A Novel Of Multi-Agent Based Architecture Design For Wireless Body-Area Network Monitoring System

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Abstract: in developing countries, governments face serious problems in offering quality health services at a reasonable cost due to the rapid redness of the population and chronic illness. Due to available health resources, it is currently insufficient; there are many drug-free deaths. That is why the most important issue is present. Our approach to solving this problem is based on the Multi-Agent System (MAS) architecture. Our Patient Monitoring-System (PMS) monitors patients captivating into account physiological with ecological parameters. During this method, PMS provides reliable and cheap health care for adults, chronic and injured people, both inside and out-of-doors. Our hypothesis is that effectively make use of health care will lead to a reduction in unnecessary hospital care, minimizing costs, treatment, and follow-up. The despite potential use of PMS, it does not happen to a vital part of patient care in a heterogeneous environment, mainly due to not have knowledge and infrastructure. In this paper describes the design along with the performance of PMS-MAS architecture, identifies constraints and provides a prediction for the expectations.

Index Terms: Multiagent System Design, Telemedicine, e-health, remote diagnosis and monitoring, wireless body-area network.

1. INTRODUCTION

The worldwide spread of patients with chronic disease is growing steadily and is the leading cause of death in the world. Because of chronic illness, there are more than 60% of the world's deaths, 80% of which are in the Third World. The problem is further aggravated by the lack of qualified medical staff. Population's population exceeds the number of existing health facilities, reducing access to healthcare[1]. This confusion aggravates the health sector to find effective ways to improve patient care[2].Currently, ICT developments allow remote monitoring for patients who can routinely perform daily activities. On the other hand, we can offer efficient, reliable and inexpensive quality services. Traditionally, remote patient monitoring (PMS) uses fixed telephone lines to provide home health care to patients[3]. Now technological revolution, high-speed internet infrastructure, and sensor networks make better and more accessible patient surveillance for people in remote areas while retaining their freedom of mobility.The PMS typically consists of the given vital signs, the necessary environmental factors, and the transmission of this data to a central server[4].

The Appropriate monitoring tools for performing this type of task are not widely available, although the customized solution adapts to the working environment. Most PMS systems are not agency-based architecture, although their own strengths and limitations in health care do not provide basic features under a single umbrella[5]: security and privacy, CDSS, scalability, flexibility, mechanism, patient visits, system awareness and problem solving, disease awareness, clinical guidelines, preventive measures, diet planning and suggestions[6][7].The introduction of Multi-Agents (MAS) technology in health care is much more interactive, intelligent, organized, distributed and collaborative remote patient treatment. A MAS not only helps to share knowledge and knowledge between patients and caregivers, but also provides quick responses through distributed computing[8].This article presents a Remote Sensing Patient Monitoring System (RPMS) based on MAS technology, which is characterized by the cheap and effective management of available health resources. The II. Part provides overview of existing research in this area and some important features that are included in good RPMS. Section III. Part details our approach, the designed and implemented the architecture. The IV. Section discusses the implementation and hypertension, which confirms the proposed approach. Conclusion and future work can be found in Chapter V.

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2 LITERATURE REVIEW

Albahri et al[9]. The study provides the healthcare services in telemedicine applications, particularly in the health center's server. It also highlights the open issues and challenges that relate to the provision of health services to the server of telemedicine medical centers. The first section presents the DM decision process based on the multiple health crossovers and the second section covers the selection of DM hospital based on the integrated VIKOR-analytical hierarchy process (AHP). Finally, the final phase examines the process of validating the proposed framework.A. L. Barriuso et al[10].This work introduces multiple agency architectures based on a virtual organization that enables the deployment of a new embedded agent model through computerized, limited autonomous sensors using the Intelligent Brokerage Organization (PANGEA) automation platform. Various tests have been carried out to validate the proposed platform for parameters specific to each animal such as physical activity, temperature, the status of the Estonian cycle, and animal activity. In addition, many applications have been developed to allow farmers far to watch animals.Patil et al[11].The study provides a multi-agent health monitoring system where the wireless sensor module is combined with data mining techniques. Its system architecture is divided into three parts: the Body Area Network, the Intelligent Medical Server, and the hospital system. Data sets are classified into real-time sensor data and historical data that doctors can later diagnose. The system classifies normal and urgent data based on the changes in each set value.H. Nazeran et al[12].The prototype working on personal digital assistants (PDAs) will be

presented. This prototype is based on patient monitoring systems, real-time tones, images and vital signs, and transmits this information to a server in the central hospital. This prototype is devoted to a person who provides diagnostic, intraoperative care and therapeutic treatment in consultation with other caregivers in remote locations. Its scalable, modular and flexible architecture allows system development of new technologies.P. Zhang et al[13].Real-time hospital systems have been developed to automate the traditional patient monitoring of the ICU / CCU. Using the 3G Java Web Portal and mobile phone application, critical illnesses are identified and correspondence is implemented in real-time for paramedical and patient care physicians.B. Qureshi et al[14].Given RPM, which is a special treatment health-based expert system, which provides a knowledge base for analyzing vital signs from the patient remotely? PDAs acquire vital Bluetooth signals wireless sensors installed in the patient's body.M. Meingast et al[15].This study analyzes the existing methods of improving procedures at present and further considerations to address the increased EPR and network security sensors in RPM to preserve medical ethics and social expectations.V. Chan et al[16].Describes a common MAS framework that enhances awareness and shared knowledge between patients and caregivers. Special disease-based guidelines and an emergency alert mechanism have been developed.M. Pinsker et al[17].The remote treatment system for diabetics can be found on the following page. Using the Java-based mobile phone application, they acquire vital signs, medicines, and physical activity and then move to the health center. Users can view data, custom feedback, reminders, and important events, including.S. Khan et al[18].The RPM system of remote villages [12] describes basic care services. The system automates the traditional forms of time-consuming and predisposing prenatal care that a badly qualified healthcare worker has so far provided. Gathering the physiological data of the patients, this system allows the patient to remotely monitor the patient and to help with the clinical decision.J. Fursse et al[19].Longer utilization of traditional RPMs is given in [13]. This approach introduces a custom automated algorithm for identifying health emergencies and a warning mechanism. The algorithm is based on the predefined personal threshold of vital signs and medical history. This algorithm identifies the health risks and decides that the patient needs rapid health care.J. Y. Khan et al [20].OPNET is the Wireless Body Area Network (WBAN) based IEEE802.15.4 / Zigbee MAC Performance Evaluation. Evaluation of patient monitoring is carried out in different operating environments. The OPNET-based simulation model is used.R. J. Rosati et al[21].To assess the effectiveness of RPM, the study is conducted by the US Homicide Agency. The main hypothesis of this study is that visiting nurses can be reduced to City Health Service by using RPMS. In addition, healthcare management is also improved.D. Foster et al[22].Today, Multi-agent systems are one of the most exciting fields of artificial intelligence. In recent years there has been an increasing interest in the healthcare system based on the MAS approach, including RPM, diagnosis of diseases, prescribing of medicines, guidelines for expert surgeries and so on. These applications can work in heterogeneous environments to speed up clinical decision making, automated learning systems, and assist caregivers in treating patients during diagnosis and treatment. The Global Positioning System (GPS) provides important and wider spectrum support for healthcare. Sites and time services are served in RPM, post-disaster recovery and emergency services to reach a new level of personal security. RPMS registers patients, regularly coordinate GPS and use genotyped mapping to monitor active sites to help carers and patients in an emergency. Although observed far away and due to the state of health, the patient may need a regular or urgent medical examination by the healer. Thus, based on the patient's health analysis, the system must be intelligent to help carers and patients automatically design their appointment on request to remind and reinforce all concerned.G. Czibula et al[23].As a PIA, a well-designed and implemented CDSS available to caregivers and patients should be part of the RPMS. In order to make clinical decisions, the well-system provides automated clinical guidelines based on the current analysis of the patient's vital symptoms and environmental factors. The PIA inherited a database compatible with medical data centers (MDC), which could be life-saving in unexpected situations when there is no remote health care.

3 MULTI-AGENT BASED WIRELESS BODY-AREA NETWORK

The Demographic growth is constantly minimizing medical resources. As a result, higher mortality rates in the backward countries, family moreover the elderly are visible. Towards resolve these problems, our expert system is based on the RPMS technology MAS works in real time, whose main features are the analysis of remotely acquired continuous or intermittent life signs in the patient, in a discreet way, provided health services.In architecture, the proposed system is shown in Figure-1; the main components that work together in the MAS environment for providing medical services, hospitals, and now the elderly home are in their environment:

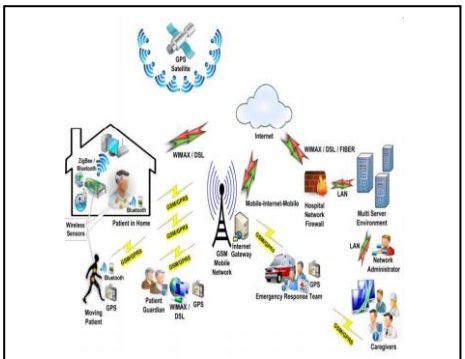

Fig. 1. *System Architecture of RPMS*

1. Patient Terminal: patient terminal can be used for providing patient care. This is a portable non-intrusive sensor communicating with each other over the network, based on ZigBee or Bluetooth wireless technology, one that best meets the requirements. These sensors gain patient-specific hypertension, blood sugar, body temperature, humidity, and temperature, continuously or intermittently depending on the current state of health and the history of the patient[24]. The patient has the right to control the activities of everyday life in the internal or external home operation, ensuring their free movement. Based on two interactive graphical user-interfaces (GUI), the intended application for the patient is one that works on a home computer under the supervision of a web-based technology and other built-in operating patients outside of the

CPC. Both applications are responsible for sending and receiving patient data from MDC. Patient Diagnosis Temporarily Locally Locates a Patient Terminal on Potential Health Dangers Immediate Patient Consultant Who inherits the rule of diagnosis of MDC.The Patient Advisor Immediate Analysis of Locally Acquired Vital All Sensors. If any of the critical symptoms are diagnosed, the patient's application raises the appropriate alert for the current location of the patient, the time and the state of health and sends all concerned persons including staff to the hospital, patient's family and Response Team (ERT). ERT works as a lifesaver and is responsible for detecting and first aiding the patient's minimum response time. If your health status is normal or critical, your patient record will always forward MDC for further analysis, health management, and storage for the purpose of a secure communication channel to prevent potential threats to network security. In patients at home, World-wide Interoperability for Microwave-Access (WiMAX) or Digital Subscriber-Line (DSL) is used for data transmission. On the contrary, the Global Mobile Communications System (GSM) and the General-Packet Radio Service (GPRS) mobile communication network are used outside of PDA patientsThe Patient application is designed to facilitate patients' clinical guidelines, reasoning, meetings with teachers, attention to system and troubleshooting attention to the disease, warnings, suggestions, health information, diet control, secrecy and safety of the EPR. With GPS, the system can easily find the patient in an emergency to help her get back to being interested. This will allow the patient to discover the nearby health centre for immediate care in an emergency. For some reason, if any application for the patient lost contact with the health centre, another application can be used as an alternative to the appropriate alerts questions. The convenient may be a chance if the health centre is not available because of unforeseen reasons the patient's immediate counselor will provide the patient. This common experience increases the interest of the patient and the trust in the system.

2. Medical Information Centre: MDC stores EPR and facilitates analytical work and health management in real time, intelligent agents. MDC includes a knowledge base for the conclusion and reasoning module that works together with a knowledge base in the field of pharmacy, diseases and EPR system to help Doctors in patient-specific instructions.

3. Caregiver Terminal: The terminal's concern consists of two applications, an Internet portal and other PDA-specific. These applications to permit approved users to provide medical services within or outside the health centre. An Interactive Graphic With these applications enabled service, medical staff and ERT to effectively manage the health protection of patients, including medical reports, patient profiling analysis based on patient health based on current and historical records, decision making, diagnosis and the prescription medicines for patients are meeting physical and laboratory tests, medical history, treatment, meditation, warnings, suggestions, diet, active and reminders, re-management SORS, and knowledge sharing with remote doctors.

4.Instantaneous Advisor: Instant Advisor for CDS that intelligently integrates the medical knowledge base EPR to facilitate the timely maintenance of the patient's concrete recommendations for improving decision-making process, searching for information, risk analysis, therapy management, preventing and managing the following events, generations, and reminders to improve patient care. Supposition Engine (SE) uses a series of computer algorithms used to treat the EPR, Clinical Knowledge Base (KB) to be a clinical symptom. As shown in the illustration-2, i.e. this controls the processes in the decision-making process. Efficiency at the moment counsellor is based on base CB and submission system. Speech module is responsible for clarification request, offering clinical solutions to the rule base system methodology

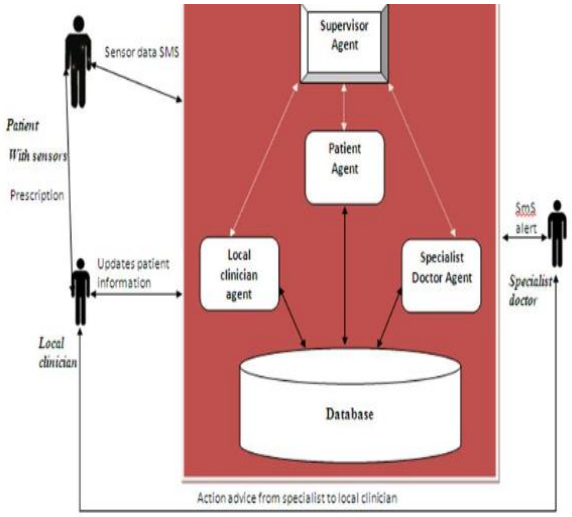

***Fig. 2**. The architecture of Instant Advisor*

To implement our proposed application, we have to Use Java Framework with Agent Development (JADE[25]) to complete the proposed system. This is in line with the basic intelligent physical-agent (FIPA[26]) specification and allows the system to be distributed.

Platform is a tool for multiple users:

1. Hospital staff: all drugs that are related to the availability of patient care in the healthcare system. This community should be able to know and confirm an abstract representation of a theoretical model of the hospital as well as manipulate it and the results of the system. The main components of this category are:
2. Medical staff: physician, surgeon, radiologist, anesthetist, etc.
3. Kindergarten staff; Devices such as laboratory personnel; Reception and gas staff;
4. Medical support staff: security, library, procurement, cleaning, etc.
5. Research team, researchers and engineers.
6. Patients are the main users of the healthcare system and supply system kernel.
7. Application Administrator.

EPR is a collection of patient-stored data in a database of MDC data. The patient record may include demographic data (eg birth date, no), vital signs, symptoms, allergy, medication, history, laboratory test results, etc. A database showing inputs from the GSM wireless Sensor and diagnostic, prescription Action responses from the Specialist Agent as shown in the figure-3.

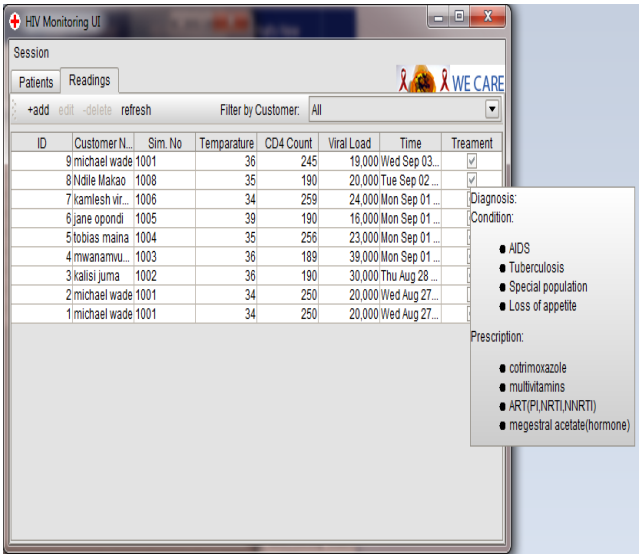

Fig. 3. *Diagnosis and prescription*

Acquiring and Patient-Specific Data Sensors, and a Communication Tool and MY Caring Terminal are Medical Centre. This keeps the system components in a secure loop. It is based on the wireless sensor network (ZigBee / Bluetooth)[24], GSM / GPRS, WiMAX, DSL, fiber. An interaction diagram describing the interactions between agents as shown in the figure-4:

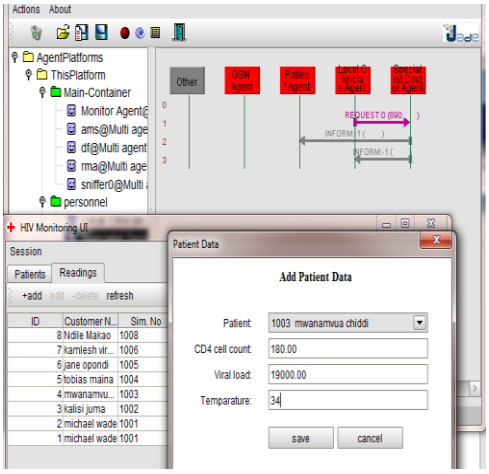

Fig. 4. *Agent interaction*

The patient can consult in real-time for sending and receiving notifications from doctors. Source allocation: doctors and patients can source resources from the distance (IRM, scanner...). Connect to a cloud computing container (for example, patient charts):Applying the system will allow the medical staff to save and load distributed medical data. Supports DICOM Medical Pictures command. Registration of patients: the ability to cancel the registration and select the medical centre and the appropriate service (paediatric, radiology).

4.1 Role of Agents and Responsibility

8. The proposed system is based on RPM secret agents. Medical agent at the top of the hierarchy communicates with the outside world as drug based systems in other health centres.
9. An agent is a system controller for the main control RPMS body that interacts with other materials in order to provide reliable audit services. The role of each agent is described below, the employment of his commands responsible for pathogens functions. Each team must have the coordinator agent as an internal communication, a signalling agent, an alarming device that reflects any strange situations as a result of its activity, and an agent records the status of each task.
10. The agent interface is the provision and maintenance of the GUI human interaction tool throughout the performance of the system.
11. The Patient agent on behalf of the patient, coordinating with other agents to perform concrete actions of the patient.
12. Caregiver carries out all the activities of the carer.
13. Security Monitor Agent provides network management and security information to provide trusted tools for privacy, security and medical confidentiality. These services are: authentication, authorization, and identification qualified potential users of the coordination as glowing as providing data encryption, encryption, and consistency. Such material is also responsible for neutralizing the most common network threats security such as interruptions, injections, interfering.
14. Network agent network monitoring and network services provide patient accurate location, vital signs and humidity, and temperature. EPR transmitted MDC as well as clinical guidelines for patient-related emergency alerting the patient terminal.
15. The patient profile of the medication monitors the full information about the patient, the EPR, which carries the entire workflow of the system in the health processes.
16. Patient Monitor Agent is working on real-time or on-demand, it is responsible for acquiring and monitoring patient's specific signs (blood pressure, blood sugar, body temperature) and environmental factors (temperature, humidity).
17. Immediate Consultant Agent provides medical guidelines, suggestions and clinical decision support at any time, combined with other agents. The use of diagnostic tools is capable of real-time analysis of EPR patient control. Their work on engine terminals as a knowledge base agent and EPR is the diagnosis of critical symptoms.
18. Appointment Scheduler Agent provides services to install on a regular, urgent or destination request teacher. These tasks can be referred to automatically or manually, depending on the patient's health.
19. Power Management agent monitors status monitors the battery running system. A Web server is responsible for supplying relevant information to the patient through the Internet and through the intranet of computers and PDAs to eligible users.
20. Data centre agents are responsible for counteracting MDC storage and updating EPR, the system knowledge base, disease, and drug.
21. Arguing a substance that is arguing for all the accomplished tasks

22. Monitor alert agent generates an agent working with each team, the system, and alarm agents. Monitoring Agent can report on request status of all tasks. Log Agent logs all the tasks in the system. The controller agent is accountable for communication within an agent. This also makes it easier for various caregiver agents to cooperate and share information at the same time.

5 CONCLUSION AND FUTURE WORK

The RPMS expert system based on MAS technology has been designed and built to work with chronic illnesses. The support system for providing health services is addressed to remote villages of the population, diagnosis, treatment in any geographic location, without geographical constraints of the elderly, chronic and acute sick people in their own internal and external home environment activities during their daily life. This approach ultimately reduces the burden on doctors, unnecessary hospital care, improves treatment, and reduces control costs. Thus, it increases access to care for those who really need this kind of examination urgently. In addition, the proposed approach is able to improve the quality of life of the patient, allowing continuous or periodic control of free movement. Our system works as a helping hand for teachers and other staff to get better the excellence of services for patient care, accelerate clinical decision making and reliable diagnosis. A more complete test environment is set to evaluate the functionality, features, and functions of the expert system based on RPMS-MAS technological activities that we are continuously working.

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