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"AarogyaCare: A Unified Framework for Smart Hospital Automation Using Wireless Sensors

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Abstract—The proposed research paper presents AarogyaCare, an IoT-Based Smart Hospital Automation and Patient Monitoring System, designed to improve patient care and reduce the workload of hospital staff. The system integrates multiple monitoring and automation modules, including patient identification using RFID, heart rate and oxygen saturation monitoring using the MAX30100 sensor, bed occupancy detection using a switch, saline level monitoring using a load cell and HX711 module, and medicine reminders using an LED and buzzer. The collected information is displayed on an LCD and a web-based dashboard, allowing hospital staff to monitor important patient-related parameters through a centralized interface. The proposed system aims to support timely attention, improve monitoring efficiency, and reduce the need for continuous manual observation. By combining sensor-based monitoring with IoT connectivity, AarogyaCare provides a practical and cost-effective approach to smart hospital management. The system is intended as a monitoring aid and does not replace professional medical judgment. Further testing under real hospital conditions is required to evaluate its accuracy, reliability, and overall performance.

1. INTRODUCTION

AarogyaCare is an IoT-based smart hospital automation and patient monitoring system designed to improve patient care and reduce the workload of healthcare staff. The system integrates multiple modules, including RFID-based patient identification, heart rate and oxygen saturation (SpO_2) monitoring using the MAX30100 sensor, bed occupancy detection using a switch, saline level monitoring using a load cell and HX711 module, and medicine reminders using an LED and buzzer. The collected information is displayed on an LCD and a web-based dashboard, allowing hospital staff to monitor different parameters through a centralized platform. By combining sensor-based monitoring and IoT technology, the proposed system aims to reduce routine manual monitoring, improve the accessibility of patient information, and support timely attention when required. AarogyaCare provides a practical approach to smart hospital management, while medical decisions and patient care remain under the supervision of healthcare professionals.

2. RELATED WORK

Several studies have explored the use of Internet of Things (IoT) technology in healthcare for remote patient monitoring and hospital automation. Existing systems use sensors to measure vital signs such as heart rate and oxygen saturation, helping healthcare professionals monitor patients more efficiently. RFID technology has also been used for patient identification and information management. Similarly, sensor-based systems can monitor bed occupancy and saline levels, while alert mechanisms such as buzzers and LEDs can provide medicine reminders. However, many systems focus on individual monitoring functions rather than integrating multiple features into a single platform. To address this limitation, the proposed AarogyaCare system combines patient identification, vital sign monitoring, bed occupancy detection, saline level monitoring, and medicine reminders, with information displayed on an LCD and a web-based dashboard. This integrated approach aims to support efficient and centralized hospital monitoring.

3. PROPOSED SYSTEM

A. System Overview

The proposed AarogyaCare system integrates patient monitoring and hospital automation functions into a single platform. It includes RFID-based patient identification, heart rate and SpO_2 monitoring using the MAX30100 sensor, bed occupancy detection using a switch, saline level monitoring using a load cell and HX711 module, and medicine reminders using an LED and buzzer. The collected information is displayed on an LCD and a web-based dashboard to support centralized monitoring.

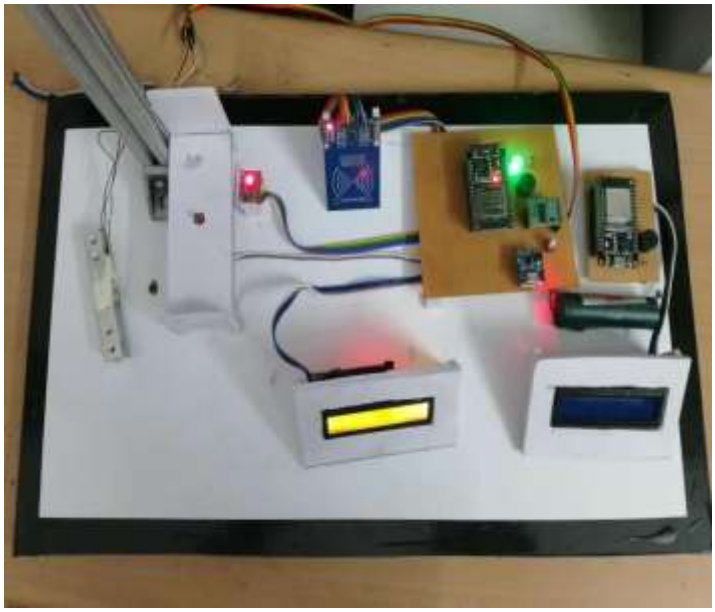


Fig.1 AarogyaCare smart hospital automation and patient monitoring system prototype.

B. Functional Architecture

The functional architecture describes the flow of information from the monitoring modules to the display interface.

Patient RFID / MAX30100 / Bed Switch / Load Cell and HX711 / Medicine Reminder → Controller → LCD and Web Dashboard

The controller receives information from the connected modules and processes it for display. The system combines patient identification, vital sign monitoring, bed occupancy status, saline level estimation, and medicine reminders within one monitoring platform.

C. Patient Monitoring and Identification

RFID technology is used to identify patients through their assigned RFID cards. The MAX30100 sensor measures heart rate and estimates peripheral oxygen saturation (SpO_2). These readings can be displayed on the LCD and dashboard to help healthcare staff observe patient-related information. The sensor readings are intended for monitoring support and should not be considered a replacement for medical-grade measurements.

D. Bed Occupancy and Saline Monitoring

Bed occupancy is detected using a switch that indicates whether the bed is occupied or unoccupied. Saline monitoring is performed using a load cell connected to the HX711 module, which measures changes in the weight of the saline bottle. The weight readings can be used to estimate the remaining saline level. These functions aim to help staff monitor bed status and saline availability more conveniently.

E. Medicine Reminder and IoT Dashboard

The medicine reminder module uses an LED and buzzer to provide alerts at configured reminder times. The LCD displays local system information, while the web-based dashboard presents the available monitoring data through a centralized interface. Integrating these features aims to improve information accessibility and support routine hospital activities.

4. HARDWARE AND SOFTWARE DESIGN

A. .Hardware component

The proposed AarogyaCare system consists of hardware components for patient identification, health monitoring, bed occupancy detection, saline level monitoring, and medicine reminders. The RFID reader and RFID card are used for patient identification. The MAX30100 sensor is used to measure heart rate and estimate oxygen saturation (SpO_2). A switch is used to detect bed occupancy, while a load cell connected to the HX711 module measures the weight of the saline bottle. An LED and buzzer provide medicine reminders. The system also includes a controller, LCD display, power supply, and connecting wires to integrate the modules and display the collected information.

I. The main hardware components are:

II. RFID reader and RFID card

III. MAX30100 heart rate and SpO_2 sensor

IV. Bed occupancy switch

V. Load cell and HX711 amplifier module

VI. LED and buzzer

VII. Microcontroller and interfacing modules

VIII. LCD display

Power supply, connecting wires, and supporting circuit components

B. Controller and Interfaces

The controller acts as the central processing unit of the AarogyaCare system. It receives inputs from the RFID reader, MAX30100 sensor, bed occupancy switch, and load cell module. Based on the programmed logic, it processes the available information and coordinates the connected output devices. The LCD displays information locally, while the web-based dashboard provides a centralized view of the monitoring data. The controller and interface connections must be configured according to the electrical and communication requirements of each module.

C. .Software Modulec

The software is responsible for initializing the hardware, acquiring sensor readings, processing inputs, controlling alerts, and updating the display interface. The patient identification module reads RFID card information, while the health monitoring module acquires heart rate and SpO_2 readings from the MAX30100 sensor. The bed monitoring module reads the switch status, and the saline monitoring module processes the load cell readings through the HX711 module. The medicine reminder module activates the LED and buzzer according to the configured reminder logic. The display module updates the LCD and web dashboard with the available information.

D. IoT Monitoring and Dashboard

The web-based dashboard provides a centralized interface for viewing patient-related monitoring information. Data received from the controller can be presented in a readable format, allowing hospital staff to observe the status of the connected modules. The LCD provides local information, while the dashboard supports remote viewing when the required network connection is available. The actual dashboard software and communication method should be specified according to the technologies implemented in the project.

5. WORKING PRINCIPLE

The AarogyaCare system works by integrating patient identification, health monitoring, bed occupancy detection, saline monitoring, and medicine reminders into a single platform. When the system is powered on, the controller initializes the connected modules and starts collecting information from the sensors. The RFID reader identifies the patient using an RFID card, while the MAX30100 sensor measures heart rate and estimates oxygen saturation (SpO_2). The bed occupancy switch indicates whether the bed is occupied or unoccupied. For saline monitoring, the load cell measures the weight of the saline bottle, and the HX711 module converts the sensor signal into readings that can be processed by the

controller to estimate the remaining saline level. The medicine reminder module activates an LED and buzzer according to the configured reminder schedule. The collected information is displayed on the LCD and web-based dashboard, allowing hospital staff to observe the available patient-related data through a centralized interface. The system repeats the monitoring process during operation and is intended to assist healthcare staff with routine monitoring and timely attention.

6. IMPLEMENTATION PROCEDURE

The AarogyaCare system is implemented by integrating hardware components, developing the control program, and connecting the monitoring interface. First, the hardware components, including the RFID reader, MAX30100 sensor, bed occupancy switch, load cell, HX711 module, LED, buzzer, and LCD, are assembled and connected to the controller according to their interface requirements. Next, each module is tested individually to verify patient identification, heart rate and SpO_2 readings, bed status detection, saline weight measurement, and medicine reminder operation. The controller program is then developed to collect sensor data, process inputs, and control the connected output devices. After individual testing, the modules are integrated into a single system, and the LCD is configured to display the monitoring information. The web-based dashboard is then connected to display the available data through the selected communication method. Finally, the complete system is tested to check sensor readings, alert operation, display updates, and communication between the controller and dashboard. The system should be evaluated under controlled conditions before being considered for practical hospital use.

7. PERFORMANCE EVALUATION PLAN

The performance of the proposed AarogyaCare system is evaluated by testing each module individually and then verifying the complete integrated system. Patient identification is checked using RFID cards, while the MAX30100 sensor is assessed by comparing its heart rate and SpO_2 readings with a suitable reference device. The bed occupancy switch is tested in both occupied and unoccupied conditions. Saline monitoring is evaluated by checking load cell readings at different bottle weights, and the medicine reminder module is tested to verify LED and buzzer activation at the configured time. The LCD and web-based dashboard are checked for correct data display and updates. Communication reliability and system response are also examined during operation. Since verified experimental measurements have not been provided, numerical accuracy, response time, and reliability values are not claimed. Actual test results should be recorded and analyzed to determine the system's performance and identify areas for improvement.

8. APPLICATIONS AND LIMITATIONS

A. Applications

The proposed AarogyaCare system can be used in hospitals, clinics, and patient-care environments to support routine patient monitoring and hospital management. RFID-based identification helps identify patients, while the MAX30100 sensor provides heart rate and SpO_2 readings. Bed occupancy detection helps staff monitor bed status, and the load cell with the HX711 module supports saline level estimation by measuring bottle weight. The medicine reminder module uses an LED and buzzer to provide alerts at configured times. The LCD and web-based dashboard provide a centralized view of the available information. The system can also serve as an educational prototype for demonstrating IoT-based healthcare automation.

B. Limitations

The system has certain limitations that must be considered. The accuracy of heart rate and SpO_2 readings depends on sensor placement, movement, and operating conditions. Saline level estimation depends on load cell calibration and correct bottle placement. The bed occupancy switch may require proper positioning to detect bed status reliably. Medicine reminders depend on correct time configuration and do not confirm whether a medicine has been taken. The web dashboard requires a functioning communication connection for remote viewing. Furthermore, the system requires testing to establish its reliability and suitability for practical use. AarogyaCare is intended to assist healthcare staff and cannot replace professional medical supervision or medical-grade monitoring equipment.

9. CONCLUSION AND FUTURE WORK

The proposed AarogyaCare system presents an IoT-based approach to smart hospital automation and patient monitoring. It integrates RFID-based patient identification, heart rate and SpO_2 monitoring using the MAX30100 sensor, bed occupancy detection, saline level monitoring using a load cell and HX711 module, and medicine reminders using an LED and buzzer. The LCD and web-based dashboard provide a centralized view of the available monitoring information. The system aims to reduce routine manual monitoring efforts and support healthcare staff in managing patient-related activities more efficiently. However, further testing is required to verify its accuracy, reliability, and performance under practical conditions

Future work may include improving sensor accuracy through calibration, adding automatic alerts for abnormal readings and low saline levels, and enhancing dashboard features for patient data storage and historical analysis. Additional features such as real-time notifications, secure patient records, and improved wireless connectivity could also be incorporated. With further development and validation, AarogyaCare could become a more reliable and efficient solution for IoT-based hospital monitoring while continuing to support, rather than replace, professional medical supervision.

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