Generic Medical Equipment Interface

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ABSTRACT
With the advancement in ICT, Health Care industry now-a-days is well equipped with Medical Equipments to provide the investigation & examination result accurately in time. The term "MEDICAL EQUIPMENT" can be interpreted as including a wide range of instruments, equipment, machinery or apparatus used for medical and para-medical purposes. Medical Equipments available in market are laboratory test specific. Their result format also varies from vendor to vendor i.e. no standard format of machine outcome. To view the result, Doctor/Technical needs to check the console of Medical Equipment. They need to manually enter the data into Hospital Information System to make investigation report a part of patient EMR, which is time consuming and chances of error are more. To overcome this one needs to interface these equipments with Hospital Information System as per data format and communication specification of medical equipments. There will be no plug and play in market which interfaces these equipments easily with Hospital information System or in case if HIS is not available in hospital then publishes these reports across Hospital.

The Generic Medical Equipment Interface solution detailed in this paper is to interface the medical equipments and provide the result of all machines at central point. This solution removes the burden of reentry of patient details into the Electronic Medical Record.

General Terms
User Management, Report Generator, Report Verifier, Data Format, Simulator, Medical Equipment, Alert Management, Audit log etc.

Keywords HIS, EMR, GMEI, ICT

1. INTRODUCTION
Today's hospital is well equipped with Medical Equipments. Doctors get results in the form of report directly through machines like coulters, analyzer and Diagnostic Equipments. There was a time when doctors used manual procedure for investigation and examination. With Medical Equipment not only the time of receiving results is reduced but also the accuracy has been increased. To make the medical equipments reports a part of patient EMR, Hospital needs to enter the result into Hospital Information System (HIS). An Electronic Medical Record (EMR) is a computer-based patient medical record. Entering record into system is time consuming and chances of errors are more.

With influence of ICT in Healthcare an integrated solution is needed where data generated as a result of lab test through different medical equipments can be easily transferred in an automated process to HIS. Equipment Interfacing reduces the extra cost, improves patient care service and reduces paper work for the hospital.

GMEI (Generic Medical Equipment Interface) solution provides customized way to interface different medical equipments and HIS application using single solution. If HIS solution is not available in Hospital then inbuilt report module of GEMI work the purpose of report generation and view across Hospital.

2. Why medical equipment interface
To generate comprehensive Patient EMR, it is required to integrate all Medical Equipments with HIS. The GMEI provides a way for users to configure it for multiple communication protocols and for different data format of machine. It acts as middle layer between Hospital Equipments and HIS Application.

Drawbacks of Standalone Medical Equipments:

- Technician need to rework to make Patient report a part of EMR
- Generation of report is time consuming
- Chances of Typographical errors are more
- No Linkage with Patient EMR
- No common way to view patient result
- No Role Based Access of Reports
- No linkage Mechanism with HIS
- No proper user management
- No Audit Log

3. Generic Medical Equipment Interface: Features
Generic Medical Equipment Interface (GMEI) is middle layer between Hospital Equipments and HIS Application. It makes all the information available at the same place.

Generic Medical Equipment Interface has following features:

- Web Based Application
- Configurable for Multiple Hospitals
- Role & Rule Based
- Comprehensive User Security & Alert Management Comprehensive Audit Trail & Audit Log
- Customized interfacing according to communication protocols and data format
- Easily Interface with HIS application
- Bidirectional Interfacing
- Medical Equipment Based Appointment
- Interfacing support major data format
- Comprehensive Reporting Capabilities

4. Generic Medical Equipment Interface: Solution
Generic Medical Equipment Interface has following components

- Serial Communication Simulator
- Application Setup
- Application execution

4.1 Serial Communication Simulator Utility
The Serial Communication Simulator is developed using VC++. Serial Communication Simulator is used to collect the

data from the medical equipment for verification of data format and communication capability of equipments. Figure 1 shows Serial Communication Simulator Interface.

At time of installation the host computer asks for machine name. After selection of particular machine, the configuration details will be saved on host computer. This will be one time process and the admin can change the equipment settings as per the need. This completes out application set-up.

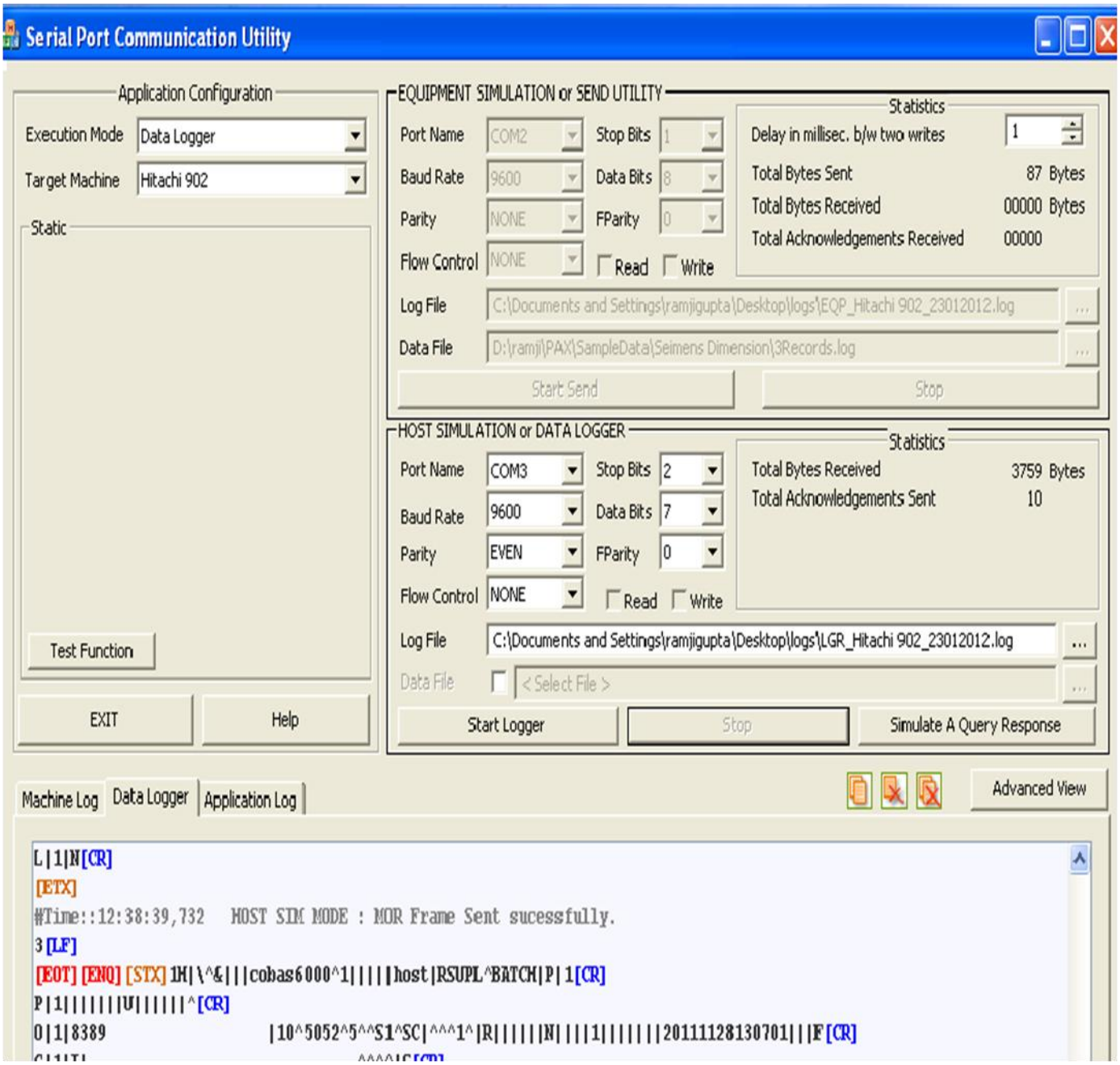

Figure 1: Serial Communication Simulator

4.2 Application Setup

To configure Medical Equipment with application following will be needed

- Medical Equipment Master : to capture the machine information like communication protocol, data format, comport setting etc
- Machine-wise Test Parameter Master: used to capture the machine-wise test
- User Master: for the creation of user

4.3 Application Execution

It consists of two processes assign sample to machine and fetch result from machine. At time of assigning samples to machine we will fetch the information about pending tests. Now we need to fetch the results of pending tests from machine. For this the listener module of application listens for the data from the medical equipment. After getting data it passes it to appropriate parsing module according to equipment configuration settings done at time of application set up and displays it on screen. After saving data will be saved to the HIS data base and is available at doctors desk.

4.4 . The Generic Equipment Interface process

The generic equipment interface will consist of following process. Figure 2 shows the diagrammatic representation

- User Management: Web and Client based User management, deals with security through controlling the access to the application & its related data. A user will have access to only Menu & Data for which the user has rights. User management creates mainly users and assigning the entire role to that particular user
- Request Generator: It is used to generate the Patient Request to a particular Medical Equipment. It also generates sample labels. With this process Appointment to a particular Machine can also be given
- Medical Equipment Listener: It is used to capture the Medical Equipment Data, parse it and store it into Database. It can be easily configured as per Equipment Data Format and Communication Protocol
- Result Verifier: Result Verifier is a checkpoint to make sure patient demographics are correct as well as other important attributes before storing the data into CDAC HIS Database
- Report Generator: It used to generate a report in HIS application

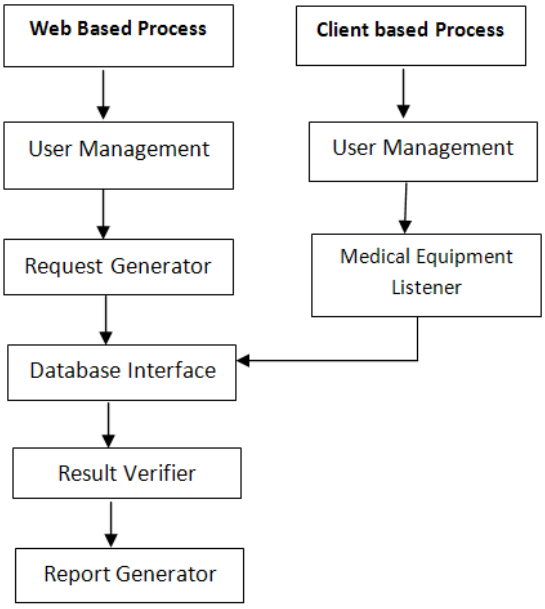

Figure 2: Generic Medical Equipment Process

4.5 Medical Equipment Listener Workflow

Figure 3 shows Medical Equipment Listener Workflow.

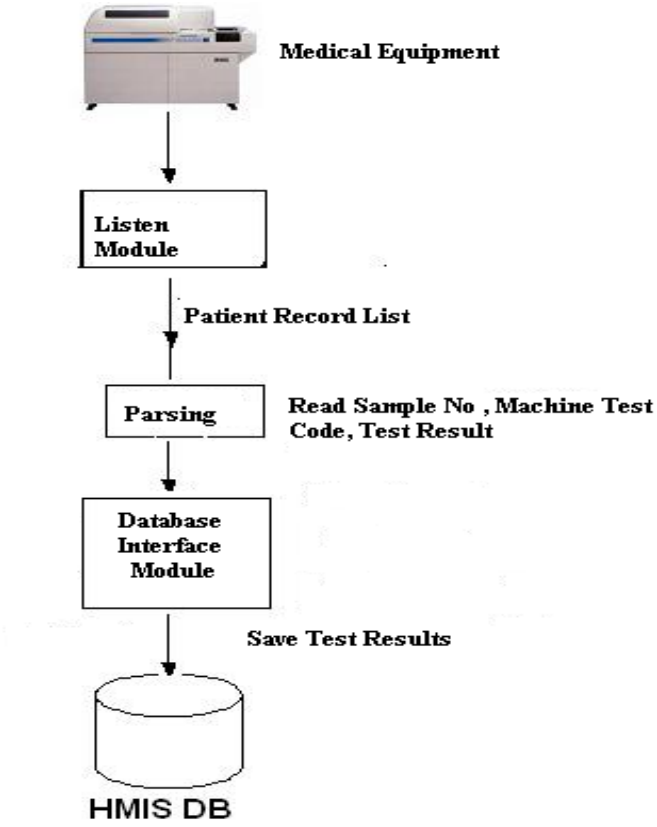

Figure 3: Medical Equipment Listener Workflow

It consists of following steps:

- Study of Data format of medical equipment
- Listener module connects to Medical Equipment using the communication protocol configured and listens for the data from the equipment.
- Data is received from the equipment which varies from machine to machine like START Bit, INFORMATION data, RESULT data and END bit. The information about the data format can get from technical manual. Using this information and the test data available develop parser to extract the result.

5. Generic Medical Equipment Interface: Workflow

Figure 4 shows Generic machine Interface workflow. Here equipment interface software is configured for different medical equipments. It uses centralized HIS database for uniformity and security. It listen the results from the medical equipment and stores it in the centralized database. The through Heath Management and Information Software the data can be available at the doctor's desk.

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- Elecsys 2010
- Hitachi 902
- LH-750
- LH-500
- Pentra 120
- STA Compact

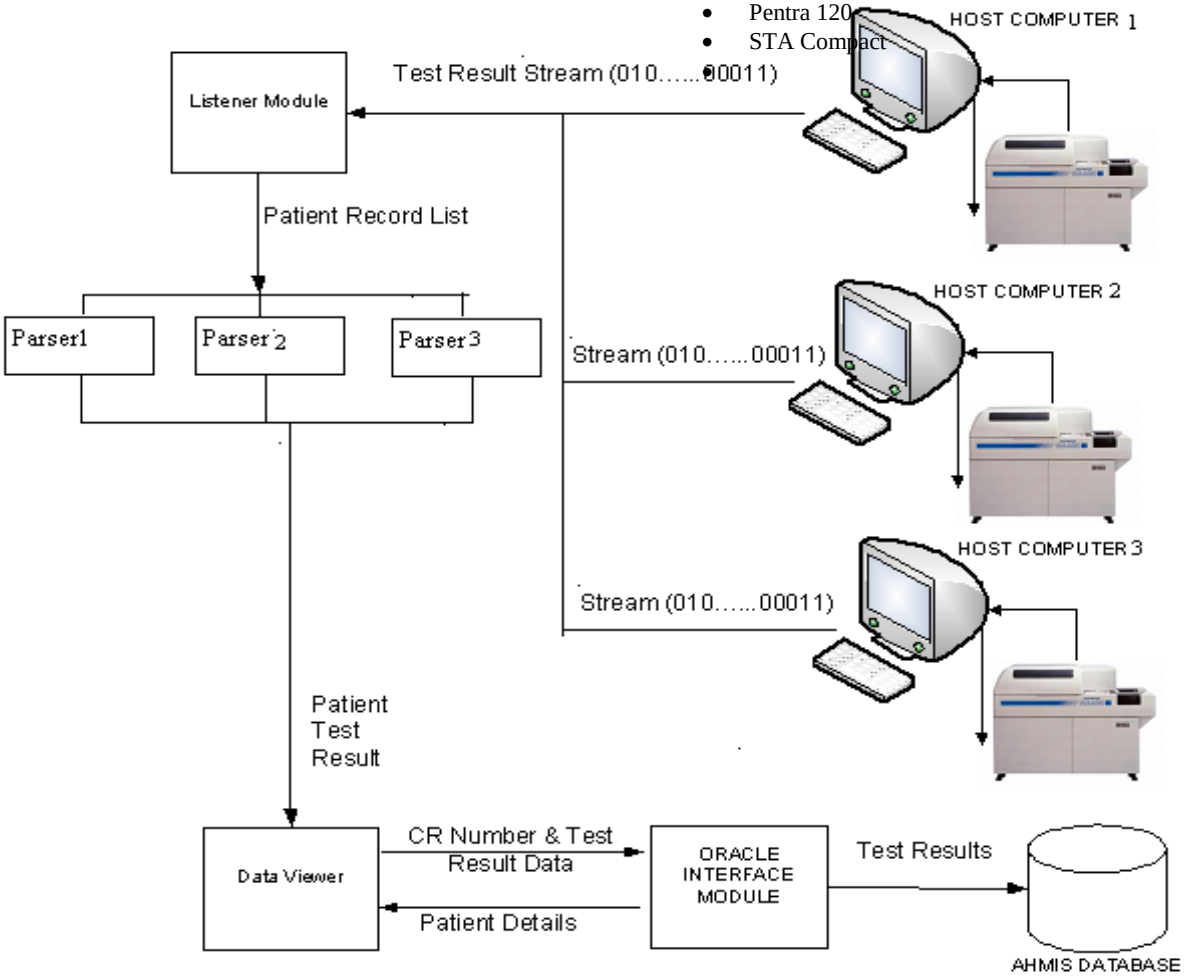

Figure 4: Generic Machine Interface technical Approach

6. Advantages

Generic Medical Equipment Interface has following advantages over traditional interfaces and standalone medical equipments

- Generic Machine Interface software have the following advantage
- Centralized database
- User Management
- Customized for communication protocols
- 9 Pin Comport
- 25 Pin Comport
- Configurable for various data formats
- Easily configuration of a new Medical Equipment
- Comprehensive Error Log
- Comprehensive Reporting Facility

GMEI is configured for following Medical Equipments

- AU 2700
- AU 400
- Biorad
- Cobas 6000
- Dimension AR

7. Conclusion

GMEI solution provides an integrated solution where the data generated through the lab test, through different medical equipments can be easily transferred to HIS. Through this the patient test results are provided at doctors' desk and hence it improves manageability of information. This GMEI software solution can be further extended to make more common application for interfacing different equipments.

8. Acknowledgment

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