Patient Monitoring and Care System

Vaishali Savale[1], Moksh Sanghvi[2], Rohitashva Kumawat[3], Ruzan Verma[4], Shreya Mantri[5]
[1,2,3,4,5]Department of Multidisciplinary Engineering (DOME) Vishwakarma Institute of Technology, Pune, 411037, Maharashtra, India

Abstract — Patient Monitoring and Care System This study presents a complete Patient Monitoring System (PMS) that integrates cutting-edge technology to improve healthcare administration. The three key elements of the suggested system are an automatic pill dispenser, saline level monitoring, and facial recognition—all of which function flawlessly with OpenCV.

Real-time facial data and patient activities are captured and analysed by the Facial Recognition module either and ftdi module which makes use of OpenCV's computer vision capabilities. Medical practitioners analyse psychological well-being and potential distress by continuously monitoring a patient's movements.

Saline Level Monitoring system uses sensor technology to make sure that saline levels are measured and recorded precisely. Healthcare practitioners maintain optimal levels of hydration and rapidly address any deviations from the norm.

Automatic Pill Dispenser provides an effective and automated medication management solution. The pill dispenser may administer pills at predefined intervals by integrating OpenCV.

These three elements come together to form a single Patient Monitoring System, which offers a comprehensive method of managing healthcare. The technology gathers real-time data, which helps healthcare providers make prompt decisions that enhance patient outcomes and overall healthcare efficiency.

Keywords —Patient Monitoring, Healthcare, Patient Management, Saline Monitoring, Automatic Pill Dispenser

INTRODUCTION

Technological advances are driving a transformation in the healthcare sector that aims to rethink patient care and monitoring. Given this, it is critical to integrate cutting-edge technologies in order to meet the increasingly complicated healthcare needs. In this study, a novel Patient Monitoring System (PMS) using OpenCV (Open Source Computer Vision Library) and pose library as a key component is examined. With the integration of Saline Level Monitoring, Automatic Pill Dispenser, and Facial Recognition, this system is specially intended to treat patients holistically. The need for this kind of technological intervention is necessary since patient care needs are changing and there is an increasing need for accuracy, effectiveness, and comprehensive treatment.

When it comes to evaluating emotional states and reactions in particular, traditional patient monitoring techniques frequently fall short of capturing the whole range of the patient's health. This gap is filled by the integration of facial recognition, made possible by OpenCV, which gives medical personnel instantaneous access to information about their patients' mental wellbeing. This novel method offers a more comprehensive awareness of the patient in addition to enhancing standard vital sign monitoring. This enables prompt interventions in response to emotional distress or discomfort.

Accurate and timely monitoring of physiological indicators is essential, and it goes hand in hand with the need for comprehensive patient care. One essential part of the suggested PMS, the Saline Level Monitoring system, is made to satisfy this requirement. Since many medical illnesses depend on optimum hydration, it is critical to accurately detect and track saline levels. Healthcare professionals can keep a close watch on patients' hydration levels thanks to the integration of sensor technology, which enables proactive modifications to saline levels and improves patient care overall.

LITERATURE REVIEW

Smart Saline Level Monitoring System Using ESP32 and MQTT-S:

This paper discusses the development of an IoT-based system for monitoring the level of saline in hospitals. The system uses a load sensor and an ESP32 WiFi chip to measure the weight of the saline bottle and send alerts when the level reaches certain thresholds. The communication between the components is facilitated by the MQTT-S protocol, which allows for asynchronous messaging and guaranteed delivery of messages. The paper also highlights the advantages of using MQTT-S over other protocols like HTTP and CoAP.

A Review Paper on Patient Monitoring System:
The paper explores patient monitoring systems' methodology, employing smart bio-sensors to detect and log patients' physiological traits. It emphasizes linking this data to computers wirelessly. Highlighting patient satisfaction in healthcare management, it illustrates how these systems gauge healthcare needs. Various examples, like wearable body sensor networks and remote home-based monitoring, are presented, underscoring these systems' user-friendliness and efficiency for both patients and healthcare providers.

I. METHODOLOGY

A. TOOLS / TECHNOLOGIES USED

- Pose and open-cv Library
- Arduino Uno
- Load Sensor & HX711 Module
- ESP 32 CAM & FTDI module
- Servo motors

B. WORKING

Patient Posture Monitoring
Components Used:
Pose Detector Library: This library facilitates the detection and identification of body poses, generating dot representations corresponding to various body parts.

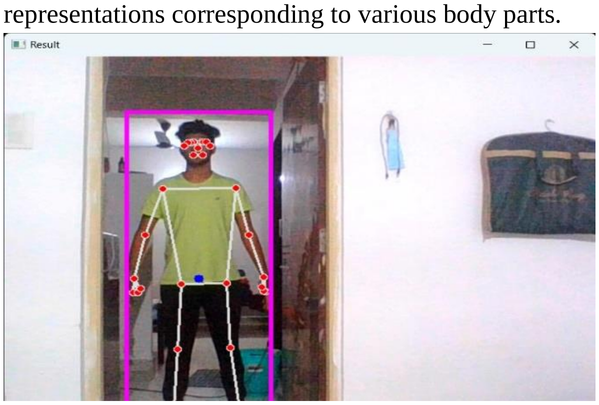


Fig 1. Tracking body parts using pose library.

The Patient Posture Monitoring System operates by first using the Pose Detector Library to capture body poses and generate dot representations. These dots are encoded with specific angles denoting different postures, such as 180 degrees for lying down or 90 degrees for sitting. The encoded posture data, including angle measurements and their associated posture states, is then systematically stored in a dedicated database. This integration with a database management system allows for the secure storage and organization of the posture-related information for each patient. Continuous monitoring of posture using the Pose Detector Library allows real-time tracking of changes.

Stored posture data is analyzed to identify patterns or deviations that may indicate discomfort or health concerns. Healthcare providers use this analysis to generate reports or alerts, enabling timely interventions. This methodology seamlessly integrates pose detection, encoding, database storage, and analysis, ensuring comprehensive patient posture assessment and responsive healthcare actions

Fig2. Body encodings

The saline monitoring system operates by integrating a load sensor, buzzer and the HX711 module using IOT.

Components and Utilization:
Arduino Uno:
Function: Serves as the central processing unit, executing the monitoring code.
Utilization: Interacts with the load sensor, processes data, and triggers the buzzer when saline levels are low.

Load Sensor:
Function: Converts physical force (weight) into electrical signals using strain gauge technology.
Utilization: Placed beneath the saline container, it measures weight changes to detect variations in the saline level.

HX711 Module:
Function: Acts as an amplifier and analog-to-digital converter (ADC).
Utilization: Interfaces with the load sensor, amplifying and digitizing its output for precise weight measurement.

Buzzer:
Function: Serves as the alert mechanism.
Utilization: When activated by the Arduino Uno based on weight measurements, it produces an audible sound, signaling a decrease in saline levels.
This comprehensive setup ensures accurate monitoring of saline levels, providing a timely alert system for healthcare professionals to take necessary actions, thus contributing to the overall efficiency of patient care.

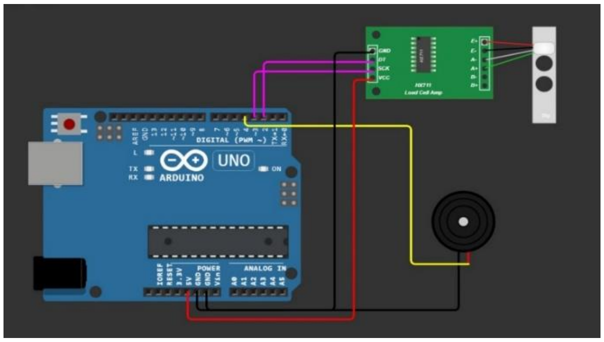
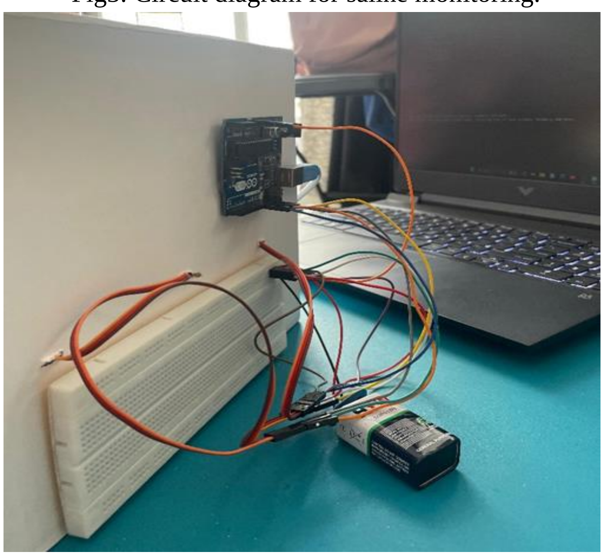


Fig3. Circuit diagram for saline monitoring.



The automated pill dispenser was constructed using key components, including an Arduino board as the central control unit and a servo motor for precise medication release. Pill compartments were integrated for organized storage, each corresponding to a specific dosage or scheduled time. A 9V battery powered both the Arduino board and servo motor. The systematic methodology involved careful design, positioning the servo motor, and programming it to follow a predefined schedule. Rigorous testing confirmed the dispenser's accuracy and reliability in delivering the correct pills at designated times. This approach ensured the successful development and integration of the automated pill dispenser, enhancing the overall efficiency of the patient care system.

Circuit diagram of the Automatic Pill Dispenser

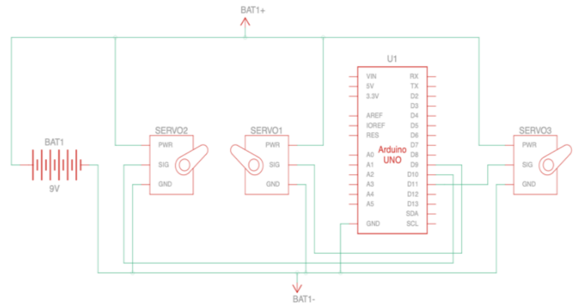


Fig4. Hardware used and Circuit diagram for pill dispenser

The Patient Monitoring System (PMS) employs high-resolution cameras and OpenCV for real-time facial analysis, capturing emotions and actions. Non-invasive sensors monitor continuous saline levels, and an Automatic Pill Dispenser follows the medication schedule, issuing alerts for missed doses. Data, including facial information, saline levels, and medication schedules, is securely stored. Robust communication protocols facilitate seamless data exchange, while user interfaces offer real-time insights. Future enhancements include advanced facial recognition, IoT integration, predictive analytics, and Electronic Health Records compatibility. This integrated approach aims to revolutionize patient care through timely, personalized, and efficient healthcare management.

II. PROPOSED SYSTEM

The proposed Patient Monitoring System (PMS) integrates advanced technologies, notably OpenCV, to transform healthcare management. Hardware components include a Facial Recognition Module with high-resolution cameras, a Saline Level Monitoring system with non-invasive sensors, and an Automatic Pill Dispenser. Software features real-time facial analysis, comprehensive data storage, and logic-driven medication dispensing. The centralized database ensures security and regular backups. Robust communication protocols facilitate seamless data exchange, and user interfaces cater to healthcare professionals and patients. Future enhancements include advanced machine learning for facial recognition, IoT integration, predictive analytics, and Electronic Health Records compatibility, ensuring continuous technological evolution in healthcare.

III. RESULTS

Automated Pill Dispenser:

Fig5. Physical pill dispensing machine

Patient Monitoring:

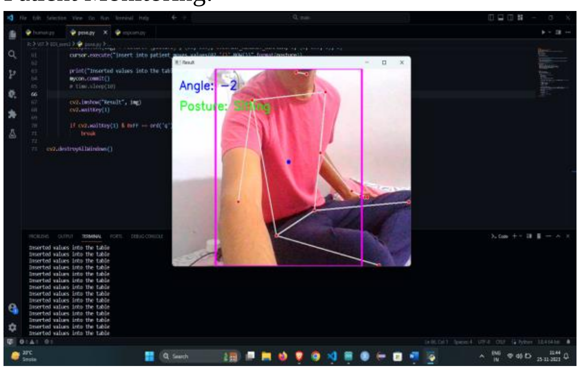


Fig6. Classifying postures into sitting, standing, unknown

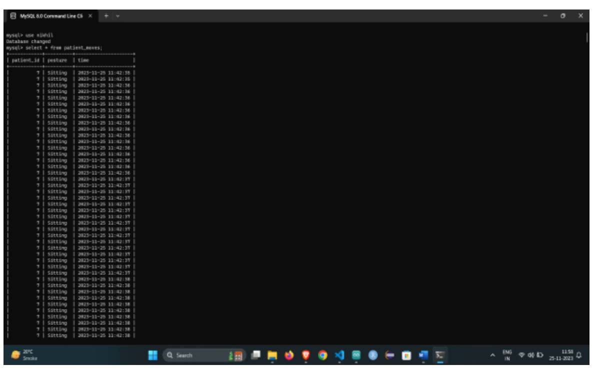


Fig7. Adding patient movements to my-sql database.

Saline level monitoring and alerting system:

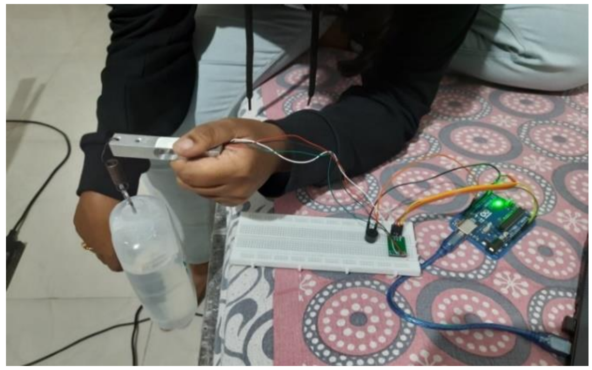


Fig8. Working saline monitoring system with a buzzer attached to it for announcing alerts.

User Interface:

Health Tracker

Have you taken today's medicine?

Yes No

How much water did the patient drink today?

Save

id	medicine_taken	water_consum...	entry_time
1	No	NULL	2023-11-25 12:35:33
2	NULL	1.00	2023-11-25 12:35:37
NULL	NULL	NULL	NULL

Fig9. GUI for attender to add record into database.

IV. FUTURE SCOPE

Future scope includes advancing facial recognition through sophisticated machine learning, integrating IoT for remote patient monitoring, incorporating predictive analytics for medication adherence, and ensuring seamless compatibility with Electronic Health Records (EHR). These enhancements aim to keep the system at the forefront of healthcare technology, providing continuous improvement and adaptability to emerging trends and needs in patient care.

V. CONCLUSION

In summary, the suggested Patient Monitoring and Care System (PMCS)'s integration of OpenCV is a ground-breaking strategy to transform healthcare administration. Through the integration of Saline Level Monitoring, Automatic Pill Dispenser, and Facial Recognition, the system provides a comprehensive approach to managing the physiological and psychological elements of patient care. This creative combination of technology has the potential to improve patient outcomes by giving medical personnel fast access to real-time insights and enabling interventions. The study emphasises how cutting-edge technology have the power to fundamentally alter the healthcare industry by promoting accuracy, effectiveness, and all-encompassing patient care.

VII. Acknowledgment

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