**SMART MEDICINE REMINDER**

## A PROJECT REPORT

***submitted by***

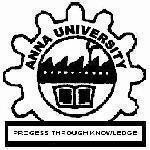
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***in partial fulfillment for the award of the degree of***

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### BONAFIDE CERTIFICATE

Certified that this project report titled “**SMART MEDICINE REMINDER”**

is the bonafide work of “**AKSHITHA (230701025), KAVYA(230701148), RAGAVI K(230701249)”** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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#### ABSTRACT

This project proposes a smart medicine reminder and tracker system to improve medication adherence, particularly for elderly users and patients with chronic illnesses. The system addresses the limitations of manual tracking and existing reminder systems by providing timely, multi-sensory alerts through a smart pillbox and a vibrating wristband. The smart pillbox emits beeping alerts and uses a proximity sensor to detect hand movements. It also incorporates motion tracking to verify medicine intake and escalates reminders via phone calls if doses are missed. The wristband offers discreet vibration alerts and monitors vital signs like heart rate and body temperature. The system utilizes components such as ESP32 and Arduino microcontrollers, various sensors, and a GSM module for communication. The working mechanism involves scheduled alerts, user interaction, intake detection, and escalation through phone calls. The system architecture includes a mobile application, integration with healthcare systems, IoT process management, and robust security features. Overall, this integrated approach aims to enhance medication adherence, patient safety, and health monitoring.

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**CHAPTER 1**

#### INTRODUCTION

Adherence to medication schedules is a crucial aspect of effective healthcare, particularly for elderly patients and individuals suffering from chronic illnesses. Despite the availability of conventional tools like alarms, written reminders, and caregiver assistance, many patients still struggle with forgetting doses or taking the wrong medication at the wrong time. These traditional methods often lack reliability, real-time tracking, and verification, making them insufficient in ensuring consistent medication intake.

To address these shortcomings, the *Medicine Reminder & Tracker* system introduces a comprehensive and intelligent solution that combines modern hardware and software technologies. At the heart of this system is a smart pillbox integrated with sensors that provide scheduled alerts through beeping sounds and stop once user presence is detected via a proximity sensor. Additionally, a wearable vibrating wristband complements the system by discreetly notifying users, especially in noisy environments or for those with hearing difficulties. It also includes health monitoring features like heart rate and body temperature sensing.

The system goes beyond simple reminders by incorporating motion detection to verify whether the medicine has been taken. If no activity is detected within a predefined period (e.g., 15 minutes), the system escalates the alert by initiating an emergency phone call using a GSM module. This layered approach enhances medication compliance, ensures safety, and offers peace of mind to both patients and their caregivers. Overall, the *Medicine Reminder & Tracker* is a smart, user-centric solution aimed at transforming the way medication adherence is managed in daily life.

**1.1 Motivation**

**1. Challenges in Medication Adherence**

Medication non-adherence is a common problem, especially among elderly patients, individuals with chronic illnesses, and those with memory-related conditions. Forgetting to take medications, incorrect dosages, or skipping doses altogether can lead to serious health complications, increased medical costs, and reduced treatment effectiveness. Existing solutions like alarms, mobile apps, and pill organizers often lack the capability to confirm whether the medication was actually taken, making them unreliable for ensuring adherence.

**2. Limitations of Existing Solutions**

Current reminder systems are mostly passive—they alert users but don’t track or verify intake. Most of these systems are either too simplistic, like handwritten schedules, or inaccessible for technologically challenged users. Furthermore, they do not offer multi-sensory alerts, health monitoring, or escalation mechanisms. This leaves a significant gap in healthcare technology for individuals who require both reminders and accountability in their medication routines.

**3. Vision for a Smarter Healthcare Tool**

The motivation behind this project is to build a smart, integrated system that goes beyond simple reminders. By combining a pillbox with proximity and motion sensors, a vibrating wristband, health monitoring sensors, and GSM-based emergency escalation, we aim to provide a comprehensive solution. This device not only reminds users to take their medicine but also verifies intake and tracks vital signs—ultimately improving patient safety, reducing caregiver stress, and enhancing the overall quality of healthcare.

##### 1.2 Objectives

The primary aim of the *Medicine Reminder & Tracker* project is to develop a smart, reliable, and user-friendly system that ensures timely medication intake and supports overall health monitoring. The key objectives are:

* **Ensure Timely Medication Intake**  
  To provide users—especially elderly individuals and patients with chronic illnesses—with timely alerts and reminders to take their prescribed medicines without fail.
* **Implement Multi-Sensory Alerts**  
  To use both auditory (beeping) and tactile (vibration) cues through a smart pillbox and a wearable wristband, ensuring the reminders are effective in various environments and user conditions.
* **Track and Verify Medicine Intake**  
  To integrate motion and proximity sensors for confirming whether the medication has been taken, reducing the chances of missed or double doses.
* **Introduce Emergency Escalation Mechanism**  
  To initiate an automatic phone call using a GSM module if the user fails to respond to reminders within a specified time frame (e.g., 15 minutes).
* **Incorporate Health Monitoring**  
  To continuously monitor vital signs such as heart rate and body temperature via the wristband and synchronize this data with the medication schedule for a more holistic approach to health.
* **Enhance Accessibility and Ease of Use**  
  To design an intuitive, standalone system that can be easily used by patients with minimal technical knowledge, reducing dependency on smartphones or internet access.

**CHAPTER 2**

#### LITERATURE REVIEW

The problem of medication non-adherence has been widely acknowledged in medical and technological literature. Various studies indicate that a significant percentage of patients—particularly those with chronic conditions—fail to follow their prescribed medication schedules, leading to poor health outcomes and increased healthcare costs. This has driven researchers and developers to explore technological interventions aimed at improving medication compliance.

**1. Traditional Reminder Systems**

Conventional methods such as alarms, calendar alerts, and pill organizers have been widely used but offer only basic assistance. They do not verify whether the user actually consumes the medication. Several mobile apps have been developed to provide scheduled reminders, yet they often depend on user interaction and smartphones, making them less effective for elderly users or those with limited digital literacy.

**2. Smart Pill Dispensers**

Recent developments in smart pill dispensers incorporate features like programmable timers, locking mechanisms, and basic alert systems. While these devices improve on manual methods, most lack verification capabilities and real-time feedback. They also typically don’t integrate health monitoring or escalation mechanisms, which are vital for patients with complex medical needs.

**3. Wearable Health Devices**

Smartwatches and fitness bands have become increasingly popular for tracking vital signs like heart rate and body temperature. However, these wearables function independently of medication schedules and do not provide integrated reminders or verification of medicine intake. As a result, they fail to close the loop between health monitoring and medication adherence.

**4. Research Gap and Project Relevance**

Existing solutions either address reminders or health tracking individually, but few combine both in a cohesive, accessible system. The *Medicine Reminder & Tracker* project aims to fill this gap by integrating a smart pillbox with proximity and motion sensors, a vibrating wristband, health monitoring, and an emergency escalation mechanism. This holistic approach ensures not only timely reminders but also confirms medication intake and monitors the user's well-being in real time.

**2.1.1 Advantages of the existing system**

While existing medication reminder systems have limitations, they still offer some advantages that have contributed to their widespread use, particularly among older adults and caregivers. These benefits include:

**1. Simplicity and Accessibility**

Manual systems such as alarms, written schedules, and pill organizers are easy to use and do not require technical knowledge. They are cost-effective and readily available, making them suitable for users with limited resources or digital literacy.

**2. Low Cost**

Most traditional solutions involve minimal investment. Basic alarms, mechanical pillboxes, or calendar-based tracking methods are inexpensive compared to advanced electronic devices or smart wearables.

**3. Independence from Internet or Power**

Manual systems do not rely on internet connectivity or frequent charging, making them highly reliable in areas with limited technological infrastructure or power supply issues.

**4. Familiarity and Comfort**

Older adults are often more comfortable using simple, non-digital tools that they are familiar with, reducing resistance to adoption and ensuring continued use.

#### 2.1.2 Drawbacks of the existing system

Despite their simplicity and low cost, existing medication reminder systems have several critical limitations that reduce their effectiveness, especially for elderly patients or those with chronic conditions. These drawbacks include:

**1. Lack of Intake Verification**

Traditional reminders like alarms or basic apps can alert users, but they do not confirm whether the medicine has actually been taken. This can lead to skipped doses or accidental double dosing.

**2. Easily Ignored or Forgotten**

Auditory reminders such as phone alarms or buzzers can be missed, ignored, or silenced, especially by users with hearing impairments or memory issues. There is no secondary follow-up mechanism to ensure compliance.

**3. No Escalation Mechanism**

If a user misses a dose, current systems offer no automatic way to alert caregivers or trigger an emergency response. This puts patients at risk, particularly those who live alone or require close monitoring.

**4. No Integration with Health Monitoring**

Most existing systems do not monitor vital health parameters such as heart rate or body temperature, making it difficult to correlate medication adherence with the patient’s health status.

**5. Limited Customization**

Manual pillboxes and simple reminder apps often lack flexibility to handle complex medication schedules (e.g., multiple medicines at different times of the day), which can lead to confusion and errors.

##### 2.2 Proposed System

The *Medicine Reminder & Tracker* is a smart, integrated solution designed to improve medication adherence and health monitoring. It consists of two main components: a **smart pillbox** and a **vibrating wristband**.

**Smart Pillbox**

The pillbox provides scheduled beeping alerts using a real-time clock (RTC). It detects user presence through a **proximity sensor** and confirms medicine intake using a **motion sensor**. If no activity is detected within 15 minutes, the system automatically triggers a phone call via the **SIM800L GSM module** to alert caregivers or emergency contacts.

**Vibrating Wristband**

The wristband vibrates to discreetly notify the user of medicine time. It also monitors **heart rate** (MAX30102), **body temperature** (MLX90614), and **movement** (MPU6050). It syncs with the pillbox through **Bluetooth** to track activity and health in real time.

**System Highlights**

* Uses ESP32 and Arduino Nano 33 BLE Sense for control
* Battery-powered and portable
* Provides multi-sensory alerts
* Ensures medicine intake is verified and monitored
* Escalates missed doses with emergency calls

This system bridges the gap between reminders and real-time monitoring, offering a reliable solution for patients who need support managing their medications.

**2.2.1 Advantages of the proposed system**

 **Automated Reminders with Escalation:**

* Scheduled beeping alerts at medication times.
* Automatic escalation via phone call if the medicine isn’t taken within 15 minutes.

 **Multi-Sensory Notifications:**

* Audio alerts (beeping).
* Tactile feedback via vibration on the wristband for discreet reminders.

 **Intelligent Verification of Medicine Intake:**

* Proximity sensor detects hand movement near the pillbox.
* Motion sensors track pillbox interaction to confirm medicine intake.
* Load cell verifies if pills were removed (optional).

 **Health Monitoring Integration:**

* The wristband continuously monitors **heart rate** and **body temperature**.
* Syncs health data with medication records for better patient monitoring.

 **Activity Detection:**

* Accelerometer on the wristband ensures the user is active and responsive, improving adherence data accuracy.

 **Real-Time Adherence Tracking:**

* Seamless data sync between the pillbox and wristband ensures that medication status is monitored in real time.

 **Wireless Connectivity:**

* Bluetooth-enabled components allow wireless communication between modules.

 **Support for Cognitively Impaired or Elderly Users:**

* Reduces dependence on memory or manual tracking.
* Emergency escalation increases safety.

 **Portable and Rechargeable Design:**

* Battery-powered with charging modules for continuous use.

**CHAPTER 3**

**SYSTEM DESIGN**

##### 3.1Development Environment

###### 3.1.1 Hardware Requirements

**1. Microcontrollers and Processing Units**

The system relies on two primary microcontrollers. The **ESP32** is used for the smart pillbox due to its powerful processing capabilities, integrated Wi-Fi and Bluetooth, and multiple GPIOs, which are essential for interfacing with various sensors and modules. For the wearable wristband, the **Arduino Nano 33 BLE Sense** is chosen as it is compact, energy-efficient, and has built-in Bluetooth Low Energy (BLE) capabilities. It also includes onboard sensors, but external modules are used for more accurate health monitoring.

**2. Smart Pillbox Hardware**

The pillbox is equipped with several essential components. A **PIR motion sensor** detects the presence of a hand near the pillbox, serving as a trigger to stop the alarm and verify user interaction. A **load cell paired with an HX711 amplifier module** is used to detect changes in weight, confirming whether a pill has been removed. The **DS3231 Real-Time Clock (RTC) module** ensures precise scheduling of medicine alerts. For auditory notifications, a **buzzer module** is integrated to emit beeping sounds at designated times. To handle emergency scenarios, a **SIM800L GSM module** is included, enabling the system to make phone calls if the user fails to take the medicine within a certain timeframe (e.g., 15 minutes).

**3. Wristband Hardware**

The wearable wristband is designed to complement the pillbox by providing discreet and continuous reminders and monitoring. A **vibration motor** is used to alert the user without disturbing others. To track the user's vital signs, the wristband incorporates a **MAX30102 pulse sensor** for heart rate monitoring and an **MLX90614 infrared temperature sensor** for measuring body temperature. Additionally, an **MPU6050 accelerometer and gyroscope** module is included to detect motion, which helps verify if the user is active or responding to alerts. A **Bluetooth module** (such as HC-05 or HC-06) is used for wireless communication with the pillbox, ensuring real-time synchronization of reminders and adherence tracking.

**4. Power Supply**

Both the pillbox and wristband are powered by **3.7V Li-ion rechargeable batteries (1000mAh or higher)** to ensure portability. These batteries are charged using **TP4056 charging modules**, which offer safe and efficient charging with overcharge protection. For longer testing sessions or deployment without frequent charging, a **12V adapter or power bank** can be used as a supplementary power source.

**5. Additional Components**

To assemble and prototype the system, standard **jumper wires and breadboards** are used for making electrical connections. In the final product, a **custom PCB** or a suitable **enclosure** may be designed to integrate all components securely and make the system user-friendly, durable, and compact.

3.1.1 Software Requirements

1. Arduino IDE

**2.**Tinkercad  
**3.**Serial Monitor

4.Optional: Visual Studio Code + PlatformIO

**CHAPTER 4**

##### PROJECT DESCRIPTION

###### 4.1 SYSTEM ARCHITECTURE

**Fig 4.1 System Architecture**

**4.2 METHODOLOGY**

The methodology used in the development of the smart medicine reminder and tracker involves an integrated system combining a smart pillbox and a vibrating wristband to ensure timely medication intake, monitoring, and verification.

The smart pillbox uses a proximity sensor to detect when a user's hand approaches and motion tracking to confirm if the medicine is taken. If no action is detected within 15 minutes, the system escalates the reminder by initiating an emergency phone call.

The wristband provides discreet vibration alerts and continuously monitors heart rate and body temperature for general health tracking. It also detects movement to confirm activity and syncs with the smart pillbox for real-time adherence tracking.

The system architecture includes:

**Standalone Application**: A mobile app for medication tracking, caregiver alerts, and health monitoring.

**Business Application**: Integration with healthcare systems for adherence reports, hospital monitoring, and emergency escalations.

**IoT Service**: Real-time medicine tracking via weight sensors and remote monitoring for caregiver access.

**IoT Process Management**: Processing real-time inputs from sensors to detect missed medications and trigger alerts.

**Virtual Entity**: Storing patient profiles, medication schedules, health history, and sensor data.

**Security**: User authentication, data encryption, key management, and compliance with data protection regulations.

The system utilizes various components such as microcontrollers, sensors, and modules for the pillbox and wristband, including:

ESP32 and Arduino Nano 33 BLE Sense microcontrollers.

PIR Motion Sensor, Load Cell + HX711 Module, Buzzer Module, SIM800L GSM Module, and DS3231 RTC Module for the pillbox.

Vibration Motor, MAX30102 Pulse Sensor, MLX90614 Temperature Sensor, MPU6050 Accelerometer, and a Bluetooth Module for the wristband.

The working mechanism involves scheduling medication, user interaction with the pillbox, alert notifications, detection of intake, and phone call reminders if necessary.

**CHAPTER 5**

**RESULTS AND DISCUSSION**

**Results:**

Improved Adherence: The system *expects* to improve medication adherence by addressing the shortcomings of the existing systems. The smart pillbox and wristband are designed to ensure timely intake through multi-sensory reminders and real-time monitoring.

Effective Reminders & Escalation: The system *anticipates* that the combination of beeping alerts, vibration, and emergency phone calls will effectively remind users to take their medication and prevent missed doses.

Accurate Monitoring: The system *intends* to accurately monitor medication intake using proximity and motion sensors in the pillbox and motion detection in the wristband.

Enhanced Safety: The system *aims* to enhance patient safety through the escalation feature, ensuring that caregivers are notified if a dose is missed.

Integrated Health Data: The system *plans* to provide integrated health data by monitoring heart rate and body temperature, potentially offering a more holistic view of the patient's condition.

**Discussion:**

Addressing Limitations of Existing Systems: The PDF frames the proposed system as a solution to the limitations of manual tracking, limited escalation methods, lack of verification, and absence of health monitoring in current practices. The discussion is centered on how the smart pillbox and wristband overcome these issues.

Importance of Integration: The PDF emphasizes the importance of an integrated approach combining reminders, monitoring, and verification to achieve proper medication adherence. The discussion highlights how the system's components work together to provide a comprehensive solution.

Technology's Role in Healthcare: The PDF implicitly discusses the role of technology in improving healthcare outcomes, particularly for patients requiring regular medication and monitoring. The use of sensors, IoT, and mobile applications is presented as a way to enhance adherence, safety, and efficiency.

Potential for Improved Patient Care: The PDF suggests that the system has the potential to improve patient care by providing timely reminders, reducing the risk of missed doses, and enabling better monitoring of both medication intake and health status.

It's crucial to remember that this is a "pre-results" discussion. A true Results and Discussion would require testing the system and analyzing the data obtained.

**CHAPTER 6**

##### CONCLUSION AND FUTURE WORK

###### 6.1 Conclusion

The proposed smart medicine reminder and tracker system offers a comprehensive solution to address the challenges of medication adherence. By integrating a smart pillbox with timely reminders and a vibrating wristband for discreet alerts and health monitoring, the system aims to improve the reliability of medication intake, provide effective escalation mechanisms, and ensure accurate monitoring. The system's architecture, incorporating IoT technology, a mobile application, and integration with healthcare systems, further emphasizes its potential to enhance patient care and safety.

**6.2Future work**

Refinements to the system's algorithms could enable more accurate predictions of when users are likely to miss a dose. Integrating the system with Electronic Health Record (EHR) systems would streamline data sharing and improve care coordination. Offering greater customization of reminders and alerts would cater to individual user preferences. Further exploration of advanced sensor technologies could enhance the precision of medication intake detection. Efforts to improve the system's user interface and accessibility, particularly for elderly users, are warranted. Finally, conducting long-term studies to validate the system's effectiveness in improving medication adherence and analyzing medication habits to predict missed doses, along with developing health monitoring services that include tracking heart rate, temperature, and motion, would provide valuable insights and further refine its capabilities.

**APPENDIX**

**SOFTWARE INSTALLATION**

**Installation of arduino 2.3.4:**

To install Arduino 2.3.4, begin by downloading the appropriate installer file from the official Arduino website. Once the download is complete, run the installer and carefully review and agree to the license terms presented. Next, proceed to choose the desired installation location on your computer's file system. During the installation process, ensure that you install any necessary drivers, as prompted by the installer. Finally, after the installation is finished, you can launch the Arduino IDE to begin using it

**Sample code**

#define BLYNK\_TEMPLATE\_ID "TMPL3nmv78uvy"

#define BLYNK\_TEMPLATE\_NAME "weight data"

#define BLYNK\_AUTH\_TOKEN "drTiz32gvKPCLoYsF06JLn5PqT6Lxg5h"

#include <WiFi.h>

#include <BlynkSimpleEsp32.h>

#include "HX711.h"

// WiFi credentials

char ssid[] = "Galaxy A54 5G AA3F";

char pass[] = "hellsyea";

// Pin definitions

const int motorPin = 27;

const int LOADCELL\_DOUT\_PIN = 5;

const int LOADCELL\_SCK\_PIN = 18;

HX711 scale;

BlynkTimer timer;

// Motor control from Blynk button on V1

BLYNK\_WRITE(V1) {

  int value = param.asInt();

  Serial.print("Motor Button Value: ");

  Serial.println(value);

  digitalWrite(motorPin, value);

}

// Send weight to Blynk gauge on V2

void sendWeight() {

  if (scale.is\_ready()) {

    float reading = scale.get\_units(5);  // Take average of 5 readings

    if (isnan(reading) || isinf(reading)) {

      Serial.println("Invalid weight reading.");

      return;

    }

    Serial.print("Weight: ");

    Serial.println(reading, 2);

    Blynk.virtualWrite(V2, reading);

  } else {

    Serial.println("HX711 not ready.");

  }

}

void setup() {

  Serial.begin(115200);

  pinMode(motorPin, OUTPUT);

  digitalWrite(motorPin, LOW);  // Make sure motor is off at start

  Blynk.begin(BLYNK\_AUTH\_TOKEN, ssid, pass);

  scale.begin(LOADCELL\_DOUT\_PIN, LOADCELL\_SCK\_PIN);

  // Wait until HX711 is ready

  Serial.println("Waiting for HX711...");

  while (!scale.is\_ready()) {

    Serial.println("HX711 not connected or not ready.");

    delay(1000);

  }

  // Tare scale

  Serial.println("Taring the scale...");

  scale.tare();

  // Calibration

  Serial.println("Place a known 30g weight on the scale...");

  delay(5000);  // Give you time to place the weight

  float raw = scale.get\_units(10);

  if (isnan(raw) || isinf(raw) || raw == 0) {

    Serial.println("Calibration failed. Check load cell and try again.");

    return;

  }

  float scaleFactor = raw / 30.0;  // 30g known weight

  Serial.print("Raw average: ");

  Serial.println(raw, 2);

  Serial.print("Calculated scale factor: ");

  Serial.println(scaleFactor, 4);

  scale.set\_scale(scaleFactor);  // Save the scale factor

  // Start weight readings every second

  timer.setInterval(1000L, sendWeight);

}

void loop() {

  Blynk.run();

  timer.run();

}

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