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Voice Based Medicine Dispensing Machine

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Abstract - Access to essential medications in remote and underserved regions remains a significant challenge due to limited healthcare infrastructure and resources. This paper presents the design and implementation of a voice and button-controlled medicine vending machine integrated with real-time stock management via the Blynk IoT platform. The system employs an ESP32 microcontroller to interface with a VC02 voice recognition module, enabling users to obtain medications by articulating common symptoms or using manual buttons. Servo motors control the dispensing mechanism, ensuring accurate delivery of medicines from designated compartments. An LCD display provides real-time feedback, enhancing user interaction. The integration with Blynk facilitates continuous monitoring and management of medicine inventory, allowing for timely replenishment and maintenance. This autonomous solution aims to bridge the healthcare accessibility gap in remote areas by providing a reliable, user-friendly, and efficient method for dispensing essential medications without the need for direct human intervention.

***Key Words*:** medicine vending machine, voice recognition, ESP32, IoT, Blynk, remote healthcare.

1.INTRODUCTION

Access to essential healthcare services and medications remains a significant challenge in remote and underserved regions due to limited infrastructure, scarcity of medical professionals, and inadequate supply chains. Residents in these areas often face long travel distances to the nearest healthcare facilities, leading to delays in receiving timely medical attention and treatment.

Technological advancements have paved the way for innovative solutions aimed at bridging the healthcare accessibility gap. Automated medicine dispensing systems, integrated with Internet of Things (IoT) platforms, have emerged as promising tools to enhance the distribution of medications, especially in areas lacking traditional pharmacies. These systems can operate autonomously, reduce human errors, and provide real-time monitoring of medicine inventory.

This research focuses on the design and implementation of a voice and button-controlled medicine vending machine equipped with real-time stock management capabilities via the Blynk IoT platform. The system utilizes an ESP32 microcontroller to interface with a VC02 voice recognition module, allowing users to obtain medications by articulating common symptoms or using manual buttons. Servo motors control the dispensing mechanism, ensuring accurate delivery of medicines from designated compartments. An LCD display provides real-time feedback, enhancing user interaction. The integration with Blynk facilitates continuous monitoring and management of medicine inventory, allowing for timely replenishment and maintenance.

The objective of this study is to evaluate the effectiveness of such a system in improving access to essential medications in remote areas. By providing a reliable, user-friendly, and efficient method for dispensing medications without the need for direct human intervention, this solution aims to address the critical healthcare challenges faced by underserved communities.

2. METHODOLOGY

2.1 System Architecture

The system architecture combines both hardware and software components to enable autonomous operation with real-time cloud synchronization. Fig. 1 depicts the high-level system block diagram, illustrating the connections among the ESP32 microcontroller, VC02 voice recognition module, servo motors, LCD display, physical buttons, and the cloud platform. The ESP32 microcontroller acts as the central processing unit, interfacing with the voice recognition and button input modules to interpret user commands. Upon receiving valid inputs, the ESP32 triggers the appropriate servo motor to dispense the selected medication. Simultaneously, it updates the LCD display to provide the user with clear status messages. The ESP32 also maintains a Wi-Fi connection to the Blynk platform to update medicine stock levels in real-time and receive commands for maintenance or stock replenishment.

2.2 Hardware Components

- ESP32 Microcontroller: A powerful and energy-efficient microcontroller featuring dual-core processing and built-in Wi-Fi and Bluetooth connectivity. It serves as the system's brain, managing all input/output operations and cloud communications.
- VC02 Voice Recognition Module: This module enables the system to accept and process voice commands. It supports predefined voice commands for common symptoms such as headache, fever, cold, and cough, converting them into digital signals for the ESP32 to process.
- Servo Motors: Precision actuators used to control the opening and closing of medicine compartments. Each servo motor corresponds to a unique compartment, ensuring accurate dispensing without human error.

-LCD Display: A 16x2 character LCD screen that provides users with real-time feedback, displaying selected symptoms, dispensing status, and stock alerts.
- Physical Buttons: Tactile buttons serve as an alternative input method for users uncomfortable with voice commands or in noisy environments where voice recognition might be less effective.
- Wi-Fi Module: Integrated within the ESP32, this module facilitates wireless communication with the Blynk cloud platform for continuous stock monitoring and control.

2.3 Software Implementation

The firmware for the ESP32 microcontroller is developed using the Arduino IDE. The codebase handles input parsing from the VC02 voice recognition module and button presses, drives servo motors for medicine dispensing, manages LCD updates, and communicates with the Blynk IoT platform via REST APIs. The voice recognition commands are mapped to specific symptoms and linked to designated servo motors responsible for dispensing the corresponding medication. Upon successful dispensing, the stock count for that medicine is decremented and sent to the cloud database. The software also includes error handling routines for invalid commands, out-of-stock notifications, and system resets.

2.4 Medicine Dispensing Mechanism

When a user provides input—either through voice or button—the ESP32 validates the command and activates the corresponding servo motor. Each servo motor is connected to a compartment containing a specific medicine. The motor opens the compartment door, allowing the user to retrieve the medication safely. After dispensing, the servo closes the compartment automatically. This process ensures accuracy in dispensing and minimizes risks of wrong medicine delivery, which is critical for remote areas where medical supervision might be unavailable.

2.5 Real-Time Stock Management

The Blynk IoT platform plays a vital role in inventory control. After each dispensing event, the system updates the stock level on the cloud. Administrators can monitor the remaining stock remotely and receive automated alerts when inventory falls below a critical threshold. This feature ensures timely replenishment of medicines, preventing stockouts that could jeopardize patient health. Furthermore, detailed usage logs allow healthcare providers to analyze consumption patterns and forecast future demands.

2.6 User Interaction Modes

Voice Control Mode: The user states a symptom aloud. The VC02 module processes the command, and the ESP32 executes the corresponding dispensing action.

Button Control Mode: The user navigates through symptom options using buttons and confirms their selection with an 'OK' button. This mode supports users who prefer tactile interaction or where voice recognition is unreliable. Both modes are designed for simplicity and accessibility, ensuring that individuals with varying degrees of technological familiarity can operate the machine effectively.

2.7 Deployment Considerations for Remote Areas

The device's compact and modular design allows for easy installation in diverse settings, including community centers, rural clinics, and public gathering places. Recognizing the power limitations in remote areas, the system is designed to operate on minimal power and can be integrated with solar panels for sustainable operation. Connectivity is ensured by supporting mobile Wi-Fi hotspots or offline data caching with periodic synchronization to the cloud. The robust construction protects the system from environmental factors such as dust, humidity, and temperature fluctuations.

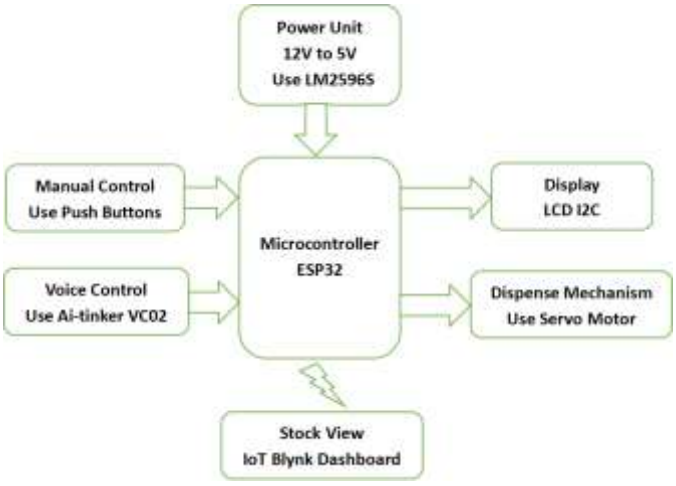

Fig -1: System Architecture Diagram

3. CONCLUSIONS

This paper presented a voice and button-controlled medicine vending machine designed to improve healthcare access in remote areas. By leveraging the ESP32 microcontroller, VC02 voice recognition, servo-driven dispensing, and Blynk IoT integration, the system provides an autonomous, accurate, and user-friendly solution for dispensing essential medications. Real-time inventory monitoring ensures sustained availability, while dual input modes enhance accessibility. Future work will explore biometric user authentication and solar power integration to enhance security and operational sustainability in resource-constrained environments.

REFERENCES

1. C. H. Patil, N. Lightwala, M. Sherdiwala, A. D. Vibhute, S. A. Naik, and S. M. Mali, "An IoT based Smart Medicine Dispenser Model for Healthcare," in *Proc. IEEE World Conf. on Applied Intelligence and Computing*, Pune, India, 2022, pp. 391–395.
2. A. Mathew, J. Paul, K. Nair, and U. S. Sachin, "Design and Implementation of a Smart Medicine Dispenser," in *Proc. TENCON 2019 - 2019 IEEE Region 10 Conference*, Kochi, India, 2019, pp. 1338–1343
3. P. Patil, V. S. Kumar, S. Hosamani, and R. M. Rudresh, "Medicine Dispensing using ESP–32 CAM," *Int. J. Adv. Res. Sci. Commun. Technol.*, vol. 4, no. 4, pp. 1–5, Apr. 2023
4. M. S. V. Kumar, "IoT Based Vending Machine with Cashless Payment," *Int. Res. J. Eng. Technol.*, vol. 6, no. 6, pp. 1234–1238, Jun. 2019.