International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 10 | Oct 2023 www.irjet.net p-ISSN: 2395-0072

# AN IOT BASED SMART PILL DISPENSER WITH HEALTH MONITORING

**Ms.GODHA KRISHNA M [1], Ms.JOSHIKKA SRI E [2] , Ms.KEERTHANNA R [3], Mrs.K NITHYA [4]**

*[1,2,3] Student, B.E, ECE, Department of ECE MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE*
*[4] Assi.Prof, ECE, Department of ECE MEENAKSHI SUNDARARAJAN ENGINEERING COLLEGE*

---

**Abstract -** *In an era heavily reliant on medication, ensuring timely and accurate pill consumption remains a critical aspect, particularly for individuals with memory impairments or the elderly. This research focuses on the development of a sophisticated and user-friendly smart pill dispenser system, designed to facilitate medication adherence among vulnerable populations. The proposed system leverages an ESP Module, IR sensor, heartbeat, Spo2, and temperature sensors, along with a buzzer-equipped alert mechanism, to assist patients in adhering to their prescribed medication schedule. The user-friendly interface accessible via a smartphone enables remote management and monitoring from any location globally. With an emphasis on ease of use and accessibility, the system aims to cater to the needs of elderly individuals, particularly those with limited literacy. Notably, this intelligent pill box serves as a vital tool in ensuring timely medication intake, a crucial factor in managing health conditions, including those exacerbated by the recent Covid-19 pandemic.*

***Key Words***: Smart Pill Dispenser, ESP Module, Remote Monitoring, Medication Adherence, Elderly Healthcare, IoT-based Healthcare Systems.

## 1. INTRODUCTION

In accordance to prescribed medication remains a formidable challenge within the healthcare industry, particularly among older individuals prone to memory lapses. The complexities associated with managing multiple medications further heighten the risk of inadvertent overdosing, potentially leading to severe health implications and, in some cases, irreversible consequences. It is evident that effective intervention strategies are crucial in addressing this pervasive issue.

In response to the pressing need for reliable medication management, this study focuses on the design and development of an affordable and user-friendly Automated Medicine Dispenser (AMD) capable of administering both solid and liquid medications. The proposed system aims to ensure timely and accurate drug intake while mitigating the risks associated with inadvertent non-compliance or overdosing. Leveraging a combination of premeasured dose release and manual compartment sorting, the AMD offers flexibility in catering to diverse patient needs and medication types.

Furthermore, the research acknowledges the significant role of innovative packaging solutions, including memory aids and portable, user-friendly containers, in facilitating medication adherence. By incorporating advanced technological features and intuitive design elements, the AMD seeks to bridge the gap between patient needs and effective medication management, thereby promoting improved health outcomes and patient safety.

Keywords: Automated Medicine Dispenser, Medication Adherence, Drug Safety, Innovative Packaging Solutions, Health Care Intervention.

### 1.1 INTERNET OF THINGS(IOT)

The Internet of Things (IoT) represents a transformative paradigm that has revolutionized various industries, including healthcare. By interconnecting a multitude of physical devices and systems through the internet, IoT enables seamless data exchange, real-time monitoring, and remote control functionalities. In the context of healthcare, IoT has emerged as a groundbreaking solution, facilitating the development of smart and interconnected medical devices, personalized health monitoring systems, and efficient patient management platforms.

Through the integration of sensors, actuators, and advanced data analytics, IoT empowers healthcare professionals to collect, analyze, and leverage patient data for accurate diagnosis, proactive treatment interventions, and optimized healthcare delivery. Furthermore, IoT-driven innovations have facilitated the implementation of telemedicine solutions, enabling remote patient monitoring, teleconsultations, and timely intervention, particularly in underserved or remote regions.

As IoT continues to evolve, it holds the potential to significantly enhance the efficiency, accessibility, and quality of healthcare services, fostering a more patient-centric and data-driven approach to healthcare management and delivery.

### 1.2 PROBLEM STATEMENT

In healthcare facilities such as hospitals and old-age homes, the management of medication adherence among multiple patients presents a daunting challenge, especially for a single caretaker tasked with overseeing a considerable number of individuals simultaneously. The

complexity is further compounded as self-reliant senior citizens and patients with Alzheimer's disease experience difficulties in maintaining a consistent medication schedule, often resulting in detrimental health consequences. Instances of inadvertent medication errors and improper dosing not only jeopardize patient well-being but also impose significant burdens on the already strained healthcare system.

The criticality of timely and accurate medication intake is particularly pronounced for patients grappling with chronic conditions, including hypertension, diabetes, and cardiovascular ailments, necessitating an urgent and effective solution that can ensure seamless and error-free medication management. Addressing these pressing concerns is imperative to enhance patient safety, reduce healthcare costs, and alleviate the burden on caregivers in healthcare settings.

## 2. PROPOSED SYSTEM

The development of the smart pill box entails the integration of advanced IoT technology to ensure seamless and timely medication management. The system employs a Node MCU, enabling efficient data transmission and control of the pill box. Incorporated within the smart pill box are vital health monitoring elements, including a heart rate sensor, temperature sensor, and spo2 sensor, facilitating regular health check-ups for patients.

These health metrics are seamlessly synchronized with the accompanying mobile application, providing patients and caregivers with real-time updates on the patient's health status. The app features a dual login interface, catering to both patients and doctors/caretakers, allowing for streamlined medication scheduling and monitoring. Through the app, users can input prescription details, facilitating automated and accurate medication dispensing as per the predefined schedule.

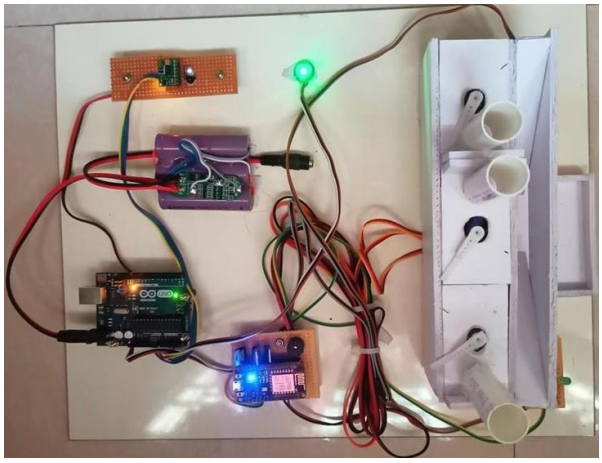
Furthermore, the inclusion of an infrared sensor, buzzer, and servo motors enhances the functionality of the pill box, ensuring precise and controlled medication distribution. The "Find my pillbox" feature offers added convenience, enabling users to locate the device effortlessly in case of misplacement.

To address emergency situations effectively, the system incorporates an emergency toggle button, empowering patients to alert caregivers promptly in case of any health abnormalities, thereby facilitating swift and targeted intervention when necessary. This comprehensive solution aims to revolutionize medication adherence and healthcare management, fostering patient independence, safety, and well-being while alleviating the burden on caregivers and healthcare providers.

## 3. WORKING ARCHITECTURE

### 3.1 HARDWARE SETUP

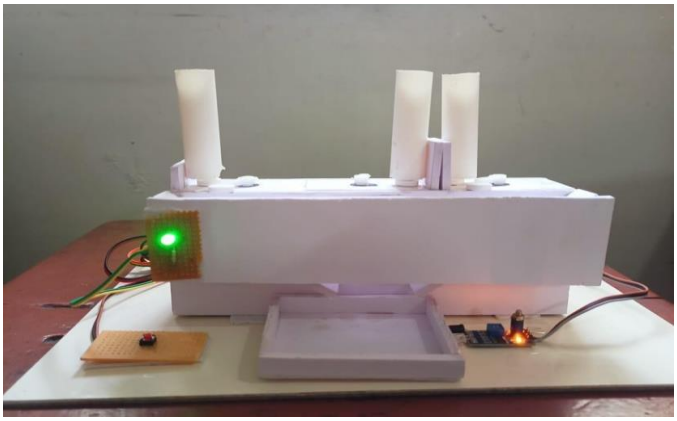
The smart pill dispenser features a cylindrical casing with customizable compartments to accommodate varying tablet shapes, ensuring secure and organized storage. A dedicated space beneath the casing is allocated for the last tablet, directly accessible to the rotating shaft of the servo motor. Different casings are available for morning, afternoon, and evening medication, eliminating the need for manual input of medicine names in the software, thereby simplifying the caretaker's responsibilities.



Upon rotation, the servo motor expels the designated tablet through the inclined pathway, directing it smoothly into the tray without spillage. The dispensation process is indicated by LED and buzzer alerts, providing visual and auditory confirmation of successful medication delivery. The presence of the dispensed pills in the tray is continuously monitored using an IR sensor, ensuring accurate tracking and management of medication intake.

Furthermore, the hardware setup incorporates vital health monitoring components, including heart rate and Spo2 sensors, facilitating real-time health parameter assessments. The Node MCU serves as the Wi-Fi module, enabling seamless connectivity to external networks for data transmission and remote monitoring.

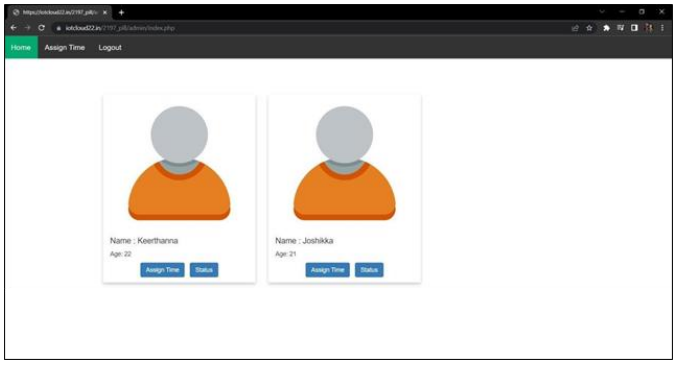
Integrated within the system, the Arduino acts as the central control unit, effectively managing sensor inputs, servo motor operations, and pushbutton functionalities. The entire hardware system is powered by a rechargeable battery, supported by a compatible adapter for convenient and sustained operation



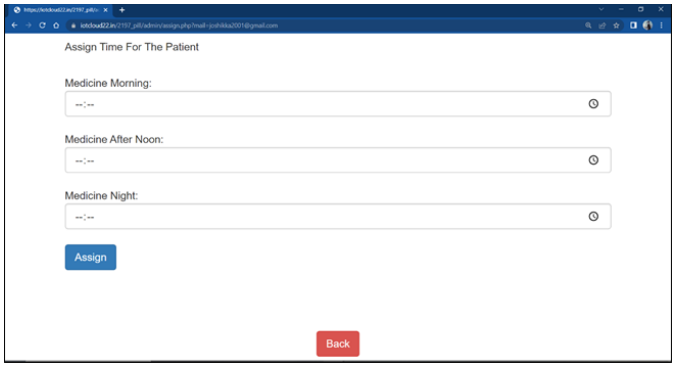
### 3.2 SOFTWARE

1. Login/Signup Page: The Login/Signup page serves as the initial point of access, facilitating both user authentication and registration. Registered users, including caretakers and patients, can log in using their designated credentials. Access is granted only upon successful authentication, ensuring data security and confidentiality. New users are prompted to complete the registration process by providing essential details, including name, email address, phone number, age, username, and password. The signup process is exclusively reserved for patients, enabling personalized medication management and monitoring.

2. Admin Dashboard: Upon successful login, the admin is directed to the personalized dashboard, featuring comprehensive patient management capabilities. Patient details are displayed in individual cards, each containing relevant information. Two distinct options, "Assign Time" and "Status," provide the caretaker with essential functionalities for efficient medication scheduling and health monitoring. The "Assign Time" option allows the admin to set specific medication schedules for each patient, aligning with their prescribed regimen. Meanwhile, the "Status" option enables real-time tracking of patient health metrics, including heart rate and oxygen saturation levels, ensuring proactive intervention and timely healthcare management.




3. Time Assigning Page: The Time Assigning Page serves as an intuitive interface for the admin to configure and allocate medication schedules for patients. This page presents three dedicated time slots for morning, afternoon, and night medication intake, aligning with common medication administration practices. The selected time slots are securely stored in the cloud, triggering synchronized signals sent to the Node MCU, an integral component of the hardware setup. Upon synchronization with the real-time schedule, the Node MCU facilitates the activation of the Arduino, triggering visual and auditory cues, such as LED and buzzer alerts, to prompt patients to take their medication as scheduled.




4. Patient Status Page: The Patient Status Page empowers the admin to monitor and assess the health status of individual patients comprehensively. Integrated heart rate sensors and SpO2 sensors enable accurate and non-invasive health parameter measurements, capturing real-time data on heart rate and blood oxygen levels. Typically worn on the wrist or fingertip, these sensors provide vital health insights, facilitating proactive healthcare interventions and ensuring prompt medical attention in case of any abnormal health indicators.

## 4. RESULT AND DISCUSSIONS

The implemented design of the smart pill dispenser successfully facilitated the systematic and timely dispensation of medications in accordance with the preset schedules. The integration of the servo motor, coupled with the optimized pathway design, ensured efficient and accurate delivery of medications into the designated tray without spillage or disruption. The combined use of LED and Buzzer alerts provided effective visual and auditory indicators of the dispensation process, enhancing user awareness and adherence to the medication regimen. The seamless functionality of the emergency toggle button enabled prompt communication of critical health situations to the caretaker, ensuring rapid response and timely intervention in emergency scenarios.

Furthermore, the inclusion of vital health monitoring components, such as the heart rate and SpO2 sensors, demonstrated consistent and reliable performance in

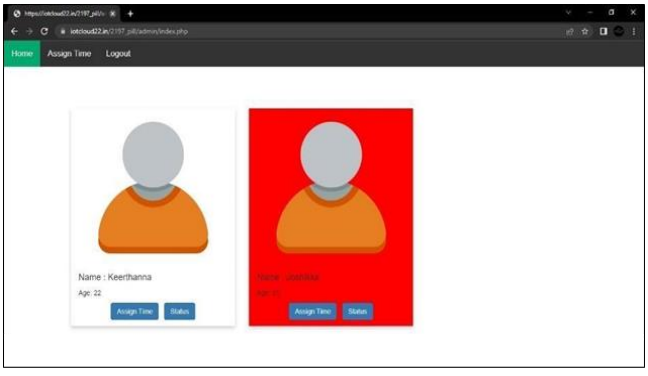
capturing real-time health data, enabling continuous monitoring and assessment of key health indicators.

The successful integration of the Node MCU as the Wi-Fi module facilitated seamless data transmission and synchronization with the cloud-based storage, ensuring secure and accessible data management. The central role of the Arduino microcontroller in coordinating sensor inputs, servo motor operations, and pushbutton functionalities contributed to the seamless functioning and coordination of the entire hardware system, fostering a user-friendly and efficient medication management process.

The developed smart pill dispenser represents a significant advancement in medication management systems, addressing critical challenges associated with medication adherence and patient health monitoring. The optimized design of the pill dispensation pathway, coupled with the integration of LED and Buzzer alerts, enhances user engagement and compliance, minimizing the risk of medication errors and missed doses. The successful implementation of the emergency toggle button serves as a crucial feature in ensuring patient safety and enabling timely intervention during critical health situations, reflecting the system's user-centric design and emphasis on patient well-being.

Moreover, the reliable performance of the heart rate and SpO2 sensors underscores the system's capability in providing accurate and continuous health monitoring, particularly for patients with chronic cardiovascular conditions. The seamless integration of the Node MCU and Arduino microcontroller, supported by a rechargeable battery, demonstrates the system's robust and sustainable operational capabilities, ensuring uninterrupted functionality and data accessibility.

The successful integration of hardware components and software functionalities highlights the system's potential in revolutionizing medication adherence and healthcare management, fostering improved patient outcomes and caregiver efficiency.




## 5. CONCLUSION

In conclusion, the development of this sophisticated smart pill dispenser system represents a significant stride towards addressing the crucial issue of medication adherence, particularly for individuals facing memory impairments or belonging to the elderly demographic. By integrating cutting-edge technologies such as the ESP Module, IR sensor, heartbeat, Spo2, and temperature sensors, coupled with a well-designed alert mechanism, this system provides a comprehensive solution to ensure timely and accurate pill consumption.

The user-friendly interface accessible through a smartphone adds a layer of convenience and remote management, empowering caregivers and family members to monitor medication adherence from anywhere in the world. This aspect is especially beneficial for those caring for elderly individuals, making the process not only efficient but also reassuring.

The emphasis on accessibility and simplicity is a key feature, acknowledging the diverse needs of the elderly population, including those with limited literacy skills. By tailoring the design to be user-friendly, this intelligent pill box becomes an inclusive tool that caters to a wide range of users, promoting independence and autonomy in managing their health.

## REFERENCES:

1. Casciaro, S., Massa, L., Sergi, I., & Patrono, L. (2020, September). A smart pill dispenser to support elderly people in medication adherence. In 2020 5th International Conference on Smart and Sustainable Technologies (SpliTech) (pp. 1-6). IEEE.

2. Erazo, O, Guerrero Ulloa, G, Santana Sornoza, R, Chavez Boza, B.(2017) A Ubiquitous Photo Frame to Pro- ´ vide Reminders to Older Adults. Revista Conrado. 16(72): 34-8.

3. Huang R, Zhao X, Ma J. (2014) The Contours of a Human Individual Model Based Empathetic U-Pillbox System for Humanistic Geriatric Healthcare. Future Generation Computer Systems.; 37(July):404–16.

4. Xu H, Yu W, Griffith D, Golmie N. (2018) A Survey On Industrial Internet Of Things: A Cyber-Physical Systems Perspective. IEEE Access. Dec 4; 6: 78238–59.

5. Salkin C, Oner M, Ustundag A, Cevikcan E. (2018)A Conceptual Framework for Industry 4.0. In: Ustundag A, Cevikcan E, editors. Industry 4.0:

Managing The Digital Transformation. Springer, Cham;. p. 3–23.

6. Singh U, Sharad A, Kumar P. (2019)IoMT Based Pill Dispensing System. In: 2019 10th International Conference on Computing, Communication and Networking Technologies, ICCCNT 2019; jul 6-8; Kampur, India, India. IEEE. p. 1–5.

7. Guerrero-Ulloa G, Rodr´ıguez-Dom´ınguez C, Hornos MJ. (2019) IoT-Based System to Help Care for Dependent Elderly. In: Botto-Tobar M, Pizarro G, Zu´niga- Prieto M, D'Armas M, Z ˜ u´niga S ˜ anchez M., editors. ´ Communications in Computer and Information Science. Springer, Cham;. p. 41–55.

8. Jaipriya S, Aishwarya R, Akash NB, Jeyadevi AP. An intelligent medical box remotely controlled by doctor. In: Proceedings of the International Conference on Intelligent Sustainable Systems, ICISS 2019. 2019 Feb 21-22; Palladam, Tamilnadu, India, India. IEEE. p. 565–9.

9. Kumar SB, Goh WW, Balakrishnan S. (2018) Smart Medicine Reminder Device For The Elderly. In: Proceedings - 2018 4th International Conference on Advances in Computing, Communication and Automation, ICACCA 2018. Subang Jaya, Malaysia, Malaysia. IEEE. p. 1–6.

10. Atzori L, Iera A, Morabito G. (2010)The Internet Of Things: A Survey. Computer Networks. Oct 28; 54(15):2787–805.