

## IoT type Blynk App based Voice Pellet Medicine Dispenser

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### Abstract.

This paper presents the innovative concept of a computer-controlled voice-activated medicine dispensing device. This system integration is a great move towards autonomous administration of pharma in a technologically advanced way. The elderly members, as they are popularly known as the older adults, face a range of issues, and one of them is the forgetfulness that they may develop in taking their medications at the right time. This is due to the fact that their tendency to misremember the intake and the proper timing of the drugs can result in medication overdose and severe clinical problems. The world is overwhelmed with numerous models of medication dispensers, but each of them has a plethora of drawbacks that should be taken into serious consideration. These constraints support the need to continue innovation and solution-based research. The aforementioned deficiencies can be addressed by installing a reliable, inexpensive automatic dispenser that will have the capacity to hold two to three weeks of therapeutic regimens, and thus the older adults will not need to rely on the help of another person.

**Keywords:** Blynk app, Pill dispenser, SMD, Elderly people, Arduino.

### 1. INTRODUCTION

As it has been proven by empirical literature, medication non-adherence is widespread at any age, as older adults are especially vulnerable [1]. Automated medication devices include a range of designs, all of which are oriented to solid dosage forms [2]. Compliance with prescribed regimens is a major issue in the field of modern-day healthcare [3]. Specifically, the aged patients often do not take their medications at the right time, and the simultaneous presence of several drugs enhances the chances of unintentional overdose. These types of medication errors may trigger serious negative effects, including permanent disability or death [4-7]. Apparently, the pervasiveness of this issue dictates the need to have remedial measures.

Many modern research works have sought to achieve the same goals as those discussed herein, that is, the creation of an automated drug dispensing device among the elderly [8]. However, these studies do not mention much about the refill paradigm and frequency of medication [9]. A user can upload records to the cloud and consequently query patient medication history and predict their future clinical needs, but system failed to use the Internet of Things (IoT) paradigm.[10]. With the capabilities of IoT, manipulation of the device can be done using such applications [11]. The system reminds the patient about the dosage that he/she is supposed to take, and in case of non-compliance, the system will sound an audible alarm that will attract the attention of the patient [12]. The innovation will guarantee increased transparency between the dispenser, the patient, and their caregivers, who will receive real-time updates no matter their location across geographical boundaries whenever medication intake does not take place at the predetermined times [13].

The manuscript describes the design and development of a smart medicine dispenser (SMD), which is a voice-activated pellet-dispenser that is a part of an Internet-of-Things (IoT) system using the Blynk application and cloud storage. SMD can deliver solid and liquid drugs, thus eradicating the risks of overdosing and underdosing, which is of significant concern among elderly people. The system will help caregivers to maintain elderly patients on their therapeutic schedules

at the right frequency and at the right time by enabling them to operate, monitor, and control remotely using a mobile device.

## 2. STRATEGY OF PROPOSED APPROACH

### 2.1. Overall Technology

An automated pill dispenser can be configured so that caregivers can also administer medications to patients remotely. Hardware architecture consists of a set of components that will provide this functionality, such as an Arduino microcontroller, GSM module, servo motor, centrifugal pump, piezoelectric buzzer, drug pill container, and the dispenser unit itself [14].

### 2.2. System Design

The system design is based on the literature available, specifically, the research that outlines the relevant gaps and limitations as presented in References [15]. The current proposal states a scenario in which elderly patients are issued medication at the right time, and more challenges related to medication adherence are expected to be resolved. Other hardware elements can be connected with the Arduino platform [16]. Upon the activation of the piezoelectric buzzer, a sound notification will be sent to the Blynk application, which promotes an increased level of caregiver awareness. After this alert, clinicians enter medication drop data in ThingSpeak, which allows holistic analytics.

### 2.3. Components

#### 1. Servo Motor

A servo motor is a complex electrical rotating motor, which can be used in angular position and velocity control, thus allowing precise control of a mechanical system [17]. It is a combination of a traditional motor and a position-feedback sensor usually connected through a servo drive as in Fig. 1. Within standard specification, the motor has the ability of giving the deflection up to 90 degrees on either sides of its neutral position and the rotation angle is proportional to the pulse width of the control pin using the PWM principle [18, 19].



Fig. 1: Servo Motor

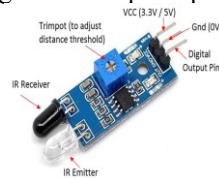


Fig. 2: IR sensor



Fig. 3: Arduino Uno



Fig. 4: Node MCU

#### 2. IR sensor

The sensors shown in Fig. 2 of proximity, which use infrared radiation, work on the principle of reflection of infrared light and the interpretation of its reflection. Being a passive device, it does not emit any level of illumination but just measures the presence of incident infrared radiation [20]. A conventional IR proximity sensor has two basic parts: an infrared transmitter and an infrared receiver. The IR LED is normally used as the transmitter, and the receiver is implemented using a photodiode that can change the reflected infrared light into an electrical signal.

#### 3. Arduino Uno

The Arduino Uno board shown in Fig. 3 is a platform that will be based on a Microchip ATmega328P microcontroller and will be an open-source, hobbyist-grade platform. It incorporates a variety of I/O peripherals, such as a quartz crystal oscillator to keep time, a voltage regulator, and UART serial interfaces [21]. It has fourteen exposed digital pins, six of which are for pulse-width modulation and six analog input channels. The microcontroller is communicated with the help of the Arduino Integrated Development Environment (IDE) that provides a Type B USB connection and a simplified programming framework utilizing a limited subset of the Wiring language [22].

#### 4. Node MCU and experimental model of proposed work

The Node MCU platform is named after the two words, node and MCU (microcontroller unit). It is a low-priced Internet-of-Things (IoT) development board based on the ESP-12, which has an ESP8266 processor running on the XTOS real-time operating system. The board has customizable

firmware based on the Lua scripting language. The ESP8266 includes built-in Wi-Fi, and thus the Node MCU has been a popular platform to use in IoT projects [23-24]. Fig. 4 is Node MCU with ESP8266 core. The prototype has also proven to be satisfactory in meeting the objectives of the project stated.

### 3. BLYNK APP ROLE IN PROPOSED WORK

Blynk is a complete software solution that enables quick prototyping, remote control, and deployment of both large and small electronic devices. Blynk is used as an Internet-of- Things - based application in the methodology described below that allows users to connect to the hardware-based experiment depicted in Figs. 5, 6, and 7 through a cloud platform supporting Android, web, and Blynk-operated medicine dispensing systems. The platform evaluates past and current data that are collected through the devices and allows the caretaker to control the devices remotely, regardless of the geographic location. It also sends the caretaker vital notifications about patient status and triggers the system in response to it. The mobile interface is specified in the prototyping stage and implements the experimental hardware settings described in the given work automatically. The Blynk application that was used in the current research has the following features:

1. It is a combination of the experimental setting on the hardware side and the cloud and user authentication.
2. It operates as a bridge administration of Ethernet, Wi-Fi, and cellular networks.
3. It is also an application-programming interface (API) integrator.

#### 3.1 Algorithm: Blynk Based VN MEDIPRO System Proposal.

Step 1: Start running of the algorithm.

Step 2: Set Blynk authentication identifier and template designation

Step 3: Opening debugging state of Blynk.

Step 4: Include Proposed VN MEDIPRO.h.

Step 5: Carry out setup routine after specified time.

Step 6: Call VN\_MEDIPRO.begin () to start

Step 7: Start the endless cycle and initiate the Blynk services

Step 8: Keep on with this until the termination of real-time functioning.

Table. 1

S. No.	Notification Time	Application Name	Dosage Message Displayed
1	Morning	VN MEDIPRO	Morning Dosage: Omeprazole – 20 mg
2	Afternoon	VN MEDIPRO	Afternoon Dosage: Atenolol – 50 mg
3	Evening	VN MEDIPRO	Evening Dosage: Cetirizine – 40 mg

### 4. RESULTS ANALYSIS

Automatic dispensing of medication, in this case, will focus on the accurate and computerized provision of both solid and liquid therapeutics based on the prescriptions of the user.

#### 4.1. Delivering medicine at the dispenser

The dispensing mechanism as shown in fig. 6 has been able to deliver the correct dosage at the required time upon movement detection. The Blynk application allows setting the temporal parameters, which are adjusted according to the prescriptions of the physician. The Blynk interface, as shown in Fig. 7, fits perfectly with the rest of the hardware system of the proposed system. In addition, the caregivers can also check whether the patients respond properly to the dispenser alerts, taking the appropriate medication at the right time and dosage. As a result, the system ensures that the device is acutely conscious of the precise time of the administration of every medicine and thus, requires flawless data transmission. The string value of the chosen medicine is read in the Arduino microcontroller, which means that every dispensation operation will be performed at the right date and time.



Fig. 5: Experimental model



Fig 6: Pill deliverance



Fig. 7: Pill received by the user

#### 4.2. Performance analysis

To be able to properly measure the liquid therapeutics, the pump had to be calibrated by trial and error to decide on how much time it would take to dispense a certain amount of liquid medication. This included the aqueous and syrup formulations. Fig. 8 shows a graphical representation of the dependence between the amount of medicine that is dispensed (in this case, it is the number of pills) and the time during which this dispensing is taking place (in seconds). The experimental results show that there is a direct proportion, which demonstrates a linear tendency with almost unchanged time consumption per pill. The dataset was processed by a linear regression (best-fit line) in order to measure this relationship.

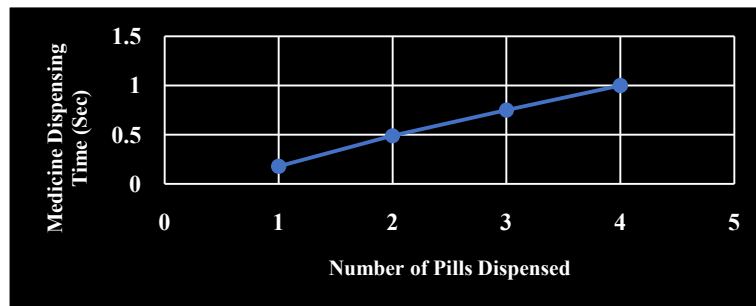


Fig. 8: Performance analysis graph of proposed prototype

#### 5. CONCLUSION

This manuscript outlines the design of SMD which is a smart computerized voice assisted pellet dispensing device that incorporates an IR sensor and Blynk mobile application. Blynk application is created on the basis of the proper software framework which guarantees the effective functioning of the SMD. The SMD use has a significant effect on improving medication compliance, which increases the effectiveness of the therapy. We can see that the tool manages the risk of dosage errors, especially in older people. Caregivers get to ease their fears when they are not available to escort elderly patients undergoing chronic or periodic dosing schedules since the system automatically checks the time of dosage. The SMD suggested below is easy to use, adjustable and capable of being scaled to higher dispensing capacities.

#### 6. REFERENCES

1. Mathew, Ajay, et al. "Design and implementation of a smart medicine dispenser." In TENCON 2019-2019 IEEE Region 10 Conference (TENCON), pp. 1059-1064. IEEE, 2019.
2. Kumar, Praveen, et al. "Solar Powered Medic Vending Machine." In 2020 2nd International Conference on Advances in Computing, Communication Control and Networking (ICACCCN), pp. 465-468. IEEE, 2020.

3. Tomlinson, Justine, et al. "Successful care transitions for older people: a systematic review and meta-analysis of the effects of interventions that support medication continuity." *Age and aging*, vol.49, no. 4, pp: 558-569, 2020.
4. Prajwal, K. T., et al. "Design and Development of an Intelligent Medicine Dispenser." In 2023 7th International Conference on Electronics, Communication and Aerospace Technology (ICECA), pp. 1860-1864. IEEE, 2023.
5. Sanam J, et al. "Reduction of Harmonics using PQ based Hysteresis Controlled Active Filter." In 2021 International Conference on Sustainable Energy and Future Electric Transportation (SEFET), pp. 1-6. IEEE, 2021.
6. Thangella, Rajesh, et al. "Optimal design for solar cell and fuel cell renewable source to enhance the power quality in a micro grid system." In 2022 International Conference on Intelligent Controller and Computing for Smart Power (ICICCS), pp. 1-6. IEEE, 2022.
7. Sanam J, et al. "Impact on Voltage Profile and Power Loss in Electrical Distribution Networks with the Integration of DG using Exhaustive Search based Load Flow Algorithm." In 2022 International Conference on Intelligent Controller and Computing for Smart Power (ICICCS), pp. 1-6. IEEE, 2022.
8. Chandana, N., et al. "IoT-based medicine reminder and dispensing machine." In 2022 Second International Conference on Artificial Intelligence and Smart Energy (ICAIS), pp. 1060-1066. IEEE, 2022.
9. Patil, C. H., et al. "An IoT-based smart medicine dispenser model for healthcare." In 2022 IEEE World Conference on Applied Intelligence and Computing (AIC), pp. 391-395. IEEE, 2022.
10. Marengo, LiviaLuize, et al. "Involvement of Human Volunteers in the Development and Evaluation of Wearable Devices Designed to Improve Medication Adherence: A Scoping Review." *Sensors* 23, no. 7, pp:3597, 2023
11. Nimmantardwong, et al. "Human-centered design of mobile health apps for older adults: systematic review and narrative synthesis." *JMIR mHealth and uHealth* 10, no. 1, e29512, 2022.
12. Muppalla, NR Kishore, et al. "Design of Compensator for High Gain DC-DC Converter." In 2021 International Conference on Sustainable Energy and Future Electric Transportation (SEFET), pp. 1-5. IEEE, 2021.
13. Sanam J, et al. "Impact on Electrical Distribution Networks with The Integration of Shunt Capacitor Model Using Exhaustive Search Based Load Flow Algorithm." In 2022 International Conference on Intelligent Controller and Computing for Smart Power (ICICCS), pp. 1-5. IEEE, 2022.
14. Eppe, Bhanuprasad, et al. "A Power-Aware Algorithm for Mobile Devices Focused on Batteries." In 2024 10th International Conference on Communication and Signal Processing (ICCSP), pp. 183-187. IEEE, 2024.
15. Mnati, Mohannad Jabbar, et al "An open-source non-contact thermometer using low-cost electronic components." *HardwareX* 9, e00183, 2021.
16. Indraratna, Praveen, et al. "A smartphone-based model of care to support patients with cardiac disease transitioning from hospital to the community (TeleClinical Care): a pilot randomized controlled trial." *JMIR mHealth and uHealth* 10, no. 2, pp:32554, 2022.
17. Das, Arnab, A et al. "Development of a novel design and subsequent fabrication of an automated touchless hand sanitizer dispenser to reduce the spread of contagious diseases." In *Healthcare*, vol. 9, no. 4, p. 445. MDPI, 2021.
18. Mallavarapu Lakshmi Sowjanya, Sanam J, DoppalapudiPujitha, SangulaChaithanya, and B. Mani Deepika. "Optimal reactive power sizing in distribution systems to optimize the voltage profile and power loss using fbs based esa algorithm." In 2020 IEEE 17th India council international conference (INDICON), pp. 1-6. IEEE, 2020.
19. Ravipati, Srikanth, et al. "Efficient control of sensorless hybrid electric vehicle using RBFN controller." *Studies in Informatics and Control* 30, no. 4 (2021): 87-97.
20. Sanam, J. "Planning and Operation of DSTATCOM in Electrical Distribution Systems." PhD diss., 2017.
21. Fehringer, Hannah, et al. "User-Informed Adaptation in IoT Home Healthcare: Grounding Development in Empirical Evidence." *Journal of Theoretical and Applied Electronic Commerce Research* 18, no. 4, pp: 1901-1925, 2023.
22. Deepak, P., et al. "Development of Automated Vending Machine for the Application of Dispensing of Medicines." In *International Conference on Soft Computing and Signal Processing*, pp. 527-535. Singapore: Springer Nature Singapore, 2023.
23. A. K. Panda, Sanjib Ganguly, and Sanam J. "Placement of DSTATCOM in radial distribution systems for the compensation of reactive power." In 2015 IEEE Innovative Smart Grid Technologies-Asia (ISGT ASIA), pp. 1-6. IEEE, 2015.
24. Sanjib Ganguly, Sanam J, and A. K. Panda. "Distribution STATCOM with optimal phase angle injection model for reactive power compensation of radial distribution networks." *International Journal of Numerical Modelling: Electronic Networks, Devices and Fields* 30, no. 6 (2017): e2240.