

# Cloud Based Real-Time Patient Support System with NADRA SNIC Integration

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**Abstract**—The “Cloud Based Real-Time Patient Support System (CBRPSS) with NADRA SNIC Integration” is a web based application that is built upon cloud infrastructure. This system will allow patients to interact with health care providers via a real-time chat or video. Patients can create an account, log in, create a health event, provide a health history, and then enter a customer service queue and wait for a physician operator to speak with them. The system is essentially a merger of a customer support service application and a custom build electronic medical records (EMR) system.

This system is integrated with NADRA (National Database and Registration Authority), Pakistan Smart National ID Card (SNIC) through a custom developed computer program that provides an interface between SNIC and main application with an exposed Web Service. A patient can get his health history anywhere through SNIC by scanning it with custom developed software.

There is also a management console for watching the queue of patients, running reports, uploading files, creating users, etc. for different actors like doctor, manager, clerk and biller.

**Index Terms**— NADRA, SNIC, EMR, Web Service

## I. INTRODUCTION

To provide better health care services to patient it's necessary to derogate the communication gap between doctor and patient. A patient may belong to remote area or face any other difficulty to come to hospital for initial tests or any other cure. The proposed system will facilitates patient to talk to physician for relevant disease through text/video chat. If there is a separate account and health history maintained for each patient then in future it's much easier for a physician to track all medical history for a specific patient. Also, if a patient wants to change his physician then the new one can track all of its past medical history and chat data that the patient had done with prior physician.

Target of the research is to develop a system that will facilitate a patient for initial tests and to provide an interface that can help him to get rid of managing paper based records. NADRA is an independent and constitutionally established institution of the Government of Pakistan and is responsible for issuing the computerized national identity cards to the citizens of Pakistan. NADRA has just introduces its new chip based Smart NIC that have multiple features. The proposed system will maintain all patients' health history in a database that will be managed in cloud. The basic aim of this research is to

establish an interface between a patients' SNIC and its health history. By linking SNIC with cloud data a patient can get all of his health history anywhere he wants. So there is no need to maintain paper based records for a patient except to keep his SNIC with him. So all medical record of patient will be available any time and at any place where he wants.

NADRA SNIC have also many security features that will ultimately help to keep all patients' data secure and by adopting cloud architecture for system it will provide strong refutation against hacking. When a patient wants to get his data from online system through its SNIC then he will go through all of its security stages that have embedded into SNIC. The proposed system will also verify patient against its requested data. So by adopting this scenario a patient have health data at a place that is much secure and real-time availability against the former paper based system.

When a patient, who is suffering from illness and require regular cure, went outside of his city, and need some advice from doctor, should always manage a file related to his prescriptions and health history; if such a file got misplaced then this will produce a lot of problems for patient as well as his new physician. So managing this type of crucial information in hard file is not a good practice from security and availability point of view. On the other hand better solution will be transforming this important data to soft form and make it available all along whenever a patient want, with ease of access and security. In this scenario patient does not need to worry about managing multiple things related to cure but only his SNIC that, in a practice, he will be never forget about to carry. Different hospitals that have multiple branches across the world can also manage their patients' data and will provide services to their patients whenever they are on the move from one place to another.

Different technologies have been used for application development like C#, Asp.net, SQL Server, Web Services etc. This application is implemented by execution of the following phases.

- Database Creation.
- Data Access Layer creation
- Web site front end development for patients' interaction
- Web admin side development for administrators

- Text/ Video chat application development and integration with front/ back end
- Custom desktop application development for NADRA SNIC reading.
- An exposed web service development for providing interface between NADRA SNIC and desktop application.

The web end with database of the application is hosted on cloud that it can be accessed from anywhere through custom developed desktop application. Cloud hosting is useful from many perspectives, some of them are as following.

- You can start with a package that suitable your needs and do not require high investment. Most cloud hosting packages only charge users based on amount of computing power used.
- You can upgrade your hosting plan as you require more space and processing speed by maturing your system time to time and do not require starting from scratch.
- The servers that host your application also have backup machines that means there is no chance of unavailability.

## II. LITERATURE REVIEW

### A. NADRA SNIC Interfacing Options:

To integrate NADRA SNIC with a custom build application we have to read information from it and make an interface with main application. To make a link with patient health history data we have to read patient NIC number from NADRA SNIC. There are two options to read patient NIC number viz.

- Reading from NARDA SNIC chip through a card reader
- Reading from QR code

1) *NADRA SNIC QR Code*: There is a method for reading NIC number from NADRA SNIC i.e. Decoding QR code and getting NIC number from it. The details of the QR code is described as follows.

a) *QR Code*: QR code stands for “Quick Response Code”. A QR code is a machine readable two-dimensional barcode that contains information about the item to which it is attached. The physical appearance of a QR code consists of square dots arranged in a square grid on a white background that can be decoded by an imaging device, e.g. a camera, and decoded using Reed-Solomon (non-binary cyclic error-correcting codes invented by Irving S. Reed and Gustave Solomon) error correction. [21][22][23][24][25]



Fig. 1. A QR Code containing the text “Cloud Based Real-Time Patient Support System with NADRA SNIC Integration”

A QR code consists of several region that interpret different information to a reading device. The detail of a QR code portions are depicted in following figure [23]

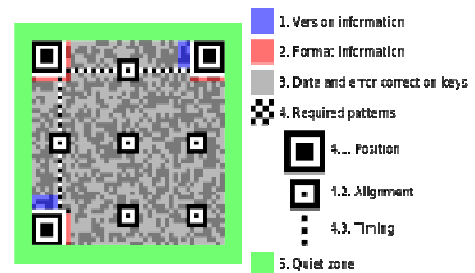


Fig. 2. QR Code Regions [23]

## III. SYSTEM DESCRIPTION

This section briefly describes the detailed design of the components that are assembled to make CBRPSS with NADRA SNIC Integration’s architecture. The graphical user interface (GUI) of all modules and their interaction with respective users and end results are also depicted.

The overall structure of the application is graphically shown in Fig. 3. The system can be divided into several components viz.

- *Patient Web Site* – login, create health event, manage health history, communications module etc.
- *NADRA SNIC Interfacing Application* – A desktop application that will provide an interface between main application and NADRA SNIC for downloading health history data.
- *Patient Chat Module* – Secure text/video chat with operator
- *Operator Console* – Operator perform everything from here. Login, logout, view chat queue, view mail queue, chat, view patient health history, private notes (not visible to patient) etc.
- *Manager Console* – Management functions such as manage users, run reports, set hours & days of operation etc.
- *Clerk Console* – Manage patient accounts, upload files etc.
- *Biller Console* – Manage patient credit, debit adjustments.

To implement the proposed system Model View Controller (MVC) architecture have been followed to make system more efficient. Each layer of the system communicate to other according MVC methodology. User interface (UI) have been implemented in View section, all database architecture maintained at Model and a middle layer, Controller, have been established that is communicating between Model and View.

To make system more powerful, scalable and reliable cloud computing techniques (e.g. SAAS) is used. By designing system architecture according to cloud computing structure we will manage problems i.e. single hardware goes down, local power disruption, natural disasters etc. As system architecture will be implemented on cloud so it will be decentralize.

Furthermore, to implement text/ video chat, custom modules have been developed to apply those features. The system also have admin module to handle administration operations.

An interface is built between NADRA Smart National ID Card (SNIC) and main application (that is deployed on cloud) through a custom developed computer program. A user can get all their health history data by scanning its SNIC with card reader which will interact with custom developed computer program to the main application through an exposed web service.

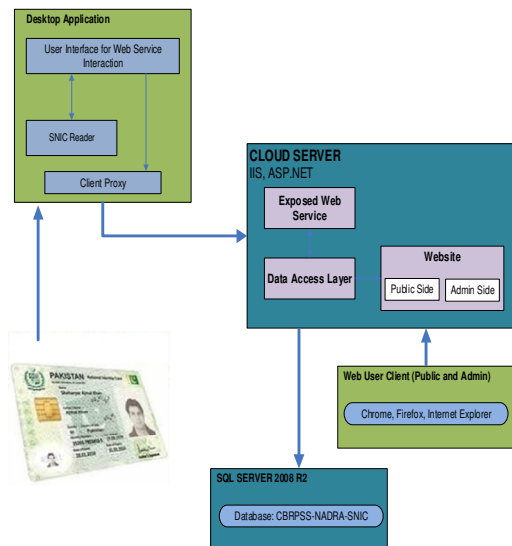


Fig. 3. System Layout

The major tasks that needs to be performed by this system are as follows.

**A. Tasks Performed by Patient – Patient Web Site:** The front end module of the application is designed for patient interaction. The overall patient’s functions, after logging in to the web site, are depicted graphically in Fig. 6.

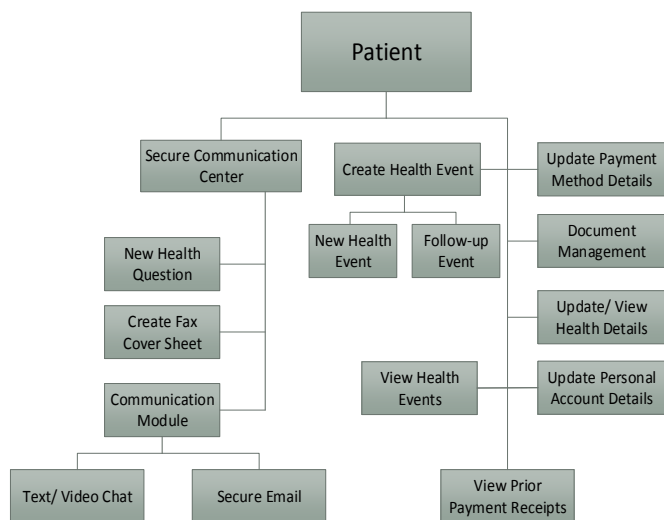


Fig. 4. Patients’ Functions

The overall patient’s flow in the system is described in Fig.5.

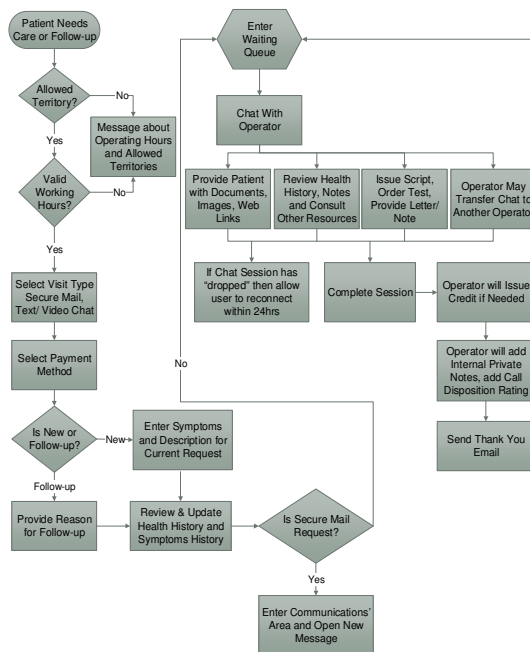


Fig. 5. Patient Flow

On accessing front end of web site, by patient, a login page will be displayed with public contents. The user have to provide his/ her username/ password. If a particular user don’t have an account then he/ she will go to the registration page for creating account.

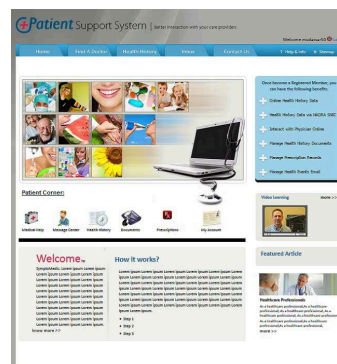


Fig. 6. Patient’s Dashboard

After successful login patient dashboard will be display that is used by patient to perform different tasks described as following through GUIs

- Create a New/ Follow-up Health event
- Secure Message Center Communication
- View/ update health history record
- View prior health issues against each health event created
- Manage health history documents
- Prescriptions record
- Manage personal account



Fig. 7. New/Follow-up Health Event Type Selection

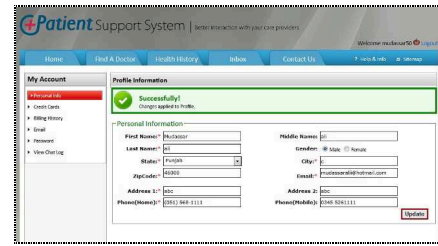


Fig. 11. Patient Account Management

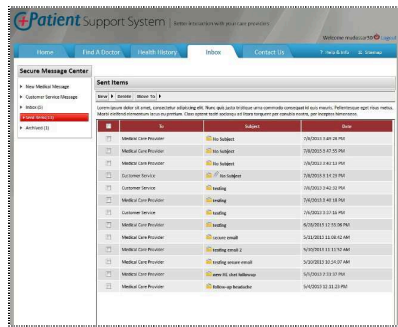


Fig. 8. Secure Message Center

**B. NADRA SNIC Interfacing Application:** The system consists of custom developed software that provides an interface between NADRA SNIC and main application. This will assist a person to access their health history data by scanning it with custom developed desktop application, that will ultimately interact with main application, hosted on cloud network, through an exposed web service to get relevant information that the particular person can see and print.

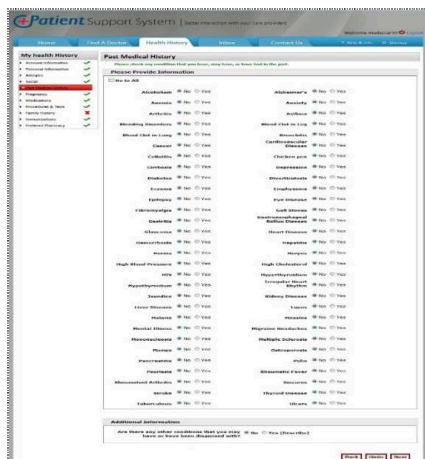


Fig. 9. Health History Record

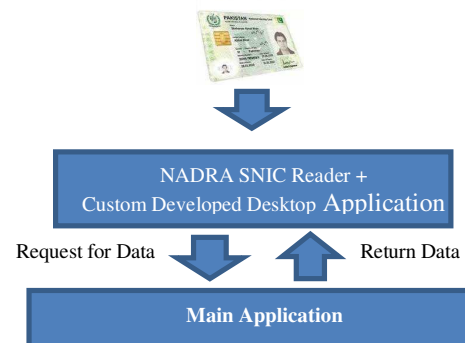


Fig. 12. NADRA SNIC Interfacing with Main Application

The GUI of the desktop application that is used to interact between NADRA SNIC and particular patient's health history data on main application is depicted in Fig. 16.

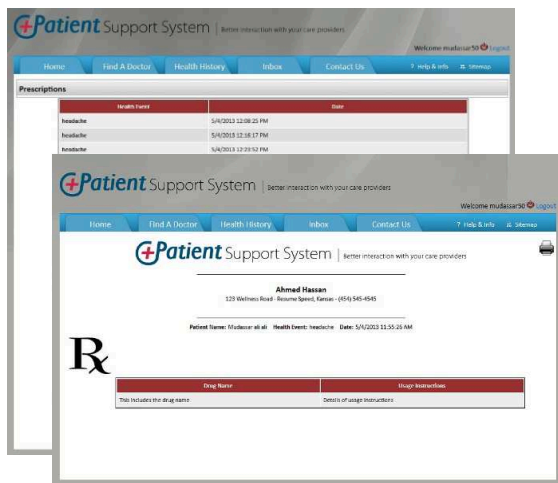


Fig. 10. Prescriptions Record



Fig. 13. NADRA SNIC Interfacing Application

**C. Patient Chat Module:** When a patient selects text/ video chat to communicate with physician then the following window will display. Through this interface a patient can interact with physician for his assistance.

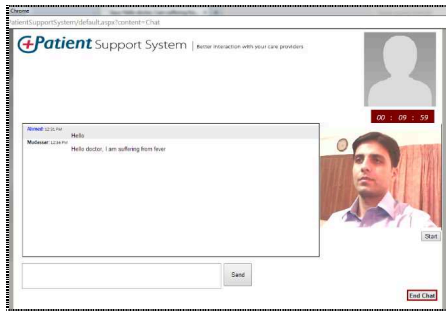


Fig. 14. Patient Chat Interface

**D. Tasks Performed By Care Operator – Operator Console:** The Care Operator is basically a “chat operator”. They are presented with a list of patients currently in queue. The list is real-time and shows symptom, time in queue, follow-up or new health event, area (patient is from) and Operator. The Operator then selects a Patient from the queue and begins the chat. The operator can also see a list of prior patients.

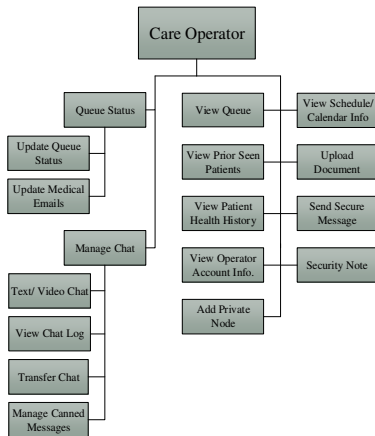


Fig. 15. Care Operators' Functions

The Care Operator can performed tasks mentioned in Figure 15, the GUIs of tasks are depicted in Fig. 16.

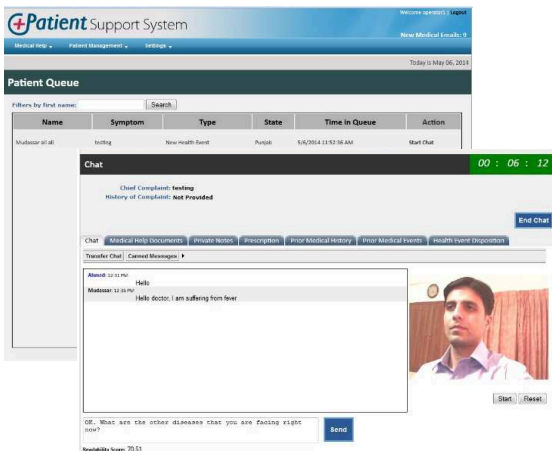


Fig. 16. Care Operators' Functions

**E. Tasks Performed By Biller – Biller Console:** The biller user performs accounting functions in the system. They can assign credit or debit adjustments to accounts. Credit card transactions in case of refunds etc. are performed off line by the biller manually.

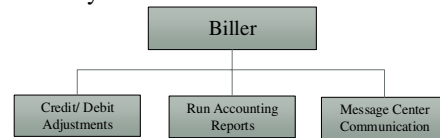


Fig. 17. Billers' Functions

**F. Tasks Performed By Manager – Manager Console:** Manager has all access to the system. The manager is the only one that can create new users. The manager set the hours of operation. The hours of operation vary by different territories. Operators’ hourly schedules and the territories they are allowed to interact with patients are defined in the console.

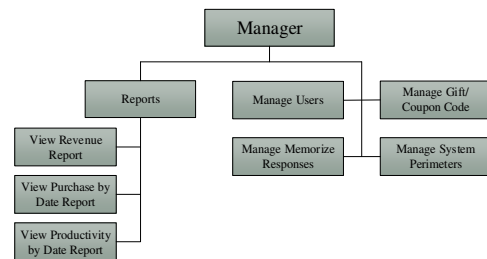


Fig. 18. Managers' Functions

**G. Tasks Performed By Clerk – Clerk Console:** The clerk user can upload documents to a patient’s account and to a specific health event. This user can also communicate with a patient via the message center. A clerk can manage patient accounts such as resetting a password.

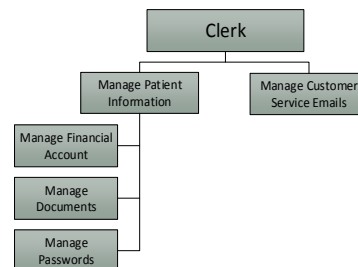


Fig. 19. Clerks' Functions

The GUIs of tasks are described in following figure.

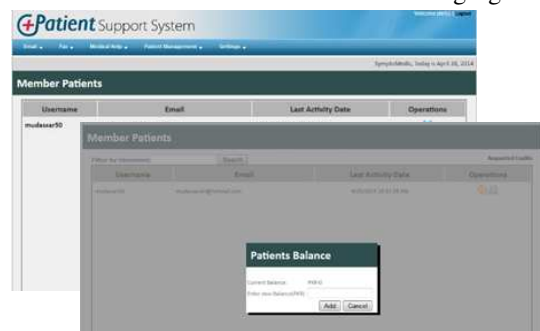


Fig. 20. Clerk Console

#### IV. CONCLUSION AND FUTURE WORK

The “Cloud Based Real-Time Patient Support System with NADRA SNIC Integration” is an online solution that will allow patients to interact with health care providers in real-time. The system is essentially a merger of a customer support service application and an electronic medical records (EMR) system. The system is a complete solution for maintaining a particular person’s health history online that can be managed and access with ease.

The proposed system provides an efficient solution to integrate one’s NADRA Smart National ID Card (SNIC) with his online health history. The online health history record can be access anywhere through a custom developed computer program that provides an interface between SNIC and main application with an exposed Web Service.

The proposed system can be enhanced in many ways to make it available for different operating systems and environments. The future work involves following

- The system can be developed for Android operating system at start, and then enhanced it to iPhone and other mobile operating systems, for accessing most deprived areas of the world to capture images related to eye care, skin care etc. These images would be uploaded to patient’s online health history data that a physician can then examine and diagnose.

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