Design And Development of Smart Pill Box

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1. ABSTRACT

A smart pill box is a high-tech device that helps people manage their medication schedule more effectively. This device eliminates the risk of medication errors that can happen due to forgetting to take medicine at the right time or in the right amount. With several features that make it easy to handle medication regimens, smart pill boxes are typically connected to an app on the user's smartphone or tablet. This app offers many functions to track medication adherence, such as providing reminders for dosage, sending alerts when it's time to refill, and helping with scheduling doctor's appointments. Smart pill boxes have sensors which detect when medication has been taken, and they can alert family members or caregivers if a dose is missed. Additionally, some models use machine learning algorithms to analyze medication adherence patterns and provide personalized feedback. Smart pill boxes come in various sizes and configurations, from simple single-dose devices to more complex systems with voice reminders and multiple medication capabilities. They can also be useful for people with visual or hearing impairments. Overall, smart pill boxes are innovative and effective technology to help people with medication management and improve patient outcomes.

Keywords: Arduino UNO, Medication management, Medication schedule, Patient Outcomes, Healthcare.

2. INTRODUCTION

Medication adherence is a crucial component of managing chronic conditions and improving health outcomes. However, it can be challenging for individuals to remember to take medications at the right time and in the right amount. This often results in medication errors and poor health outcomes. Smart pill boxes are advanced devices designed to assist individuals in managing their medication schedule effectively. They eliminate the risk of medication errors by providing a range of features that help patients manage their medication regimen.

The innovations in smart pill boxes include an app that allows users to schedule dosages and receive reminders for their medication. The sensors in the pill boxes detect when medication has been taken, alerting caregivers or family members if doses are missed. Machine learning algorithms analyze patterns in medication adherence to provide personalized insights and improve medication management further. These devices come in various sizes and configurations, making them inclusive for individuals with visual or hearing impairments.

Smart pill boxes are an innovative and effective solution for individuals who struggle with medication management. Their features ensure that medications are taken on time and in the right amounts, improving patient outcomes while reducing the burden on caregivers and healthcare providers. By providing a more effective way to manage medication schedules, patients are better equipped to manage chronic conditions and improve their overall quality of life.

2.1 Background

Smart pill boxes have revolutionized medication management for individuals worldwide. Adherence to medication schedules is crucial for the treatment of chronic illnesses and diseases. However, many individuals forget to take their medications or miss dosages, leading to poor health outcomes. Smart pill boxes provide a solution to this problem by utilizing cutting-edge technology to ensure that medication schedules are followed correctly. They remind individuals to take their medications and provide notifications to caregivers or healthcare professionals if a dosage is missed. Smart pill boxes have been noted to improve compliance rates and reduce medication errors, making them a valuable tool for improving patient outcomes. This technology is particularly beneficial for the elderly and individuals with chronic conditions who require multiple medications throughout the day. Smart pill boxes have the potential to significantly improve medication management and enhance patient outcomes, making them a promising technology for the future of healthcare.

2.2 Objectives

The objective of a smart pill box is to help individuals manage their medication schedules more efficiently and effectively. It can help to reduce the risk of medication errors, missed doses, and overdosing. The smart pill box can send reminders and alerts to users when it's time to take their medications, and it can be connected to a healthcare provider to allow for improved monitoring and care. Additionally, smart pill boxes can help to improve medication adherence, which is crucial for managing chronic conditions and achieving better health outcomes. Ultimately, the objective of a smart pill box is to promote better medication management and overall wellness.

3. LITERATURE REVIEW

3.1. IoT Based Smart Pill Box Using Arduino Microcontroller

(2021 JETIR, Ninu P.J.1, Varun Kesav M.N.2 M.Tech Student, Department ECE, Vidya Academy of Science and Technology, Thrissur)

As the population ages, it is becoming increasingly common for elders to have multiple chronic diseases and rely on medication to stabilize their health conditions. The Pharmacists Association has recommended greater family involvement in medication safety for these patients. However, ensuring that patients take the right medication at the right time can be challenging. To address this issue, an IoT-based intelligent home-

based health care platform has been proposed that connects smart sensors attached to the body for biological monitoring with an intelligent medical packaging system for daily medication management. The system can provide timely reminders to patients about their medication and closely monitor the type and amount of prescribed medicines to prevent misuse and abuse. When a patient visits a doctor, their information and prescription details can be uploaded to an online server, making it easy for remote physicians to update or create a prescription for a specific patient. This platform has the potential to improve medication adherence and health outcomes for patients with chronic diseases, while also providing peace of mind for their families and caregivers.

3.2. Medical Health Care Chain Systembased on IoT

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The field An Internet of Things Approach for Managing Smart Services Provided by Wearable Devices" present an autonomous physical condition performance system based on a WSN that allows for the integration of several elements in an Internet of Things scenario, including a smartwatch, a physiological tracking unit, and a smartphone, in this paper. These wearable devices have been linked using Bluetooth, wireless sensor networks, and smart services. The unit collects physiological data from a commercial Bluetooth device. When an unsafe level of any vital parameter (e.g., heart rate) is reached, the user is warned to stop performing the workout. This alarm can be sent to a smartphone or a wearable smartwatch, as well as the emergency services via the ESB if activated

4. EXISTING SYSTEM

The existing system of Smart Pill Box include a container which is designed to hold pills, tablets or capsules in a specific order and quantity.

- Smart pill boxes have a container designed to hold pills in a specific quantity and order.
- They are connected to a smartphone application enabling users to set reminders for timely medication.
- Some models have sensors which detect box opening for medication tracking.
- Advanced models have voice reminders, automatic refills, and internet connectivity for remote monitoring.
- The primary aim of smart pill boxes is to improve medication adherence, decrease medication errors, and increase patient autonomy in managing their health.

5. NEED FOR THE PROJECT

1. Safety: The need for a smart pill box project is to create a device that can address the issue of medication non-adherence by providing a safe and efficient way for patients to manage their medication regimen. The device needs to incorporate advanced safety features to prevent medication errors and overdose. It also needs to provide an easy-to-use medication management system that can track medication adherence and alert patients when it's time to take their medication.

2. Family Coordination : Another important aspect of the project is to promote family coordination and support. The device should allow family members and caregivers to monitor medication adherence and offer support if needed. The SPB should have the ability to communicate with healthcare to provide them with accurate and real-time data about patient medication adherence.

3. Cost Effective : The project should also focus on making the smart pill box cost-effective for patients and healthcare providers. The device needs to be affordable and accessible to a wide range of patients, including those with limited financial resources.

4. the need for a smart pill box project is to develop a device that can effectively address the issue of medication non-adherence by providing a safe, efficient, and cost-effective medication management system. The device needs to incorporate advanced safety features, promote family coordination, and be affordable for patients and healthcare providers.

5. PROPOSED METHODOLOGY

1. Design and simulation: Firstly, the proposed system will be designed and simulated using the Arduino UNO board, RTC module, LCD display, LED, buzzer, servo motor, and other necessary components. The simulation will be done on software like Proteus or TinkerCAD to ensure that the system works flawlessly.

2. Hardware assembly: After the simulation and testing are done, the hardware components will be assembled according to the design. The RTC module will be connected to the Arduino board to provide the time for medication schedules. The LCD will be connected to the Arduino board and mounted on the front of the pillbox for easy usage. The LED and buzzer will be connected to the Arduino board to provide visual and audio alerts to the patient.

3. Programming: Once the hardware is assembled, the next step is to program the Arduino board. The code will be written in the Arduino IDE, which will communicate with the RTC module, LCD display, LED, buzzer, and servo motor to operate the pillbox. The program will be designed in such a way that it can store the medication schedule of each patient and also retrieve it when necessary.

4. Testing: After the programming is done, the system will be tested thoroughly to ensure that it works as intended. Testing will be done by running the pillbox for multiple medication schedules and observing its performance. The system will also be tested for reliability and safety.

5. SMS Integration: The last step is to integrate SMS functionality to the system. This will be done by using GSM modules, which will allow the system to send SMS alerts to the patients or caregivers. A button will be added to the system to trigger the servo motor to open the pillbox. On pressing this button, the system will also send an SMS alert to the caregivers informing them about the task being completed.

In conclusion, the proposed methodology for the smart pillbox project involves designing and simulating the system, assembling the hardware components, programming the Arduino board, testing the system thoroughly, and integrating SMS functionality to the system.

5.1 Software Requirements

Arduino IDE

In the implementation of a smart pill box, the Arduino Integrated Development Environment (IDE) is a crucial tool that facilitates the development of code that controls the box's functionality. This open-source software includes a text editor, message area, toolbar, and menus that simplify the process of writing and uploading code to the board. Additionally, the Arduino IDE can be used with any Arduino board, making it a versatile programming tool for any project. With the Arduino IDE, developers can easily implement features such as reminders for taking medication, alerts for missed doses, and tracking of pill usage, all controlled by carefully crafted code. Therefore, the Arduino IDE provides an essential foundation for the development of a smart pill box that can improve the health and well-being of its users.

5.2 Benefits

The benefits of a smart pill box are many and varied. By improving medication adherence, these devices can help prevent medication errors, reduce hospitalizations, and improve patient outcomes. They also provide peace of mind to patients, caregivers, and family members who can rest assured that medication is being taken on time and in the right amount. In addition, smart pill boxes offer a convenient and easy-to-use platform for medication management, with features that help users stay organized, track medication history, and set reminders for upcoming appointments or refills. These benefits make smart pill boxes an excellent investment for anyone who wants to take control of their medication regimen and improve their overall health.

5.3 Scope

The The increasing number of people diagnosed with diseases, irrespective of their age, has resulted in a need for medication to alleviate symptoms. However, patients often forget to take their medication, which can exacerbate their symptoms. Smart medicine boxes provide a solution by storing medication and setting alarms to remind patients to take their medication on time.

Although smart medicine boxes are available in the market, many are difficult to use and understand. As a result, there is a need for a more straightforward and user-friendly device. The research conducted up to now has provided a prototype for such a device, which is simple, affordable and easy to use.The device makes use of a GSM module to inform the patient and guardian whether the medication has been consumed or not. This is achieved through a button that controls the drawer, making it easy to access the medication. Additionally, the buzzer can be set to sound for a minute or two.

Smart medicine boxes have numerous benefits, including simplifying the process of taking medication and reducing the likelihood of patients forgetting to take their medication. They can also ensure that patients take their medication at the right time and in the correct dosage, leading to improved health outcomes. Smart medicine boxes provide an innovative solution to a significant healthcare problem. They can help patients take their medication on time and avoid exacerbating their symptoms. The development of a user-friendly and affordable device can have a significant impact on patients' lives, resulting in improved health outcomes and quality of life.

5.4 Hardware Block Diagram

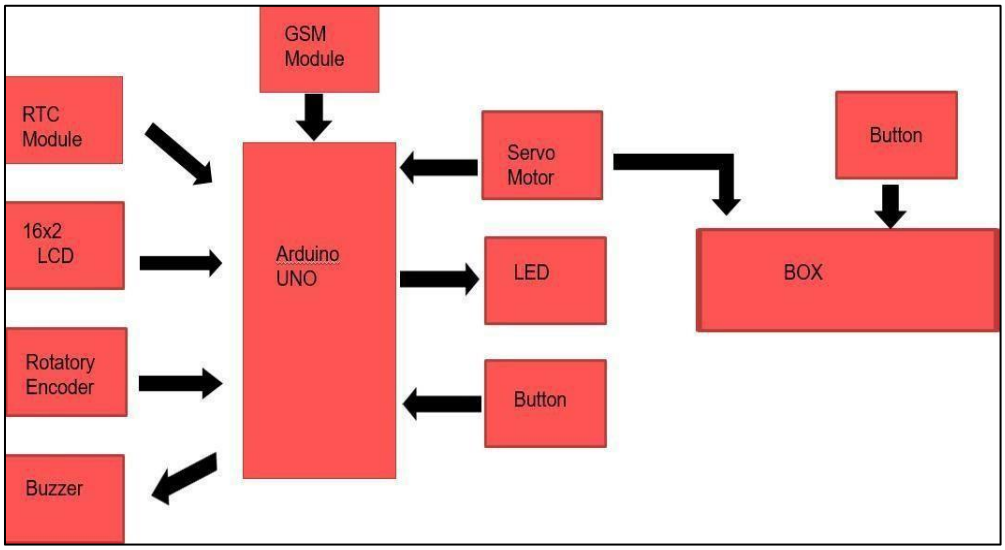

Fig: Hardware Block diagram

Explanation of Diagram

The Smart Pill Box system is an innovative solution that aims to provide patients with an easy and efficient way to manage their medication. This system uses an LCD as an interface to help users select the compartment and time for taking their medication. The rotary encoder is also essential in assisting patients to choose the options that best suit their needs. The selected time is stored in the system's Arduino memory, making it easier for the system to remind the user when it is time to take their medication.

When it is time for the user to take their medication, the buzzer and LED indicators will turn on, indicating which compartment needs to be opened. Additionally, a button is used to control a micro servo motor that opens the pill box. If the button isn't pressed, an SMS is sent to the patient to remind them that they missed their medication. However, if the patient presses the button, an SMS is sent to confirm that they have taken their medication, ensuring that the patient's caregiver is informed of their medication management progress.

Smart Pill Box System: How it Works

Once the user has set the time for their medication through the Smart Pill Box System's interface, the system stores this data in its memory. Once that time arrives, the buzzer and LED will turn on to alert the user that it is time to take their medication.

Simultaneously, an SMS will be sent to the user's caregiver to confirm that the medication has been taken. If the user does not take their medication and fails to press the button within a designated period, the system will send an SMS reminder to the user to take their medication as well as their caregiver.

If the user takes their medication, they are required to press the button which activates the servo motor and opens the designated pill compartment. Once this happens, the Smart Pill Box System sends a confirmation SMS to the caregiver, confirming that the medication has been taken.

5.5 Hardware Requirements

S.No	Component name	Qty
1	Arduino UNO	1
2	RTC Module	1
3	LCD Display	1
4	Rotatory Encoder	1
5	Buzzer	1
6	LED	1
7	Button	1
8	Power supply and Breadboard Power supply	1
9	GSM Module	1
10	Servo Motor	1

6. RESULTS & DISCUSSION

Smart pill box systems utilizing Arduino microcontroller, LCD, rotary encoder, LEDS, buzzer, and micro servo motor have proven to be a user-friendly and effective device for medication management. These devices store medication schedules, alert patients when it's time to take their medication, and send SMS notifications to caregivers or family members, which leads to better patient outcomes and reduced healthcare costs.

The combination of these various components makes the device reliable, efficient, and convenient for use. It supports patients who may have difficulty managing their medication schedules, ensuring medication adherence is not only a patient's responsibility but a collective effort.

The potential of smart pill boxes is enormous, as they can become an important tool in managing medication schedules, achieving better health outcomes, and reduce healthcare costs. With further development and refinement, it may address disparities in healthcare and improve medication adherence for vulnerable populations.

7. CONCLUSION

In conclusion, smart pill boxes are a valuable tool in improving medication adherence and managing medication schedules for patients. The system designed using Arduino microcontroller, an LCD, a rotary encoder, LEDS, a buzzer, and a micro servo motor provides a reliable, user-friendly, and effective device for medication management. With its ability to store medication schedules, alert patients, and send SMS notifications to caregivers, the smart pill box has the potential to reduce healthcare costs and improve patient outcomes, especially for vulnerable populations. Overall, the development and refinement of smart pill boxes using microcontroller-based systems like Arduino have promising potential in addressing healthcare challenges and improving patient outcomes..

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