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Smart Pill Bottle

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ABSTRACT: Smart pill bottles are a revolutionary development in medical technology that are intended to improve drug compliance and reduce associated health hazards. Real-time monitoring of medication usage is made possible by the sensors, connection features, and data analytics capabilities included into these smart medicine containers. They provide medicine consumption reminders, monitor missing or incomplete doses, and alert caretakers or medical professionals about missed doses or unopened bottles at prescribed times. Furthermore, some smart pill bottles can sync with smartphone apps, allowing users to keep an eye on how much medication they're taking and get alerts straight to their phones. Those who have cognitive limitations that make it difficult for them to follow recommended prescription regimens, are managing complicated medication schedules, or are dealing with chronic diseases may find these devices very helpful

In this project, the system uses sensor data to monitor patients and, in the event of an emergency, instantly contacts the patient, a family member, or a healthcare provider. Two types of sensors are used by the Internet of Things bottle to help physicians and patients: a cap button that determines if the pill bottle has been opened or closed allows the bottle to know if patients have taken their prescription.

If a patient overlooks the initial notification, our system can escalate by sending a text message. The smart pill bottle is synced with a mobile application that issues reminders when it's time for a dose. Additionally, when the scheduled dose time arrives, the bottle cap emits a bell sound and displays a message. Our solution ensures that patients can effectively adhere to their prescription schedules by analyzing tracking data and making informed decisions about when to trigger alarms.

KEYWORDS: SMART PILL BOTTLE, ARDUINO IDE SOFTWARE, PIEZZO BUZZER, ESP-8266, BLYNK APP, HW-107 CHARGING MODULE.

I. INTRODUCTION

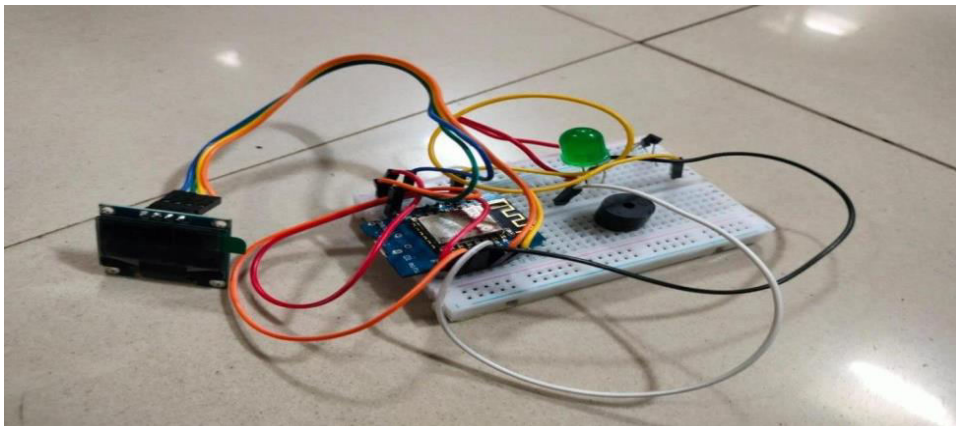
Smart pill bottles are technologically enhanced prescription containers that help people manage their medication regimen by tracking and monitoring drug usage in real-time. They are equipped with sensors, connection, and data analytics capabilities. These bottles can notify caregivers or healthcare providers of missed doses or deviations from the prescribed prescription schedule. They can also serve as reminders and track doses taken or missed. Additionally, they might link with smartphone apps, enabling users to track usage and get notifications. This would be especially helpful for people who have complicated drug schedules, long-term health issues, or cognitive impairments that make it difficult to take medications as prescribed. Caregivers can also benefit from smart pill bottles, which allow them to remotely check the medication compliance of their loved ones and take appropriate action if needed. All things considered, they help to raise patient involvement in their own care, lower the chance of unfavourable health outcomes, and improve drug adherence. There are numerous ways to be reminded to take medication; these include vibrating timepieces and text message alerts. Normally, there are two primary components to this reminder system: first, it detects changes in the drug container, and then it sets off alarms in response to those changes. The system interprets motion as the taking of medication when it detects motion that indicates the opening of the pill bottle. On the other hand, the system alerts the patient to take their prescription if no changes are found.

II. LITERATURE SURVEY

1. A systematic evaluation of 25 research found that smart pill packaging improved medication adherence. Yue et al.'s review from 2021 revealed notable gains in medication adherence, especially for those with complicated drug schedules or cognitive impairments.
2. One randomized controlled experiment by Granger et al. (2020) found a correlation between lower healthcare expenditures and the use of smart pill bottles. The study found that fewer patients required hospital stays, which resulted in a \$148 monthly savings in healthcare costs per patient.
3. Smart pill bottles have been associated with better patient outcomes, as evidenced by a McHorney et al. (2021) study on older persons with hypertension. The usage of a smart pill bottle was linked to improved medication adherence and a significant drop in blood pressure, according to the results.
4. According to a study by Patel et al. (2020) involving patients with chronic diseases, the incorporation of smart pill bottles has been found to improve patient satisfaction. The study found that using a smart pill bottle reduced caregiver stress and improved patient satisfaction with medication management.
5. Pilot research by Liu et al. (2021) showed that smart pill bottles might interface with electronic health records (EHRs) in an easy way. According to the study, pharmaceutical errors can be decreased and drug reconciliation procedures can be improved by connecting smart pill bottles with EHRs.
6. The combined results of these research suggest that smart pill bottles are a promising technological advancement that can enhance drug adherence, lower healthcare expenses, and promote better patient outcomes. To determine the most effective implementation tactics and to evaluate the long-term effects of smart pill bottle consumption, more research is necessary. To fully realize the potential advantages of smart pill bottles in healthcare settings, these kinds of studies are important.

III. METHODOLOGY

The goal of the project is to improve medication adherence for those with complicated drug schedules, long-term illnesses, or cognitive impairments by developing a smart pill container system. With the use of sensors and connectivity, this technology tracks and detects drug usage in real-time, sending out alerts and reminders on schedule.

**Component Description:**

1. **ESP 8266:** -
 - Microcontroller ESP-8266EX
 - Operating Voltage 3.3 V
 - Digital I/O Pins 11
 - Analog Input Pins 1(Max input: 3.2V)
 - Clock Speed 80MHz/160MHz
 - Flash 4M bytes
 - Length 34.2mm
 - Width 25.

2. **OLED 0.96 inch:** -
 - Size 0.96 inch
 - Resolution: 128 x 64
 - Controlling Chip: SSH1106
 - Display Area: 21.74 x 10.86mm
 - Driving Voltage: 3.3-5V
 - Operating Temperature: -40~70 Celsius
 - Interface Type: IIC
 - Light Color: White

3. **HW-107 charging module:** -
 - Power supply voltage: 5v
 - supply current: 1A
 - Charging cut-off voltage: 4.2v
 - Large charging current: 1000mA
 - Battery over-discharge protection voltage: 2.5v
 - Battery overcurrent protection current: 3A

4. **Piezzo Buzzer:** -
 - Operation Voltage: 5V DC
 - Frequency: 3,300Hz
 - Current: <15mA
 - SPL: 85dBA/10cm
 - Color: Black
 - Operating Temperature: - 20° to +60°C
 - Polarity: Positive Pin marked on the surface
 - Number of pins: 2

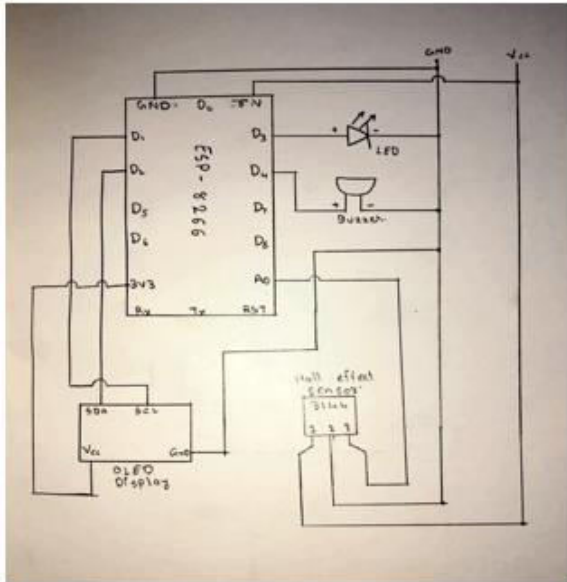
5. **Software implementations:** -
 - Arduino IDE
 - Blynk

IV. WORKING

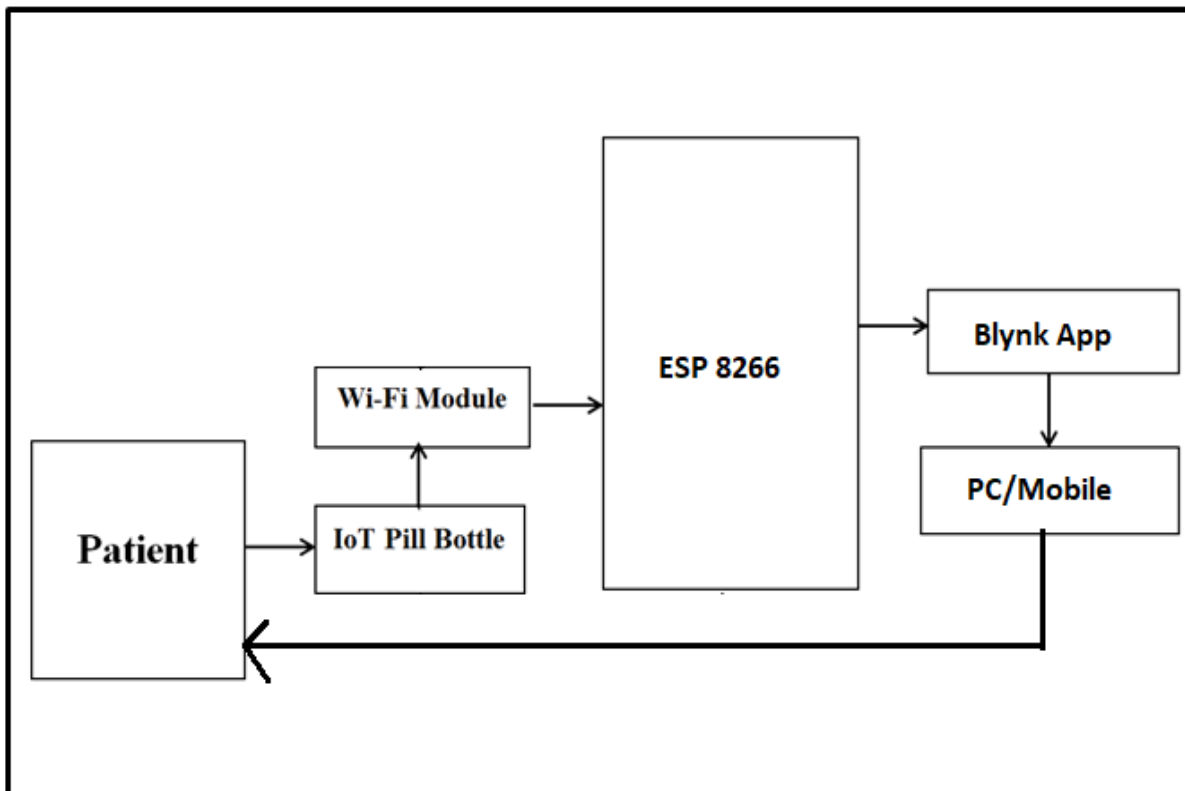
To measure medication usage, the smart pill bottle uses a digital clock that is linked with the patient's prescription schedule. The bottle buzzes to remind the patient when to take a dose and notifies the patient's mobile device if they forget. These alerts don't stop until the lid of the bottle is opened, indicating that the medication has been consumed. Medication adherence is improved and timely medication reminders are guaranteed by this integrated system.

Essentials:

1. **Change Detection Mechanism:** The smart pill container has sensors built into it that allow it to recognize when it has changed states, like when it has been opened.
2. **Medication Intake Recognition:** The system interprets a change in the pill bottle's state as the user taking medication.
3. **Real-time Monitoring:** By connecting the system to mobile apps, customers can keep an eye on how much medication they're taking and get alerts straight to their smartphones.
4. **Notification System:** The system notifies the user to take their medication if it detects no changes in the pill bottle's condition within the anticipated time range.
5. **Caregiver Involvement:** By remotely monitoring their loved ones' medication adherence and taking appropriate action when needed, caregivers can enhance healthcare outcomes.



V. BLOCK DIAGRAM



VI. CONCLUSION

Smart pill bottles offer substantial advantages for medication management and adherence, making them a potential development in healthcare technology. These bottles, which have sensors, connection, and data analytics capabilities, may track prescription usage, send out reminders, and notify caregivers or healthcare practitioners when a dose is missed. Improved adherence can lead to lower medical expenses and better results, particularly for patients with complicated

drug requirements or cognitive impairments. Current research indicates that smart pill bottles can be a useful tool for enhancing medication management and patient outcomes, but more study is required to fully understand their long-term effects and maximize their application. Smart pill bottles could be included into healthcare delivery more and more as technology develops, encouraging higher patient engagement and eventually improving health.

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