Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5366

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (6):** 1037-1041 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Intelligent Mobile Agent Based Context Aware E-Health Monitoring and Information Retrieval

Rahul Singh Chowhan[1*], Archna Karel[2] and Shilpa Kumari[3]

[1]SRF, Computer Science, AU, Jodhpur, Rajasthan

[2]SRF, Food & Nutrition, AU, Jodhpur, Rajasthan

[3]SRF, Horticulture, AU, Jodhpur, Rajasthan

*Corresponding Author E-mail: word2rahul@gmail.com,

Received: 2.08.2017 | Revised: 27.08.2017 | Accepted: 3.09.2017

ABSTRACT

The study aimed at e- health monitoring system with mobile phone and web service capabilities providing specific solutions on physiologic parameters, including respiration rate and heart rate, are measured by wearable sensors and recorded by a mobile phone presenting the graphical interface for the user to observe his/her health status more easily. It also provides doctors and family members with necessary data through a web interface and enables authorized personnel to monitor the patient's condition and to facilitate remote diagnosis and it supports real-time alarming and positioning services so that unexpected events can be handled in a timely manner during an urgent situation, such as a heart attack. India needs to leverage its "technology" oriented growth until now (e.g., few satellite-based telemedicine projects, etc.) simultaneously toward development of "information"-based public health informatics systems in future. Under the rapidly evolving scenario of global public health, the future of the public health governance and population health in India would depend upon building and integrating the comprehensive and responsive domain of public health informatics.

Key words: *Remote Health, Mobile Monitoring, Intelligent Agents, Context Aware System.*

INTRODUCTION

Medical Healthcare is the prominent need of humans, as everyone seeks for a healthy and quality lifestyle vital to maintaining health. E-health management is one way of supervising and helping patients manage and control the disease. The application will result in health care costs besides providing high-quality E-health solutions to chronically ill patients. The rising number of chronically ill patients and increasing work load in care bring along a growing need for structural change within the health care system. Additionally, healthcare is one of the most complex streams due to its intrinsic medical science and ever expanding research area. The domain of healthcare not only possesses largely distributed data but also has diverse and intense information. The processing of immense volume of data makes it more complex to model and handle with conventional computational methodologies.

Cite this article: Chowhan, R.S., Karel, A. and Kumari, S., Intelligent Mobile Agent Based Context Aware E-Health Monitoring and Information Retrieval, *Int. J. Pure App. Biosci.* **5(6):** 1037-1041 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5366

Technological development in medicine and health can, as well as improved treatment methods are the keys to the earlier detection & the adequate treatment of chronic disease. Information Technology offers various tools to people involved in the management of the healthcare and welfare, which will affect communication and integration of different levels of management, support to decision-making and increase of the autonomy of patients. Patients with chronic diseases constitute an increasing proportion of the population and a significant burden on the budgets of western world healthcare systems.

The mobile agent is an emerging and promising technological paradigm that adds up a new dimension to the area of distributed and parallel computing. It has been introduced in multifarious domains from network computing, health management tasks, server monitoring, intelligent bots to autonomous decision making, health information retrieval, data integration and much more. It supports substantially easier to construct, develop, and manage distributed systems than conventional ways such as Client-server mechanism. Mobile agents possess agent server on their home machines to provide an infrastructure for execution, migration, coordination, and communication between different agents on various computers. Recently, the mobile agent paradigm has been commercialized as viable software integration entity for the support of automated healthcare systems. Ahead of the traditional mechanism, mobile agents have become famous in healthcare domain because of their productive and proactive nature. The introduction of mobile agents in healthcare has evolved this dimension of emerging paradigms for re-structuring service and applications over the internet.

DIMENSION OF MOBILE AGENT IN HEALTH CARE DOMAIN

The mobile agent is a self-executing software program that is capable of traveling within a supervised heterogeneous network as a delegate of the original user on various clients/hosts beginning from the originating host accomplishing various tasks. The agent itself is responsible for making decisions "when to migrate, where to migrate, what to execute, how to execute, with whom to communicate and why to communicate". They are able to autonomously adapt, interact, cooperate, learn and react as per the change in the underlying environment in which they are deployed. Consequently, mobile agents are not confined to the computer where they are created, but they can roam freely among computers looking for desired resources. The mobile agent can defer its execution at any arbitrary point saving its current state, jumps to another machine and re-commences the execution there. The mobile agents have three main constituents: business logic, its state, and attributes. The business logic of an agent resembles the software program compiled in an appropriate programming language that defines the behavior, working and the ability of an agent. There exist two states of an agent: Data state and Execution state. In data state, it only involves thread and just restarts on every machine during its itinerary. While for execution state, it not only carries execution thread but also the program stack that contains information about internal data members, member functions etc., which enables it to resume execution after moving to another host maintaining its previous state. Agent attributes represent the information describing the state of internal variables, its origin and owner information, its movement history, resource requirements, authentication keys etc. which allows it to resume its execution on remote hosts.

Health care domain can imbibe various impressive characteristics of Heterogeneous Multiple Mobile Agent Systems (HMMAS). The features that healthcare applications possess can be developed not only with an interactive interface using mobile agents down the line but also for better management of back-end activities like coordinating, lazy loading and much more. Though existing technologies like telemedicine programs, webinars, live streaming has made life easy by allowing the

connectivity across the globe. They make use of an interactive video screen for communication with patients and care providers and consultants. With the help of artificial intelligence in combination with mobile agents, telemedicine and patient monitoring system can be transformed into a self-decision making, cost efficient, advanced and self-governing body. In addition to these, the dynamic nature i.e. location mobility, of both care providers and the patients have made technical scholars and researchers allowed intervening of mobile agents as a context-aware service for real time monitoring of various healthcare related entities. Until the last decade, the major commercial area has been covered by personal computers that were physically linked to a fixed wired network lacking the features like mobility, self-governing, adaptability and much more. An introduction of Mobile agents has likely affected the execution of incoming remote requests even at areas with weak connectivity. A remote patient can be monitored using several automated needful things with less or no need for its relocation to health care clinics.

WIRELESS TECHNOLOGIES IN MEDICAL ENVIRONMENT

There is a wide adoption of mobile agent paradigm which incorporated with Mobile Agent based Remote Patient Monitoring System (MARPMS) that focuses on helping in the conduct towards severe disease conditions. Advancement and refinement of technologies have made available more configured and facilitative forms of RPMS. Mobile Agent technology includes active remote monitoring of wireless or wired connected medical devices, distant conference mechanism, and evaluation of the data related to patient's health. With the use of modern patient monitoring systems health monitoring data is not only relinquished in a medical environment but also at patient's personal desk. Lingering, recurrent and incurable diseases such as asthma, anemia, diabetes, hypertension, congestive cardiac failure (CCF), acute decompensated heart failure (ADHF), migraine and other similar diseases involve immense care and supervision. The emergence of Mobile Agent based Monitoring Systems (MAMS) and other advances in wireless hardware level device and smart technologies such as Infrared, Bluetooth, Wireless Fidelity, GPS, GPRS, UMTS, LTE, VoLTE, and other wireless technologies have overcome the mobility limitations.

INTEGRATION AND WORKING OF MOBILE AGENT IN THE HEALTH CARE SYSTEM

In this Mobile Agent based Remote Patient Monitoring Systems (MARPMS) various sensors work individually or in collaboration with each other for the collection of patient's data. Then a copy of this collected information of a patient is dispatched to a health care center for further scrutinizing of symptoms and reports. The training sets and rules based on symptoms are introduced and implemented in mobile agents using artificial intelligence to the system so proper recommendations can be given after analyzing of patient's medical data. Firstly, this whole set up of the system can work for patients staying at home. An interactive voice channel starts communicating to the patient for any abnormal activity noticed in patient's health. To use this service patient needs to register to the software and based on the unique registration number or ID one can interact with the device locally getting assistance from the remote doctor. All smart medical devices capable of receiving, processing and transmitting mobile agents or intelligent agents will perceive data from various sensors via a middleware application installed on the patient's machine. This application runs every time on startup to check the data for the current registered patient and the complete information of the patient is obtained from the managing server device. A doctor or nurse or care taker of the patient can go through various details and confirms the data to get live status from the patient. This allows an audiomatic and automatic log in generating the backup at managing server for complete access to monitored data using

mobile agent technology. As the mobile agent technology works at the middleware layer allowing the developers to concentrate on business logic of getting various vital physical sensory data with more accuracy.

Secondly, mobile agents can be used to deploy ambulatory services in the real time when a patient needs the real time medical services live on the accident site. The hierarchy of operation involves aggregation of medical records that are widely distributed across numerous medical and healthcare centers. The ambulance service is made available at pin points in the city to reach out for help at the accidental site. There may be chances of intermittent connections and low bandwidth connectivity with the central server to commute the patient. Considering an emergency consequence, where a middle-aged man subjected to an accident while on his way to the office. Straightaway, a liable site-seer/eye-witness calls upon for emergency ambulance service giving the site details, type of accident, vehicle number on number plates, the color of the vehicle, number of injured persons, any id of the patient, etc. During its way to the accidental site, after receiving the site information the para-medical staff may launch three mobile agents i.e. information agent, history agent and nurse agent. The information agent moves on to the respective hospitals near to the accidental area. This agent tries to obtain the details of available emergency operating facilities and staff availability at the nearest hospital and updating the shortest route as an internal variable passed on the history agent. The history agent, on the other side, retrieves the updated medical history of patient side by side getting the route details of the nearest chosen hospitals. By the time the ambulatory service reaches the accidental site, their on-board screen inside the ambulance is already flushed with the relevant details. Based on the available facilities and the distance factor from the accidental site, the flushed list of nearby hospitals is shown in sorted order from the most appropriate to the least one along with the patient's medical details and the nearest available route map. Finally, the nurse agent delivers the messages by communicating with the finalized hospital so by the time ambulance reaches the hospital an appropriate action plan can be executed. This way the mobile agents can be supportive in real time decision making supplying and making the critical information available at the emergency time.

CONCLUSION

The application of Mobile Agent helps in remote monitoring of the patient in areas with low connectivity and intermittent connections. Its ability to replicate automatically for communication and backup purposes induces more research scholars and commercial industries to make use of them. It possesses bright future because of its functionalities of acting as a middleware without shedding any load on the main server and taking actions on its own decision power. This also helps mobile agent developers to concentrate on business logic only. Due to the rapidly evolving scenario of public health, the future of the public health governance and population health in India would depend upon building and integrating the comprehensive and responsive domain of public health informatics. India needs to leverage its "technology" oriented growth until now (e.g., few satellite-based telemedicine projects, healthcare based mobile health units, automated management of patient related data etc.) simultaneously toward development of "information"-based public health informatics systems in future.

REFERENCES

1. Chowhan, R.C. and Purohit, R., "Study of mobile agent server architectures for homogeneous and heterogeneous distributed systems." *International Journal of Computer Applications*, **156(4):** 32-37. (2016).
2. Chowhan, R.C., Mishra, A. and Mathur, A., "Aglet and kerrighed as a tool for load balancing and scheduling in distributed environment." In Recent Advances and Innovations in Engineering (ICRAIE),

International Conference on, pp. 1-6. (2016).

3. Bagga, Pallavi, and Rahul Hans. "Applications of mobile agents in healthcare domain: a literature survey*." International Journal of Grid Distribution Computing*, **8(5):** 55-72. (2015).
4. Chan, Victor, Pradeep Ray, and Nandan Parameswaran. "Mobile e-Health monitoring: an agent-based approach." *IET communications*, **2(2):** 223-230. (2008).
5. Su, Chuan-Jun, and Chia-Ying Wu. "JADE implemented mobile multi-agent based, distributed information platform for pervasive health care monitoring*." Applied Soft Computing* ,**11(1):** 315-325. (2011).
6. Van Halteren, A. T., Richard GA Bults, K. E. Wac, Dimitri Konstantas, I. A. Widya, N. T. Dokovski, G. T. Koprinkov, Valerie M. Jones, and Rainer Herzog. "Mobile patient monitoring: The mobihealth system." (2004).
7. Su, Chuan Jun. "Mobile multi-agent based, distributed information platform (MADIP) for wide-area e-health monitoring." *Computers in Industry*, **59(1):** 55-68. (2008).
8. Dinh, Hoang T., Chonho Lee, Dusit Niyato, and Ping Wang. "A survey of mobile cloud computing: architecture, applications, and approaches." *Wireless communications and mobile computing*, **13(18):** 1587-1611. (2013).
9. Jara, Antonio J., Miguel A. Zamora-Izquierdo, and Antonio F. Skarmeta. "Interconnection framework for mHealth and remote monitoring based on the internet of things." IEEE *Journal on Selected Areas in Communications*, **31(9):** 47-65. (2013).
10. Shiraz, Muhammad, Abdullah Gani, Rashid Hafeez Khokhar, and Rajkumar Buyya. "A review on distributed application processing frameworks in smart mobile devices for mobile cloud computing." *IEEE Communications Surveys & Tutorials*, **15(3):** 1294-1313. (2013).
11. Baig, Mirza Mansoor, Hamid Gholamhosseini, and Martin J. Connolly. "A comprehensive survey of wearable and wireless ECG monitoring systems for older adults." *Medical & biological engineering & computing*, **51(5):** 485-495. (2013).
12. Iwaya, Leonardo H., Marco AL Gomes, M. A. Simplício, T. C. M. B. Carvalho, Cristina K. Dominicini, Rony RM Sakuragui, Marina S. Rebelo, Marco Antonio Gutierrez, Mats Näslund, and P. Håkansson. "Mobile health in emerging countries: a survey of research initiatives in Brazil." International journal of medical informatics, **82(5):** 283-298. (2013).