

ICU MANAGEMENT SYSTEM

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Abstract - Being a bystander in front of an ICU not knowing the updates of your loved ones who are admitted, is not the best feeling. This paper introduces a system that gives updates on ICU patients. In this system, the reports of the doctor's and nurse's rounds will be updated along with the status of the patient. The frequent readings such as temperature, oxygen level, blood Pressure Levels, and ECG of the patient can be viewed as well. This system also has a feature of consent approval in case of any emergencies. There will be an alert notification if there is any variation in the heart rate or if the patient's life is at risk. Blood Donation Center and ambulance driver's contact information nearby the hospital will also be available in this system.

Key Words: ICU, Bystanders, Vitals, Patient, Doctor, Nurse

1. INTRODUCTION

An intensive care unit (ICU), also known as an intensive therapy unit or intensive treatment unit (ITU), or critical care unit (CCU), is a special department of a hospital or health care facility that provides intensive care medicine. Intensive care units cater to patients with severe or life-threatening illnesses and injuries, which require constant care, close supervision from life support equipment, and medication to ensure normal bodily functions. They are staffed by highly trained physicians, nurses, and respiratory therapists who specialize in caring for critically ill patients. Patients may be referred directly to the ICU from an emergency department or a ward if they rapidly deteriorate, or immediately after surgery if the surgery is very invasive and the patient is at high risk of complications.

1.1 Background

An Intensive Care Unit (ICU) provides critical care and life support for acutely ill and injured patients. Sometimes the ICU medical team needs to solve so many issues with patient or their family members. When they admit a person in ICU, their conscious level is poor or unconscious like comma stage the patient does not feel anything about

their life situations. When the team receives a patient like this they do the life-saving procedures as soon as possible and they don't have the time to rethink or discuss the patient's condition with their family members at that time. As we all have experienced at least once being a bystander in ICU, and we all know the problems we have faced while being one. Having no idea about your patient status. Even if a nurse or a doctor steps out of the ICU there will always be a rush of all the Bystanders to ask about their patients, and usually, there is always chaos and no one gets their doubts cleared as well. After some discussions with a few staff, we even got to know that, they do face problems of not being able to answer all the queries from the bystander's side and most of the time, turning their back and not giving a proper service cause of the workload they face. That's where we felt the need for such a system. So we are introducing a system where the medical condition or the progress of the patient who has been admitted to the ICU will be tracked in real-time and updates about their whereabouts are provided simultaneously

1.2 Objectives and Scope

The main objective of this ICU-based system is to guarantee safe care of the patients admitted to the ICU. In general terms, its main tasks are to provide and promote an adequate environment referring to patient safety, document and analyze critical incidents, inform of the corrective measures taken, and supervise follow-up and adherence to the adopted measures. We have a regular update of the reports provided by the doctors and nurses after each round which is accessible at all times by the patient's corresponding bystander, and on the other hand, we have the vitals update corresponding to the information collected daily at several points during the day, also the consent is provided to the bystander which they can approve through the app itself in case of any emergency. As well to the current treatment being provided the certain reports of the test that the patient has undergone, and also some added help like blood bank details, ambulance services are provided through this system to make use in case of emergency.

2. EXISTING SYSTEMS

2.1 iNICU

iNICU[2] automatizes the workflow of NICU starting from the day of admission/birth till the discharge of the baby, thus reducing the responsibilities of users (nurses, doctors and administrators). In addition, the system captures real-time clinical parameters of every neonate coming from multiple devices (which can be viewed on a single interface) and stores variations of the same forever on the cloud, so it can be accessed by the doctor at any point of time.

2.2 Intelligent Neonatal Monitoring System Based on Android Application using Multi Sensors

Intelligent Neonatal Monitoring System Based on Android Application using Multi Sensors. The purpose of the paper[6] is to develop an Intelligent Neonatal Monitoring System based on temperature and pulse rate data. In the Neonatal Intensive Care Unit (NICU), there are premature babies and other ill babies who need extra care from the doctors, nurses as well as medical supplies.

2.3 HealthyYou Card

HealthyYou Card[4] is a search engine and online appointment booking app. This app has the features to search doctors, hospitals, diagnostic centers and pharmacies. It can search by name, specialty and location and can book an appointment online. It also provides alerts and reminders that is to get notified by SMS and email on booking an appointment, to get reminder for your appointment by SMS as well as email, to get SMS and email alert on appointment cancellation / modification (from either of the parties)

2.4 Pocket ICU

Pocket ICU[3] provides users with an essential tool for quickly locating information from every subspecialty area of critical care is concise guidance written by attending physicians for everyone in critical care. It covers subspecialty areas including pediatric, neuro-critical, cardiac, transplant, burn, and more. This app contains detailed images, figures, and decision support algorithms. It is a helpful appendix including calculation tables, formulas, and more. There are entries with diagnosis, treatment, and management details. It has a provision for universal index search which helps to find topics quickly and "Favorites" for bookmarking important entries.

2.5 IoT based NICU baby healthcare monitoring system

The main objective of the paper[7] is particularly designed and developed for kid and infant ICUs. In health care space and its systems if you see, the deaths because of delayed designation of malady for Infants and Neonates become responsible. To beat this state of

affairs, dedicated devices for Infants and Neonates are essential. During this style,

IOT with sensors are used for watching all parameters that are additional appropriate for Infants and Neonates, efficiency and reliability which will play a vital role for better care.

3. SYSTEM STUDY

The system is divided into four modules.

- (1) Report Module
- (2) Vitals Updation Module
- (3) Consent Module
- (4) Alert Module

3.1 Report Module

The report module contains both doctor's and nurse's reports of the patient. The doctor's report consists of a report by the doctor about the patient admitted to the ICU after each round. After each round, the doctor will be updating the report of each patient in the system. This report will be viewable to the bystander of the patient. The report of the patient is written in a particular format which also consists of some medical terms out of which the app shows the overall report of the patient which is understandable for each of its users. This module is so helpful for both doctors and bystanders. In some cases, the doctors have to explain the condition of the patient to more than one person which is difficult and time-consuming. Using this module, the condition or report of the patient could be conveyed to their family members easily. The family members could get the details of the patient from anywhere at any time. The nurse's report consists of the reports by the nurses about the patient admitted to the ICU. After attending to a patient the nurses will be writing the report in the system which will also be viewable to the bystanders. The nurse's report is also written in a particular format. The app will only show what is required to be visible to the bystanders.

3.1 Vitals Updation Module

The vitals updation gives the recordings of the vitals of the patient admitted to the ICU at regular intervals of time. The recordings include temperature, pulse rate, heart rate, blood pressure, respiration, etc measured at an interval depending on the condition of the patient. If the condition of the patient is worse, then the recordings are made at shorter intervals. If the condition of the patient is stable, the recordings are made at longer intervals. These readings are made visible to the family members, so they could use this to get further suggestions of the patient from experts known to them. They could also use this to check whether the condition of the patient is improving or not. The updated vitals are viewable to the doctor also, this helps the doctor to keep track of the vitals of the patient after the duty time of the doctor.

3.3 Consent Module

The consent module is a module where the hospital contacts the family members for various consents regarding different tests, scans, etc. There are many tests or procedures which require the consent of the family members before starting the initial steps. Some procedures which require consent are before intubation, before changing to a ventilator, etc. When consent is required it is being updated by the nurses in the system, then a notification is sent to the app. When the family member receives the consent form, he/she could read through the consent and then the family member needs to approve the consent and is returned it. The next step of the procedures could only be started after receiving consent from the family member. The consents agreed or disagreed will be stored in the database for future references if necessary. Sending the consent in this format will help the bystander to easily agree to the consent and make the procedures much faster.

3.4 Alert Module

The alert module will send alert notifications through the app to the family members when there is any variation in the health conditions of the patient admitted to the ICU. In every hospital, an alert will be sent to the nurse's station during an emergency. When the alert is sent to the nurse's system it simultaneously sends an alert to the app also. The alert is sent to the bystander and the doctor treating the particular patient. The alert is sent based on the heart rate of the patient. This helps the bystander to reach the hospital in the emergency of their family members admitted to the ICU. This also helps the doctor treating the patient know about the alert situation.

5. TECHNOLOGY USED

- Web Application
 1. JavaScript
 2. Bootstrap
 3. MySQL
 4. HTML
 5. CSS
 6. JSP
- Mobile Application
 1. Android
- Hardware
 1. Arduino IDE
 2. Firebase
 3. Internet of Things

5. RESULTS AND DISCUSSIONS

The website is initiated with a welcome page where you will find a login option.

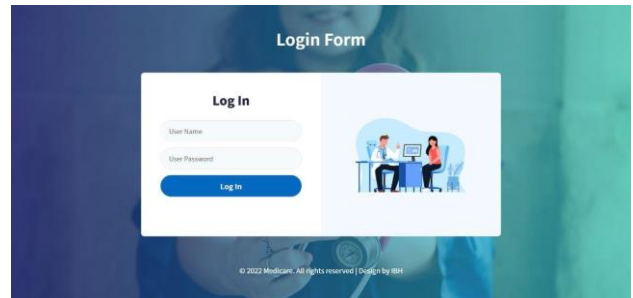


Fig -1: Login Page

The login credentials can either be an Admin, Doctor, or Nurse. If the login credentials are of the Admin, then he can update the system and can handle the system. He has the authority to add to the Doctor's and the Nurse's lists. He also has access to the patient's information and can admit the patients; he can make changes in the service sector as well.

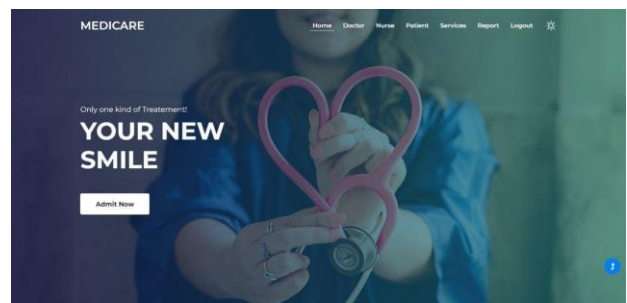


Fig -2: Admin Page

If the login credentials are of the Doctor, then the Doctor gets to use the interface where he can Enter/Update the conditions of the patient(SBAR).Also the Doctor can view the Patient's Vitals and the consents.



Fig -3: Doctor's Homepage

If the login credentials are of a Nurse, the Nurse can also Enter/Update the Nurse SBAR. Then the Nurse gets to see the SBAR which the Doctor has updated, the nurse can also Enter/Update the vitals and can issue any consent letters to the respective bystanders.

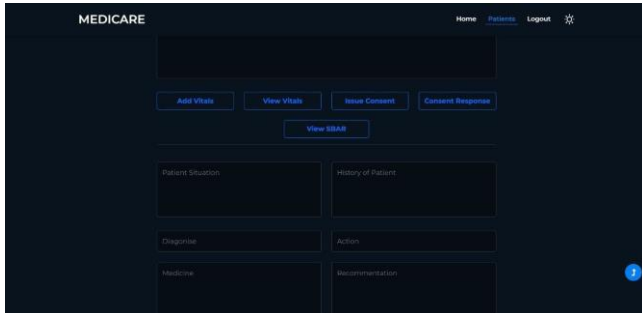


Fig -4: Nurse's page

SBAR represents the S-situation of the patient while arrived. B-background of the patient if any past experience. A-actions to be taken for the patient. R-recommendations, any recommendations to other Doctors.

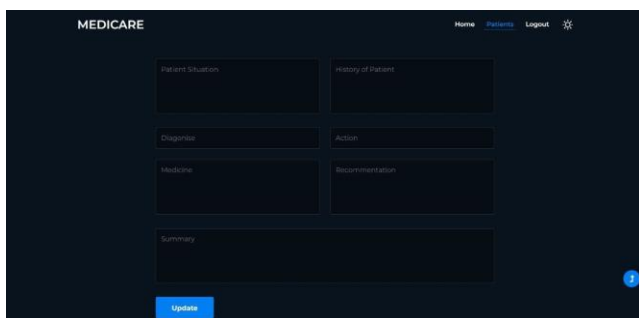


Fig -5: SBAR Form

In the application, we have a login page that can be used by the Doctor or the bystander.

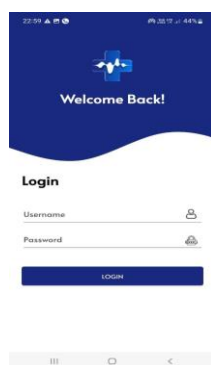


Fig -6: Login Page of the application

If the Doctor wishes to log in, then he can log in using his credentials and he can view his patient's details along with their vitals. The status of the patient can also be viewed as well.



Fig -7: Doctor's Home page

If the Bystander wishes to log in, then he can log in using his credentials. He gets to view the Doctor's and the Nurse's reports and can view the vitals of the patient which has been updated by the nurse in charge of the patient. The bystanders using the app also get a notification on their phones when there is a difference in the patient's status. They can access the ambulance and nearby blood bank service for their patients as well. The consent form which is issued by the nurse can be viewed by the bystander as well.

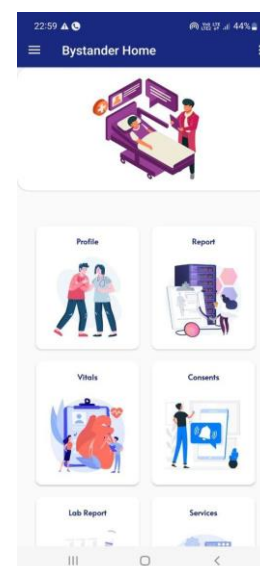


Fig -8: Bystanders Home page

The android application accesses the values of the device from the firebase and gets it displayed continuously in the application. The application should give an alert message if the vitals of the patient vary rather than the normal level.

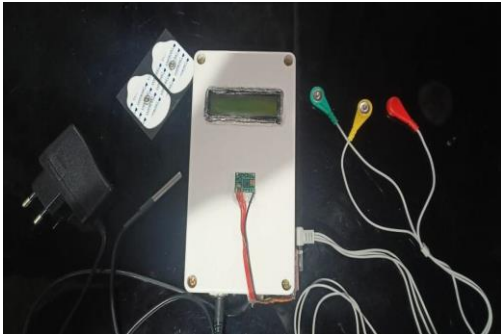


Fig -3: Hardware Component

3. CONCLUSIONS

The ICU team cannot always update each patient's details to their family members frequently. Also, the family members of these patients will be restless in such a situation to know about the updates and current condition of their dear ones. Hence this paper develops a system that could monitor the patient throughout and record the readings periodically which would help the team to provide updates regarding the patient's conditions and this system also reduces the workload that the team faces within the ICU. The system provides various modules like consent approval, vitals reading updates, doctors' and nurses' reports about the condition of the patient after each round, and the test reports are also available on the system. All these modules ensure proper communication regarding the patient's current situation to their family. Thus this system will be a great help to both the ICU team and the bystanders of the patient, helping in reducing all the unwanted problems outside an ICU.

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