FORM 2

THE PATENT ACT 1970

(39 OF 1970)

AND

The patent rules, 2003

COMPLETE SPECIFICATION

(See section 10: rule 13)

TITLE OF INVENTION:

Smart IoT Embedded Automated Medicine Dispenser

APPLICANTS:

Name	Nationality	Address
Chetan Shrihari Awari	Indian	GHRCE, Nagpur - 440016
Shreyas Vilas Ekharkar	Indian	GHRCE, Nagpur - 440016
Akashprasad Suryadevprasad Yadav	Indian	GHRCE, Nagpur - 440016
Prof. Achamma Thomas	Indian	GHRCE, Nagpur - 440016
Prof. Madhuri Sahu	Indian	GHRCE, Nagpur - 440016
Prof. Saundarya Raut	Indian	GHRCE, Nagpur - 440016

PREAMBLE TO THE DESCRIPTION:

COMPLETE

Following specification particularly describes the invention and the manner in which it is to be performed.

DESCRIPTION:

Technical field of invention:

Present invention in general relates to design and manufacture a smart IoT embedded automated medicine dispenser and in particular to easy-to-use dispenser design and feature like hand detection and refill notification.

Prior art:

An automated medicine dispenser is a device designed to provide medication in a timely and dose-specific manner. This device simplifies and enhances medication management, particularly for individuals who need to take multiple doses at different times and for those who struggle to remember their medication schedules. Numerous existing designs, patents, and prior art related to automated medicine dispensers continue to improve the technology within this field.

US 4019425 A - Timer-Controlled Pill Dispenser (1977): This invention unveiled a pill dispenser equipped with a timer that automatically administered medication at designated intervals, enhancing adherence and compliance with dosing. Targeted primarily at elderly individuals, particularly those experiencing memory issues or chronic ailments, it removed the necessity for external prompts. The device was groundbreaking for its era, offering a straightforward yet impactful solution to guarantee accurate medication routines. It laid the foundation for contemporary progress in automated medicine dispensing systems, encompassing AI and IoT-driven technologies, highlighting its enduring influence on healthcare advancements.

US 8679993 B2 - Programmable Automated Pill Dispenser (2014): Patented in 2014, this innovative pill dispenser transformed how medication is

managed with its automated and user-friendly approach. It includes several compartments for storing and dispensing doses at specific times, accompanied by light and sound notifications to prompt patients to take their medication. An integrated LCD screen displays clear instructions and schedules, ensuring accuracy and minimizing confusion. Created for elderly individuals and those with memory impairments, it allows caregivers or users to customize medication schedules. This breakthrough simplifies adherence, promotes independence, and meets the evolving demands of contemporary healthcare.

CN 11023364 A - Intelligent Medication Dispenser with IoT Technology (2019): Registered in 2019, this innovation marks a considerable advancement in medication management by utilizing Internet of Things (IoT) technology. Its main goal is to improve real-time tracking and adherence to medication, allowing users and caregivers to remotely manage and operate the dispenser via a mobile app. The intelligent medication dispenser features sophisticated elements that enhance patient care and compliance. It encompasses refill notifications that alert healthcare professionals when medication supplies are dwindling, ensuring continuous treatment. Furthermore, integrated sensors monitor whether doses are taken on time, assisting users in establishing consistent routines. The connection of real-time data enables caregivers to more effectively oversee critical health conditions, facilitating timely interventions when required. This innovation transforms medication management by fusing IoT features with a user-focused design, encouraging improved health results and providing a dependable solution for patients with intricate medical needs.

EP 1862297 A1 - Method for Compacting and Storing Medications (2007): Patented in 2007, this invention presents an effective and compact approach for the storage and dispensing of medications, catering to the demands of

portability and efficient use of space. The device includes a mechanism for pre-compacting that diminishes the size of medications while preserving their potency and effectiveness, making it especially advantageous for travellers and patients who manage multiple prescriptions. Additionally, the design incorporates a sophisticated dispensing system that accurately delivers compacted doses in a convenient manner, reducing the likelihood of medication errors. By merging space-saving capabilities with precise dosing, this innovation offers a practical solution for both healthcare and travel needs, enhancing medication management and accessibility.

WO 2019056782 A1 - Intelligent Medication Dispenser with AI Monitoring (2019): Patented in 2019, this advanced medication dispenser employs artificial intelligence (AI) to oversee and evaluate a patient's medication usage, presenting a contemporary solution to conventional pill dispensers. The device modifies reminders according to the user's schedule, guaranteeing punctual medication adherence. This system is crafted to be flexible, delivering reminders that correspond with the unique needs and routines of each individual patient. Beyond reminders, the AI algorithms monitor and assess the patient's health information, providing crucial insights to healthcare providers. These insights aid in making more informed choices, enhancing overall patient care. This innovation enhances medication management by merging convenience with data-driven support, assisting both patients and healthcare professionals in ensuring optimal treatment.

Objective:

1. Primary objective of present invention is to design and manufacture modern Automated Medicine Dispenser.
2. Another objective of present invention is to design and manufacture modern medicine dispenser.

3. Yet another objective of present invention is to design and manufacture user friendly refill mechanism of Automated Medicine Dispenser.
4. Yet another objective of present invention is to add hand detection system in Automated Medicine Dispenser.
5. Yet another objective of present invention is to add SOS highly alert notification and Emergency audio and visual alert.
6. Yet another objective of present invention is to increase efficiency and reduce time consumption of hospital staff for pill dispensing.
7. Yet another objective of present invention is to easy-to-use Automated Medicine Dispenser with less error prone.
8. Yet another objective of present invention is to establish seamless real-time communication between device and mobile application through cloud.
9. Yet another objective of present invention is to Modernize patient health adhere through mobile app.
10. Yet another objective of present invention is to integrate Firebase real-time database for communication.
11. Yet another objective of present invention is to add next day device refill/collect notification.

Other objective, feature and benefits will become clear from detail description and review of attach claim to those skilled in art.

STATEMENT:

The present invention provides a novel design for easy to use and user-friendly refill and dispensing design. Its successful implementation relies on the integration of software and hardware technologies. The device can store different types of medications, dispense them at scheduled times based on prescriptions, and send reminders when it is time for medication. This

invention providing real-time updates on patient adherence, enabling remote monitoring between the device, patients, and healthcare providers.

The present invention has key focus on areas like the effectiveness of automated dispensers in ensuring patient adherence. The impact of cloud-based solutions on real-time tracking and patient management. The role of technology in minimizing human errors and enhancing healthcare outcomes.

Existing medication management systems lack easy to use design, real-time data handling, emergency response capabilities, and predictive refill notifications, further exacerbating these challenges. To address these limitations, present invention is proposed. It has modernized pill dispenser mechanism with 16 compartments with removable cover of it so that refill can we done easily. This system uses QR codes to register patient details, assign devices to specific beds, and schedule medications with notifications for missed doses. It has hand detection system connected to tray to prevent direct medicine dispensing on ground. For SOS situation present invention is embedded with audio and visual alert by using buzzer and red LED and also send emergency notification to caretaker on mobile application. For normal pill dispensing visual and audio alerts for timely reminders in. To add medicine schedule and proper medication we have built mobile app which is integration with a Firebase-connected database.

BRIEF DESCRIPTION OF DRAWING:

This invention is illustrated through an example in conjunction with the drawing below, where,

Figure 1(a), 1(b) of sheet 1 shows Automated Medicine Dispenser.

where,

1 denotes Outer Body

2 denotes Dispenser Cover

3 denotes Dispenser

4 denotes Stepper Motor

5 denotes Support Pillar

6 denotes Servo Motor

7 denotes Tray.

Figure 2 of sheet 1 shows blueprint views of inner and outer look of automated medicine dispenser in CAD Model.

Figure 3 of sheet 2 shows Automated Medicine Dispenser CAD Model.

where,

1 denotes Battery

2 denotes Ultrasonic Sensor

3 denotes Display

4 denotes SOS Button

5 denotes Buzzer Grid

6 denotes S1

7 denotes S2.

Figure 4 of sheet 2 shows left side look.

where,

1 denotes Back Support

2 denotes Base-2

3 denotes Base-1.

Figure 5(a), 5(b) of sheet 2 shows Dispenser with CAD Model.

where,

1 denotes Compartment

2 denotes Compartment Separator

3 denotes Grid less circle for attaching motor

4 denotes Start compartment.

Figure 6(a), 6(b) of sheet 3 shows Base-2 cutout with CAD Model.

where,0

1 denotes cutout-3 (servo motor cutout)

2 denotes cutout-2 (ultrasonic sensor cutout)

3 denotes cutout-4.

Figure 7(a) of sheet 3 shows tray position in device.

Figure 7(b) of sheet 3 shows tray.

where,

1 denotes tray boundary

2 denotes tray base.

Figure 8(a), 8(b) of sheet 4 shows back side look with CAD Model.

where,

1 denotes Dispenser cover.

2 denotes back support.

Figure 9(a), 9(b) of sheet 4 shows support pillar with CAD Model.

where,

1 denotes support pillar

2 denotes cutout-3.

Figure 10(a), 10(b) of sheet 5 shows dispenser measurement with CAD Model.

Figure 11(a) of sheet 5 shows dispenser cover measurement with CAD Model.

Figure 11(b) of sheet 5 shows cutout-5 and back support measurement with CAD Model.

Figure 12(a) of sheet 5 shows font side measurement with CAD Model.

Figure 12(b) of sheet 6 shows front support measurement with CAD Model.

Figure 13 of sheet 6 shows cutout-1 measurement with CAD Model.

Figure 14(a) of sheet 7 shows front body cover measurement with CAD Model.

Figure 14(b) of sheet 7 shows outer body measurement with CAD Model.

Figure 15 of sheet 7 shows support pillar measurement with CAD Model.

In order to further clarify how the previously mentioned benefits and goals of the invention are realized, a more comprehensive explanation of the invention, which was briefly introduced before, will be provided. This explanation will reference the accompanying illustrations, which depict typical embodiments of the invention. Nevertheless, these illustrations are meant purely for clarification and should not be viewed as restricting the scope of the invention. Additional specifics and details regarding the invention will be elucidated using the accompanying drawings.

Detailed Description:

The procedure for automatic medicine Dispenser as follows:

1. When a patient is admitted to the hospital for an extended stay of more than one day, an Automated Medicine Dispenser (AMD) will be assigned to their care.
2. Each machine displays a QR code, which can be scanned using a mobile app by an authorized individual, typically a doctor or nurse.
3. Upon scanning the code, patient registration is completed with all necessary information, and the machine is supplied with data such as patient ID, bed number, and the specific machine assigned to that patient and bed.
4. Concurrently, the names of the medications and the times they should be dispensed are input so that the names appear on the display when it is time for administration.
5. Following this, the authorized person removes the machine's back panel and fills the compartments with the required doses for the next 24 hours according to the schedule.
6. This information is transmitted to Firebase for that particular patient record, and the machine retrieves data via an ESP32 Wi-Fi module.
7. Since the ESP can receive and send data to the server, it keeps a local record of the medicine schedule while connected to the internet and Firebase. The ESP checks for any schedule updates every 5 minutes.
8. When the designated time arrives, the ESP sends a message to the Arduino instructing it to "start dispensing," which triggers visual and audio alerts through the display, LED, and buzzer.
9. The medicine dispenser contains 16 compartments, of which 15 can be filled. It is connected to a stepper motor that rotates the filled compartment by 22.5 degrees to release the pill into the tray.
10. The tray, positioned directly under the pill drop compartment, collects the dropped pills from the main dispenser.

11. Once the pill has been dispensed, the Arduino sends a confirmation to the ESP indicating that dispensing is complete. Meanwhile, both audio and visual alerts continue until a hand is detected under the dispenser using an ultrasonic sensor.
12. When the ultrasonic sensor identifies a hand, it relays a signal to the Arduino stating "hand is detected," prompting the tray attached to a servo motor to rotate 180 degrees, allowing the pill to fall through an opening in the bottom of the tray. The tray returns to its original position after 3 seconds.
13. If any doses are missed, both alerts will activate after 2 minutes and continue for 1 minute, repeating this process twice. If the pill has still not been taken by the next scheduled dose, two pills will drop from the tray, and the name of the missed pill will be displayed to ensure that the patient takes the current dose correctly.
14. This cycle continues for 24 hours, and if any doses are missed by the patient, a notification is sent to the authorized individual that reads, "Patient number: xxx and Bed number: xx missed dose of xx: xx am/pm." (Where x represents integers.)
15. Pressing the SOS button triggers a high alert notification, and both alerts will activate. The following morning, the authorized staff member for that ward will receive notification regarding which machines require filling and which need to be collected. Based on this information, the machines will either be filled according to the available data/prescription on the app or be collected.
16. If a patient requires admission for more than the initially assigned duration, only the authorized doctor can adjust the machine assignment period.

Building of Automated Medicine Dispenser:

Automated Medicine Dispenser shown in figure 1 and figure 2 (show inner and outer view of device), its mainly consist of following parts:

1. Dispenser

To ensure timely medicine dispensing, we have implemented a round dispenser with 16 compartments. It is connected to a stepper motor for efficient rotation. When the ESP sends a "start message," the Arduino first rotates the servo, which causes the dispenser to move. Out of the 16 compartments, 15 can be filled, while one remains empty to ensure the starting position does not dispense a pill. The dispenser has a diameter of 160mm and a radius of 80mm. The thickness of the bottom circular plate measures 3mm. Each compartment is separated by rectangular-shaped dividers, each measuring 65mm x 25mm. With a total of 16 compartments, we utilized 16 separators. The angle separating each compartment is 22.5 degrees. The overall height of the dispenser is 28mm. In the center of the dispenser, there is a grid less circular area with a diameter of 30mm left empty to allow the motor to be mounted from the back. This dispenser is oriented backward so that it can be refilled by removing its cover.

2. Dispenser Cover

To prevent pills from accidentally dropping out of compartments other than the one at the bottom, we have designed a round cover with a diameter of 170mm and a height of 80mm. This cover effectively encapsulates the entire dispenser, ensuring that pills remain in their designated compartments. It also serves as a removable back cover for the device, allowing for easy filling of medicines from cutout-5. There is a small cutout namely cutout-4 area measuring 35mm in perimeter and 30mm in height, which permits pills to drop from the bottom compartment while keeping those in the other compartments secure. For initial filling or refilling, we simply remove this cover to place the pills into the dispenser.

3. Tray

The tray is positioned beneath the round dispenser cover. When the designated time arrives, pills are released from the dispenser compartments into the tray.

This tray operates in conjunction with an ultrasonic sensor fixed at cutout-2, and when a hand is detected, it rotates 180 degrees, drop pill through cutout-1 and returns to its original position. A servo motor, fixed inside the support pillar cutout namely cutout-3, facilitates this movement (the height of the pillar is detailed in the support pillar section). This tray is rectangular in shape, measuring 60mm x 50mm, and incorporates a boundary with a height of 14mm to prevent accidental pill drops during the dispensing process.

4. Motors

To ensure the dispenser and tray function properly, a stepper motor is attached to the dispenser for accurate 22.5-degree rotations. This motor is positioned at the top of the support pillar. For the effective movement of the tray, a cutout has been made in the pillar to accommodate the servo motor. The servo motor rotates 180 degrees and returns to its original position after a delay of 3 seconds.

5. Support Pillar

This support pillar has a cuboidal shape, featuring dimensions of 30mm in length, 30mm in breadth, and a height of 180mm. A stepper motor is mounted at the top, and we created cutout-3, located 50mm above the ground, to house the servo inside the pillar. This servo cradle cutout measures 30mm in length, 15mm in breadth, and 10mm in height. The pillar is securely fixed vertically to base-2.

6. Outer

To conceal the inner appearance, we utilized a cover that spans from base-2 to the top, which consists of the front cover, left, right, and top covers. The front cover measures 325mm x 260mm and includes a display, SOS button, LED light, and a grid for the buzzer. The left and right side covers each have dimensions of 325mm x 155mm, while the top cover measures 260mm x 160mm. Both base-1 and base-2 have a size of 260mm x 155mm. The back support is 430mm x 260mm in size. Located 25mm from the top is cutout-5,

which features a circular opening intended for the dispenser cover and back cover, with a diameter of 180mm and depth of 90mm. To provide structural support for the dispenser mechanism, two supports, identified as S1 and S2, are positioned at the front between base-1 and base-2, measuring 18mm x 45mm and standing 83mm tall. Base-2 includes cutout-1 beneath the tray, where the Ultrasonic sensor and additional components are connected. Cutout-1, measuring 80mm x 35mm, allows for the transfer of pills from the tray to the user's hand.

7. **Microcontrollers**

For operations and communications, we have integrated two microcontrollers. The hardware operations are managed by an Arduino UNO R3, while communication with the database is facilitated through an ESP32. The Arduino operates on 5V, whereas the ESP functions on 3.3V. When the scheduled time arrives, the ESP sends a signal to the Arduino to initiate dispensing and also receives confirmation from the Arduino regarding whether the pill has been taken. The entire functioning of the device is regulated by these two microcontrollers.

Best method of performance of the invention:

When a patient stays for over a day, the QR code on the machine is scanned to assign the machine and bed number to that patient, and their data and prescription are entered. After this, the pills are filled into the necessary compartments.

According to the schedule and given to the patient. Once the device's ESP connects to the internet, it retrieves the schedule from Firebase and saves it locally. Using the RTC module, at the scheduled times, the ESP sends a message to the Arduino, which then carries out all hardware-related tasks such as rotating the dispenser by 22.5 degrees, detecting the hand, rotating the tray by 180 degrees, and returning information to the ESP about whether the pill

was taken or not. When the scheduled time arrives, an audio and visual alert is activated; users must place their hand between base-1 and base-2, where an ultrasonic sensor detects the hand. After this, the tray will rotate 180 degrees to drop the pill into the hand before returning to its original position. This cycle continues for 24 hours based on the set schedule.

Material And Method:

In one of the preferred embodiments of this invention, the specifics regarding the materials utilized for the various components of the Automated Medicine Dispenser, along with their measurements, assessment techniques, and experimental processes for evaluating different performance parameters, are presented. However, it should be clear that the illustration provided serves merely to enhance the understanding of the invention and should not be interpreted in any way as a restriction.

In this present invention, the essential element is the design of a new type of dispenser mechanism and its cover to fill/refill pill along with hand detection mechanism. It is evident to those knowledgeable in the field that additional alterations or replacements in the design and approach are feasible and should be regarded as an integral part of this invention.

Development of Device:

The machine that was created was made up of various components, and the details of these components are outlined under the headings below.

1. ESP32: -The ESP32 serves as the primary microcontroller, responsible for managing Wi-Fi connectivity, executing high-level logic, and facilitating communication with the Arduino Uno for controlling sensors and motors. It interfaces with Firebase to access pill dispensing schedules and transmits

commands to dispense pills at the designated times, while also updating Firebase regarding missed doses and emergencies. The link between the ESP32 and Arduino is made through GPIO17 (TX) and GPIO16 (RX) on the ESP32, which are connected to RX (Pin 0) and TX (Pin 1) on the Arduino, respectively. An IC 7805 is used to regulate the 5V power supply for the ESP32 while maintaining a common ground.

2. Arduino UNO: - The Arduino Uno acts as a secondary microcontroller that concentrates on hardware-specific functions such as controlling stepper motors, processing sensor data, and managing real-time scheduling. It communicates with the ESP32 using either the UART (serial) or I2C protocol. As previously described, this connection with the ESP32 enables it to oversee the dispensing of medicine and relay commands related to the dispensed pills and their collection status. The Arduino is powered directly by a charger that transforms AC into DC with an output voltage of 5V.

3. Display: - The system is equipped with a high-resolution display that can clearly present QR codes, measuring 128px by 160px. It interfaces with the communication microcontroller to show the names of the pills being dispensed. In instances of missed doses, it provides suitable messages along with the names of the medications, enabling users to identify both current and missed pills, even when several are dispensed at once.

The display is powered by the ESP32 microcontroller and is connected to the necessary pins on the ESP32 to function correctly.

4. Stepper Motor: - A stepper motor is linked to the rotating disk of the dispensing mechanism and is managed by the main microcontroller. It is programmed to rotate exactly 22.5 degrees, allowing for proper alignment with the 16 compartments on the disk. As the motor turns, pills from each

compartment fall into the collection tray. The motor is powered by a battery through a IC7805 voltage regulator that ensures a 5V operational voltage, with the ground connected to the common ground. A ULN2003 connector enables the connection of the stepper motor to the Arduino, with pins 1NF, 2NF, 3NF, and 4NF linked to digital pins 8, 9, 10, and 11, respectively.

5. Servo Motor: - The servo motor system controls the pill collection tray and operates in coordination with the ultrasonic sensor. When the sensor detects a hand, it prompts the secondary controller to release the pill from the tray, causing the servo motor to rotate 180 degrees before it returns to its initial position after a duration of 3 seconds. Power is provided through the IC7805's 5V output, with the signal wire linked to digital pin 5 on the Arduino and the ground connected to a common ground.

6. Switches: - To ensure security and proper functionality, the system uses multiple switches. A limit switch observes access to the compartments, sending notifications whenever they are opened. This improves the security of the system by keeping a log of all compartment entries. The switch links to the D2 pin on the Arduino, sharing a ground connection with the common ground. Furthermore, an SOS switch connected to the main microcontroller (ESP32 GPIO23) allows for emergency alerts when activated.

7. RTC Module: - The RTC module guarantees accurate timing synchronization, allowing the medicine dispenser to uphold precise schedules for medication dispensing, sending reminders, and monitoring missed doses. It runs on 5V supplied by the ESP32, with SDA and SCL linked to the ESP32 pins GPIO21 and GPIO22, respectively.

8. LED and Buzzer: - Visual and audible notifications are facilitated by LED

and buzzer components overseen by the secondary controller. These notifications last for one minute until medication time hand detection occurs, with repeated signals for any missed doses. In emergency or SOS circumstances, they function with unique patterns: during normal operations, a frequency of 500Hz paired with 500-millisecond intervals is used, whereas emergencies are characterized by a frequency of 1kHz with 100-millisecond intervals. The buzzer is connected to Arduino pin D13 and the LED to pin D12, each incorporating 220-ohm resistors.

9. Ultrasonic sensor: - The ultrasonic sensor interacts with the secondary controller to sense hand presence, which helps avoid direct ground drops of dispensed medication. It draws power straight from the Arduino's 5V output, with the trigger and echo pins linked to D7 and D6, respectively.

10. Power Supply: - The power supply setup supports several IoT devices using a configuration of 12V lithium-ion rechargeable batteries. Devices such as the ESP32, stepper motors, and servo motors are powered by the battery through IC7805 voltage regulators, while the Arduino gets its power from an AC-DC converter. By employing lithium-ion batteries and three step-down voltage regulators, this system guarantees dependable and precise medicine dispensing.

There will undoubtedly be further benefits and adjustments that those with expertise in the field will recognize. As a result, the invention, in its wider interpretation, is not confined to the particular details and examples provided and discussed here. Hence, numerous alterations can be made without straying from the essence or scope of the overall invention concept as outlined by the claims that follow and their equivalents.

CLAIM

We claim: -

1. An automatic medicine distribution device, consisting of:
    - A circular dispenser with 16 equal-sized sections, where:
        - 15 sections are designed to contain medication pills, leaving one empty to establish a starting point and prevent unintentional dispensing;
        - The dispenser is linked to a motor that allows for accurate 22.5-degree rotations to align the selected section with a dispensing opening;
    - A cover for the dispenser that encloses the circular dispenser, featuring:
        - An opening located at the bottom that permits pills to fall only from the selected section into a tray below, while blocking pills from other sections from dropping;
        - A design that allows for easy removal for quick refilling of the sections without the need to take apart the entire device.
2. The automatic medicine distribution device as detailed in claim 1, additionally includes a tray system, wherein:
    - The tray is situated beneath the dispensing opening of the circular dispenser for pill collection;
    - The tray is attached to a motorized mechanism that allows it to rotate 180 degrees to deliver pills into the user's hand and return to its starting position after a set delay;
    - The tray is designed with elevated edges to prevent pills from spilling during movement.
3. The automatic medicine distribution device as described in claim 1, in which:

- A user interaction system based on sensors is set up to recognize the presence of a user's hand beneath the tray, activating the tray's dispensing mechanism upon detection.

4. The automatic medicine distribution device as outlined in claim 1, further includes:
    - A vertical support pillar fixed to the base of the device, offering structural stability for both the dispenser and tray systems, wherein:
    - A motor is installed at the top of the pillar for controlling the rotation of the dispenser;
    - A designated housing inside the pillar securely holds the motor responsible for the tray's motion, ensuring a compact and stable design.
5. The automatic medicine distribution device as indicated in claim 1, additionally comprises an alert and feedback system, wherein:
    - Auditory and visual signals inform the user when it is time to dispense a pill;
    - A sensor confirms pill retrieval by detecting the user's interaction with the tray and provides feedback indicating successful dispensing.
6. The automatic medicine distribution device as stated in claim 1, wherein:
    - The dispenser is engineered for easy maintenance, allowing for the swift removal of the dispenser cover and refilling of the sections without interfering with scheduled operations.
7. The automatic medicine distribution device as specified in claim 1, also includes an outer casing that encases all internal parts, which includes:
    - A front panel featuring a display screen, an SOS button, LED indicators, and a buzzer array;

- Side panels and a removable back panel offer convenient access for maintenance while ensuring the security of internal components.

8. The automatic medicine distribution device as described in claim 1, wherein the device is designed to:
    - Access a pre-set dispensing schedule from an associated database and retain it locally for offline functionality;
    - Carry out dispensing actions utilizing a real-time clock (RTC) module, guaranteeing the precision and reliability of the schedule.
9. The automatic medicine distribution device, where the structural design and arrangement of components ensure:
    - Compactness and mobility for application in various settings, including hospitals, residences, and facilities for the elderly;
    - Accurate and secure dispensing to avoid unauthorized or accidental usage.
10. The automatic medicine distribution device, wherein the dispensing procedure involves:
    - Activating a motor to rotate the dispenser, aligning a loaded section with the dispensing opening;
    - Triggering the tray rotation mechanism following sensor detection of a user's hand;
    - Offering a real-time alert system to keep the user informed and compliant with the dispensing timetable.

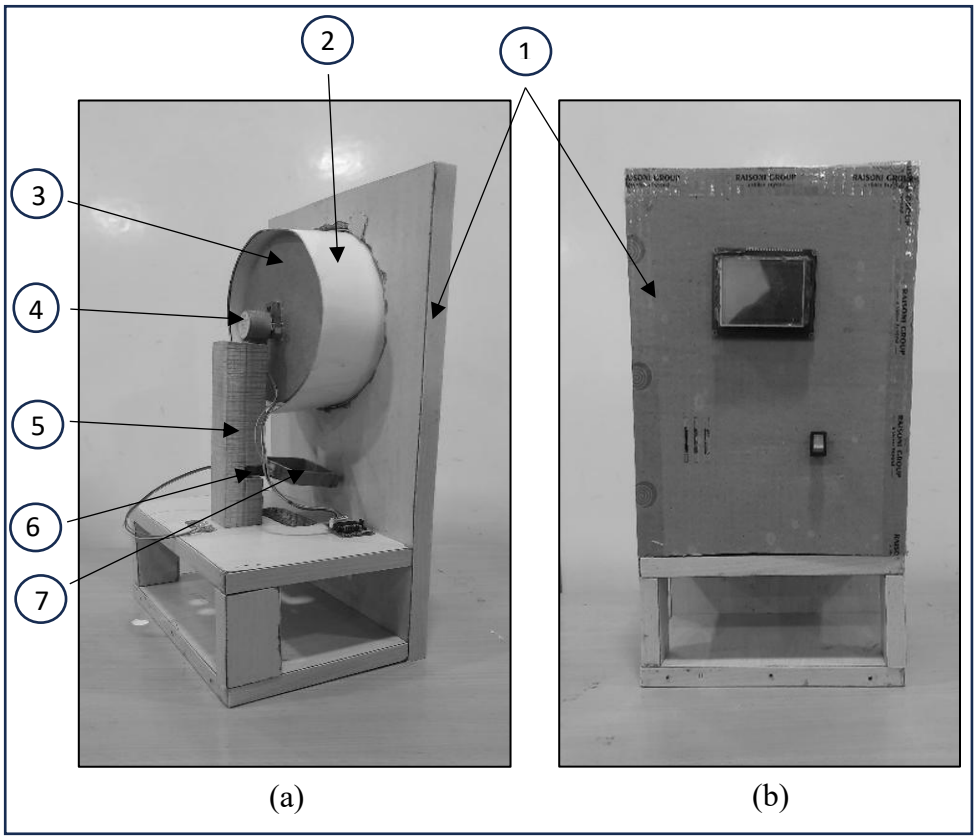

Figure 1: Automated Medicine Dispenser

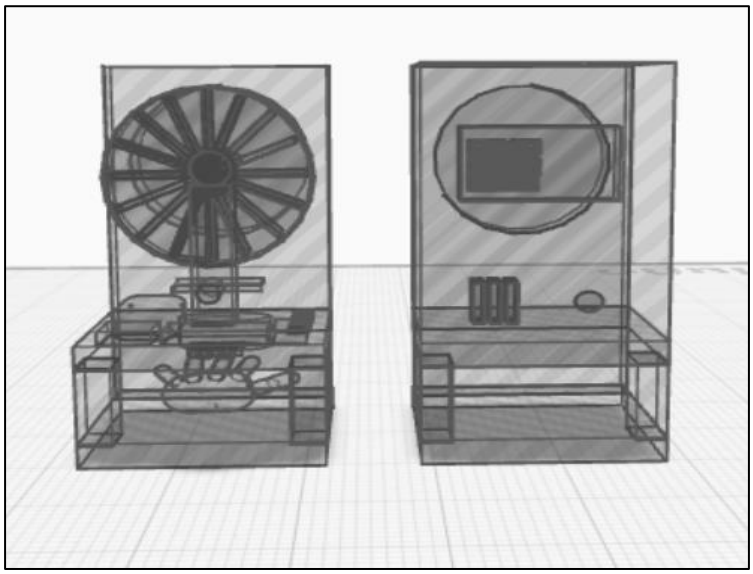

Figure 2: Hollow CAD Model

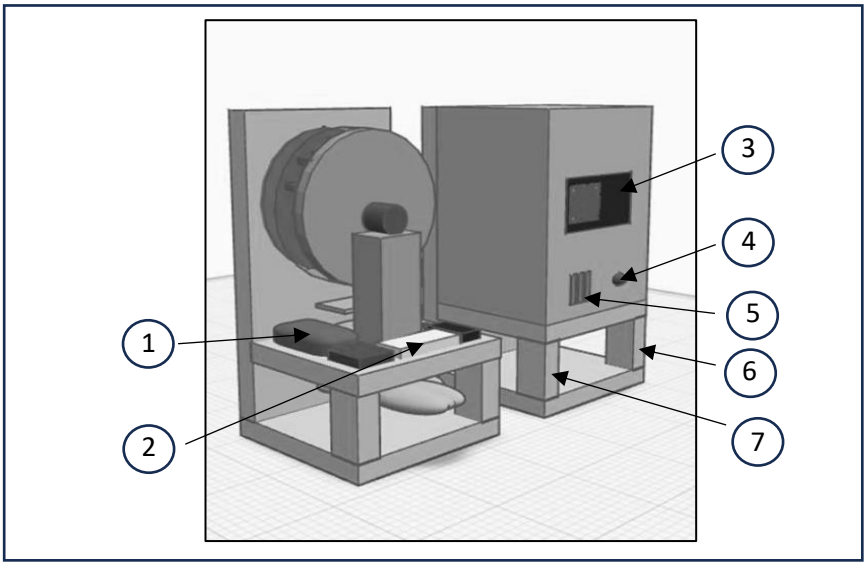

Figure 3: Automated Medicine Dispenser CAD Model

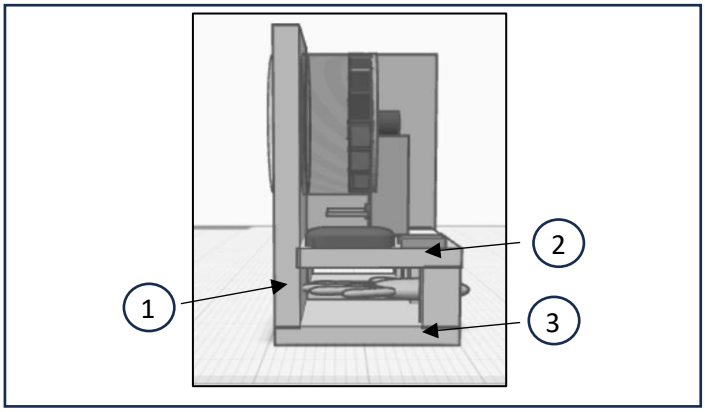

Figure 4: Left side look

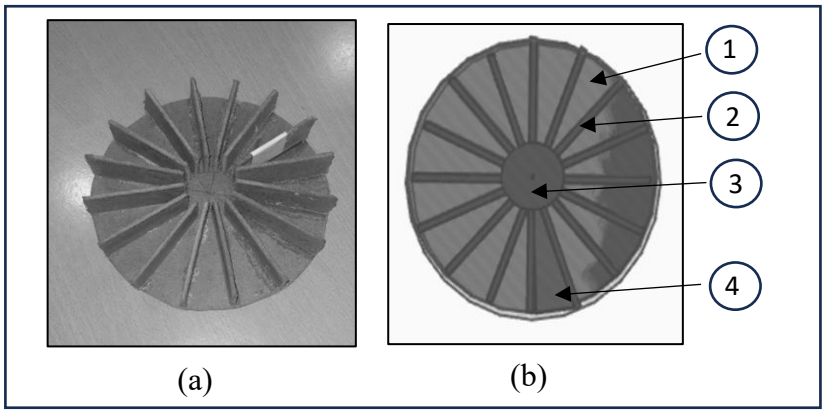

Figure 5: Dispenser

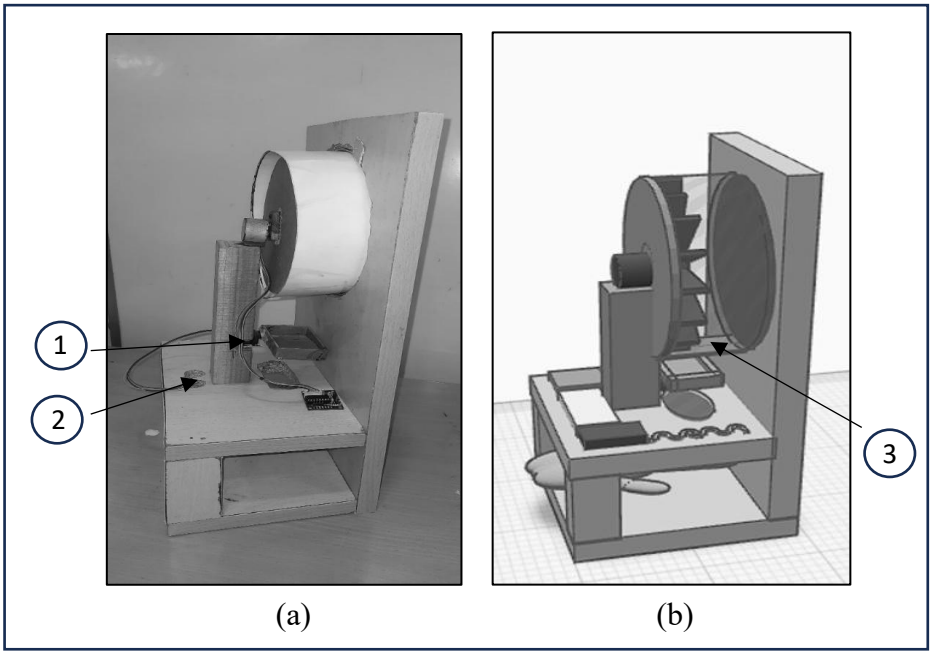

Figure 6: Base-2 cutout with CAD Model

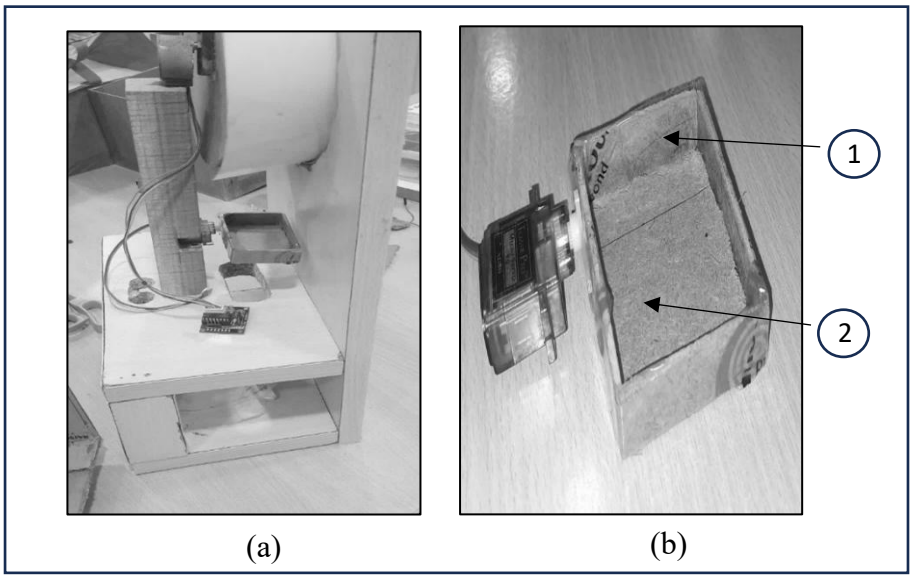

Figure 7: Tray position in device

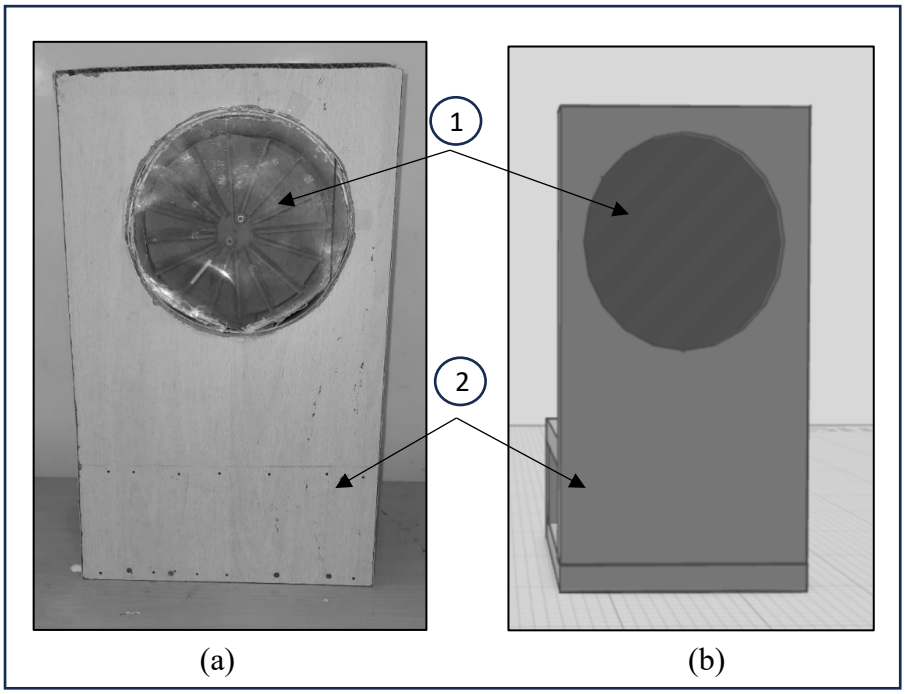

Figure 8: Back side look

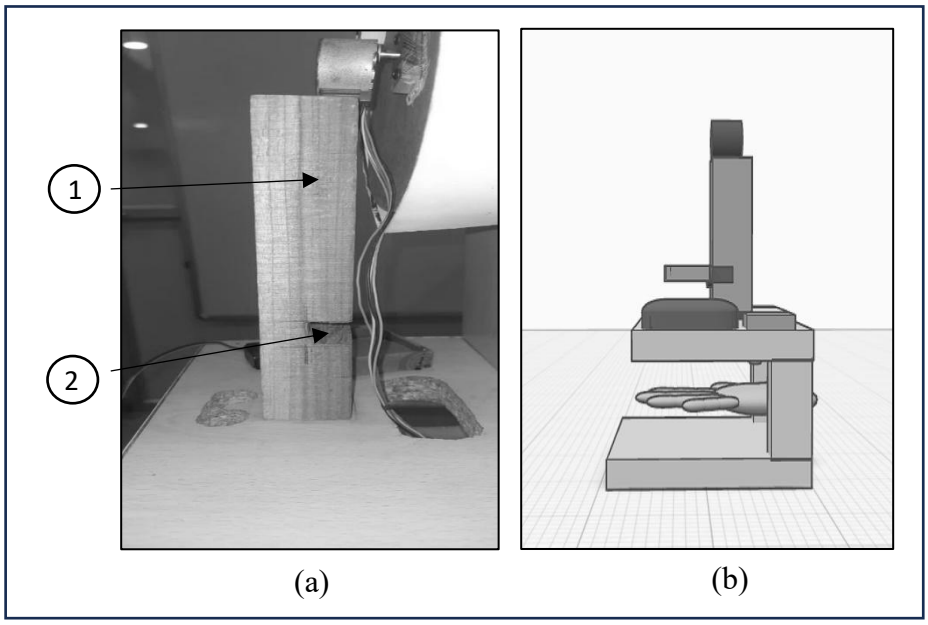

Figure 9: Support pillar

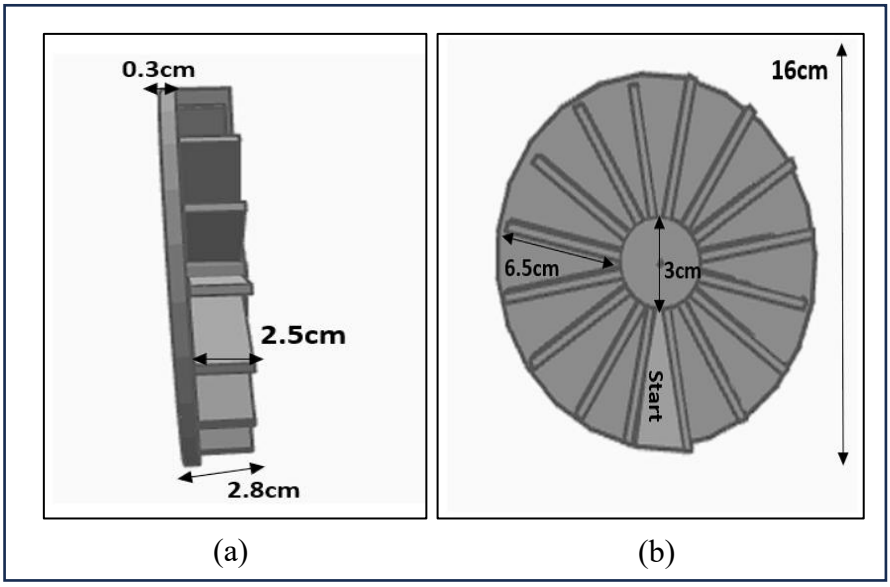

Figure 10: Dispenser measurement

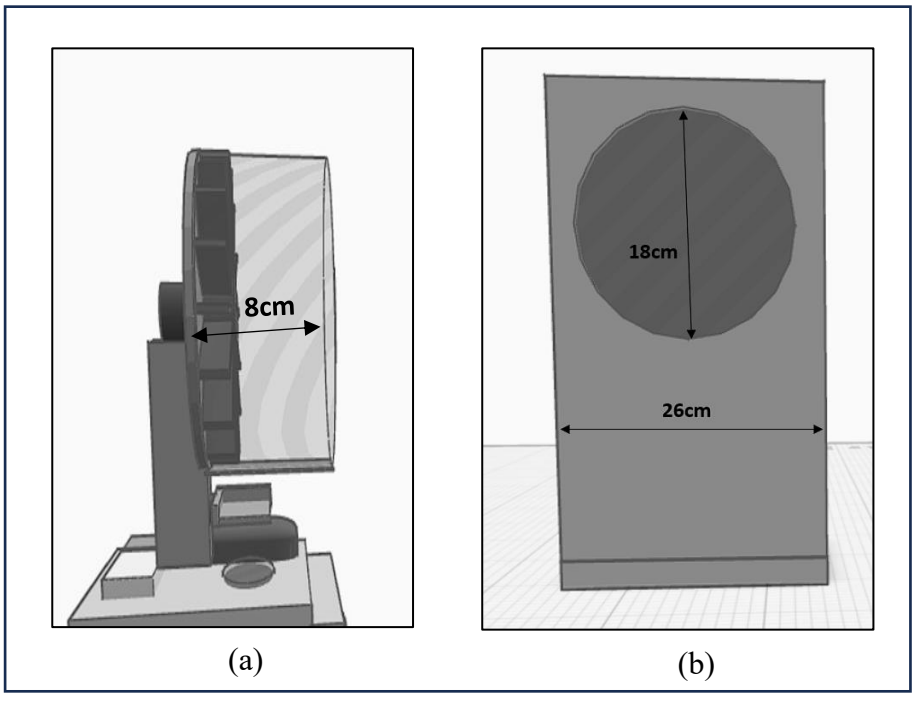

Figure 11: Dispenser cover and cutout-5 and back support measurement

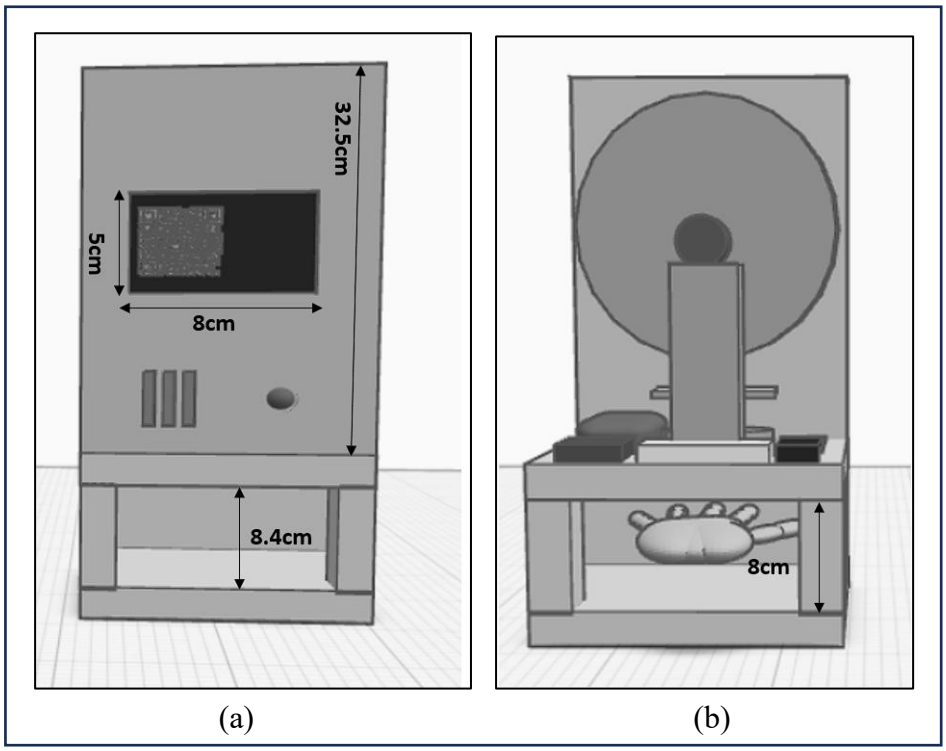

Figure 12: Front side and support measurement

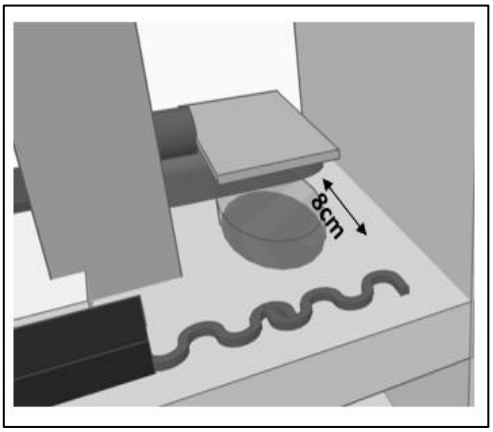

Figure 13: Cutout-1 measurement

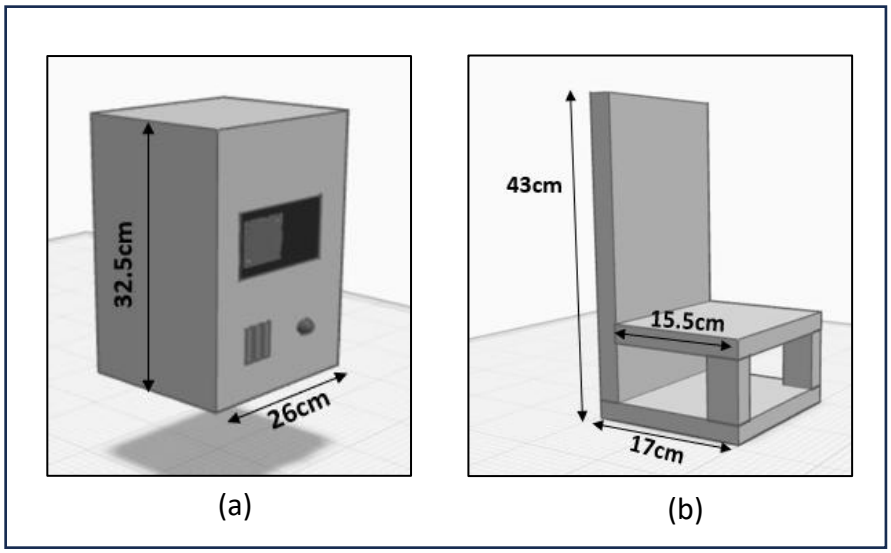

Figure 14: Front body cover and outer body measurement

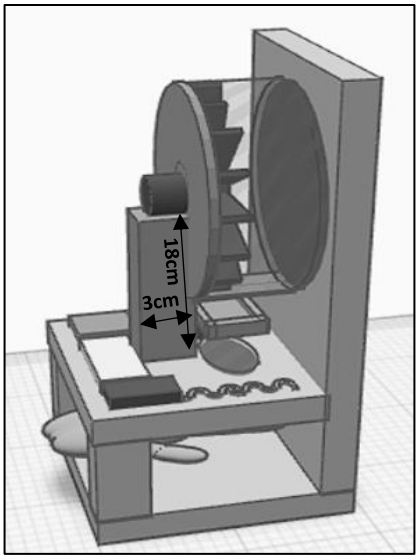

Figure 15: Support pillar measurement

ABSTRACT

A proposed automated medicine dispensing system harnesses the Internet of Things (IoT) to tackle challenges encountered by long-term patients, especially the elderly or those with mobility limitations, while also easing the burden on nursing staff. The system incorporates a contemporary pill dispenser with a detachable cover for convenient refilling, an intuitive design, hand-detection features, SOS alerts, and medication reminders. By utilizing QR codes to collect patient data, it connects to a real-time Firebase database to oversee refill schedules and handle patient discharge information. This solution addresses shortcomings present in current systems, such as the absence of real-time data processing and predictive refill notifications, guaranteeing enhanced medication accuracy. It reduces medication errors by as much as 98% and achieves a 97% accuracy rate in notifications. Intended for application in hospitals, elder care facilities, and home healthcare, it optimizes resource usage and fosters better mental and physical health for healthcare professionals. The system represents a significant leap forward in IoT-enabled healthcare, with the potential for scalability to integrate with hospital management systems and manage chronic diseases, thereby improving the quality of patient care.