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Automatic Pill Dispenser

S. Pavithra[1], V. Boomika[2], S. Jeyasree Bala[3], G. Prisha[4*]
[1]Assistant Professor, Department of Biomedical Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, India
[2,3,4]UG Student, Department of Biomedical Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore, India

***Abstract*: An automated pill dispenser is a state-of-the-art device designed to help people, particularly those with complex prescription schedules, administer medications more effectively and quickly. This device automatically distributes tablets at predetermined periods, which promotes medication adherence and reduces medication errors. Typically, the gadget has a programmable interface that allows users or caregivers to set exact dose schedules. To make sure users take the proper pills at the right time, the device is designed to dispense certain prescriptions at predefined times. To reduce the possibility of missed doses, many dispensers have built-in visual indicators, mobile notifications, or even auditory alarms to remind users when it's time to take their prescription. Automatic pill dispensers frequently feature safe storage areas that are only accessible at prearranged dispensing periods in order to guard against unwanted entry and guarantee the security of pharmaceuticals. A further degree of security and a lower chance of over- or undermedication are offered by features found in some sophisticated models that confirm the right dosage has been administered. These devices' interfaces are usually made to be as user-friendly as possible, so programming and operating the dispenser won't be difficult for people with different degrees of technological expertise.**

***Keywords*: automatic pill dispensing, auditory alarm, dosage level, storage facility.**

1. Introduction

A technological innovation in healthcare, the Automatic Pill Dispenser aims to solve the problems related to drug administration. This inventive technology, which simplifies the medicine administration process, provides a dependable option for people with complicated drug schedules, long-term medical issues, or those who must strictly stick to prescribed prescription schedules. Having to keep track of numerous prescriptions can be difficult and increase the risk of mistakes, missing doses, and poor health results. In an effort to address these issues, the Automatic Pill Dispenser offers a simple, automated method for delivering prescription drugs on predetermined schedules. This greatly improves patient adherence to recommended treatment plans while also streamlining the pharmaceutical delivery process.

Key characteristics of an automated pill dispenser frequently include configurable interfaces that let caretakers or consumers to create individualized drug regimes. The gadget has alerts or notifications that sound when someone has to remember to take their medication. The dispenser's secure storage compartments guard the integrity and safety of the pharmaceuticals that are kept there by preventing unwanted access. Certain sophisticated dispensers might have extra features like dose verification and remote monitoring as technology develops. By enabling caregivers or medical professionals to remotely monitor drug adherence and take appropriate action, these features help to increase safety.

2. Literature Review

[1] Automatic medicine dispenser Tahaseen Hasrath et al., (2021) This research presents automatic medicine dispenser is made for people who take drugs without the supervision of doctor. It frees the user from the risky chore of giving the wrong medicine at the wrong time.

[2] Design of Automatic Medication dispenser, Mukund et al., (2021) This study introduced a medication dispensing device as a medication management intervention to older adults discharged from a home health care program.

[3] A Review on Dispenser Mechanisms of Medicine Dispenser Sowmya Kini et al. It dispenses medicines on prescribed time with notifying the caretaker. There are various medicine dispensers with same functionality and IOT but different dispenser mechanism and design. The design and mechanism vary with the type and size of medicine.

[4] Automatic Medicine Vending Machine, Abhijeet Bhande et al., (2021) From this concept we are conclude that, the automatic medicine wending machine is technically feasible to the peoples. It is based on ATmega16. Although looking towards the requirement, need of medicine. This vending machine provide medicine 24*7.

[5] Smart Pill Dispenser, Jayanthi et al., (2020) This is helpful for old age patient especially who used to forget to take medicines on time or they couldn't recognize the name of the medicine with a facility to send remainder.

[6] Automatic Medicine Dispenser Robot, Priyanka Rajendra Budhvant et al., (2021) In today's world, people are suffering from several diseases and due to this the need for medication has increased exponentially. An average person takes 2-3 tablets a day and there is a chance for the person to miss the tablets. In order to avoid such mistakes an automated system for dispensing medicines is required.

[7] Automatic Medicine Dispenser, Jayalakshmi et al., (2023) This uses Arduino Mega as a microcontroller. It enables patients to become more self-sufficient in their daily lives by

*Corresponding author: prishaa121@gmail.com

helping them take their medicine on time.

3. Proposed Model

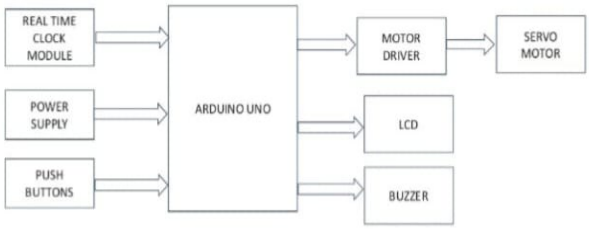

Fig. 1. Block diagram

A. *Components Used*

- Arduino UNO
- RTC (Real Time clock Module)
- Servo motor
- Motor Driver
- Push button
- LCD display
- Buzzer
- Power supply

1) *Arduino Uno*

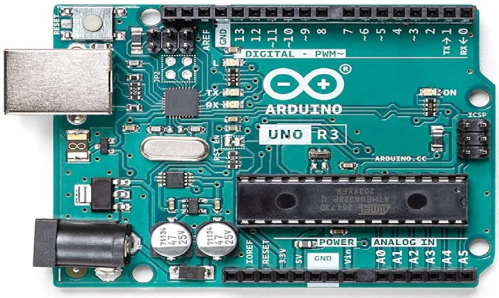

Fig. 2. Arduino Uno

A microcontroller board called Arduino UNO is based on the ATmega328P. It contains 6 analog inputs, a 16 MHz ceramic resonator, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery. Due to the fact that it is not soldered to the board, the ATmega328P can be simply replaced. Additionally, the ATmega328P includes 1 kb of EEPROM, a memory that is not erased when the device is turned off. The barrel plug connector of the Arduino UNO works well with a typical 9V battery.

2) *RTC Module*

An RTC (Real-Time Clock) module is a specialized electronic component designed to keep track of the current time and date. It operates independently and continues to maintain accurate timekeeping even when the main system or microcontroller is powered off. RTC modules are commonly used in various electronic devices, such as microcontroller-based projects, embedded systems, and other applications where accurate timekeeping is essential.

Fig. 3. RTC module

Features:

- *Lock Accuracy:* RTC modules are made to maintain precise time for lengthy periods of time. Parts per million, or ppm, are typically used to express precision and indicate how much the clock may vary over time.
- *Battery Backup:* To keep track of time even when the primary power source is disconnected, RTC modules frequently feature a battery backup. This guarantees that the clock will keep running in the event of a power loss.
- *Date and Time:* RTC modules normally give users access to the current date, time, day, month, and year, as well as hours, minutes, and seconds.
- *Alarm Functionality:* You can program particular times for alarms or triggers using the alarm functionality found in many RTC modules
- *Configurability:* The capacity to alter characteristics including daylight saving time modifications, time zone offsets, and 12- or 24-hour time formats.10-bit ADC (successive approximation ADC)

3) *Servo Motor*

Fig. 4. Servo motor

DC servo motors are typically employed as the main motor in machines controlled by numbers, computers, or other applications that require rapid and precise starts and stops. Lightweight, low-inertia servo motors react swiftly to changes in excitation voltage. These servo motors' extremely low armature inductance also contributes to a very short electrical time constant (usually between 0.05 and 1.5 msec), which further improves the servo motors' responsiveness to command signals. Permanent-magnetic, printed-circuit, and moving-coil (or shell) DC servo motors are all types of servo motors. Characteristics include speed, weight, inertia, physical form, costs, shaft resonance, and shaft configuration. These dc servo motors have torque ratings that are comparable, but their

physical and electrical constants differ. Permanent-magnetic, printed-circuit, and moving-coil (or shell) DC servo motors are all types of servo motors. A cylindrical shell of copper or aluminum wire coils that rotates in a magnetic field in the annular space between magnetic pole pieces and a stationary iron core makes up the rotor of a shell dc servo motor. Cast AlNiCo magnets with radial magnetic axes give the servo motor's field.

4) Motor driver

An electronic device or circuit that regulates an electric motor's direction and motion is called a motor driver. It acts as an interface between the motor and a microcontroller or other control equipment. A motor driver's main job is to control the electrical current, voltage, and direction that are given to the motor in order to precisely control how it moves. Certain kinds of motors, such as DC motors, stepper motors, or servo motors, are intended to be operated by motor drivers. Motor drivers are designed to satisfy the varying control requirements of various motor types.

5) Push buttons

Fig. 5. Push buttons

Push buttons are common human input devices and system components that are basic yet straightforward electronic components. Since they are usually momentary switches, you have to press and hold them in order for them to make contact. Because push buttons are made for brief action, pressing the button is the only way they may establish or lose electrical contact. The contact reverts to its initial configuration when you depress the button. Normally Open (NO) and Normally Closed (NC) are the two primary configurations for push buttons. In the NO setup, the button is closed (contact created) when it is pressed and open (no contact) when it is not. It is the opposite in the NC setup.

6) LCD display

Fig. 6. LCD display

Liquid Crystal Display (LCD) is a type of flat-panel display that is widely used in many different kinds of electronic equipment. Digital watches, calculators, television screens, computer monitors, and many other gadgets that need a thin, light display frequently employ LCDs. Compared to its predecessors, gas-plasma and light-emitting diode (LED) displays, LCDs represented a significant technological advance. Comparing LCD technology to cathode ray tube (CRT) technology, displays might now be much thinner. Because LCDs operate on the concept of blocking light rather than emitting it, they require far less power than gas-display and LED displays.

7) Buzzer

Fig. 7. Buzzer

An electronic gadget that beeps or buzzes is called a buzzer. It is frequently utilized in many different applications to deliver warning signals, warnings, or audio alerts. A piezoelectric element, a type of crystal that produces mechanical vibrations in response to an applied electric field, is used in the majority of buzzers. The audible sound is produced by sound waves in the air, which are caused by these vibrations. Buzzers can emit sound at one frequency or several, producing a variety of tones. Buzzers are easily incorporated into electronic systems and managed by digital devices or microcontrollers.

B. Software Used

Operating system: ARDUINO IDE

Tool: ARDUINO UNO

1) Arduino IDE

The Arduino software (IDE), developed by arduino.cc, is an integrated development environment that is open source and used to program the Arduino boards. Permit programming and uploading to Arduino boards. It also included a number of libraries and a collection of sample mini-projects. The C/C++ programming languages are supported by the Arduino software (IDE), which is compatible with multiple operating systems (Windows, Linux, and Mac OS X). Beginners and more experienced users can both easily utilize the Arduino software. It is used to create interactive prototypes and get started with robotics and electronics programming. Arduino software is therefore a tool for creating new things. by Anyone (children, hobbyists, engineers, programmers, etc.) and develop new electronic creations.

C. Detailed Methodology

The process of creating an automated pill dispenser is multidisciplinary and requires a thorough methodology. The first step is to identify the requirements, which include details on the intended user group, compartment layouts, and user interface features. It is crucial to conduct in-depth research on drug schedules and compliance requirements. The next step is mechanical design, where safety measures are taken into consideration while crafting the dispensing mechanism and

physical structure. Sensors, microcontrollers, and power management are all incorporated into electronics integration to control functions. Developing a user-friendly interface, precise dispensing algorithms, and security features are all part of software development. User interfaces and connectivity elements are made for simple engagement and remote monitoring. The target user group is involved in usability testing, which guarantees the dependability of mechanical, electronic, and software components through robust testing. Observance of regulations, optimization of production, and user training finish the pre-launch phase. Continuous improvement and adherence to real-world needs are ensured through post-launch monitoring, upgrades, and a feedback loop in which users and healthcare professionals participate.

D. Proposed System

The proposed system of an automatic pill dispenser involves a technologically advanced device designed to streamline medication management for individuals, particularly those with complex medication regimens or requiring assistance. The dispenser comprises a compact, user-friendly physical structure with multiple compartments for organizing different medications and dosages. The system incorporates an electronic control unit, possibly a microcontroller, to manage dispensing schedules, user interactions, and connectivity features. The dispenser's user interface is intuitive, allowing users or caregivers to easily program medication schedules and monitor the device's status. Additionally, a secure authentication system ensures only authorized individuals can access and modify the dispenser's settings. To enhance user experience, the interface includes feedback mechanisms such as LEDs, display screens, or sound signals to confirm successful pill dispensing and alert users to any issues. The dispenser is equipped with advanced sensors to monitor pill levels, ensuring accurate dosage delivery. A reliable dispensing mechanism, designed with safety features, prevents accidental double dosages and safeguards against tampering. The system can be powered efficiently, with consideration for battery life and potential power sources.

4. Results and Discussions

The use of an automated pill dispenser has revolutionized medication management with encouraging results, especially for people with complicated dosage schedules or those who need help taking their prescription drugs as directed. The whole experience of taking medication has been much enhanced by the system's cutting-edge technological features and intuitive UI. The simplicity of programming and monitoring drug schedules is valued by users, including patients and caregivers. Users and healthcare providers can now feel more at ease because of the dispenser's accuracy in providing accurate dosages and safety features that guard against mistakes or manipulation. Incorporating sensors to track pill levels reduces the possibility of missing dosages and guarantees prompt refills. Connectivity characteristics allow for remote monitoring, giving proactive care and real-time updates on drug adherence.

A. Disadvantages

Though the above-mentioned work has vast advantages over this field, it is also in the position to overcome a very few drawbacks such as,

Limited Medication Types:

Some automatic pill dispensers may have limitations in handling certain types of medications, such as large or irregularly shaped pills, liquid medications, or medications that require special storage conditions.

Limited Capacity:

The number of compartments in a pill dispenser may be insufficient for individuals with a high number of medications or complex dosing schedules. This limitation may require frequent refilling, impacting user convenience.

B. Future Work

Prospective developments and improvements in automatic pill dispensers are anticipated in the future. It's expected that further research and development will be devoted to improving these gadgets' networking capabilities. More individualized drug regimens that adjust to each patient's unique health needs and lifestyle choices may be possible with the integration of artificial intelligence (AI) algorithms. Additionally, adding Internet of Things (IoT) capabilities could make it easier for the dispenser to communicate with other medical equipment, which would support a patient care strategy that is more comprehensive. More discrete and portable designs that enhance user ease could result from miniaturization and the use of novel materials.

C. Local Survey of Target Customers

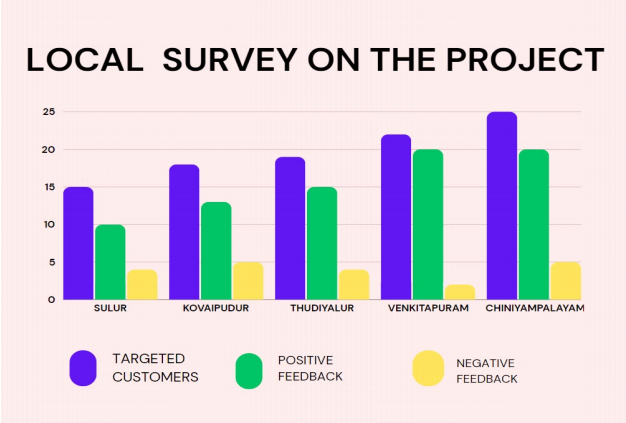

Fig. 8. Local survey on the project

5. Conclusion

In summary, the automatic pill dispenser offers a thorough and effective method of medication management, making it a revolutionary advancement in the world of healthcare technology. The gadget has proven to be useful in making the difficult work of following prescription regimens easier, especially for people who require assistance or have complex dose requirements. The medicine experience has been greatly enhanced for both users and caregivers by the dispenser's exact dosage distribution, user-friendly interface, and safety measures.

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