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College of Engineering
NAAC Accredited Autonomous Institution
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Thalavapalayam, Karur - 639 113, TAMILNADU.

A Minor Project Report

on

SMART MEDICATION ASSISTANT FOR DEMENTIA PATIENTS

Submitted by

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

M. KUMARASAMY COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to Anna University, Chennai)

THALAVAPALAYAM, KARUR - 639113.

MAY 2025

M.KUMARASAMY COLLEGE OF ENGINEERING

(Autonomous Institution, Affiliated to Anna University, Chennai)

BONAFIDE CERTIFICATE

Certified that this Report titled **"SMART MEDICATION ASSISTANT FOR DEMENTIA PATIENTS",** is the bonafide work of **DEEPAK S(927622BEE016), DHARUN K(927622BEE023)** who carried out the work during the academic year (2024-2025) under my supervision. Certified further that to the best of my knowledge the work reported here in does not form part of any other project report.

SIGNATURE	**SIGNATURE**
SUPERVISOR	**HEAD OF THE DEPARTMENT**
Mrs.S.Kiruthika M.E.,	Dr.J.Uma M.E.,PhD.,
Assistant Professor	Professor & Head
Department of Electrical and	Department of Electrical and
Electronics Engineering	Electronics Engineering
M. Kumarasamy College of	M. Kumarasamy College of
Engineering, Karur.	Engineering, Karur.

Submitted for minor project IV (18EEP302) viva voce Examination held at M.Kumarasamy college of Enginneering,Karur – 639113 on …………………

DECLARATION

We affirm that the Minor Project report titled **"SMART MEDICATION ASSISTANT FOR DEMENTIA PATIENTS"** being submitted in partial fulfillment for the award of **Bachelor of Engineering in Electrical and Electronics Engineering** is the original work carried out by us.

REG.NO	STUDENT NAME	SIGNATURE
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VISION AND MISSION OF THE INSTITUTION

VISION

- ✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

- ✓ Produces mart technocrats with empirical knowledge who can surmount the global Challenges.
- ✓ Create a diverse, fully engaged, learner-centric campus environment to provide Quality education to the students.
- ✓ Maintain mutually beneficial partnerships with our alumni, industry and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

MISSION

- ✓ Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.
- ✓ Produce highly competent professionals with thrust on research.
- ✓ Provide personalized training to the students for enriching their skills.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- ✓ **PEO1:** Graduates will have flourishing career in the core areas of Electrical Engineering and allied disciplines.
- ✓ **PEO2:** Graduates will pursue higher studies and succeed in academic/research careers.
- ✓ **PEO3:** Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.
- ✓ **PEO4:** Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

PROGRAMME OUTCOMES (POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions: Design solutions for Complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

The following are the Program Specific Outcomes of Engineering Students:

- **PSO1: Apply the** basic concepts of mathematics and science to analyses and design circuits, controls, Electrical machines and drives to solve complex problems.

- **PSO2:** Apply relevant models, resources and emerging tools and techniques to provide solutions to power and energy related issues & challenges.

- **PSO3:** Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real-world problems.

Abstract (Key Words)	**Mapping of POs and PSOs**
Microcontroller (arduino uno),load cell + hx711, Rtc module (ds3231),Nodemcu (esp8266),LCD display,Speaker.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9. PO10, PO11, PO12, PSO1, PSO2, PSO3

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ABSTRACT

Dementia is a progressive neurological disorder that impairs memory, thinking, and the ability to perform routine activities, often making it difficult for patients to adhere to prescribed medication schedules. Missed or incorrect doses can lead to severe health consequences, especially in elderly individuals. To address this challenge, this project introduces a Smart Medication System designed specifically to assist dementia patients by automating both reminders and medication dispensing. The system is centered around an Arduino Uno microcontroller, which coordinates various sensors and actuators to perform its functions efficiently. An ultrasonic sensor detects the presence of a patient near the device, upon which the system activates an audible alarm and displays a visual prompt on an LCD screen to inform the patient that it is time to take their medicine. To ensure secure and timely access, a servo motor controls a closed mechanism that opens the medication compartment. Additionally, a DC motor, powered through a relay, operates an up/down mechanism that adjusts the position of the medicine tray to make it easily reachable for the user. This integration of sensory input, automated motion, and clear user feedback creates a reliable, user-friendly solution that minimizes caregiver involvement and enhances patient independence. The system is designed to be cost-effective, scalable, and suitable for use in both domestic and assisted living settings. By combining automation with an intuitive interface, the Smart Medication System aims to improve medication adherence, reduce human error, and support the well-being of dementia patients through innovative healthcare technology.

PROBLEM IDENTIFICATION

Dementia is a chronic and progressive neurological condition that affects memory, thinking, and the ability to carry out everyday tasks. One of the most critical challenges faced by dementia patients is remembering to take their medication correctly and on time. As their cognitive abilities decline, they often become increasingly dependent on caregivers for medication management. This dependency can lead to a higher risk of missed doses, accidental double dosing, or taking the wrong medication, all of which may result in serious health complications. Existing solutions like traditional pill organizers, mobile reminders, or written instructions often prove ineffective, as dementia patients may forget the purpose of the reminder or how to respond to it. In addition, relying on caregivers for every medication cycle is not always practical, especially in households where full-time supervision is not possible. The situation becomes more complex when patients are left alone for extended periods, increasing the chances of medication non-adherence. Therefore, there is a pressing need for an automated, intelligent, and user-friendly system that can assist dementia patients in taking their medications independently while ensuring safety and accuracy. The system must be designed with simplicity, accessibility, and security in mind to accommodate the cognitive and physical limitations of the users. This project identifies the lack of such dedicated systems as a major problem in the field of assistive healthcare and proposes the development of a smart medication dispensing system that not only reduces caregiver burden but also enhances patient safety, confidence, and quality of life.

CHAPTER 1

LITERATURE REVIEW

This chapter says about the projects and their inferences which are related to the "**SMART MEDICATION ASSISTATNT FOR DEMENTIA PATIENTS"**.

Paper 1:Smart Medication Reminder and Dispenser System for Elderly Patients (2020)

Inference:

This paper presents a smart medication system designed specifically for elderly individuals. It integrates a reminder mechanism with an automated dispenser that releases the correct medication dose at scheduled times. The system utilizes microcontrollers, sensors, and alarms to ensure patients are alerted and guided clearly. It minimizes caregiver intervention, promotes medication adherence, and improves the overall quality of healthcare management for elderly patients.

Paper 2:IoT-Based Smart Pill Box for Medicine Reminder and Monitoring System (2021)

Inference:

This study proposes an IoT-enabled pillbox that reminds patients to take their medicine on time and notifies caregivers remotely through mobile applications. The system records medicine intake activities, ensuring real-time monitoring. By integrating cloud connectivity and sensors, it offers an efficient solution for medication management, particularly helping patients with cognitive impairments and reducing risks associated with missed or incorrect doses.

Paper 3: Development of an Automatic Medicine Dispensing Machine Using Arduino (2019)

Inference:

The paper introduces an automatic medicine dispensing machine controlled by an Arduino microcontroller. It features time-based alerts and compartment unlocking mechanisms that dispense medicine accurately. This approach addresses problems related to manual errors in medicine intake and offers a low-cost, user-friendly alternative suitable for domestic healthcare and small clinics.

Paper 4: IoT-Based Smart Medicine Reminder and Dispenser for Elderly People (2021)

Inference:

This paper proposes an IoT-enabled medicine reminder and dispenser aimed at assisting elderly individuals with timely medication. The system uses microcontrollers, real-time clocks, and alarm systems to trigger reminders at scheduled intervals. It also features a compartment-based dispenser to release the correct dosage. The integration of IoT allows remote monitoring by caregivers. The paper demonstrates how such a system can significantly reduce human error and support independent living among elderly or cognitively impaired patients.

Paper 5: Design and Implementation of an Automatic Pill Dispenser for Dementia Patients (2020)

Inference:

This study introduces an automatic pill dispenser system tailored for dementia patients who struggle with medication adherence. The system incorporates sensors, an Arduino controller, and alert mechanisms (buzzers and LCD displays) to notify the patient and deliver the correct medicine dose. The paper emphasizes the importance of intuitive design and automation in supporting memory-impaired individuals, ultimately promoting better health outcomes and reducing caregiver workload.

CHAPTER 2

PROPOSED METHODOLOGY

2.1 BLOCK DIAGRAM:

This chapter brings about the proposed methodology of the **"SMART MEDICATION ASSISTANT FOR DEMENTIA PATIENTS"** project.

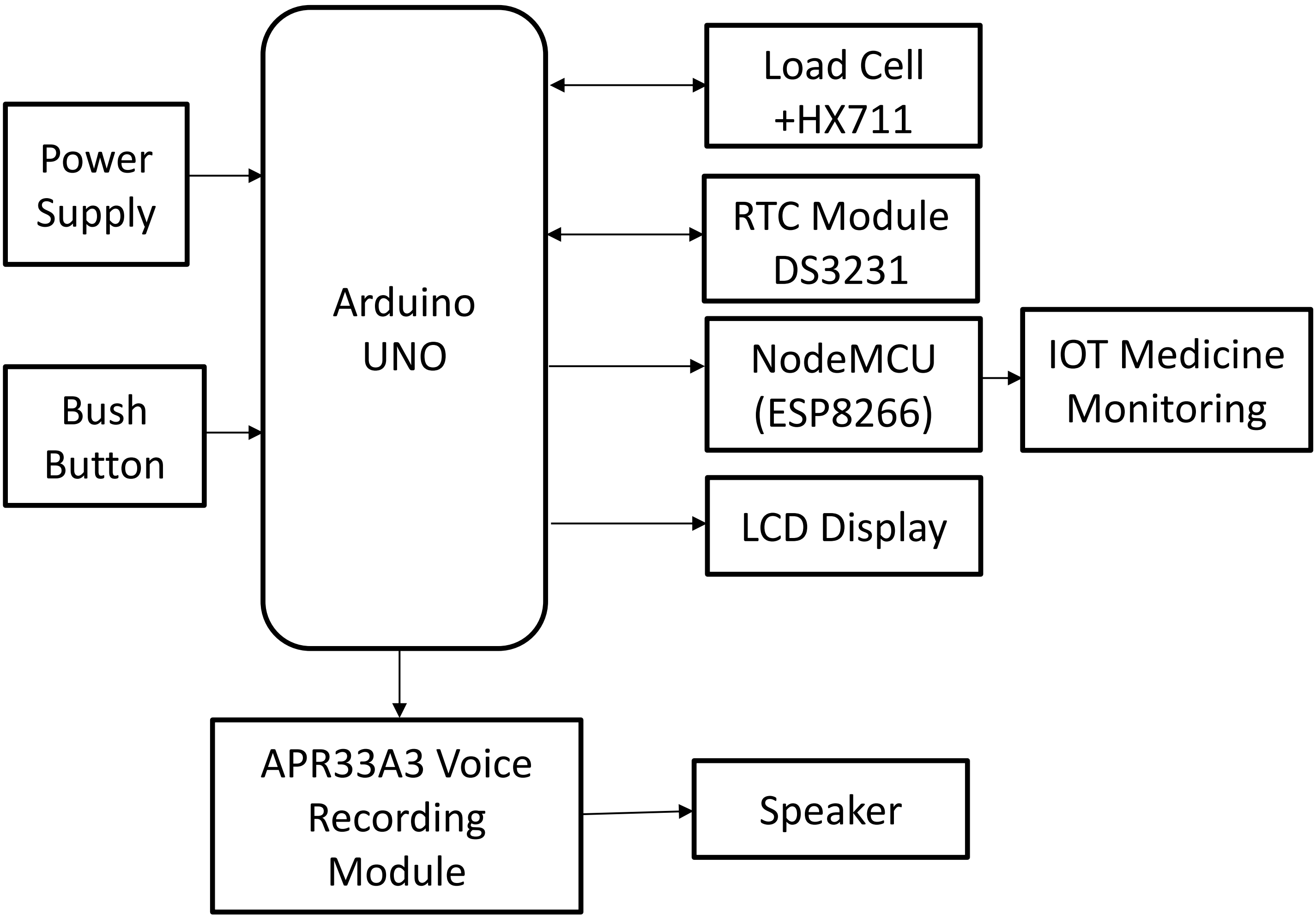

Figure:2.1

2.2 DESCRIPTION:

2.2.1 MICROCONTROLLER (ARDUINO UNO)

Figure.2.2.1

The Arduino Uno is the central processing unit in the system, controlling the flow of data and activating components based on sensor inputs. It is programmed using the Arduino IDE to process data from sensors like PIR and ultrasonic and control deterrents such as the buzzer and LED. Its simplicity, ease of use, and flexibility make it ideal for automation tasks in agricultural systems.

2.2.2 LOAD CELL + HX711:

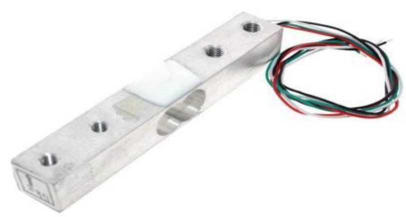

Figure.2.2.2

A Load Cell is a sensor that measures weight or force, converting mechanical force into an electrical signal. The HX711 is a 24-bit ADC that amplifies and converts the low voltage signal from the load cell into a readable digital value for microcontrollers. This combination is commonly used in weight measurement systems, including applications like medication tracking.

2.2.3 RTC MODULE (DS3231):

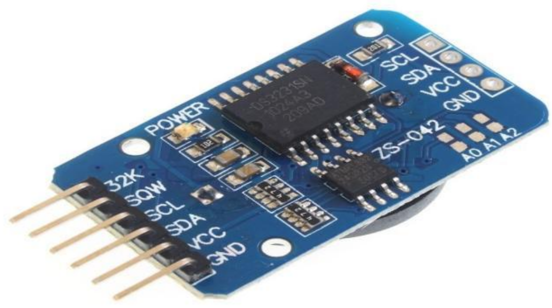

Figure.2.2.3

he **DS3231** is a highly accurate **Real-Time Clock (RTC)** module that keeps track of time even when the system is powered off, thanks to its onboard battery. It communicates with microcontrollers via I2C and provides precise time (hours, minutes, seconds, date, month, and year). The DS3231 is commonly used in time-based projects like alarms, scheduling, and timestamping applications.

2.2.4 NODEMCU (ESP8266):

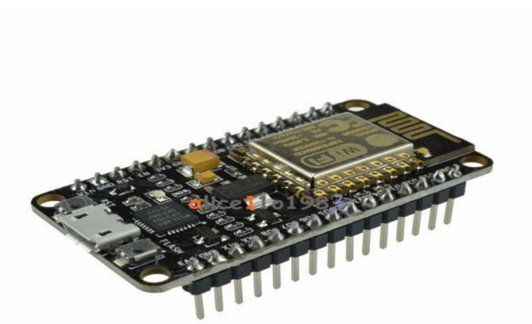

Figure.2.2.4

The NodeMCU (ESP8266) is a low-cost, Wi-Fi-enabled microcontroller that allows easy connectivity to the internet. It features a built-in Wi-Fi module and is based on the ESP8266 chip. The NodeMCU is widely used for IoT projects, enabling wireless communication, remote monitoring, and control. It supports programming via the Arduino IDE and is ideal for applications like smart home systems and remote notifications.

2.2.5 LCD DISPLAY:

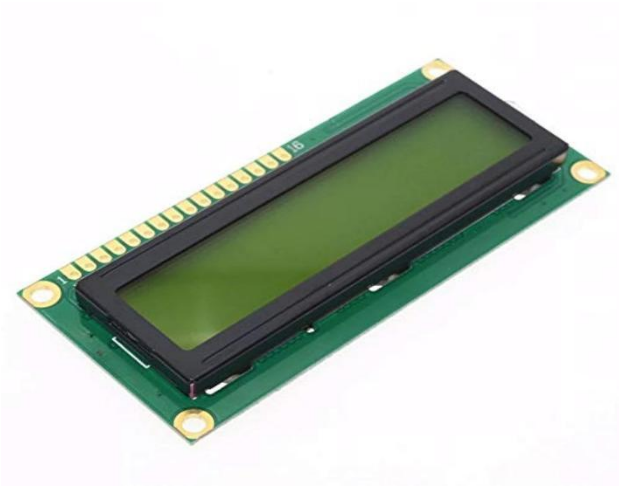

Figure.2.2.5

An LCD (Liquid Crystal Display) is a flat-panel display used to show alphanumeric characters and graphical data. It uses liquid crystals that align to control light passage, creating images or text. Commonly used in electronics, it can display system status, sensor readings, or notifications. In projects like the Smart Medication Assistant, an LCD can show time, medication status, and alerts for easy monitoring.

2.2.6 SPEAKER:

Figure.2.2.6

A Speaker converts electrical signals into sound waves, allowing audio output in various applications. In projects like the Smart Medication Assistant, a speaker can provide audible alerts or reminders, such as notifying the patient about medication times. Speakers are commonly used for alarms, notifications, or user interaction in electronic systems requiring sound output.

2.3 COST ESTIMATION:

S.NO	COMPONENT	QUANTITY	COST
1	Microcontroller	1	800
2	Load cell + HX711	1	400
3	RTC Module	1	200
4	NodeMCU (ESP8266)	1	350
5	LCD Display	1	250
6	Speaker	1	200
		TOTAL	**2250**

2.4 HARDWARE PHOTO

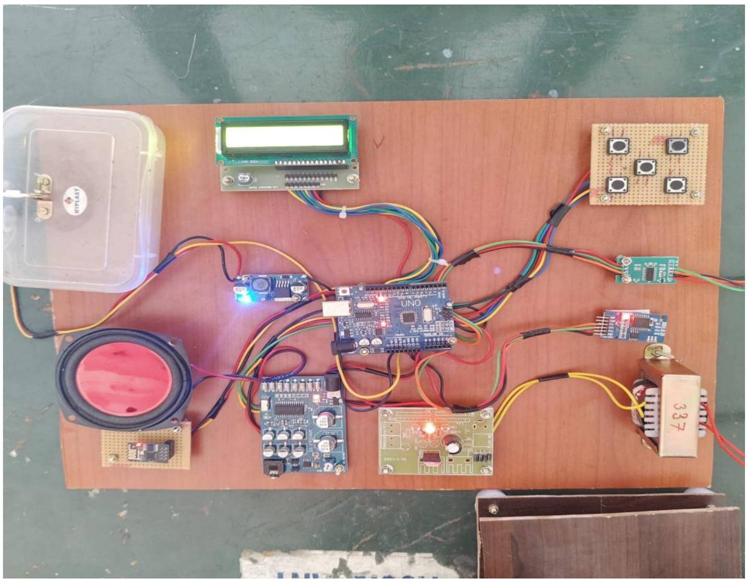

Figure:2.4.1

CHAPTER 3

RESULT AND DISCUSSION

The Smart Medication Assistant for Dementia Patients was successfully developed and tested in a controlled environment. The system demonstrated effective coordination between hardware components and software logic. The load cell integrated with the HX711 amplifier reliably detected changes in the weight of the medicine container. This feature enabled the system to determine whether or not the patient had taken the medicine at the scheduled time.

The RTC module (DS3231) functioned accurately, maintaining real-time clock synchronization even during temporary power disconnections. The buzzer and LCD display provided clear, user-friendly alerts and visual cues when it was time for the patient to take their medication. These multi-sensory reminders were critical for supporting users with memory impairment.The NodeMCU (ESP8266) facilitated seamless wireless communication by sending real-time updates to the connected IoT platform. If the system detected no weight change during the reminder window, it marked the status as “WEIGHT_LOW” and triggered a notification to caregivers via the mobile application.

This feature provides caregivers with timely information, helping prevent skipped doses. The compact and low-cost design made the system suitable for home use and practical deployment in healthcare settings. The overall functionality confirms the system's reliability and potential for enhancing medication adherence among dementia patients. Further field testing in real-life scenarios would validate long-term usability and user acceptance.

HARDWARE RESULTS

DURING NORMAL TIME

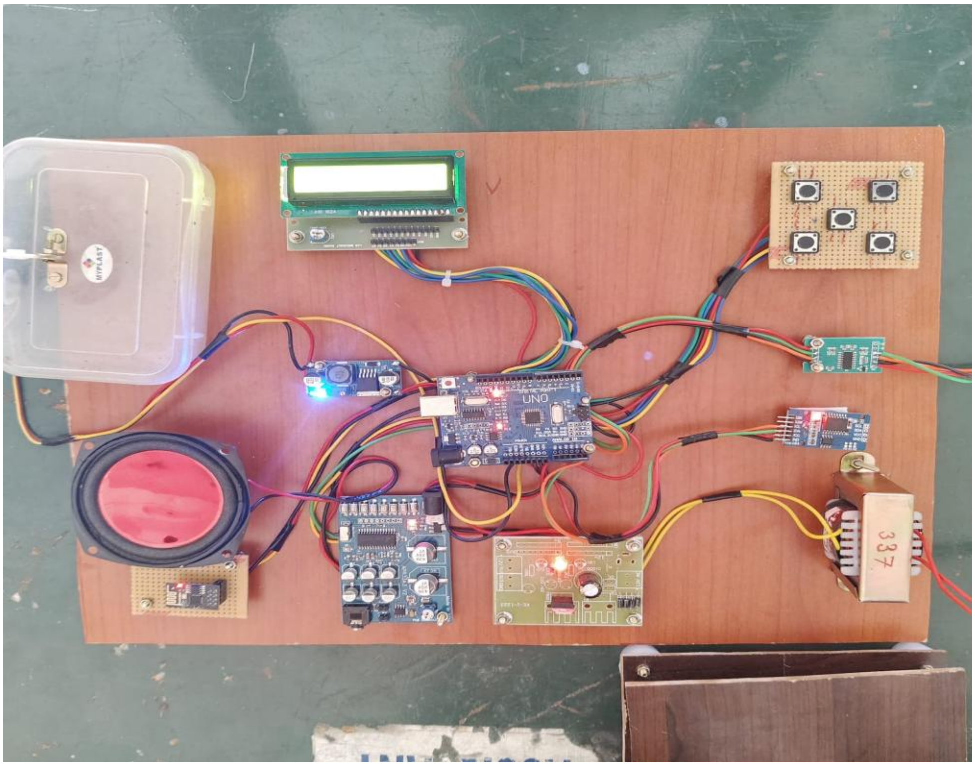

Figure:3.1

Figure 3.1 shows the front view of the hardware setup for the Smart Medication Assistant for Dementia Patients. The system is built around an Arduino UNO, which functions as the central processing unit. A load cell paired with an HX711 amplifier is used to measure the weight of the medicine container, enabling the detection of whether the patient has taken their medication. A Real-Time Clock (RTC) module maintains accurate scheduling of medicine intake. The NodeMCU (ESP8266) provides Wi-Fi connectivity, allowing remote monitoring and alert functionality. An LCD display with I2C interface presents real-time data such as time and medicine status. A keypad module is included to configure medicine timings directly on the device. For audible alerts, the system employs a buzzer or speaker connected through an amplifier circuit.

NORMAL STATUS DISPLAY

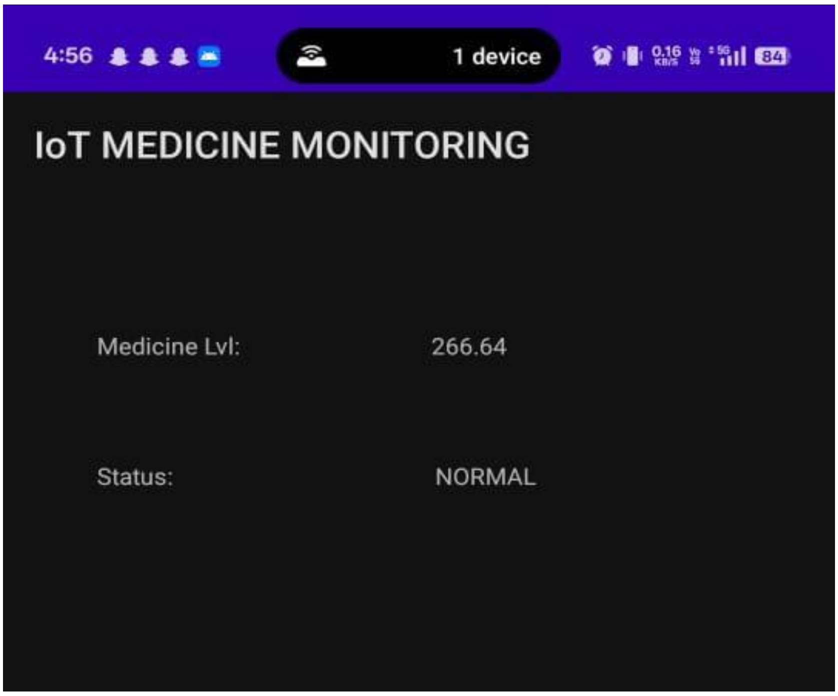

Figure:3.2

Figure 5.2 displays the system in its normal operating state. In this condition, the scheduled time for medication has not yet arrived, and the medicine container is correctly placed with no deviation in weight. The LCD screen shows the current time and a status message indicating that everything is functioning normally. This ensures that the patient and caregiver are reassured that the system is actively monitoring and there are no immediate actions required.

In this state, the RTC module continuously provides real-time clock updates, and the system checks the schedule set via the keypad module to determine when the next dose is due. Meanwhile, the load cell confirms that the medicine container remains untouched, indicating no unauthorized or accidental removal of medicine. This pre-dose monitoring plays a critical role in ensuring the integrity of medication adherence.

TIME TO TAKE MEDICINE

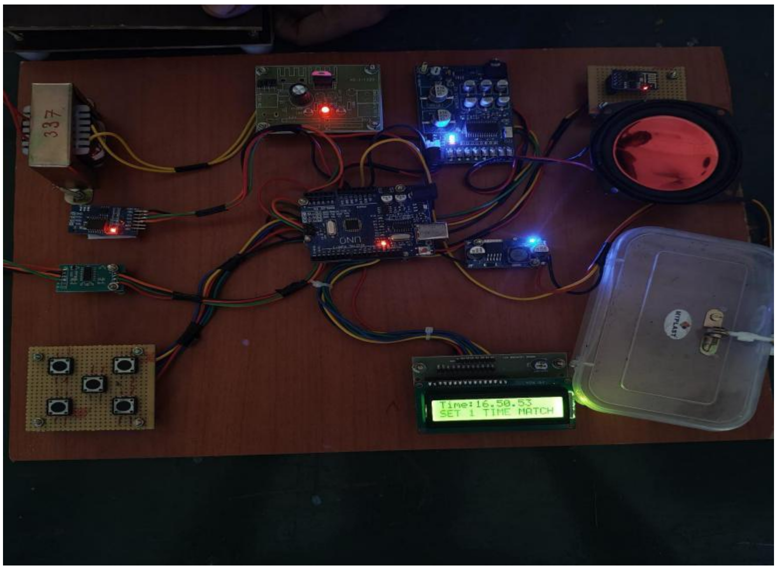

Figure:3.3

Figure 5.3 illustrates the system behavior when it is time for the patient to take their scheduled medication. The RTC module triggers the alarm at the pre-set time, prompting the system to activate the buzzer and display a message on the LCD screen reading “Time to Take Medicine.” This alert serves as a reminder for the patient to take their dose on time. Simultaneously, the system begins monitoring the load cell for any weight change that indicates the medicine has been picked up. If a weight change is detected within a predefined window, the alert stops, confirming the dose was taken. However, if the weight remains unchanged, the system assumes the dose was missed and automatically sends a notification to the caregiver through the NodeMCU via Wi-Fi. This dual-alert mechanism—audio and IoT-based—ensures that the patient is reminded while also keeping caregivers informed, supporting adherence to medication schedules and reducing health risks.

LOW MEDICINE ALERT STATUS

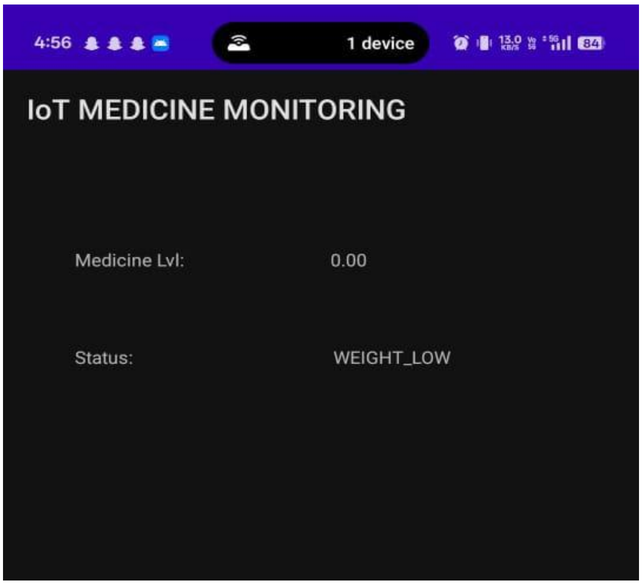

Figure:3.4

The screenshot showing the "WEIGHT_LOW" status represents a critical feature of the Smart Medication Assistant for Dementia Patients. In this instance, the system has detected that the scheduled medication was not taken, as indicated by the Medicine Lvl reading of 0.00. This value is measured by a load cell sensor interfaced with the Arduino UNO and processed using the HX711 amplifier. When the scheduled time is reached, if no reduction in weight is detected, the system concludes that the medicine has not been consumed and updates the status to "WEIGHT_LOW." This status is sent to the connected mobile application via the NodeMCU (ESP8266), ensuring caregivers are instantly notified of a missed dose. The "internet connected" message confirms active cloud connectivity, allowing real-time monitoring. This functionality is crucial in assisting dementia patients with timely medication intake and reducing caregiver burden through automated reminders and alerts integrated into the IoT system.

CHAPTER 4

CONCLUSION

The Smart Medication Assistant for Dementia Patients presents a practical, cost-effective, and user-friendly solution to address one of the most pressing challenges faced by individuals with memory loss—medication adherence. By integrating IoT technology with commonly available hardware components such as Arduino UNO, a load cell with HX711, an RTC module, and NodeMCU for cloud communication, the system ensures timely reminders, real-time monitoring, and caregiver alerts. The LCD display and buzzer provide visual and auditory notifications to the patient at scheduled times, while the load cell detects whether the medicine has been taken based on changes in weight. If the medicine is not consumed, a "WEIGHT_LOW" alert is triggered and transmitted to a mobile app through the internet, ensuring immediate awareness and intervention. This system not only reduces dependency on constant caregiver supervision but also enhances the safety and independence of dementia patients. Its low power consumption, affordability, and ability to be expanded or customized further increase its practical value. The success of the prototype demonstrates the potential for real-world deployment in households, clinics, or care centers. In conclusion, this project represents a meaningful step forward in using smart technologies to improve healthcare outcomes, particularly for vulnerable individuals requiring daily medication management.

CHAPTER 5

FUTURE SCOPE AND IMPLEMENTATION

The Smart Medication Assistant for Dementia Patients has considerable potential for expansion and integration with advanced technologies to improve both usability and reliability. One of the most practical improvements would be the inclusion of voice-based reminders and audio instructions. This feature would be especially helpful for patients who may have difficulty reading or interpreting visual cues. Additionally, the mobile application can be enhanced with features such as daily logs, missed dose alerts, and real-time health dashboards, enabling caregivers and doctors to track patient compliance over time and respond proactively.

Another future upgrade could be the incorporation of biometric authentication such as fingerprint sensors or facial recognition to verify that the intended patient is accessing the medication. This would be highly beneficial in settings like elder care homes where multiple patients are monitored using a shared system. The implementation of AI and machine learning algorithms could enable the system to learn and adapt to patient behavior, providing personalized reminders and generating alerts if irregular patterns are detected. These intelligent features would make the system more autonomous and capable of identifying early signs of non-compliance or health deterioration.Moreover, to enhance system reliability, the addition of battery backup or solar power would ensure uninterrupted operation, especially in areas with unstable power supply. Data storage on a secure cloud platform could allow long-term medication tracking and be shared with healthcare professionals for diagnosis and treatment adjustments. Integration with emergency contact systems could send immediate alerts to family members or doctors in case of repeated missed doses. Overall, these improvements would make the system more robust, intelligent, and adaptable to the evolving needs of dementia care.

IMPLEMENTATION:

The implementation of the Smart Medication Assistant for Dementia Patients begins with selecting the core hardware components, including the Arduino UNO, load cell with HX711 amplifier, RTC module, NodeMCU (ESP8266), LCD display, and buzzer. The Arduino acts as the central controller, managing inputs and outputs based on programmed instructions. The load cell is calibrated to detect changes in the weight of the medicine container, allowing the system to monitor whether the medicine has been taken. The RTC module keeps track of real-time schedules, and the buzzer provides an audible alert to the patient at the preset medication time. If no weight change is detected after the alert, the NodeMCU sends a "WEIGHT_LOW" status to the cloud, which is then reflected in the connected mobile application.

The system is powered through a regulated supply and tested using multiple timing cycles and different weight thresholds to ensure accuracy. The LCD display provides a local status interface, while the NodeMCU handles all wireless communication. After successful testing in a controlled environment, the system is enclosed and made ready for practical deployment in a home or clinic setting.

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