iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** IV **Month of publication:** April 2025

DOI: https://doi.org/10.22214/ijraset.2025.69522

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue IV Apr 2025- Available at www.ijraset.com

Automated Drug Dispensing System with Integrated QR Coded Prescription and IVRS

Adari Satya Srinivasa Rao[1], Puthika Ashok[2], Sure Manideep Naga Sai[3], Attada Santosh Kumar[4], Bandi Bharath[5], Jami Venkata Mani Krishna[6], Kasireddi Venkata Meghana[7]
Department of ECE, Aditya Institute of Technology and Management

Abstract: It is challenging even today to get proper healthcare facilities like availability of medicine in the rural as well as underserved areas like hilly and etc . To help bridge this gap, we've developed a Automated medicine dispensing system that brings a new level of automation, accuracy, and ease of use to medication management. The medicine Dispenser dispenses the medicine based on the QR Coded prescription generated by the hospitals or medicine practitioners it helps to reduce the human errors in understanding the manual prescription and also the QR Coded prescription is unique and helps the patient details to be encrypted . The main part of the Medicine Dispenser is a mobile app built using Flutter and Dart, allowing users to either scan QR-coded prescriptions or manually choose the medicines they need. The app is easy to use and talks directly to an Arduino-based control unit through Bluetooth. This unit controls the relays and motors that handle the actual medicine dispensing. To make the system even more user-friendly, Dispenser consists an Interactive Voice Response System (IVRS) using a DFPlayer Mini module, which guides users step-by-step in either Telugu or English to get Medication based on the problem they are facing like fever, cough, cold and etc. We've also added a DHT11 sensor to monitor temperature and humidity, which helps keep the medicines in good condition. When the sensor detects conditions outside the ideal range, a cooling fan automatically kicks in to protect the medicine .The Dispensers setup is scalable, and built to be deployed anywhere from village health centers to urban clinics. With features like voice based medication selection, QR based dispensing , and environmental monitoring, this system makes smart healthcare delivery not just possible, but practical and effective.
Keywords: Automated medicine dispenser, QR-based medication management, Arduino control system, IVRS integration, smart dispensing system.

I. INTRODUCTION

Traditional medicine dispensing methods rely heavily on human involvement, which can lead to errors, long wait times, and inefficiencies. Patients often face challenges such as incorrect dosage, expired medications, and difficulty accessing medicines, especially in rural and underserved areas. Pharmacists and healthcare providers may also experience workload pressure, increasing the likelihood of dispensing mistakes. Additionally, elderly and disabled individuals may struggle with visiting pharmacies frequently or understanding complex medication regimens. These challenges highlight the need for an automated system that simplifies and secures the dispensing process while ensuring accessibility for all[1], [2].

Automating the medicine dispensing process significantly enhances healthcare efficiency and patient safety. It reduces human errors, ensures precise dosage administration, and minimizes waiting times at pharmacies and hospitals. The system provides 24/7 availability, making it ideal for both urban and rural settings where pharmacy access might be limited. For elderly and disabled individuals, features like voice commands and QR-based prescriptions enable hassle-free medicine retrieval. Additionally, maintaining optimal storage conditions using temperature and humidity sensors ensures medication quality and effectiveness. By integrating these advancements, the dispenser contributes to a more accessible and reliable healthcare system[1], [3].

The automated medicine dispenser can be deployed in hospitals, pharmacies, remote healthcare centers, and emergency medical kiosks to streamline medication distribution. It is particularly useful in rural areas where access to pharmacies and healthcare professionals is limited. Disaster relief centers and military bases can also benefit from this system by ensuring a steady and safe supply of medications. In nursing homes and elder care facilities, the dispenser assists in medication adherence for patients requiring regular doses. Moreover, it can be used for dispensing specialized medications like Ayush medicines and controlled substances while maintaining security and proper dosage tracking[4], [5].

This system offers multiple advantages, including improved accuracy in medication dispensing and reduced dependency on manual processes. QR-based prescription scanning ensures patients receive the correct medication, minimizing the risk of errors. Voice command integration makes it easier for elderly and visually impaired individuals to access their medicine without assistance.

The dispenser operates 24/7, increasing accessibility in both urban and remote areas. Additionally, integrated environmental monitoring ensures medications are stored under optimal conditions, maintaining their potency. The unit-dose packaging feature promotes safe and efficient medication administration, reducing the chances of overdosing or missed doses[4], [6].

II. LITERATURE REVIEW

Jacq.[7] created the APG/RMD818 High-Speed Liquid Unit Dose Packaging Machine, combining sophisticated pharmaceutical automation engineering and process control to automate liquid dose preparation, greatly improving efficiency and production capacity in hospital pharmacies, and summarizing it as an innovative, easy-to-use solution with obvious benefits over solid dose systems. Riti Achammal.S et al.[8] designed an inexpensive and robust automatic drug dispenser with Raspberry Pi and facial recognition, which was efficient in delivering medicine, authenticating patients, and giving low-stock reminders, eventually lowering the reliance on caregivers and increasing adherence to medicine for elderly people. Shanthini E et al.[9]. created an automatic drug dispenser with QR code technology to facilitate medication management by encoding prescriptions, secure payment platforms, and a helical spring drawer system for dispensing. Taking the technology-based approach, they achieved accuracy, transparency, and efficiency, which led to increased dispensing accuracy, minimized waiting time, and increased convenience for patients. They summed up that the dispenser revolutionizes the delivery of healthcare, fitting into contemporary advances in healthcare technology. Rekhitha Sree Ankireddypalli and Kandi Sriya Sushrutha Reddy [10] proposed an IoT-based intelligent drug administration system based on real-time monitoring, authentication, and smart alerts to enhance prescription management and minimize drug addiction. They concluded that the system supports better medication compliance, identifies abuse at an early stage, and ensures responsible prescription practices, ultimately enhancing patient outcomes.

III. METHODOLOGY

The proposed Automatic Medicine Dispenser focuses on integrating software applications and hardware to streamline the medication dispensing. The system employs two user-friendly interaction mechanisms—a QR code-based mobile interface and an IVRS-guided selection process—to ensure seamless and accessible medicine retrieval.

A. *Flowchart*

Fig. 1. Flow Diagram for Medicine Dispensing

This dual approach ensures inclusivity, catering to both tech-savvy users and individuals unfamiliar with mobile applications. By integrating QR code precision with IVRS accessibility, the system enhances efficiency, accuracy, and ease of use in medicine dispensing.

B. Block Diagram

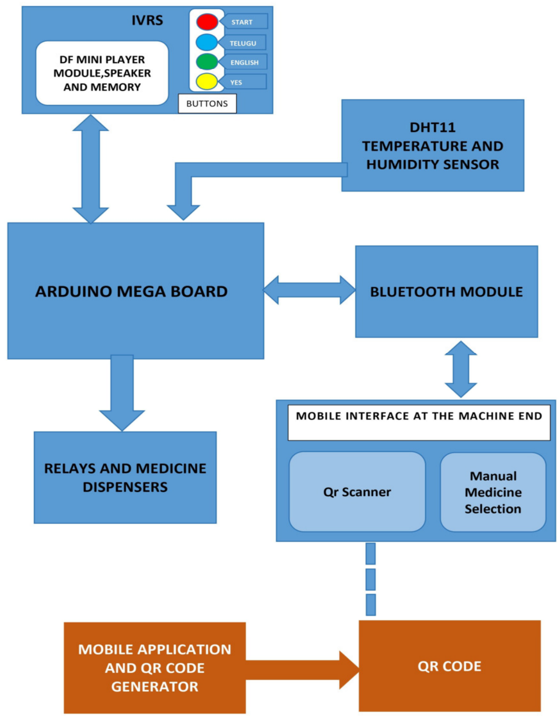

Fig. 2. Block Diagram for an Automatic Medicine Dispenser With QR Code Integration And Ivrs .

The block diagram illustrates the architecture of the Automatic Medicine Dispenser with QR Code Integration and IVRS system. At the core of the system is the Arduino Mega Board, which coordinates various components. The IVRS system, comprising a DFPlayer Mini Module, speaker, and memory, provides voice guidance through interactive prompts, supported by push buttons for language selection and symptom identification. The DHT11 Temperature and Humidity Sensor collects environmental data, which is transmitted to the user interface via the Bluetooth Module. The mobile interface offers two options: a QR Scanner for automatic medicine identification or Manual Medicine Selection for users who prefer manual input. The QR Code is generated by a dedicated Mobile Application, simplifying prescription input. Based on the selected medication, the Arduino activates the Relay and Medicine Dispenser System to release the required drugs. This integrated design ensures accurate medication dispensing, combining automation, user guidance, and environmental monitoring for improved efficiency and accessibility.

C. Components

A. Arduino Mega

Specifications:

- Operating Voltage: 5V
- Input Voltage (recommended): 7V to 12V
- Digital I/O Pins: 54 (of which 15 provide PWM output)
- Analog Input Pins: 16
- Flash Memory: 256 KB (8 KB used by bootloader)
- SRAM: 8 KB
- EEPROM: 4 KB
- Clock Speed: 16 MHz

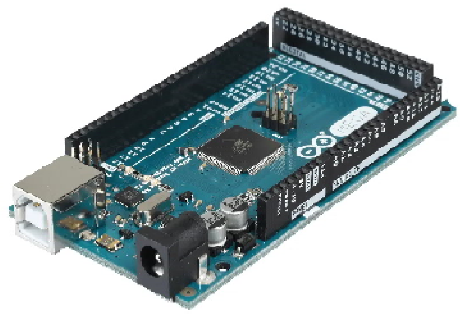

Fig. 3. Arduino Mega 2560

Purpose: The Arduino Mega serves as the central processing unit of the medicine dispensing machine. Its large number of I/O pins and extended memory capacity enable simultaneous integration of key modules like the DFPlayer Mini for IVRS, Bluetooth for user communication, relay modules for motor control, and DHT11 for environmental sensing. It receives decoded QR data from the mobile interface, identifies the required medication, and executes dispensing through voice-guided steps.

B. MP3-TF-16P Module

Specifications:

- Operating Voltage: 3.2V to 5V
- Communication Interface: UART (Serial Communication)
- Audio Format Support: MP3, WAV, and WMA
- Storage Support: MicroSD card up to 32GB

Fig.4. MP3-TF-16P Module

Purpose: This module is responsible for playing voice instructions and guidance for users interacting with the IVRS system. It plays both Telugu and English audio messages to direct users through the medicine dispensing process.

C. 8-Channel Relay Module

Specifications:

- Operating Voltage: 5V
- Channel Control: 8 independent relays
- Maximum Switching Voltage: 250V AC / 30V DC
- Maximum Switching Current: 10A

Fig. 5. 8-channel Relay

Purpose: This module controls the dispensing of medicines. Each relay is assigned to a specific medicine type, ensuring precise and automated medicine delivery based on QR code data or IVRS input.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue IV Apr 2025- Available at www.ijraset.com

D. 150 RPM DC Motors

Specifications:
- Operating Voltage: 6V to 12V
- Speed: 150 RPM
- Torque: High torque suitable for mechanical control

Fig. 6. DC Motor

Purpose: These motors drive the dispensing mechanism, ensuring each medicine is accurately released according to the user's prescription or selection.

E. Push Buttons

Specifications:
- Type: Tactile Push Buttons
- Operating Voltage: 5V

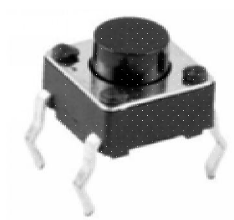

Fig. 7. Push Button

Purpose: Push buttons are used for language selection, manual medicine selection, and additional interactive controls required in the medicine dispenser interface.

F. 4 Ohms 3 Watt Speaker

Specifications:
- Impedance: 4 Ohms
- Power Rating: 3 Watts
- Compact Size for Embedded Systems

Fig. 8. Speaker

Purpose: The speaker delivers clear and loud audio instructions for the IVRS system, ensuring users can follow voice guidance easily during the medicine dispensing process.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue IV Apr 2025- Available at www.ijraset.com

G. DHT11 Sensor

Specifications:
- Operating Voltage: 3.3V to 5V
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90% RH

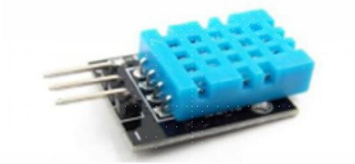

Fig. 9. DHT11 Sensor

Purpose: The DHT11 sensor measures temperature and humidity, providing data that is transmitted to the user interface via Bluetooth to ensure environmental conditions are suitable for stored medicines.

H. HC-05 Bluetooth Module

Specifications:
- Operating Voltage: 3.3V to 5V
- Communication: UART Interface
- Wireless Range: Up to 10 meters

Fig. 10. Bluetooth Module

Purpose: The HC-05 Bluetooth module facilitates wireless communication between the Arduino system and the mobile application. It transmits decoded QR code data and IVRS responses to ensure accurate medicine dispensing and effective user interaction.

I. Buck Converter

Specifications:
- Input Voltage Range: 4.5V to 40V
- Output Voltage Range: 1.25V to 37V (adjustable)
- Output Current: Up to 3A (with heatsink)
- Efficiency: Up to 92%
- Switching Frequency: 150 kHz

Fig. 11. Buck Converter Module

Purpose: The buck converter ensures stable power supply to various modules within the medicine dispenser. It steps down the input voltage to the required level (e.g., 5V or 3.3V) for safely operating components like the Arduino Mega, DFPlayer Mini, Bluetooth module, and sensors. This enhances energy efficiency and protects sensitive electronics, ensuring reliable performance of the QR-based IVRS dispensing system.

IV. RESULTS AND DISCUSSIONS

The proposed Automatic Medicine Dispenser with QR Code Integration and IVRS has been successfully implemented and tested for efficient medicine retrieval. The system's performance was evaluated based on accuracy, response time, and user accessibility. The dual-mode interaction—via mobile QR code scanning and IVRS—ensured seamless medicine dispensing for both tech-savvy users and those unfamiliar with mobile applications. Experimental results demonstrated that the QR code-based retrieval mechanism provided near-instantaneous activation, while the IVRS mode required an average processing time of a few seconds, depending on user input speed. Furthermore, the system effectively minimized human intervention and medication errors, enhancing accessibility and efficiency. The following sections provide a detailed analysis of system performance, user feedback, and potential areas for further optimization.

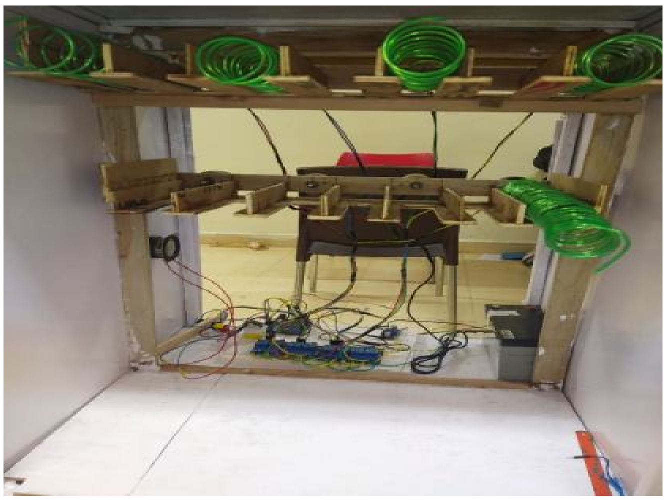

Fig 3: Prototype of the Automatic Medicine Dispenser System

The figure 3 showcases a prototype of an automated medicine dispenser integrating mechanical and electronic components for efficient drug dispensing. The system features spiral storage units controlled by an Arduino Uno, with dispensing triggered via QR code scanning or an IVRS-based selection. A relay-driven motor mechanism ensures precise medicine retrieval, while a DHT11 sensor monitors storage conditions. This system enhances accessibility, minimizes human intervention, and improves accuracy in medication distribution, making it ideal for hospitals, pharmacies, and remote healthcare facilities.

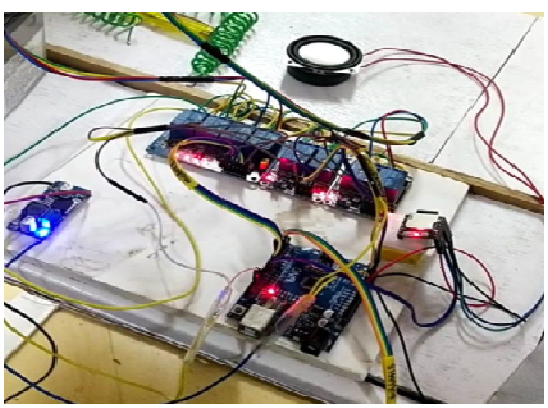

Figure 4: IVRS and Interface-Based Dispensing Circuit

The figure 4 illustrates the circuit implementation of the Interactive Voice Response System (IVRS) and interface-based medicine dispensing unit. The system is powered by an Arduino microcontroller, relays, and communication modules, enabling automated medicine dispensing based on user input via IVRS. The integration of audio feedback and real-time control ensures accurate and efficient medication retrieval. This setup enhances accessibility, particularly for visually impaired or elderly users, by providing a voice-guided, user-friendly interface for medicine selection and dispensing.

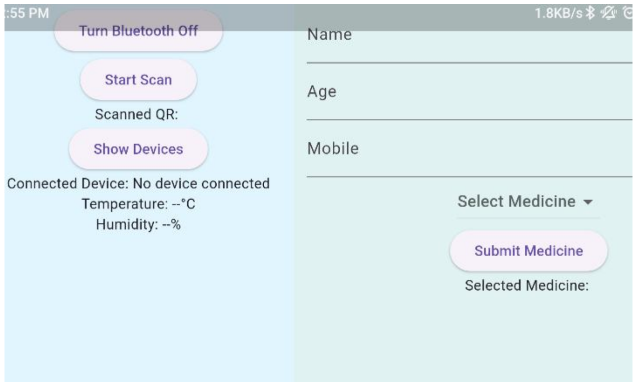

Fig 5: Interface at the Machine to scan qr code and manual medicine selection .

The figure 5 showcases the user interface of the AITAM's eClinic system, designed to facilitate seamless medicine dispensing through QR code scanning and manual input. The interface allows users to enter essential details such as name, age, and phone number while providing an option to scan a QR code for automatic prescription retrieval. Additionally, a "Medicines" button enables manual selection of medicines based on the patient's condition. The real-time temperature and humidity display further enhance the system's adaptability in healthcare environments.

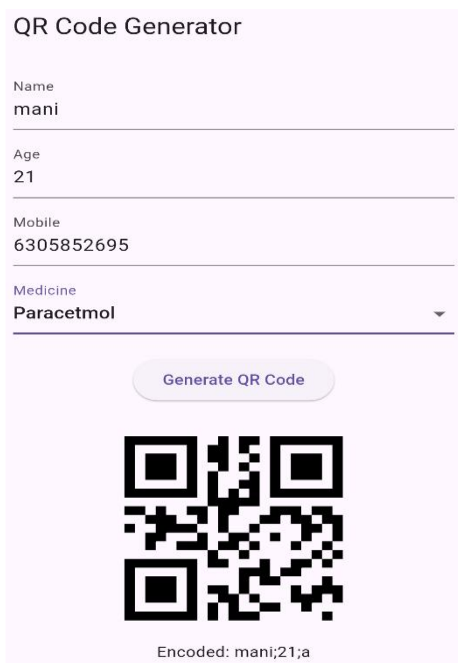

Fig 6. QR Prescription Generation Application

This figure 6 represents the interface for generating QR-based prescriptions, streamlining the medicine selection process. The system enables users to select the required medication digitally, which is then encoded into a QR code. This QR-based approach minimizes errors, enhances efficiency, and ensures seamless integration with automated dispensing systems. The application simplifies the interaction between patients and the dispensing unit, improving accessibility in healthcare environments.

Fig 7: Medicine available in dispenser

This figure 7 displays the interface of the medicine selection system within the automated dispenser. The application, named "E-prescription generator," allows users to search for medicines such as Paracetmol, Cetrizine ,Cofsils,Loperamide, Omeprazole, Amoxylin, ORS, Eldopar. By streamlining the selection process, this system enhances user convenience and ensures quick access to appropriate medication. This feature is particularly beneficial in self-service medical dispensing units, reducing dependency on pharmacists while maintaining accessibility to essential medicines.

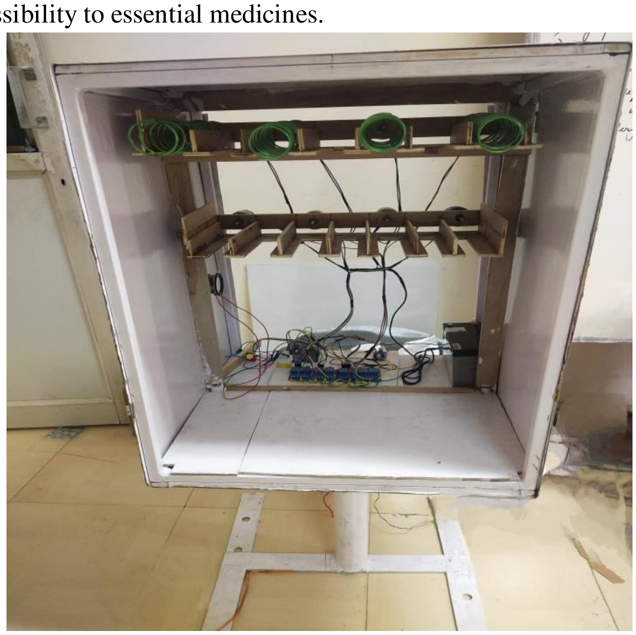

Fig 8: Overall outer body of the dispenser

This figure 8 showcases the structural framework of the automated medicine dispenser. The outer body is designed to house the internal dispensing mechanism, including electronic circuits, sensors, and medicine storage compartments. The organized arrangement of coiled dispensers and rotational mechanisms ensures smooth medicine retrieval and dispensing. The sturdy stand provides stability, making the system suitable for various public and private healthcare environments. This design ensures accessibility, durability, and efficiency in medicine distribution.

V. CONCLUSIONS

The Automatic Medicine Dispenser with QR Code Integration and IVRS presents an innovative solution to modernize medication management and dispensing. By leveraging QR codes, Interactive Voice Response Systems (IVRS), and real-time environmental monitoring, the system effectively addresses challenges such as long pharmacy queues, medication errors, and accessibility issues for elderly and visually impaired patients. Its modular and scalable design makes it adaptable for various healthcare settings, including hospitals, pharmacies, and home care environments. Future advancements could incorporate AI-powered prescription verification, cloud-based real-time monitoring, and multilingual support, further improving medication safety, dispensing accuracy, and accessibility. These enhancements would minimize manual intervention, optimize healthcare workflows, and extend the system's impact to both urban and rural populations, ultimately revolutionizing automated healthcare delivery.

VI. AUTHOR CONTRIBUTIONS

A. Satya Srinivasa Rao and P. Ashok supervised the project. S. Manideep Naga Sai contributed to hardware design and implementation. A. Santhosh Kumar and B. Bharath developed the software interface. J. Venkata Mani Krishna led the mobile application and QR integration. K. Venkata Meghana managed system integration and documentation.

REFERENCES

[1] F. J. Lagrange and F. Jacq, “Developing an innovative oral unit dose robot dispenser: Patient careperformance and industrial perspectives,” Pharm. Hosp. Clin., vol. 49, no. 2, pp. e1–e14, Jun. 2014,doi: 10.1016/j.phclin.2014.03.001.

[2] R. Achammal.S et al., “Development of Smart Automatic Drug Dispenser for Elderly and DisabledPeople,” in 2024 International Conference on Science Technology Engineering and Management(ICSTEM), Coimbatore, India: IEEE, Apr. 2024, pp. 1–5. doi:10.1109/ICSTEM61137.2024.10560887.

[3] S. E, S. A, Y. T, and V. M, “QR-Code Automated Drug Dispenser,” in 2024 2nd InternationalConference on Sustainable Computing and Smart Systems (ICSCSS), Coimbatore, India: IEEE, Jul.2024, pp. 224–230. doi: 10.1109/ICSCSS60660.2024.10625535.

[4] S. Sharmin, Md. I. K. U. Ratan, and A. H. Piash, “An Automated and Online-Based Medicine Reminder and Dispenser,” in Proceedings of the International Conference on Big Data, IoT, andMachine Learning, vol. 95, M. S. Arefin, M. S. Kaiser, A. Bandyopadhyay, Md. A. R. Ahad, and K. Ray, Eds., in Lecture Notes on Data Engineering and Communications Technologies, vol. 95. ,Singapore: Springer Singapore, 2022, pp. 513–524. doi: 10.1007/978-981-16-6636-0_39.

[5] V. Akshaya Reddy, P. Chinni, and S. Singh, “Real Time use of Automatic Voice Command DrugDispenser (VCMD),” in 2022 International Conference on Recent Trends in Microelectronics,Automation, Computing and Communications Systems (ICMACC), Hyderabad, India: IEEE, Dec.2022, pp. 21–25. doi: 10.1109/ICMACC54824.2022.10093620.

[6] “Automatic Drug Dispenser using IoT” Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol..

[7] A. Kumar, “Voice based control command signal generation for intelligent system,” in 2015 IEEEUP Section Conference on Electrical Computer and Electronics (UPCON), Allahabad, India: IEEE,Dec. 2015, pp. 1–6. doi: 10.1109/UPCON.2015.7456709.

[8] S. L. Ullankala, H. R. Buddaraju, A. Meegada, and S. K. Tallapalli, “Live Streaming Smart PillDispenser to Help Elderly/Blind People,” in 2023 7th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India: IEEE, May 2023, pp. 1186–1192. doi: 10.1109/ICICCS56967.2023.10142676.

[9] M. Vasile Moise, D.-M. Pavel, and N. Elisei, “Design of a command and control system for anautomatic pill dispenser,” in 2020 IEEE 26th International Symposium for Design and Technology in Electronic Packaging (SIITME), Pitesti, Romania: IEEE, Oct. 2020, pp. 274–277. doi:10.1109/SIITME50350.2020.9292235.