Title of Invention: Automated Pill Dispenser and Reminder System

DRAWING:

Applicant Name: Total number of sheets:1 Sheet No. 1

Dayananda Sagar College of Engineering

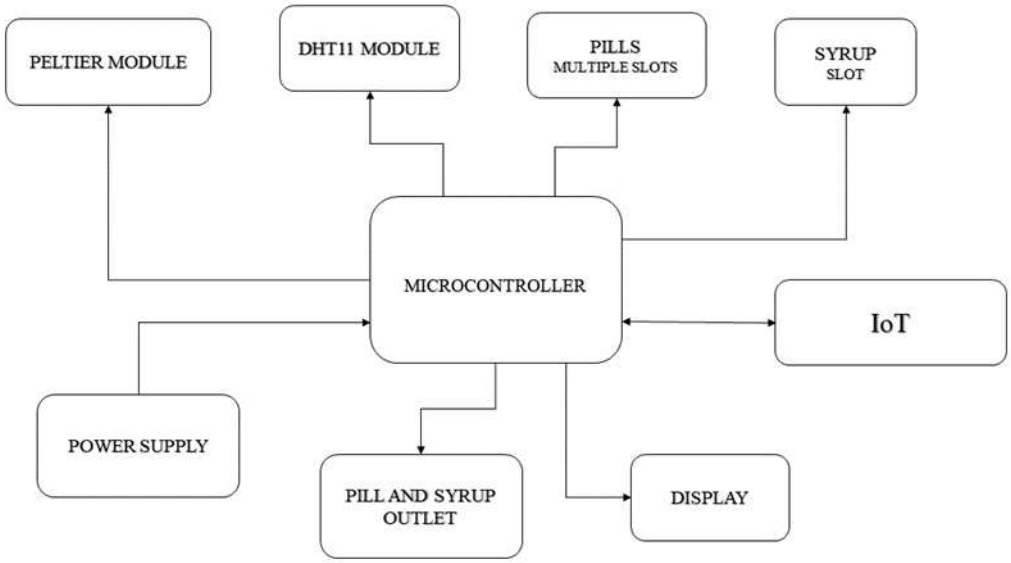

Figure 1



Figure 2

Dated: 11/12/2024

Signature of the applicants

FORM 2

THE PATENT ACT

1970(39 of 1970)

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The Patents Rules, 2003 COMPLETE SPECIFICATION

(See section 10 and M.13)

Title of Invention: Automated Pill Dispenser and Reminder System

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PREAMBLE TO THE DESCRIPTION: COMPLETE

The following specification particularly describes the invention and the manner in which itis to be performed

FIELD OF INVENTION

[001] The field of invention for the "Automated Pill Dispenser and Reminder System" lies within the domain of medical devices, healthcare technologies, Internet of Things and mechanical design engineering aimed at improving medication management and adherence through automated dispensing, scheduling, and remote monitoring capabilities.

BACKGROUND AND PRIOR ART

[002] In the realm of healthcare, medication adherence is a significant concern, particularly for elderly patients and those with chronic conditions who must adhere to complex medication schedules. Non-adherence to prescribed medication regimens can lead to deteriorating health conditions, increased hospitalizations, and higher healthcare costs. Traditional methods of medication management, such as pillboxes and manual reminders, are often insufficient, especially for individuals with cognitive impairments or busy lifestyles. Additionally, certain medications require specific storage conditions to maintain their efficacy, which complicates the issue further.

[003] Prior art in the field of automated pill dispensers includes devices that can store and dispense medications at preset times. Some advanced models incorporate alarms and notifications to remind patients to take their medication. However, these devices often lack integrated environmental control systems to maintain the required storage conditions for temperature-sensitive medications. The failure to control storage conditions can compromise the integrity and effectiveness of the medication, posing potential health risks to patients.

[004] Existing solutions also include digital applications that send reminders to patients' mobile devices, but these rely heavily on user compliance and do not physically dispense the medication, thereby not addressing the problem of ensuring the correct dosage is taken at the correct time.

[005] There have been attempts to integrate temperature and humidity monitoring in medication storage systems, but these typically only provide passive monitoring without active environmental control. For example, some prior art includes refrigerated compartments for medication storage, but these are not integrated with the pill dispensing mechanisms and lack user-friendly interfaces for schedule management and environmental adjustments.

[006] The Medicurate system advances beyond these prior art limitations by integrating an automated pill dispenser with an active thermal management system controlled by a relay-operated Peltier module. This allows the device to adjust the storage temperature according to user-defined specifications, ensuring optimal conditions for medication efficacy. The web-based interface for user interaction, scheduling, and real-time environmental monitoring further enhances usability and compliance, offering a comprehensive solution to the challenges of medication management and storage. This integration of features represents a novel approach in the field, combining automation, environmental control, and user-friendly design in a single device.

SUMMARY OF THE INVENTION

[007] The invention, Medicurate, addresses the critical problem of medication nonadherence and improper storage conditions of temperature-sensitive medications and syrups. Medicurate is an advanced automated pill and syrup dispenser that combines precise dispensing mechanisms with an integrated temperature control system, ensuring optimal storage conditions for various medications. The device uses a relay operated Peltier module to actively manage the internal temperature, which can be adjusted according to specific medication requirements.

[008] The system is controlled via an intuitive web-based interface, allowing users to input their medication schedules and preferred storage temperatures. The interface also displays real-time environmental conditions, such as temperature and humidity, ensuring that users are always aware of the storage conditions of their medications. The dispenser features multiple slots for different medications and can be programmed to dispense pills at designated times, significantly improving adherence to prescribed regimens.

[009] In addition to pill dispensing, Medicurate includes a peristaltic pump for accurate and hygienic dispensing of liquid medications or syrups. This pump ensures precise dosage and prevents contamination, making it suitable for medications that require liquid forms. The integration of this pump broadens the range of medications that can be managed by the device, providing a comprehensive solution for various medication needs.

[010] Medicurate includes a DHT sensor for accurate temperature and humidity monitoring, and the collected data is displayed both on the device and through the web interface. This ensures that the medications and syrups are stored within the required conditions, maintaining their efficacy and safety. The integration of environmental control with automated dispensing makes Medicurate a novel and comprehensive solution for managing medication adherence and storage, particularly benefiting individuals with complex medication schedules and those requiring precise storage conditions for their medications and syrups.

BRIEF DESCRIPTIONS OF DRAWINGS

[011] Figure 1 - Block Diagram: This diagram illustrates the foundational components of the "Medicurate – An Automated Pill Dispenser and Reminder System" project. It prominently showcases the integration of the ESP32 microcontroller, DHT11 sensor for temperature and humidity monitoring, relay module for controlling a Peltier device, a web server interface for user interaction, and the overall connectivity to a Wi-Fi network. The diagram also highlights the flow of data from sensor inputs to user outputs and control actions, providing a clear overview of how the system operates cohesively to achieve automated pill dispensing and environmental control.

[012] Figure 2 - First Software Prototype (User Interface): This diagram presents the initial software prototype for the "Medicurate – An Automated Pill Dispenser and Reminder System" project. It illustrates the user interface where users can select dosages for each slot, view the temperature and humidity levels of each slot, and specify the dosage of syrup to be dispensed. The interface is designed for ease of use, ensuring that users can effectively manage their medication schedules and environmental conditions for optimal storage of their pills and syrups.

DETAILED DESCRIPTION OF THE INVENTION

[013] The Medicurate system integrates an ESP32 microcontroller, a DHT11 sensor for temperature and humidity monitoring, and servo motors for precise pill dispensing. A peristaltic pump is employed for syrup dispensing, managed through a web interface that enables users to schedule medication times flexibly. Temperature control is achieved using a Peltier module, ensuring medications are stored within specified temperature ranges and adjustable according to medication requirements. An alarm system alerts users to temperature deviations, guaranteeing

medication efficacy and patient safety. The system supports medication adherence by providing reminders and detailed usage logs accessible through the web interface, thereby enhancing overall health management.

[014] The working principle of the Medicurate - An Automated Pill Dispenser and Reminder System integrates several key components to provide efficient medication management. Users interact with the system through a web-based interface accessible via a Wi-Fi connected microcontroller. This interface allows users to input their personal information, medication schedules, and preferred time slots for medication intake. Inside the device, multiple pill slots are strategically designed to securely store different medications.

[015] Central to the system's functionality are environmental sensors, including a DHT sensor for monitoring temperature and humidity. These sensors ensure that medications are stored under optimal conditions, critical for maintaining their efficacy and stability. A relay-controlled Peltier module regulates the internal temperature of the device. This temperature adjustment is crucial as medications often have specific storage temperature requirements. The system dynamically adjusts the Peltier module based on real-time environmental data, ensuring that stored medications remain within safe temperature limits, which can vary depending on the medication type and manufacturer specifications.

[016] When medication intake times arrive, a motor-driven mechanism activates to dispense the prescribed pills from their respective slots. This dispensing process is automated and precise, minimizing human error and ensuring accurate medication administration. Importantly, the system utilizes internet-based time synchronization mechanisms to maintain accurate scheduling. This eliminates the need for a separate real-time clock module, simplifying device design and maintenance.

[017] Throughout the medication schedule, users receive timely alerts and reminders via the web interface. These alerts help users adhere to their prescribed medication regimen, promoting better health outcomes through improved medication compliance.

[018] In summary, the Medicurate system combines advanced sensor technology, precise temperature control, automated dispensing mechanisms, and internet-based scheduling to create a

comprehensive solution for medication management. By integrating these functionalities into a user-friendly interface, the system enhances convenience, reliability, and effectiveness in medication administration and adherence.

WE CLAIM

[019] 1. An automated pill dispenser system utilising an ESP32 microcontroller with built-in Wi-Fi capabilities to manage medication schedules, environmental monitoring, and user interfaces, wherein the system provides real-time communication and control over pill dispensing, temperature regulation, and liquid medication management via web-based access.

[020] 2. A method of scheduling and dispensing medication using a system that features pill slots individually configured for specific time ranges, controlled by the ESP32 microcontroller, where each pill slot dispenses medication at predefined intervals based on user input through a web-based interface, without the use of an external real-time clock module.

[021] 3. The integration of a DHT11 temperature and humidity sensor for monitoring environmental conditions within the pill dispenser, connected to a Peltier module controlled by a relay, wherein the ESP32 microcontroller dynamically adjusts the internal temperature to maintain optimal conditions for medication storage based on real-time sensor data and predefined thresholds.

[022] 4. A peristaltic pump controlled by the ESP32 microcontroller, designed for the accurate dispensing of liquid medication, where the pump activates at scheduled times according to the user's input via the web interface, ensuring precise dosage delivery.

[023] 5. A system with a web-based user interface hosted on the ESP32 microcontroller, allowing users to configure pill slots, set medication schedules, and monitor real-time environmental data, wherein the interface is accessible via any device connected to the same Wi-Fi network as the ESP32.

[024] 6. The system includes a relay-controlled Peltier module for thermal management, where the ESP32 microcontroller regulates the power supplied to the Peltier module based on the temperature readings from the DHT11 sensor, maintaining the appropriate storage temperature for medications.

[025] 7. The automated dispenser comprises modular pill slots, each with individual control through the ESP32 microcontroller, where the user can specify different pill types and time intervals for each slot via the interface, ensuring precise and customized dispensing for multiple medications.

[026] 8. A method of synchronizing the system's internal clock using Network Time Protocol (NTP) over Wi-Fi, facilitated by the ESP32 microcontroller, eliminates the need for an external real-time clock (RTC) module while providing accurate time for scheduling and logging medication dispensing events.

[027] 9. A system that continuously monitors temperature and humidity within the pill dispenser via the DHT11 sensor, with real-time feedback to the ESP32 microcontroller, ensuring that medication storage conditions remain within user-defined parameters by adjusting the Peltier module accordingly.

[028] 10. The system includes a fail-safe mechanism wherein the ESP32 microcontroller verifies each dispensing action through feedback sensors, ensuring that medication is accurately dispensed at the scheduled time, and sends an alert in case of failure to dispense the required medication.

ABSTRACT

The present invention addresses the critical issue of medication adherence and proper storage, which are pivotal for patient health management, particularly for individuals with chronic conditions or complex medication regimens. Medicurate is an advanced automated pill dispenser designed to enhance medication adherence by accurately dispensing pills at user-specified times while maintaining optimal storage conditions through integrated environmental control. The system comprises an ESP32 microcontroller interfaced with a DHT11 sensor for precise temperature and humidity monitoring and a relay-controlled Peltier module for active thermal management. Users interact with Medicurate via a web-based interface where they can input their personal details, set medication schedules, and define temperature thresholds based on the specific requirements of their medications. The microcontroller processes these inputs and activates the relay to control the Peltier module, ensuring that medications are stored within the recommended temperature range. Real-time temperature and humidity data, along with IST time, are displayed on the web interface for continuous monitoring. This invention integrates robust hardware and software components to provide a reliable, user-friendly solution for automated medication management and storage, ensuring both medication efficacy and adherence. The patent application covers the detailed architecture, algorithms, and methods of interaction used in the Medicurate system, highlighting its innovative approach to solving medication management challenges.



Signature of the applicant
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