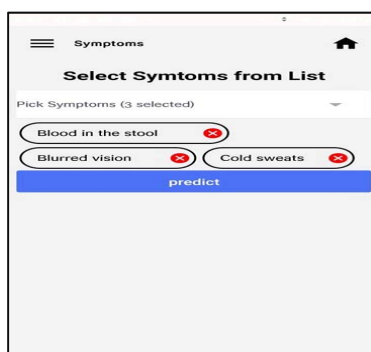

Figure 14: Symptoms Selection

This is how symptoms prediction is collected the symptoms from the patient/user and the results which I have discuss earlier is genera as shown in figure 14.

5   Conclusion

The rise of cureless pandemics has been seen in past years because of the pump in lifestyle of people, due to this humanity is facing issues regarding microbiology and needs repetitive monitoring of their livelihood, to tackle this issue, Mobile Health Monitoring System comes in and give appreciable support for health sector through different approach and opportunities for cure process and medical guidance. The whole system is designed to be run on android mobile devices which is mentioned in this paper. This is showing the physiological monitoring application. The end users will be able to visualize their medical condition through the instrument with the ease of time on a smart phone or tablet or any gadget. The system will both analyse and examine the condition and send the report to the expert of that area. Performance measures of the system has been considered the best in terms of storage and CPU if compared to the systems available in market. The challenging aspect in field of HMS is to design clinical trials diverse to discover the effects of monitoring patient groups like age, ethnicity, gender and specific disease.

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