iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 Issue: XI Month of publication: November 2024

DOI: https://doi.org/10.22214/ijraset.2024.65570

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XI Nov 2024- Available at www.ijraset.com

Medi-Mate

Prof. Vijay Kumar Bhanuse[1], Amar Shete[2], Shravyasri[3], Shreyansh Mishra[4]
Department of Instrumentation and Control Engineering, Vishwakarma Institute of Technology, Pune, 411037, Maharashtra, India

Abstract: Medication adherence is a significant challenge, especially for elderly patients and those with chronic conditions, leading to critical health complications and increased healthcare costs. This research paper presents the design and implementation of an automatic pill dispenser system aimed at improving medication compliance using an Arduino Uno microcontroller. The system incorporates a Real-Time Clock (RTC) module to maintain accurate timing, an LCD display for user interaction, and a servo motor to dispense the pills. The device is programmed to dispense the correct dosage at predetermined times, alerting the user with an audible alarm and displaying relevant information on the LCD screen. This paper details the hardware components, software algorithms, and the integration process of the system. Initial testing demonstrates the system's reliability and ease of use, highlighting its potential to significantly enhance medication management for patients. Future enhancements could include internet connectivity for remote monitoring and integration with mobile applications for better user interface and control.
Keywords: Medicine Dispensing, Robotics, Mobile App, Arduino UNO, RTC.

I. INTRODUCTION

Medication adherence is a critical aspect of effective healthcare management, particularly for elderly patients and those with chronic illnesses. Non-adherence to prescribed medication regimens can lead to severe health complications, increased hospitalizations, and higher healthcare costs. To address these challenges, this paper presents the design and development of an automatic pill dispenser system, leveraging modern technology to ensure timely and accurate medication administration. The proposed system automates the process of dispensing pills from designated compartments based on a predefined schedule set by the user or caregiver. It incorporates an intuitive user interface, featuring an LCD display and push-button controls, to facilitate easy programming and interaction with the system. An essential component of the system is the Real-Time Clock (RTC) module, which ensures accurate timekeeping and precise dispensing according to the scheduled dosage regimen. To enhance the functionality and usability of the pill dispenser, a Bluetooth module is integrated, enabling remote monitoring and control via a smartphone application. This app, which can be developed using the MIT App Inventor platform, allows caregivers to manage the dispensing schedule and monitor adherence remotely, providing added convenience and support for patients. Additionally, the system includes an eye-blink sensor designed to detect the eye blinks of patients who are physically challenged and unable to communicate verbally. The LCD display is programmed to show information based on the frequency of eye blinks, helping to convey the patient's needs effectively. Recognizing the difficulties faced by elderly individuals and children in swallowing pills, the system incorporates a mechanism to churn tablets into a more easily ingestible form. This feature aims to improve medication adherence by addressing the physical challenges associated with swallowing pills. This research paper will detail the hardware and software components of the automatic pill dispenser system, describe the integration process, and discuss the potential benefits and limitations of the system. Through rigorous testing and evaluation, the project aims to demonstrate the system's reliability, user-friendliness, and potential to significantly enhance medication management and adherence.

II. LITERATURE SURVEY

1) There are several challenges that old people face, and of them taking their medicines on time. Old people usually forget to take their medication on time and also have a hard time recollecting whether they had their medication, which sometimes could lead to overdose and severe medical complications. There are several expensive medicine dispensers available in the market now. However, most of the elderly people around the world don’t even know of such products and still resort to storing the medicines in a box. Several types of medicine dispensers are available commercially worldwide. However, they have several drawbacks that need to be resolved. These drawbacks can be resolved using an Automatic Medicine Dispenser that is reliable,affordable and can carry up to 2-3 weeks of medicines, in such a way that old people won’t need to depend on someone else. The product is designed to make sure that the quantity and timing of the pills to be dispensed can be controlled and monitored using an app, which makes things easier for everyone, including for children who work abroad. Also, it offers clear contact between the

consumer and parental figures as it will immediately notify the guardian in case the patient has missed pill intake. Furthermore,SMD provides the customer with a touchscreen that can be accessed as an application on their cell phone, enabling them to monitor and control the timetables and use information remotely.

2) In the modern age it is difficult for family members to be available all the time to support the aged and in our society most families are nuclear. Caring for the aged is of serious concern in developing countries. Sometimes despite their best effort, the aged fail to remember to take their medication on time.There are issues concerning seniors' ability to remember to take and handle their medicine on their own. Automatic medicine dispensers are one approach as a solution to this problem. It dispenses medicines on prescribed time with notifying the caretaker. There are various medicine dispensers with the same functionality and IOT but different dispenser mechanism and design. The design and mechanism vary with the type and size of medicine. The main concern is dispenser design as the medicines are in various shapes and sizes. Hence an optimal dispensing mechanism for storing and dispensing all types of medicines is required. In this paper, a detailed review of dispensing mechanism of the Automatic Medicine Dispensers and its design is presented.
3) There are several challenges that old people face,and of them is taking their medicines on time. Old people usually forget to take their medication on time and also have a hard time recollecting whether they had their medication, which sometimes could lead to overdose and severe medical complications. There are several expensive medicine dispensers available in the market now. However, most of the elderly people around the world don't even know of such products and still resort to storing the medicines in a box. Several types of medicine dispensers are available commercially worldwide. However, they have several drawbacks that needs to be resolved.
4) Automatic medicine dispensers are designed specifically to reduce manpower and shopping time in pharmacies. Normally when we go to pharmacies, we have to wait for a long time to get our medicines. Hence this project mainly concentrates to avoid the problem. The purpose of the experiment is to deliver the medicine to the customer in minimum time. The system is proposed using embedded systems and PROTEUS software. The detailed working of the dispenser machine is demonstrated in this paper.

III. METHODOLOGY

A. *Components*

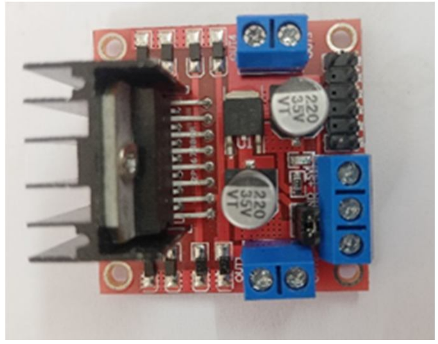
1) *Arduino UNO*

Arduino UNO is a type of microcontroller. It is fundamentally based on the ATmega328P. Arduino UNO microcontroller has 14 Input/output pins. Six pins are used for analogue input, while six pins are used for pulse width modulation. Additionally, it has a USB port for uploading code and a power jack for a five-volt power source, among other things. To transmit and receive data from one component to another, we link every component (sensors, relay, motor driver, servo motor, etc.) to the Arduino. Arduino is also used to supply the components with 5-volt power and a ground connection. Therefore, Arduino is utilized to make appropriate synchronization with all other components as well as to control all robot actions.

2) *Motor Driver*

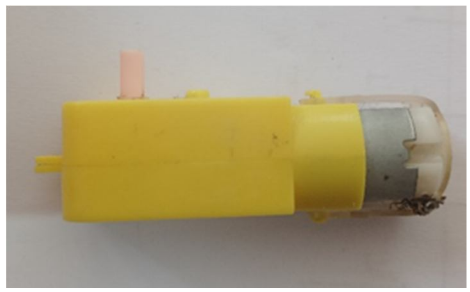
Robots employ L298n motor drivers, which operate under an H-bridge architecture. Through the L298n driver's four pins, we may direct the two or four motors (two pins for one motor) (clockwise or anti-clockwise). and it includes two enable pins that allow us to adjust the motor speed or vary the speed of the motors in accordance with our needs. The Arduino UNO was given a power source to run the motor driver, which operates on 12-volt electricity.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XI Nov 2024- Available at www.ijraset.com



3) DC Motor

We are using four simple BO-DC motors. To control the motion of the robot we used BO motors. Primary work is to move the robot in forward, left, and right direction and they convert electrical energy into mechanical energy.



4) Relay

Relay is an electronic device which is used for switching purposes. We used a 5-volt SPDT relay. We connect the pump to the relay with the help of a 9-volt battery. Relay is one of the important components in a project. We used a relay as a switch. Relay is used to perform switching operation when the pill needs to be dispensed which controls the movement of the servo motor for providing outlet to pills.

5) Eye Blink Sensor

An eye blink sensor is a device used to detect and measure the blinking of the eyes. These sensors are commonly used in various applications such as healthcare, human-computer interaction, and automotive safety. These sensors use an infrared LED and a photodiode. The LED emits IR light, which is reflected off the eyelid when the eye blinks. The photodiode detects the reflected light. The anode of the IR LED is connected to the power supply (typically 5V) through a current-limiting resistor and the cathode of the IR LED to the ground. Connect the photodiode's anode to the ground and its cathode to the power supply through a resistor. The junction between the photodiode and the resistor will give a voltage signal that varies with the amount of reflected IR light. The voltage signal from the photodiode can be noisy, so it may be beneficial to use capacitors for noise filtering. You may also need an operational amplifier (op-amp) to amplify the signal from the photodiode for better processing. A threshold value is established that distinguishes between the open eye and a blink. When the eyelid closes, the amount of reflected IR light changes, causing a detectable change in the voltage signal from the photodiode.

6) RTC Module

The DS1302 Real-Time Clock (RTC) module is a crucial component for applications requiring precise timekeeping. In the context of an automatic medicine dispenser system, it ensures accurate timing for dispensing medications at scheduled intervals.

The DS1302 is a low-power, full binary-coded decimal (BCD) clock/calendar with 31 bytes of static RAM.

It operates via a simple serial interface, compatible with SPI (Serial Peripheral Interface), which simplifies communication with microcontrollers. The module operates at a voltage range of 2.0V to 5.5V, making it suitable for various low-power applications.

The communication with the DS1302 is conducted through a 3-wire interface consisting of CE (chip enable), I/O (data line), and SCLK (serial clock). This straightforward interface is easy to integrate with most microcontrollers. Timekeeping and RAM data are transferred serially in BCD format, simplifying the decoding process for accurate time display and use.

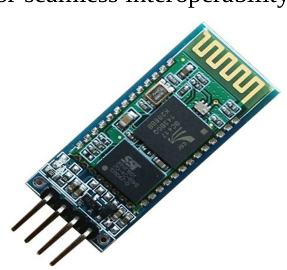
7) SG90 Micro Servo

The SG90 servo motor operates using Pulse Width Modulation (PWM) signals, where the position of the servo arm is determined by the width of the pulse sent to the control wire. Typically, a pulse width of 1ms moves the servo to the 0-degree position, 1.5ms to the 90-degree position, and 2ms to the 180-degree position. The servo motor's internal feedback mechanism ensures precise positioning by constantly adjusting the motor's angle to match the input signal.

In the automatic pill dispenser system, the SG90 micro servo motor is crucial for controlling the dispensing mechanism. Its primary function is to rotate a dispensing arm or a compartment door to release the pills at scheduled times. The servo motor's ability to accurately move to specified angles ensures that the correct dosage is dispensed reliably and consistently.

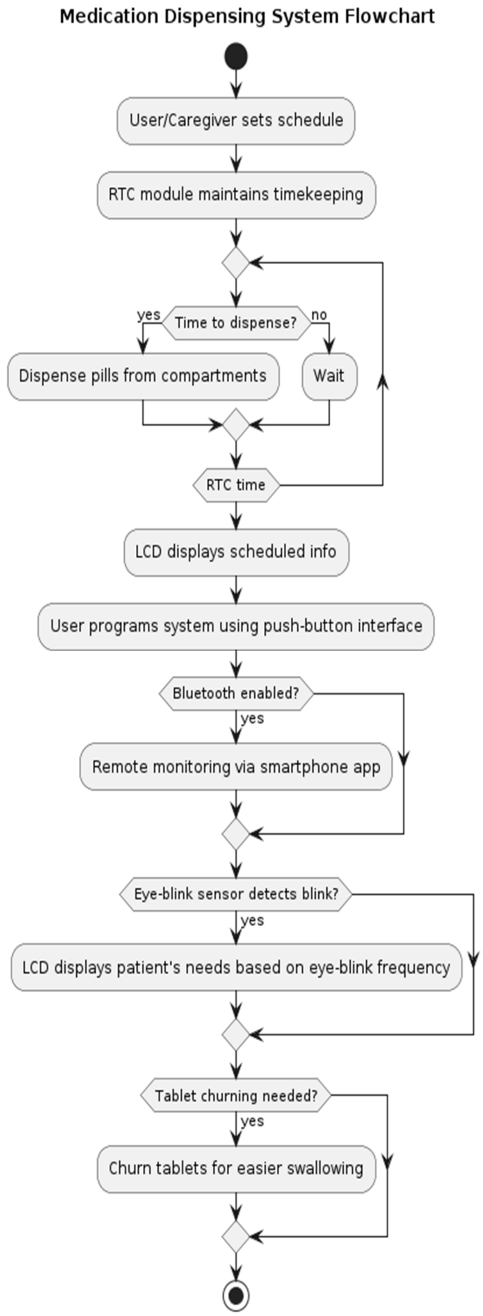
8) Bluetooth Module

A Bluetooth module is a compact electronic device designed to enable wireless communication between electronic devices over short distances. Utilizing Bluetooth technology, these modules facilitate the exchange of data, such as files, audio, and other information, without the need for physical connections like wires or cables. Bluetooth modules are commonly integrated into various electronic devices, ranging from smartphones and laptops to embedded systems and IoT devices. They operate on the globally standardized Bluetooth protocol, allowing for seamless interoperability across different manufacturers and devices.



International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XI Nov 2024- Available at www.ijraset.com

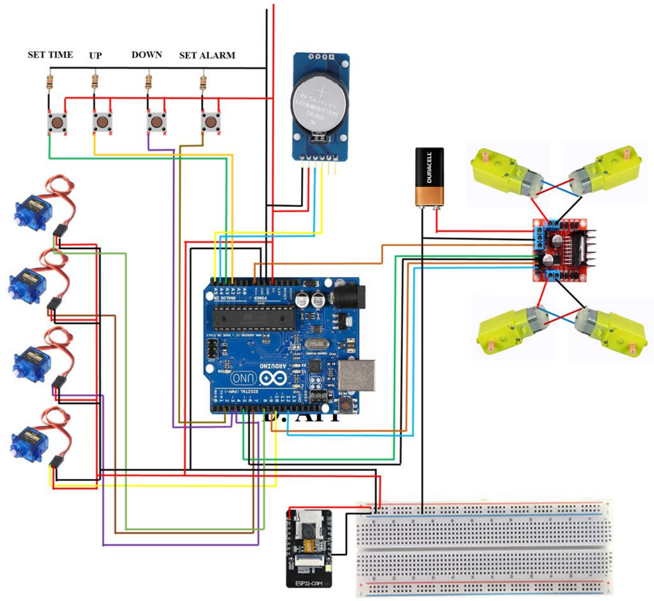
B. Flow Chart

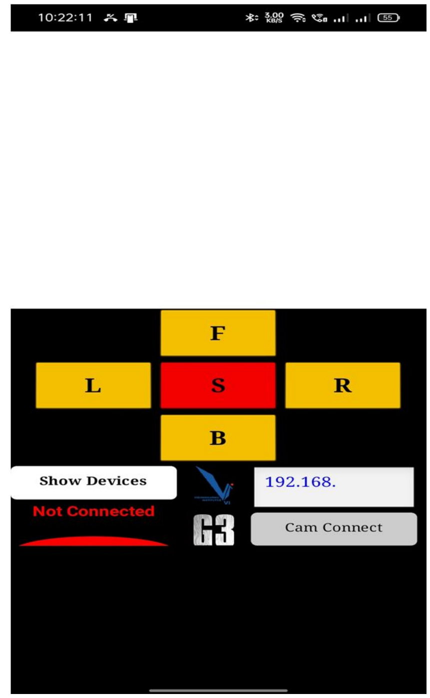


The flowchart represents an automated medication dispensing system that ensures precise and user-friendly operation. Initially, a user or caregiver sets the medication schedule, which is maintained accurately by an RTC (Real-Time Clock) module. The system continuously monitors the time and dispenses pills from designated compartments at the scheduled times. An intuitive user interface, consisting of an LCD display and push-button controls, allows for easy programming and interaction. For remote monitoring and control, a Bluetooth module connects the system to a smartphone app developed using MIT App Inventor. Additionally, an eye-blink sensor helps physically challenged patients communicate their needs, which are displayed on the LCD based on the blink frequency. For elderly people or children who have difficulty swallowing pills, the system includes a tablet-churning feature to make the medication easier to ingest. This comprehensive approach ensures the system is adaptable, accurate, and supportive of various user needs.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XI Nov 2024- Available at www.ijraset.com

C. Circuit Diagram





The Medi-Mate project incorporates a user-friendly mobile application developed using MIT App Inventor to provide comprehensive control over the bot's operations. The app's intuitive interface features an array of buttons, sliders enabling users to seamlessly command the bot's movement, monitor its surroundings, and manage various agricultural tasks. Directional control buttons allow users to effortlessly guide the bot's movement, maneuvering it forward, backward, left, and right. Four ON/OFF buttons facilitate precise control over the bot's relays, each corresponding to specific tasks.

Bluetooth connectivity serves as the communication backbone between the mobile app and the model, enabling wireless transmission of commands and data. This wireless interface streamlines control, allowing users to operate the bot from a safe distance while maintaining real-time monitoring capabilities.

In essence, the MIT App Inventor-based mobile application serves as the Agri Bot's command center, providing a user-friendly and intuitive interface for controlling the bot's movement, monitoring its surroundings, and managing various agricultural tasks, revolutionizing the way crops are tended to and enhancing agricultural productivity.

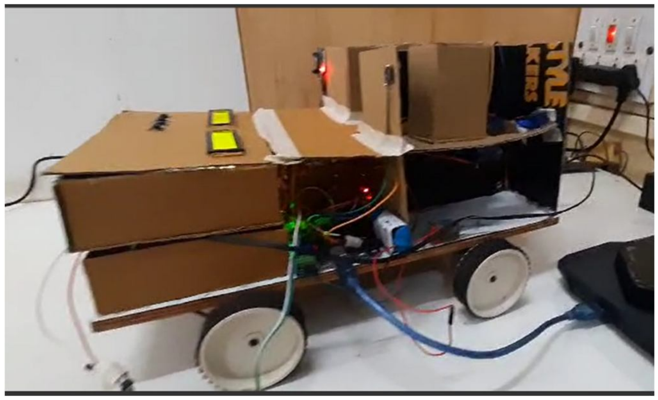
D. Algorithm

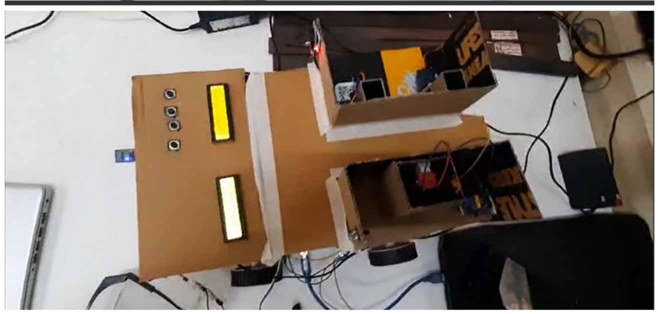
The algorithm for the automatic pill dispenser system involves several key steps to ensure accurate and timely medication dispensing. Initially, the user inputs the medication schedule via the LCD display and push-button interface, storing the schedule in the system's memory.

The Arduino Uno continuously reads the current time from the RTC module and compares it to the stored schedule. When a match is found, it sends PWM signals to the SG90 micro servo motor to dispense the pills from the designated compartment. Simultaneously, the system checks for commands from a Bluetooth module, allowing remote schedule updates and monitoring via a smartphone app created with MIT App Inventor. For patients who cannot communicate verbally, the eye-blink sensor detects blink patterns, which the system interprets and displays on the LCD screen to convey the patient’s needs. Additionally, when necessary, the Arduino activates a motor to churn tablets into powder form to facilitate easier ingestion. This comprehensive algorithm ensures precise medication management, real-time monitoring, and effective communication, enhancing usability and support for both patients and caregivers.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XI Nov 2024- Available at www.ijraset.com

IV. RESULTS AND DISCUSSIONS





The development and testing of the automatic pill dispenser system yielded promising results, demonstrating its potential to significantly improve medication adherence and ease of use for patients and caregivers alike. The system effectively automated the dispensing of pills from designated compartments according to a predefined schedule, accurately maintaining the timing with the help of the Real-Time Clock (RTC) module. The integration of the RTC module ensured precise and reliable dispensing, which is critical for adherence to prescribed medication regimens. The intuitive user interface, featuring an LCD display and push-button controls, proved to be user-friendly and efficient. Users were able to easily program the dispensing schedule and interact with the system. The clear display of information on the LCD screen minimized the likelihood of user errors and enhanced the overall user experience.

A significant feature of the system is the Bluetooth module, which enabled remote monitoring and control via a smartphone application developed using MIT App Inventor. This feature was particularly beneficial for caregivers, allowing them to manage the dispensing schedule and monitor adherence remotely. The app's user interface was intuitive and provided real-time updates, ensuring that caregivers were informed of any missed doses or irregularities in the dispensing process.

The incorporation of the eye-blink sensor was another innovative aspect of the system. It allowed patients who are physically challenged and unable to communicate verbally to convey their needs effectively. The sensor detected eye blinks, and the corresponding information was displayed on the LCD screen. This feature significantly enhanced the accessibility of the system, making it useful for a wider range of patients. Furthermore, the implementation of a mechanism to churn tablets into a more easily ingestible form addressed a common issue faced by elderly patients and children who have difficulty swallowing pills. This feature was successfully tested and proved to be an effective solution, potentially increasing medication adherence by removing a significant barrier for these patients. Overall, the system was evaluated through a series of tests to assess its reliability, accuracy, and ease of use. The results indicated that the system was highly reliable in dispensing medication at the correct times and providing accurate information to users and caregivers. The combination of hardware components and software algorithms functioned seamlessly to deliver a robust and user-friendly solution. In conclusion, the automatic pill dispenser system developed in this project demonstrates significant potential to improve medication management and adherence. The successful integration of the RTC module, user-friendly interface, Bluetooth connectivity, eye-blink sensor, and tablet churning mechanism highlights the system's comprehensive approach to addressing various challenges associated with medication adherence. Future improvements and additional features, such as IoT integration and advanced user interfaces, could further enhance the system's functionality and impact, making it a valuable tool in healthcare management.

V. FUTURE SCOPE

The automatic pill dispenser system described in this project has the potential for several enhancements and expansions to increase its functionality, user-friendliness, and adaptability to various healthcare needs. By connecting the system to the internet, real-time monitoring and management can be facilitated through cloud services. This would allow caregivers and healthcare providers to remotely access patient medication adherence data and make necessary adjustments to the regimen. By integrating with devices that monitor vital signs (e.g Blood pressure monitors, glucose meters), the system could provide a holistic approach to health management, adjusting medication schedules based on real-time health data. Implementing biometric authentication (such as fingerprint scanning) could ensure that medication is dispensed only to the intended user, increasing safety and security. The system could be programmed to alert users or caregivers when the medication supply is running low, and even automatically place orders for refills through connected pharmacies.

VI. CONCLUSION

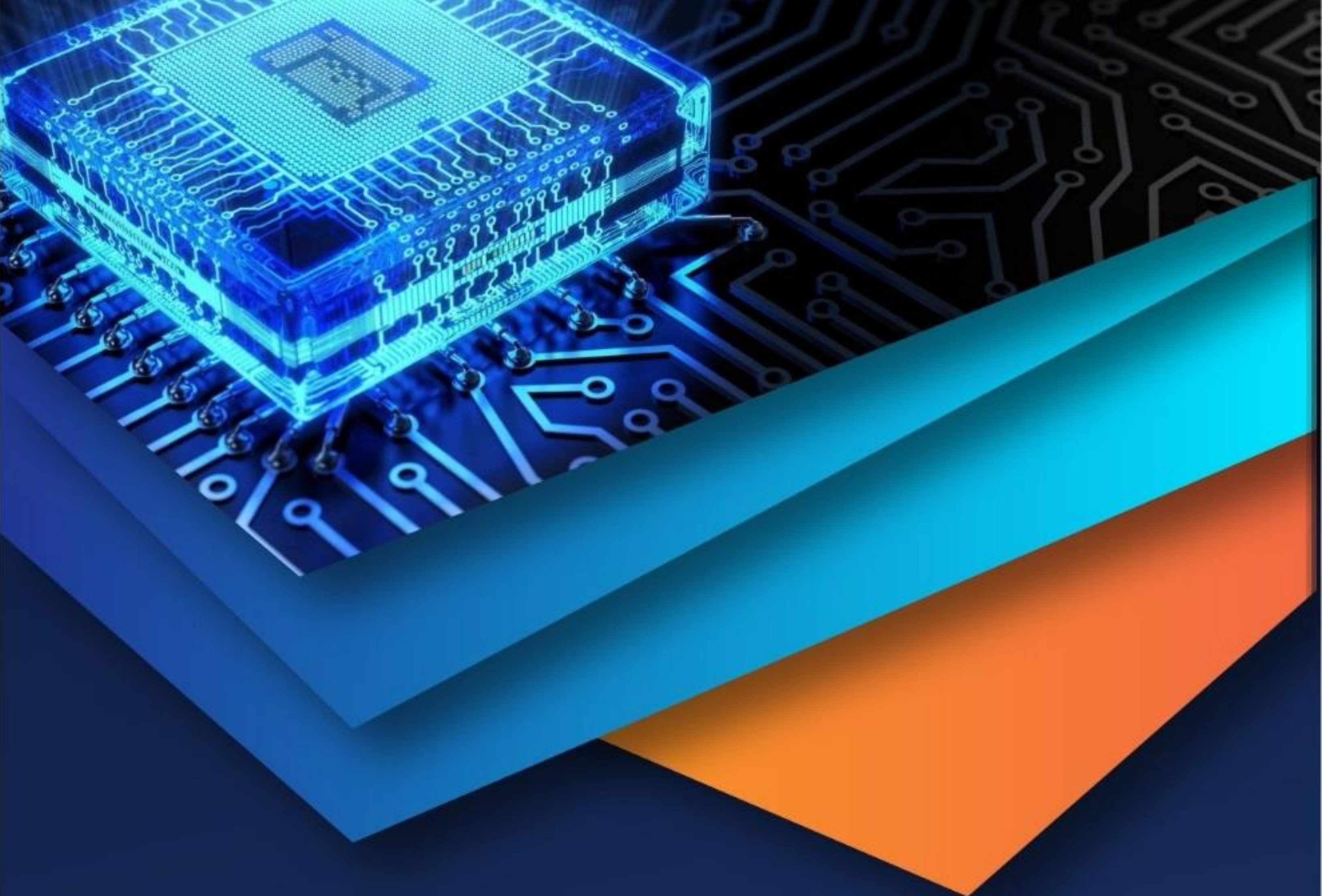
The development of an automatic pill dispenser system represents a significant advancement in the field of medication management, addressing the critical issue of medication adherence. By leveraging technologies such as Arduino Uno, RTC modules, LCD displays, Bluetooth connectivity, and eye-blink sensors, the system ensures accurate, timely, and user-friendly medication dispensing. The intuitive user interface allows for easy programming and interaction, while the Bluetooth-enabled smartphone app facilitates remote monitoring and control, providing additional support for caregivers. The inclusion of an eye-blink sensor extends the system's usability to physically challenged patients, ensuring they can communicate their needs effectively. Additionally, the mechanism to churn tablets into more easily ingestible forms addresses a common challenge faced by elderly patients and children. Initial testing demonstrates the system's reliability and potential to significantly enhance medication adherence and patient outcomes. As the project progresses, further enhancements and integrations could transform this system into a comprehensive health management tool, capable of addressing a wide range of patient needs. The future scope of this project is vast, with numerous opportunities for innovation and improvement, ultimately contributing to better healthcare delivery and patient care.

VII. ACKNOWLEDGMENT

I would like to express my sincere gratitude to Prof. Vijaykumar Bhanuse for his invaluable guidance and unwavering support throughout the development of the Medi-Mate project. His expertise, encouragement, and commitment have been instrumental in shaping the project and navigating its complexities. Prof. Bhanuse's passion for innovation and dedication to fostering a collaborative learning environment have significantly contributed to the success of this endeavor. I am truly fortunate to have had the opportunity to work under his mentorship, and his insights will undoubtedly resonate in the continued evolution of this project.

REFERENCES

[1] IOT based Advanced Medicine Dispenser Integrated with an Interactive Web Application - International Journal of Engineering & Technology - Nanda Kishor Panda, Shubham Bhardwaj, H.Bharadwaj, Rohil Singhvi - 7 (4.10) (2018) 46-48
[2] Automatic Hand Sanitizer Dispenser with Temperature Sensor and Heartbeat Measuring System- International Journal of Applied Engineering Research - Dr.S. Prasad Jones Christydass,Dr.MLSNS .Lakshmi, Dr.V.Nishok Dr.S.Suresh Kumar , Mr.V.Jaikumar - Volume. 6, Issue 1, June-2021.
[3] A Review on Dispenser Mechanisms of Medicine Dispenser - International Journal of Engineering Research & Technology (IJERT) - Asst. Prof. Sowmya Kini , Sagar S Acharya, Shreeraj Hegde & Ashwitha Sathish Kumar - Volume 10, Issue 03, March-2021.
[4] Automatic Medicine Dispenser using IoT - International Journal of Engineering Research & Technology (IJERT) - Jyothis Philip, Feba Mary Abraham, Ken Kurian Giboy,B J Feslina and Teena Rajan - Voume 9 Issue 08, August-2020.
[5] IoT based Automated Medicine Dispenser for Online Health Community using Cloud - International Journal of Recent Technology and Engineering (IJRTE) - Suganya G, Premalatha M, Anushka Sharma, Muktak Pandya, Abhishek Joshi - Volume-7, Issue-5S4, February-2019.
[6] Design of Automatic Medication Dispenser - S. Mukund And N.K.Srinath - Computer Science & Information Technology (CS & IT) pp. 251–257, 2012 & DOI : 10.5121/csit.2012.2324.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY