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CONTEXT BASED PATIENT HEALTH MONITORING SYSTEM

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ABSTRACT

In a hospital health care monitoring system, it is necessary to constantly monitor the patient's physiological parameters. In the proposed system, the physiological parameters of the patient are recorded with the help of sensors. This data will be stored in the database. When the doctor comes near to the patient bed, based on the network strength, the details of only that patient is displayed in the handheld device of the doctor. So, this feature helps in reducing the physical documentation as everything is available digitally. Also, the doctor can request and access medical test reports of those patients on the same platform.

Keywords: Sensor Node, Golang, Vue.Js, Sqlite, Context-Based.

I. INTRODUCTION

Context-aware control systems are proactive integrated structures that are able to act in an appropriate manner in a real-time changing environment. This human-free adaptation increases usability and effectiveness by taking the monitored context into account. Every context-aware application is developed for addressing three fundamental components: i) context acquisition (using sensors for collecting low-level contextual information); ii) processing (applying reasoning methods for obtaining high-level contextual information); iii) acting (automatic execution of services and actions after context detection)

Hospital settings require considerable mobility and coordination due to the complexity of the tasks performed, the intensity of the information exchange and the fact that information and resources are distributed throughout the premises. Medical records integrate patients' clinical data and constitute a main source of reference for their care. An important trend in medical informatics is the adoption of electronic patient record systems that facilitate access to clinical information and work toward preventing the loss or misplacement of information. At the same time, physicians are increasingly using handheld devices in their professional practice.

In the proposed system, the patient's physiological signals are acquired by the sensors attached on the patient body, and are then transmitted to the remote base-station and also a dashboard is designed for displaying and analyzing. Doctor node wirelessly connected to a patient sensor node can give them access to patient medical records from the database. So, this can be used to retrieve medical information relevant to the doctor's current activity. For instance, a patient's medical record can be made available when the physician is near their bed. The system also has a facility for doctors to request particular lab technicians to perform required lab tests for the patient. The lab technician can upload the test reports which can be accessed by the doctor for further examination.

The remainder of the paper is organized as follows. Section II presents the methodology and explains about how the project is implemented. Section III tells about the technology used and the features of this project. Section IV discusses our results and in Section V we present the conclusions.

II. METHODOLOGY

The architecture and methods used in working of project are described along with block diagram and implementation steps used in this project

a) Wireless Sensor Network

Sensors are connected to an attiny84 microcontroller which is also connected to an nRF24L01 module for RF communication. These devices collectively form a sensor node. A sensor node sends collected sensor data to a central node. Each sensor node also sends node ID so that it can be differentiated from other sensor data. A central node is a device which receives data from all the sensor nodes and updates it to the database through the server. nRF24L01 can communicate with up to six other nodes.

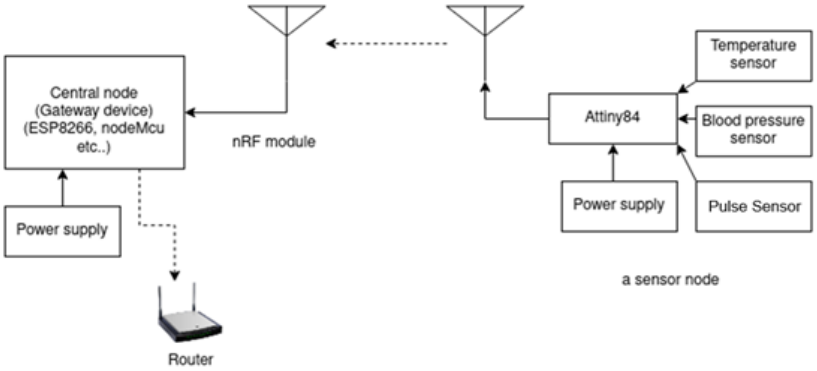


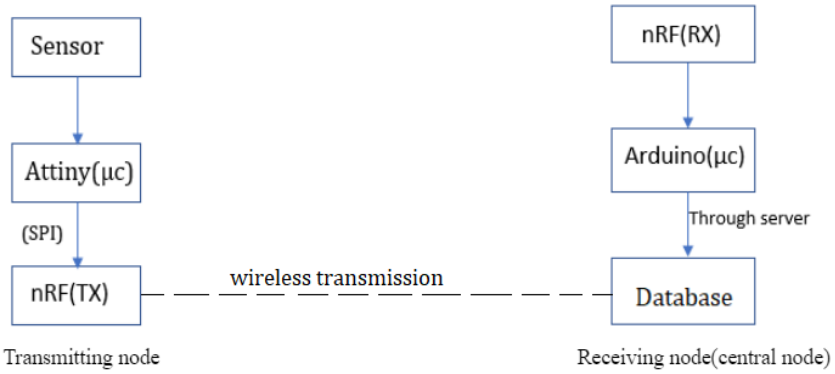
Fig 2.1 Central node and sensor node

b) Server and database

The received sensor data and other information about the patient is stored in the database. SQLite is used for database coding. A dashboard is designed to access the required data. Backend server is written using GO language and the user interface is created with vue.js. The system also has a facility for doctors to request particular lab technicians to perform required lab tests for the patient. The lab technician can upload the test reports which can be accessed by the doctor for further examination.

c) Wireless node at doctor's end

The doctor is required to carry a wireless node similar to a sensor node which is with the patient. But this node sends only the ID of the sensor node to the server. Then the server sends the patient's information corresponding to the ID received. This information is displayed in the dashboard. While the sensor node sends the data to the central node, the other node at the doctor's end also receives the data, it reads the data and extracts the node ID from it. In order to avoid collision with data from other sensor nodes, this node has very low range. Thus, it only detects the node when it's brought close to a transmitter.



Wireless node at doctor's end

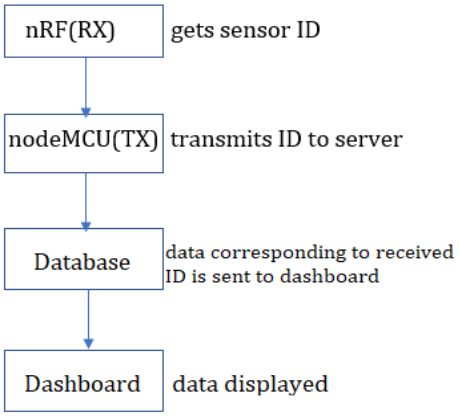


Fig 2.2: Data flow diagram

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III. MODELING AND ANALYSIS

List of hardware and software requirements for this project includes:

Vue.js: It is a progressive framework for JavaScript used to build web interfaces and one-page applications. In our application we have used it for frontend development.

Golang: Golang is used for programming servers which deals with fetching requests from the databases.

Sqlite: SQLite is the database that stores all the patient details. The SQLite file format is stable, cross-platform, and backwards compatible

nRF24L01: This single chip radio transceiver is used to detect the patient node based on the network strength.

NodeMCU: The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can send the received sensor node ID to the server to fetch the details of the patient corresponding to that ID.

ATtiny84: This 8-bit AVR RISC architecture-based 14 pin Microcontroller is used to interface different sensors, nRF module and also to process the sensor data.

Features of this project is listed below:

Feature 1: Patient Monitoring

We monitor the important physical parameters like body temperature, heart beat rate and blood pressure using the sensors which are readily available. Thus, the analog values that are sensed by the different sensors are then given to a microcontroller attached to it. This data is displayed on the dashboard which will help in analyzing the patient response and proceed with further treatment.

Feature 2: Context based display of data

Each of the sensors attached to the microcontroller with a transmitter will act as a module which has its own unique ID. Each module transmits the data wirelessly to the database. The wireless module which is with the doctor is capable of receiving different patient IDs and to get different physical parameter values of that particular patient specified by the ID. The software designed can operate on different physical parameters of each patient, consecutively with a specified time interval for each patient. At any time, a doctor can check the history of the observed critical parameters of that patient in whose vicinity he is present. So based on the context of the patient who is being observed by the doctor, the details of only that patient is displayed to the doctor on the dashboard. This is based on the radio frequency signal strength between the patient sensor node and the wireless node which is with the doctor.

Feature 3: Request lab reports

The dashboard displayed to the doctors includes an option that allows them to fill forms and communicate with other members of the staff. The information received in the dashboard is obtained from the hospital's laboratory that manages and stores the patient's clinical records. This is shown in Fig 3.1.

Documents such as patient's records, laboratory results, and forms to be filled need considerable coordination. Efforts are required to locate relevant documents. Clinical records are often misplaced and laboratory results could take hours to be delivered to the person who requested them even to the point of making them useless. So this feature is helpful to avoid such situations.

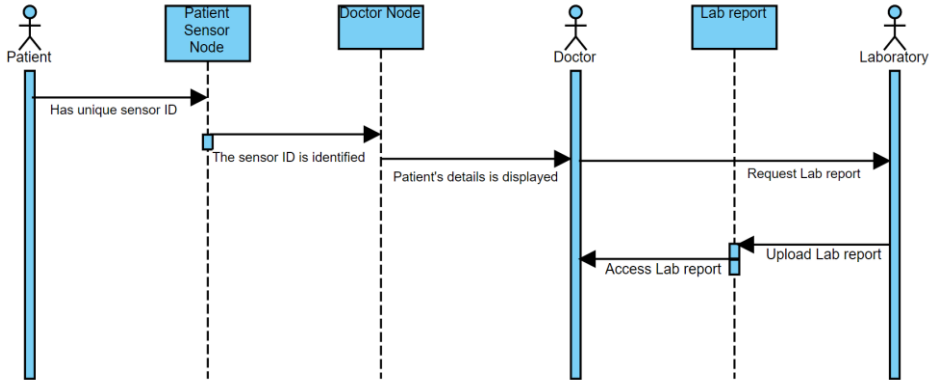

Fig 3.1: Sequence diagram for the request of laboratory analysis

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IV. RESULTS AND DISCUSSION

a) Fig 4.1(a), (b) shows the home page and page to register a new patient and the patient data will be stored in the database

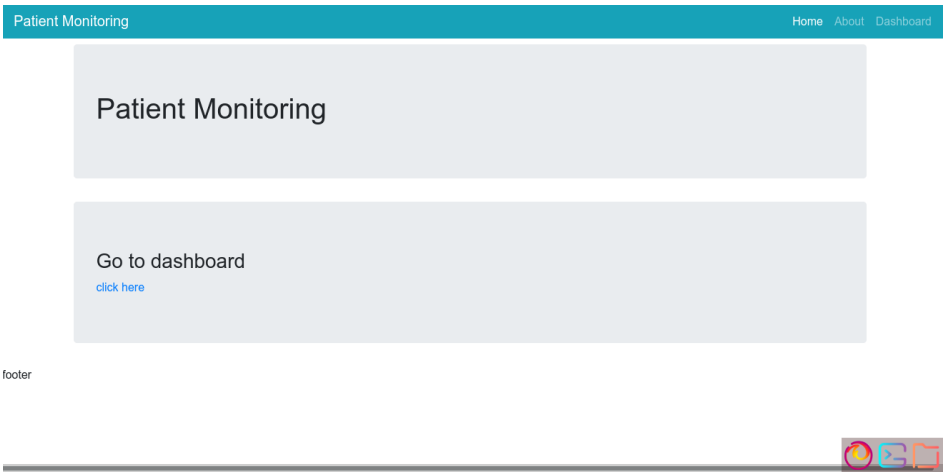

Fig 4.1(a): Home page of the portal

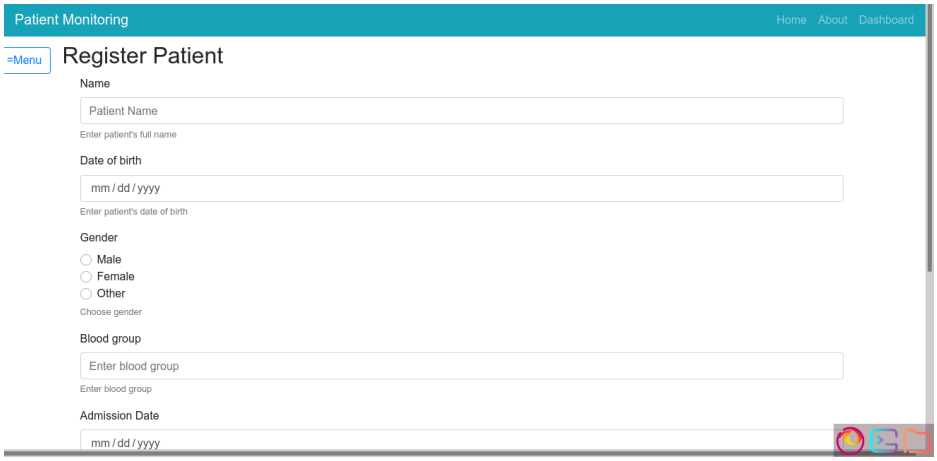

Fig 4.1(b): Registration of new patient

b) The portal will be used by the doctors, whenever doctor comes near to patient the low power receiver receives the information from the node and it will be displayed on doctor's screen showing the status of patient's health. The status can also be obtained manually by putting the patient ID in the portal. Also we can add the new bed with specific node ID assigned to it.

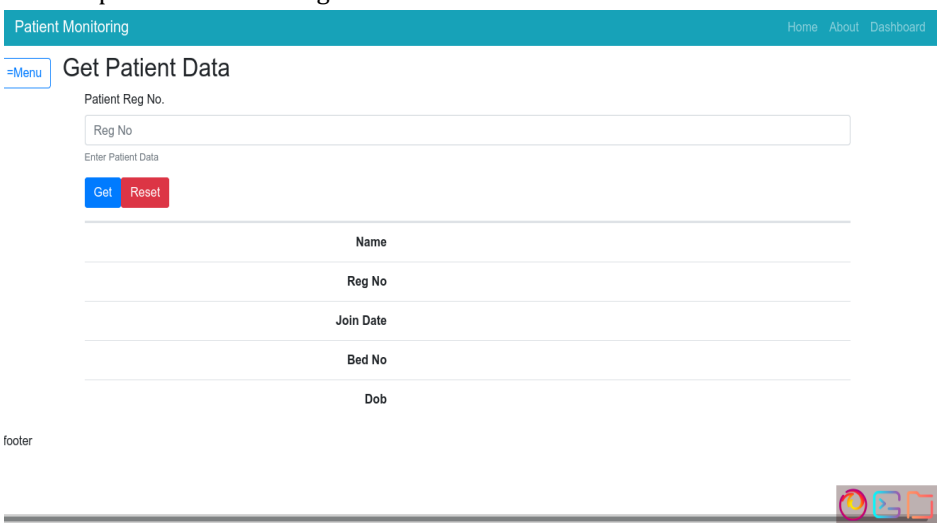

Fig 4.2(a): Getting the patient details

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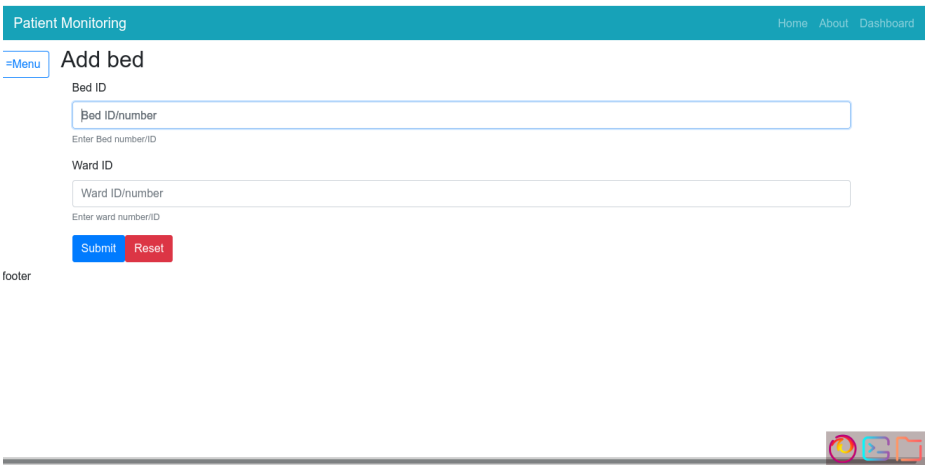

Fig 4.2(b): Adding a new bed

Fig 4.2(c): Above picture shows the temperature of patient having the node ID as Radio 3 similarly other parameters of patient health will be displayed here as the doctor goes near to the patient bed.

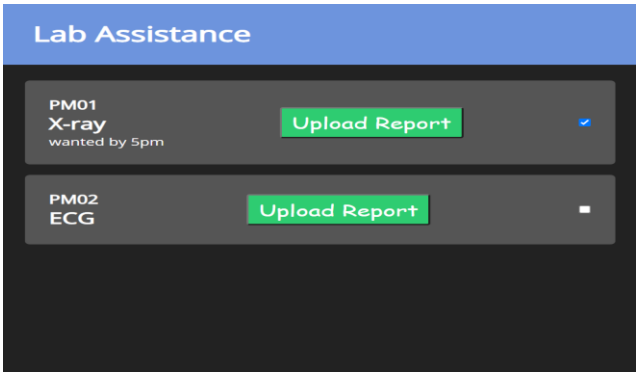

Fig 4.3: Dashboard displaying lab tests to be carried out.

V. CONCLUSION

The proposed sensor node architecture and design approach helps in proper management of data in hospitals. Hospitals are complex work environments where information and people are distributed, thus requiring considerable coordination and communication among the professionals that work in such settings. The information required by the specialists is highly dependent on their location. Access to a patient's laboratory results might be more relevant when the physician is near the patient's bed and not elsewhere. Here we have presented a hand held-based node that can be used to get information based on the nearest sensor node. Sometimes records get misplaced and laboratory results could take hours to be delivered to the person who requested them making them useless. Our result shows a solution to this also as the test reports are directly made available to the doctor in the portal.

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VI. REFERENCES

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