Enhanced PHD Manager for Mobile Agent

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Abstract---Enhanced PHD manager is being carried out to propose a solution which involves developing a manger which is capable of handling and communicating with multiple agents of different configuration. The Manager provides a common data analyzer which will parse the aggregated medical data coming from a particular Agent and will help in diagnosis of the health status of the patient in the Ambulance. It fetches the data from the XML file using efficient XML file parser. Moreover, it will decode the extracted data and display it into the GUI for easy readability to the medical representative at the hospital. The Manager also involves design and implementation of a diagnostic framework which includes generating alarm on detection of the critical medical data. This entire Manager system works on the basis of event generation and response of the event. Thus, it will help in providing proper medical treatment to the patient at the ambulance through proper and timely diagnosis. This paper describes working of Manager.

Keywords: Agent, Manager, Common Diagnosis framework, Notification Manager

I. INTRODUCTION

It provides the best and fast treatment to patients as taking care of their health issues is at the center of the attention for every hospital. Ambulance service is used to provide pre care/basic treatment to patients in ambulance before reaching to the hospital.

But the problem is that, there is no system in hospital, which provides health condition of patients whenever patient is in ambulance. Proper information in advance is not available in hospital so staff of hospital is not ready with the appropriate treatment and hence this results in delay of treatment. For medical treatment time is very critical factor, so delay in starting medical treatments may result into patient's death. At hospital there is no system like notification manager, which continuously relay the patient's health information and handle a patient's critical health status. And hospital staff is also not capable for sending advance treatment suggestion for patient who is in the ambulance.

As a solution or to overcome this problem, the Manager is developed or designed, which provides information about patient's health condition before person reaches at the hospital. A Manager has inbuilt common diagnosis framework for m-health domain which will provide an advance service for the hospital. The common diagnosis framework is built by providing common data structure analyzer. So in future if data will be received from merging of more than one devices, it can also be handled by this framework. A Manager also has inbuilt Notification Manager to generate alarm on receiving critical data during diagnosis. The Manager is used to remotely monitor the Agents by collecting data from different Agents at the same time.

A. *Overall Introduction of System:*

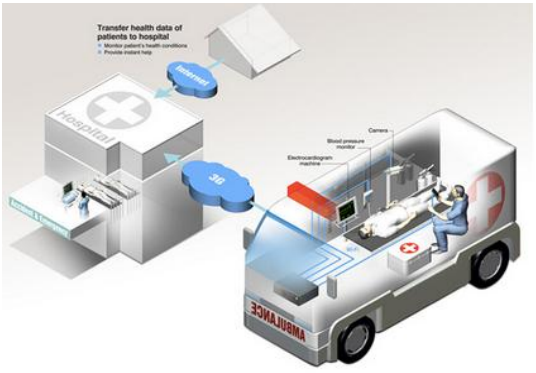

Fig. 1: Overall Introduction of System[4]

As show in above Figure1, Ambulance will act as an Agent and hospital will act as Manager. The terms "Agent" and "Manager" are defined by IEEE-11073 standard. "Manager" is used for collecting personal health data, managing and processing medical data collected from "Agents". It will remotely monitor the Agents respectively.

A diagnosis framework is implemented in Manager, which will not only display data on GUI but also diagnose that data before displaying.

II. MANAGER

Manager will act as a common server for all Agents at hospital side. The work of Manager is to receive data package from individual Agent and diagnose that received data, display that diagnosed data on GUI in convenient form to inform the hospital staff about patient who is in the Ambulance.

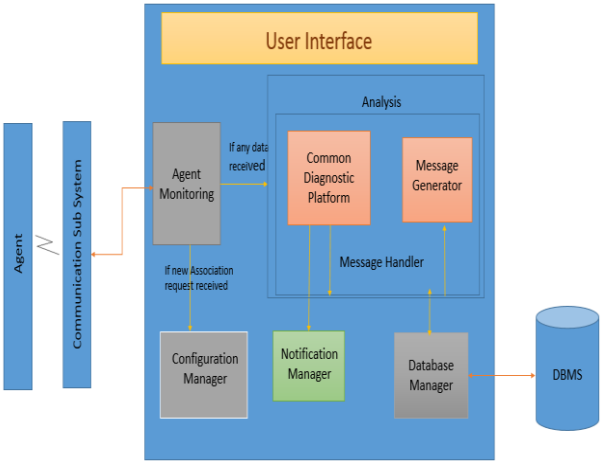

Fig. 2: Manager

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After diagnosis of revived patient health data, if any advance treatment suggestion will be needed for avoiding worsen condition of patient health then it will be send by Manager to particular Agent in proper package format.

A. Role of the Manager:

- Agent Monitoring
- Configuration Manager
- Analysis of received data
- Notification Management

B. Agent Monitoring:

Agent Monitoring: Work of Agent monitoring is to remotely monitor the Agents. There are more than one Agent clients which are connected through network to one Manager Server. So Manager has to monitor all Agents individually. First incoming package is received by Agent Monitor and it has to define which type of packages are coming like data package or request package that will be monitored by it. So Agent monitoring part of Manager is directly connected with Agent through network and it has to maintain point to point connection for individual Agents.

C. Configuration Manager:

Configuration Manager has to handle the initial states between Agent and Manager. If manager received first request package from unknown Agent then it will be handled by Configuration Monitor of Manger. It has to check the configuration of received package from Agent and has to maintain configuration table for individual Agent with respect to its own configuration detail. It will not directly receive package from Agent but through Agent Monitor of the Manager. The main work of Configuration monitor is to provide individual data channel to individual Agent with specific configuration.

D. Analysis of Received Data:

Analysis of received data is handled by Message Handler. Message handler will receive data package from Agent Monitor through/in particular data channel which is provided by Configuration Monitor. Message Handler gets medical data and perform diagnosis over it and it will display that data on GUI of hospital portal. Message handler also has to generate a message related to patient's treatment and send to Agent on allocated data channel.

E. Notification Management:

Work of Notification Monitor is to generate an alert message on GUI to inform/alert the hospital staff about the health criticality of patients.

Database will be used to store health data related to patient's health condition.

1) Workflow of Agent Monitoring:

Agent monitor will receive unknown new request package from unknown Agent and then it will be directly sent to the External Event Manager of the Event Handler.

External Event Manager is used to handle the request- response package before the actual connection is established between Agent and Manager. External Event Manager check the time stamp of the currently received package, if time stamp is new then it will accept that package otherwise discard that package. If package is accepted then forward it to the External Event Reporter. As show in Figure 2. Configuration Manager is directly connected to Agent Monitor through External Event Manager. So External event reporter forward that package to the Configuration Manager. If Configuration Manager has done its work successfully then External Event Reporter store all configuration and Agent details in database with particular Agent id which is generated by Manager and inform the Agent Monitor about newly established connection between Agent and Manager.

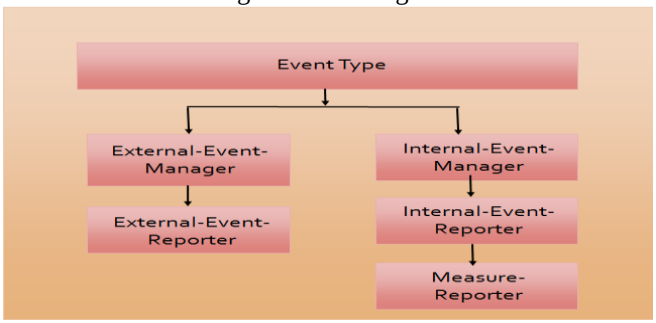

Fig. 3: Event Handler

If Agent Monitor receive data package from known Agent, then this type of package will be handled by Internal Event Manager. Work of Internal Event Manager is to check the time stamp of the currently received package, if time stamp is new then it will be accepted, otherwise that package will be discarded. If package is accepted then it is forwarded to Internal Event Reporter. Internal Event Reporter check the configuration details of the received package from the database which is stored by the External Event Reporter. If the Configuration details are correct then that package will be accepted and forwarded to the Measure Reporter. As show in Figure 2. Analysis of received data is directly connected to Agent Monitor through Measure Reporter. So Measure Reporter forward package to Message Handler of the Analysis of received data with particular Agent id.

2) Workflow of Configuration Manager:

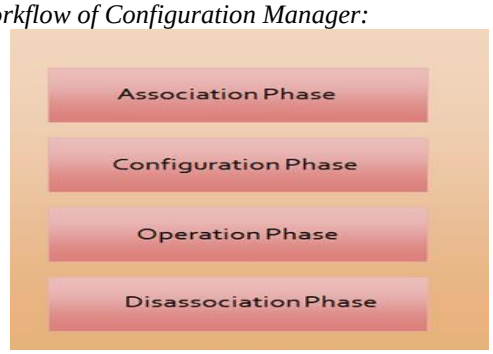

Fig. 4: Phase of Configuration Manager

Work of the Configuration manager is divided into four phases. The first two phases are handled by External Event Manager and third one is handled by Internal Event Manager.

As shown in figure 5. First both Agent and Manager are in unassociation phase, it means there is no connection between them. Now Agent want to send package, then Agent sends first "aarq" request package. So its Association phase forwards that aarq package to Manager unassociation phase. Now at Manager side unassociation phase is converted into associating phase and forward that

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aarq package to Manager. Manager checks the configuration details from aarq package.

If configuration details are not match then it will go into waiting configuration and send cfg request for getting configuration details to that Agent. After getting the configuration response that is GET rsp package, again Agent checks that new configuration details and if it is valid then directly goes into Operating phase, which provides one-to-one separate communication channel between Agent and Manager.

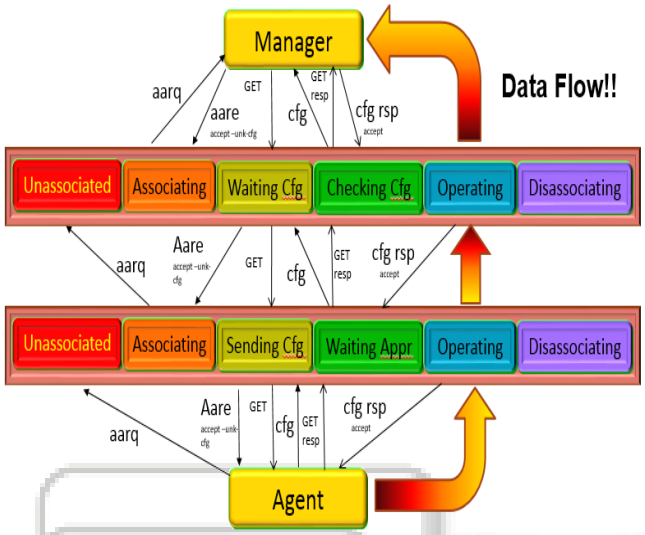

Fig. 5: . Data flow between Agent and Manager [6]

If in aarq package, Manager will get valid configuration detail then Manager does not go into Configuration phase, it will directly go into Operating phase, make connection and provide separate channel to that particular Agent. After successful completion, the communication or if any network error occurs between Agent and Manager then they will directly go into Unassociation phase from any phase.

3) Workflow of Analysis of Received Data:

The analysis part will be handled by Message handler. Message Handler has to handle it into two sub component, one is Analysis of received data by using common diagnosis platform and another is generate message and send it to Agent.

As shown in figure 6. It shows the separate layer of the diagnosis Framework. Analysis of received data is done in bottom to up approach. The patient's medical data will be received in XML file format with encoded medical values. So we have to first parse that data using XML DOM Parser. XML DOM Parser will be used because every time there will not be same data tags and received values from individual Agents. So we have to parse each and every tags and its corresponding values. After getting tag and values, we have to decode the values.

Now data separating module and data diagnosis module have to work together. Data Separating Module is used for separating each and every value with that individual data and during that, Diagnosis module is used to diagnose that data related to its value. For example in XML file, there is Blood pressure value and it contains 120/80 data which is normal range data. But if received data are not covered by this normal range then it will directly forward data to Notification Manager.

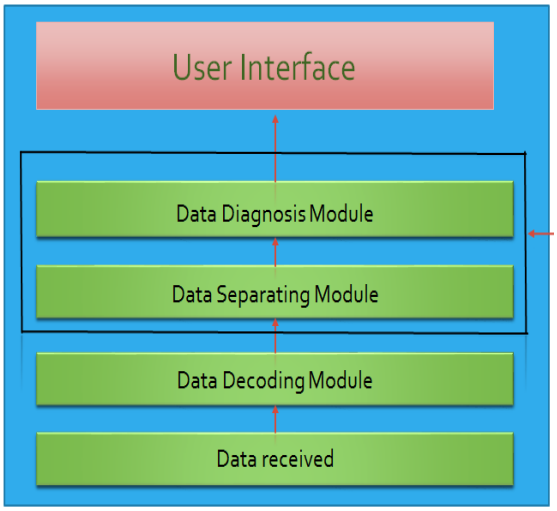

Fig. 6: Workflow of Common Diagnosis framework

Common Diagnosis platform is directly connected with Agent Monitoring to receive medical data package, with Notification Manager to generate notification according to diagnosis, and with data base to store, retrieve individual patient's related data and with GUI to display diagnosis data to hospital's (nontechnical) authorized person.

Message generate is used by hospital staff to generate treatment message according to the patient's condition criticality. If ambulance will take time to reach at hospital and patient's condition is going worsen at that time patient needs advance treatment suggested by some expert doctor. At that time treatment list is prepared by authorized hospital staff and sent it to the particular Agent.

Message Generate is directly connected with Agent Monitor to send testament data package to particular agent.

4) Workflow of Notification Manager:

Notification Manager Service is activated to provide attention on generating new normal event and specific priority on critical situation. This services will be activated on three different events.

- On received new Agent connection
- On received new updating medical data
- On received critical medical data

On received new Agent connection event will be generated by the Configuration Manager after successful completion of association and configuration phases. In this, alert will be reflected on GUI by highlighting new Agent.

On received medical data event will be generated by the Internal Event Reporter of Agent monitoring when it receive data package from already connected Agent. This alert is also reflected on GUI by highlighting Agent.

On received critical medical data event will be generated by Common Diagnosis Framework when it receive critical patient medical data. This alert is reflected on GUI by generated alert pop-up message.

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III. MEDICAL DATA PROCESS FRAMEWORK

Medical data process framework will give brief idea about actual process of data after getting data at Common Diagnosis Framework.

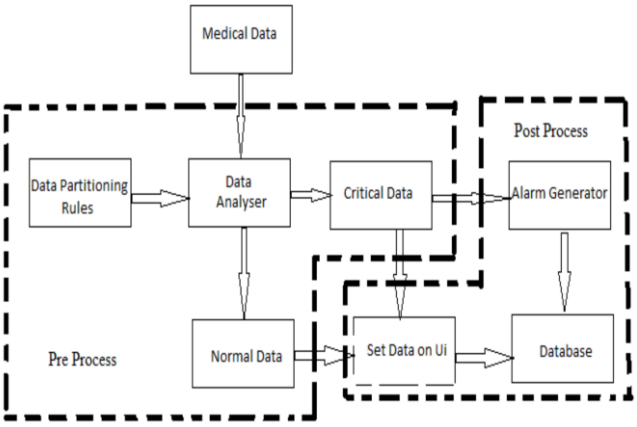

Fig. 7: Data Process Framework

After completing the data decoding module of Common Diagnosis Framework, medical data will be forwarded to Data Analyzer. As shown in Figure 7 Data Analyzer has to perform Pre Process work on data. In Pre Process work actual diagnosis of data will be done by using Data partitioning Rules. In data partitioning rules it will check that received data are in normal range or not. If it is in normal range then it generates Normal Data otherwise it will generate Critical Data. After completing the Pre Process the Post Process will be started. As shown in Figure 7 the incoming data of Post Process depends on pre Process. If Pre Process will generate normal data then Post Process has to just show that data on GUI at server side and store that data in database. But if Post Process will receive critical data then it will have to forward it to Notification Manager for generating alarm pop-up message on GUI and after that store it in database.

IV. IMPLEMENTATION OF PROPOSED SYSTEM

A. Agent-Manager Communication Algorithm:

1) Send_Button_Listener:

- Step 1: Begin
- Step 2: Read message from text field
- Step 3: Send the message
- Step 4: Clear text field
- Step 5: End

2) Hash_Table_Server_TCP:

- Step 1: Begin
- Step 2: Create Server Socket
- Step 3: Create Client Socket
- Step 4: Accept the client connection
- Step 5: Read the message received from client
- Step 6: IF message not null and message listener is not null THEN Create String Tokenizer WHILE String Tokenizer has element DO FOR index 0 to length of array Store each token in array END FOR END WHILE HASH_TABLE MESSAGE_RECEIVED END IF
- Step 7: IF client is not null THEN Close client END IF
- Step 8: IF server socket in not null THEN Close server socket END IF
- Step 9: END

3) Hash_Table:

- Step 1: Begin
- Step 2: Create Hash Table
- Step 3: Initialize Agent_Id to 1
- Step 4: Store string value as key and Agent_Id as value
- Step 5: Increment Agent_Id
- Step 6: End

4) Message_Received:

- Step 1: Begin
- Step 2: Set the value in Text
- Step 3: End

B. Health Data Diagnosis Framework Algorithm Steps:

- Get XML file
- Parser the XML file using Dom Parser
- Store Child node name and appropriate value during parsing the file
- Get real time
- Diagnosis the child node value with appropriate child node name
- Display child node name and value on GUI
- During diagnosis if critical value will be received then display it on Alert GUI

C. Design of Server GUI Using SWT:

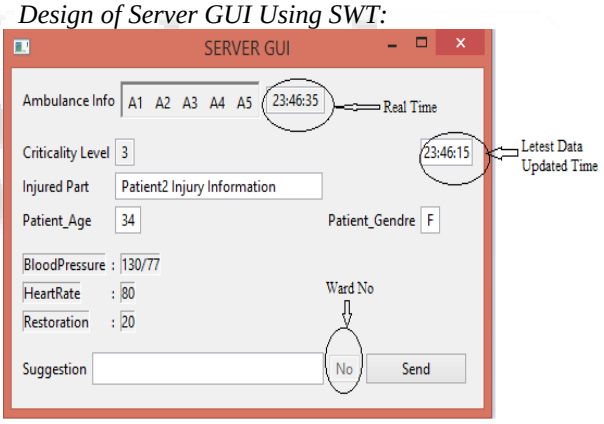

Fig. 8: Server GUI Portal

V. CONCLUSION AND FUTURE WORK

The Manager will help in improving the current diagnostic system in the Health care sector. This Manager will provide a diagnostic framework solution based on the aggregated medical data received from the agent. In addition to this, the advantageous features of this Manager will help in developing appropriate communication paradigm between Ambulance system and the Hospital Server.

Various advanced features included in the implementation of this Manager, such as event reporting, generating alarm services, will make this system widely acceptable solution in Health Care sector. Criticality of the medical data handled in this proposed research work will help in providing timely and appropriate pre hospital care to the patient in the ambulance by receiving medical treatment instructions from the hospital.

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The future extension to this research work includes proper designing, formatting and updating of the database for storing the medical data along with appropriate specification. In addition to this, its aim is to provide the agent switching functionality in the implementation of Manager.

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