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Rahul Singh Chowhan
M.B.M Engineering College, J.N.V. University, Jodhpur, Rajasthan, India

Purva Dayya
Extension Education, Mayurakshi College, Jodhpur, Rajasthan, India

Corresponding Author
Rahul Singh Chowhan
M.B.M Engineering College, J.N.V. University, Jodhpur, Rajasthan, India

Real-time medical healthcare monitoring & management system using parallel computing

Rahul Singh Chowhan and Purva Dayya

Abstract
The study focuses on developing an automated e-health monitoring system with mobile agents and interacting web service capabilities. This is to serve specific solutions on physiologic parameters such as respiration rate and heart rate, pulse rate, etc. which would be measured by biosensors and recorded by a smart phones and smart devices like wearable gadgets etc. that would display a graphical user interface to help comprehend the health status in real-time. It also provides information necessary to doctors and family members via a web interface, allowing registered patients to monitor the patient's condition and facilitate remote assessment. It also supports real-time positioning services so that emergencies, such as a heart attack, critical conditions, etc., can be taken care of on an urgent need.
India must use its current "technology"-oriented progress (e.g., sensor based tele-health programmes, etc.) to establish "information"-based community healthcare technology systems in the future. The future of health care governance and public health in India will be determined by the development, integration, understanding and use of a complete and responsive domain of healthcare informatics in the constantly growing global public health environment. As the progress with technology, health care assistance needs to be vitally active and participating for all the age group of patients. It must serve user friendly interface and not in compromising any of the facility available offline institute.

Keywords: real-time health care, e-health monitoring, web service patient assistance

1. Introduction
Humans have a strong desire for medical care, since everyone strives for a healthy and high-quality lifestyle that is essential for good health. E-health management is one method of monitoring and assisting patients with disease management and control [1]. In addition to offering high-quality E-health solutions to chronically ill patients, the application will reduce health-care costs. The growing number of chronically sick patients and the increased work load in care necessitate fundamental changes in the health-care system. Furthermore, due to its inherent medical science and ever-expanding research domain, healthcare is one of the most complex streams [2]. The healthcare industry not only has a lot of data, but it also has a lot of different kinds of data. With such a large amount of data to process, traditional computing approaches become more difficult to understand and handle.
The keys to pre-time identification and proper treatment of chronic disease include technological advancements in medicine and health, as well as improved treatment approaches. Information technology provides a variety of tools to those involved in the administration of healthcare and welfare, affecting communication and integration across levels of management, decision-making assistance, and patient autonomy. Chronic illness patients are becoming a larger part of the population and a considerable financial strain on Western healthcare systems [3]. The mobile agent is a novel and exciting technical paradigm in distributed and parallel computing. It has been used in a wide range of applications, including network computing, health management, server monitoring, intelligent bots, autonomous decision making, health information retrieval, data integration, and much more. It makes it far easier to build, develop, and administer distributed systems than traditional methods like the client-server technique. On their home computers, mobile agents have an agent server that provides architecture for execution, migration, coordination, and communication amongst multiple agents on different systems. The mobile agent paradigm has recently been marketed as a software integration entity for supporting automated healthcare systems. Because of their productive and proactive character, mobile agents have become well-known in the healthcare sphere, surpassing traditional mechanisms [4]. This facet of evolving paradigms for re-structuring service and applications through the internet has expanded with the advent of mobile agents in healthcare.

2. Mobile Agents in Healthcare Streamline

The mobile agent is a self-executing software programme that may roam across a monitored heterogeneous environment as a proxy of the original user on numerous clients/hosts, starting from the originating host, and completing various tasks [5]. The agent must decide "when to transfer, where to relocate, what to execute, how to start executing, with whom to interact, and why to start communicating" on its own. They can adapt, interact, collaborate, learn, and respond autonomously as the substrate environment in which they have been embedded transforms [6]. As a result, mobile agents are not constrained to the computer on which they are developed but may migrate freely amongst computers in search of information. The mobile agent can pause its processing at any time, save its present state, and then transfer to another host to resume processing. Business logic, state, and characteristics are the three fundamental components of mobile agents [7]. An agent's business logic is similar to a software programme written in an existing programming language that determines the agent's actions, working, and abilities.

2.1 States of Health Care Automated Agent

There are various states of an agent based on its functioning and execution environment. In major condition a thin agent can be in one amongst two states: data state or execution state. It just includes thread in the data state, and it simply repeats on each system along its path [8]. While the execution state comprises not only the execution thread but also the software stack, which encompasses information about the underlying data members, member functions, and other information that allows it to restore processing after relocating to a different host while keeping its prior state [9]. Agent characteristics describe the state of key variables, as well as its origin and operator identification, movement history, resource needs, authentication keys, and so on, allowing it to restart execution on external systems.

2.2 Agent System and Functioning

Hybrid Multimodal Mobile Agent Systems are made up of communicative characteristics that can be applied to the health care industry. The features of healthcare apps may be built not only through an active interface employing mobile agents, but also for better administration of back-end operations such as coordinating, lazy loading, and much more. Existing technology such as telemedicine and webinars, as well as live streaming, have made life easier by letting the connection all around the world For communication with patients, care providers, and consultants, they employ an interactive video screen.

Tele-health and patient monitoring devices may be turned into self-decision, cost-effective, sophisticated, and self-governing units using amalgamation of artificial intelligence mobile agents. Furthermore, the dynamic character of both healthcare professionals and patients, i.e. geographical mobility, has allowed technological researchers and scholars to intervene with mobile agents as a context-aware service for real-time supervision of multiple healthcare related entities. Until the previous few years, the majority of business activity was carried out by personal computers that were connected directly to a fixed wired network and lacked capabilities like as mobility, self-governing, flexibility, and many others.

The deployment of Mobile agents even in places with poor connection is considered to have a positive impact on incoming remote requests. A distant location patient can be examined using a variety of automated tools, reducing or eliminating the need for the patient to visit a health or medical clinic.

3. Decision Support Systems of MAs

The mobile agent paradigm has been widely used, with the Mobile Agent Remote Health care Tracking System (MARHTS) emphasizing on assistance in the treatment of moderate to severe clinical states. With the progression and sophistication of technology, more versatile and convenient variants of RPMS are now accessible.

Mobile Agent technique combines active remote management of network - connected linked medical equipment, a global conferencing facility, and analysis of health care information. Remote monitoring data is now available not just in a medical setting, but also at the patient's own workstation, thanks to the usage of contemporary patient monitoring systems. Asthma, anemia, diabetes, hypertension, congestive cardiac failure, chronic heart failure, migraine, and other chronic, recurring, and incurable disorders need extensive care and monitoring.

Mobile Agent Agility Surveillance Systems (MAASS) and other breakthroughs in portable embedded device and cognitive systems such as IR, Bluetooth, Wi-Fi, GPS, GPRS, UMTS, LTE, VoLTE, and other modern networks have transcended accessibility and accessibility barriers.

4. Conveniences of Remote Sensing and GIS

Diverse sensors operate independently or in conjunction with one another. They interact to retrieve and generate patient health information in this Mobile Agent Agility Patient Healthcare Surveillance Systems (MAAPHS). Later, a copy of the patient's information obtained is sent to a health care facility for further examination of illnesses and assessment of reports. The system integrates and implements raw data of training sets and protocols on symptoms detected using artificial intelligence in mobile agent nodes. This helps in making suitable suggestions for assessment of the patient's medical data. To begin with, this entire system can be used by patients who are able to stay at home. Any aberrant activity in the patient's health is communicated to the patient via an interactive gesture speech interface.

4.1 Decentralized Functionality & Control

Patients must first register to use this functionality with the central organizational programme, and then interact with the healthcare tool physically while receiving support from a remote doctor using the unique registration number or ID. Through a middleware programme placed on the patient's machine, all intelligent medical devices responsible for receiving, processing, and publishing mobile agents or expert systems would perceive data from various sensors [10]. This programme starts up every time to verify the information for the currently registered patient and the patient's entire information is retrieved from the management server device. A doctor, nurse, or other caregiver for the patient could go through information and validate the data in order to obtain the patient's real - time status.

This enables for an auto generated audio-matic and immediate log in, as well as backup generation at the controlling host, allowing for seamless accessibility to recorded data through mobile agent capabilities. Because mobile agent technology operates at the middleware layer, developers may engage in development of business logic for obtaining different

significant physical sensor readings with more accuracy and reliability.

4.2 Hierarchical Operational Independency

Furthermore, mobile agents can be deployed to provide ambulatory operations in real time when a patient requires immediate medical attention on the site of the incident [11]. The hierarchy of operations includes the gathering of medical records from a variety of medical and healthcare facilities virtually at one place.

Ambulance service is made accessible at strategic locations across the city so that people may call for aid if they are involved in an accident. There is a potential that the central server will have sporadic connections and limited bandwidth access when commuting the patient. Consider an emergency situation in which a middle-aged guy gets involved in an accident on his way to work. A responsible site-seer/eye-witness immediately phones for emergency ambulance service, providing information such as the location, kind of accident, car number on number plates, colour of vehicle, number of wounded individuals, any patient id, and so on. The para-medical staff may launch three mobile agents, namely an information agent, a history agent, and a nursing agent, while on their route to the accident site.

The information agent then proceeds to the different hospitals in the vicinity of the accident. This agent attempts to acquire information on the nearest hospital's emergency operating facilities and staff availability, as well as updating the quickest route as an internal variable sent to the history agent. The history agent, on the other hand, collects the patient's most recent medical history while also obtaining the route information for the nearby hospitals. The on-board screen within the ambulance is already flooded with the appropriate facts by the time the ambulatory service arrives at the accident site. The full list of neighbouring hospitals is displayed in sorted order from the most appropriate to the least acceptable, together with the patient's medical information and the nearest accessible route map, based on the available facilities and the distance factor from the unintentional location.

Eventually, the nurse agent transmits the messages by talking with the completed hospital so that a suitable action plan may be implemented by the time the ambulance arrives at the hospital. In this approach, mobile agents can assist in real-time decision-making by providing and making vital information available during an emergency to medical staff and relatives.

5. Conclusion

The Mobile Agent programme aids in remote healthcare monitoring in places with limited connectivity and inconsistent connections. Its capacity to reproduce itself autonomously for telecommunication and backup purposes encourages more researchers and businesses to utilise it. It has a promising future due to its capabilities of serving as a middleware without putting any additional stress on the primary server and taking decisions based on its own decision-making power. This also makes it easier for mobile agent developers to focus solely on business logic. With ever evolving market of public health, India's future in public health governance and general health would be critical for the development and integration of a complete and generated a great deal healthcare informatics domain. India must use its current "technology"-oriented progress (e.g., a few satellite-based telemedicine initiatives, healthcare-based mobile health units, computer - based patient data management, etc.) to build "information"-based public healthcare informatics systems in the future.

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