

Mobile Agent Based Patient monitoring System

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Abstract – Patient Monitoring Systems with smart computational capabilities and modern communication interfacings are in demand. The patients in Intensive Care units need 24/7 observation as well as doctor's diagnostic analysis to better treatment. Recently mobile agents are widely under utilization for distributing data among autonomous mobile clients. In this paper a Distributed System communication based mobile agent system approach proposed to assist doctors in tracking the diagnostic details of patient round the clock anytime. The system architecture supports autonomous interfacing with mobile computing devices and medical electronic diagnostic systems.

Key Words: mobile agent, distributed computing, client-server

1. INTRODUCTION

Distributed Systems are widely accepted flexible and secured architecture for autonomous systems communication. A mobile agent is an autonomous entity, even if user disconnects from communication network agent stay in working mode [1]. Due to stable network connectivity client-server computing is low performance on wide communication bandwidths [2]. There are wide varieties of programming languages avail in market to support Mobile Agent programming [3]. Agents are programmed to provide services like web-service activities, Interoperability, message passing, server passing, server side programs, system migrations and management group services [4]. The mobile agents visit network periodically or on demand and performs data processing autonomously migrating from node to node [5][6]. In this paper a model for patient monitoring system implemented using mobile agents. The system model supports autonomous communication among distributed systems geographically dispersed. In Section 2 Mobile Agent Technology described. Section 3 projects the proposed Patient Monitoring System. In Section 4 activities of proposed system depicted followed by conclusion and future scope.

2. Mobile Agent Technology

The Mobile Agent Technology in modern era supported by programming languages and Tools. Several third party tools are available in market. These can be easily interfaced with modern application framework. The most accepted programming languages for Mobile Agent services are C, C++ and Java. The Agent Oriented Programming (AOP) introduced flexibility methods and APIs for mobile agent invocation and communication establishment. Mobile Agents are classified into Collaborative, Interface, Mobile,

Informative, Hybrid, Intelligent and Reactive. The frameworks supported by recent AOPs include CORBA and RPC [6] which are highly robust in distributed communication environments. Mobile Agents providing efficiency band-width utilization, persistence, Peer-to-Peer and Fault tolerance features with compromised organization liabilities.

3. Patient Monitoring System

The patient monitoring system model shown in fig.1 is a real-time distributed system based which employs independent Mobile-Agents to handle autonomous doctor clients (WAN-Doctors) during communication with the Hospital Secured Server (HSS). Two Mobile-Agents are utilized one at client side other at server side.

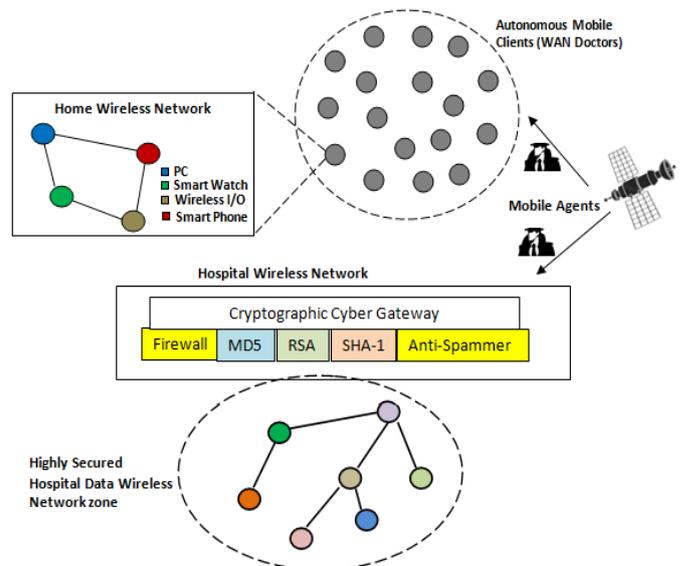


Fig -1: MA based Patient Monitor system Architecture

3.1 Hospital Secured Server (HSS)

HSS is a secured network with 'Cryptographic Cyber Gateway (CCG)' which enables a high investigative oriented data exchange over mobile public networks. The CCG consists of following modules

Firewall

Supported with a powerful firewall to investigate traffic and filter the content through the server to outside vice versa.

MD5

A Message Authentication service for Doctors WAN MAC-addresses.

RSA

The public key based data transmission encryption. Mobile agents distribute public keys. Network users use this public key and private key for message distribution.

SHA-1

A 128-bit highly confidential security for message distribution (Patient record) encrypted with SHA-1 algorithm.

Anti Spammer

The autonomous mobile clients receive patient medical diagnosis details from HSS through e-mails on fly. The communication service is bi-directional supported by mobile agents. The gateway at HSS strongly protected with anti-spammer module.

High secured Hospital Wireless Network

A collection of modern medical diagnosis equipment with wireless communication enabled available through Mobile Agent services to mobile doctor clients. Individual patient systems are linked to authenticated doctor (client) systems via Mobile Agent services. Mobile Agents carries various digital information secured distribution services on behalf of client (Doctor)-server (HSS) system.

3.2 Home Wireless Network (HWN)

The network established among digital smart systems in Doctor’s home. These smart systems are ranged from smart-watch to Laptop devices. HWN is connected with HSS via mobile agents. The necessity of Emergency Patient Case Report (EPCR) service is a special service provided by Mobile-Agent to HWS. The doctor’s home is a place where various smart devices available and attached to HSS via mobile agent service. The emergency calls activate smart devices like watches, smart phones, smart-TVs and Phones whichever are active at that time to alert doctors of specific patient.

4. Working of Patient Monitoring System

Table -1: Patient Monitoring System Activities

Patient Monitoring System Activities by MAs	
Activity/Service	Description
Automated Monitoring	Mobile Agents collect information from HSS automatically and submit data to mobile clients at redefined intervals of time.
Feedback Monitoring	Mobile Agents are requested by mobile(doctor) clients to collect specific patient’s diagnostic reports based data/query from HSS

Emergency Monitoring	HSS generates data to specific roaming doctors using mobile agents under emergency situations where patient condition reaches to critical situations
Triggered Monitoring	Either HSS or HWN networks may organize triggers (timed events) automatically using calendar based events. These actions are like scheduled diagnostic based treatment services offered by Mobile Agents through HSS.

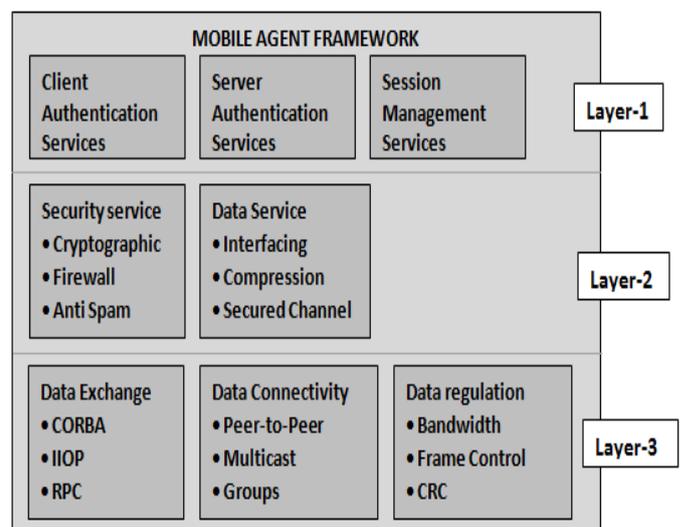


Fig -2: Mobile Agent Framework for Patient Monitoring System

The system activities are interfaced with Mobile Agents who carry services to remotely logged users (Doctors). The HSS supports five varieties of patient monitoring activities. Among them “Feedback Monitoring” and “Triggered Monitoring” are initiated by client side. The “Automated” and “Emergency” are initiated by Server. The behaviour of process activities within each system activity are listed in Table-1 as shown above. From Figure-2 Mobile Agent Framework tailored with layer wise organization of services. The layers and services are as follows

LAYER-1:

Client Authentication services (Validation and Verification), Server Authentication, Session Management (Log register, Tracking, activity logger)

LAYER-2:

High security and confidentiality achieved for both Client(Doctor) and Server(HSS) data among open network services achieved using wide range of services as shown above.

LAYER-3:

This layer support Data Exchange, Data Integrity, Data Consistency and Data Validity using various powerful schemes. Also offers seamless data connectivity schemes for distributed mobile host's communication.

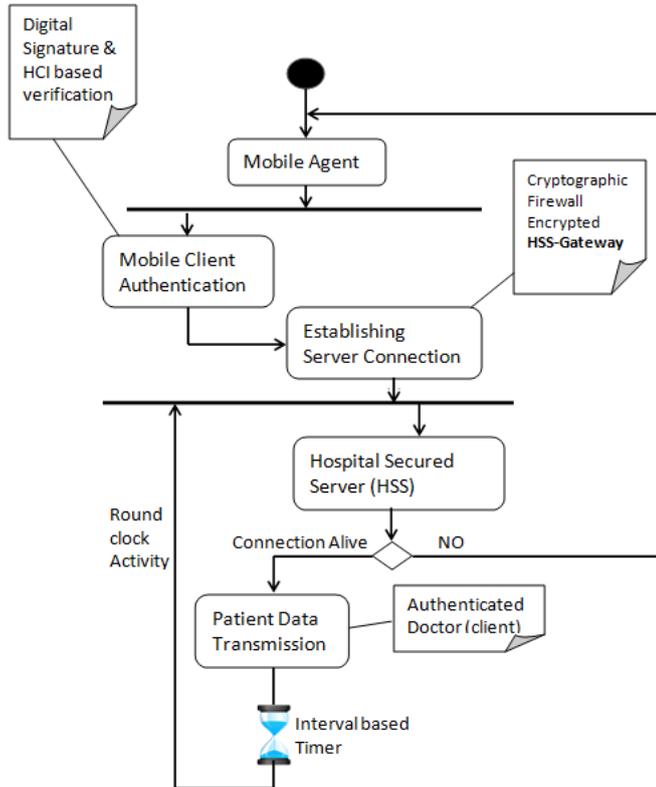


Fig -3: Automated Monitoring Activity chart

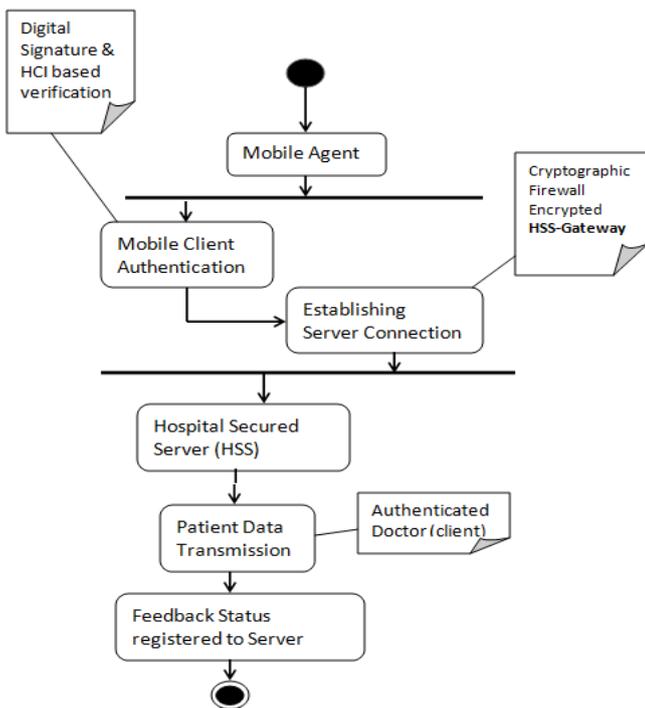


Fig -4: Feedback Monitoring Activity chart

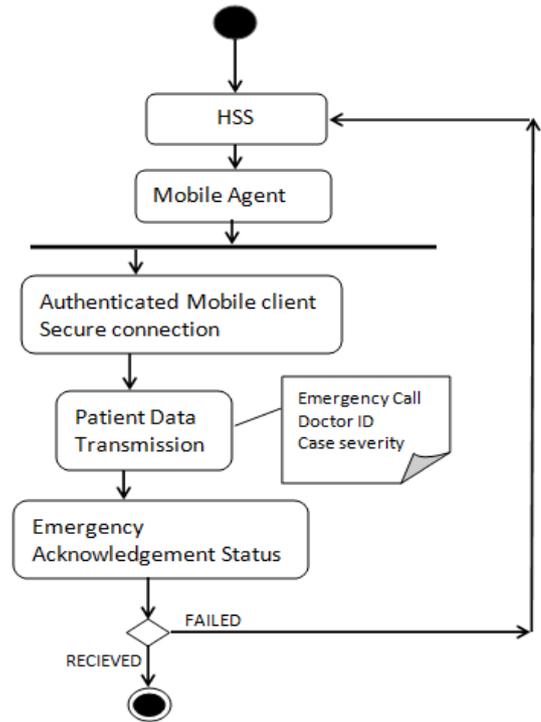


Fig -5: Emergency Monitoring Activity chart

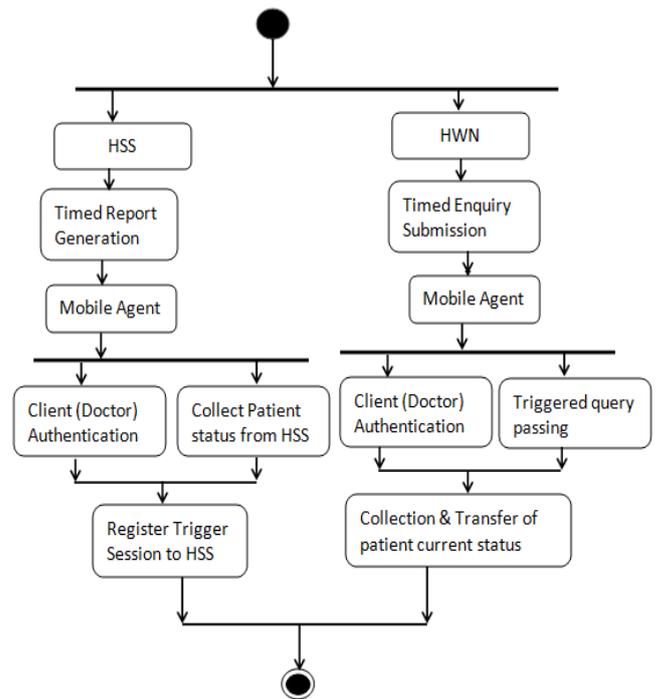


Fig -6: Triggered Patient Monitoring Activity chart

From figures 3-6 overall activities of Mobile-Agent based Patient Monitoring System explored. The system supports general patient monitoring as well as emergency monitoring and alerting. Mobile Agent collaboration with HSS to support mobile clients and HWN with high secured novel architecture resists vulnerabilities and threats from open networks.

5. CONCLUSIONS

The architecture system presented in this paper supports modernized patient monitoring system. The support of mobile agents based service support establishes a communication network among mobile devices with Hospital network. We adopted cryptographic cyber security module for secured digital information transfer among open networks. The Mobile Agent Framework discussed in this paper is with custom supported services organized into layers of hierarchy.

REFERENCES

- [1] V.Rajguru, Dr. Sushant and B.Deshmukh "ANALYSIS OF MOBILE AGENT", JGRCS, Volume 2, No. 11, November 2011
- [2] Khalid Khan far, " A MOBILE AGENT BASED FEEDBACK ANALYSIS ON SOCIAL NETWORK DATA", IJCSMC, Vol. 4, Issue. 7, pg.122 - 127, July 2015.
- [3] Abdelkader Outtagarts et. al."Mobile Agent-based Applications: a Survey", IJCSNS, Vol.9 No.11, November 2009.
- [4] Mats Persson et. al."Mobile Agent Architectures", ISSN 1104-9154, January 2001.
- [5] Rahul Singh Chowhan et. al."Mobile Agent Programming Paradigm and its Application Scenarios", International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706, Volume 7, Number-2018.
- [6] Min CHEN, Jihong GUAN, Xiaobin HUANG,"RESEARCH ON DISTRIBUTED GIS BASED ON MOBILE AGENT", Chen, Min International Archives of Photogrammetry and Remote Sensing. Vol. XXXIII, Part B6. Amsterdam 2000.

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