IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **Volume 12, Iss 4, 2023**

Arduino-Based Medicine Reminder and Vending Machine

S. Mahesh Reddy[1]

A.Saikumar Reddy[2], A. Swechha[3], A. Rushikesh Reddy[4],

[1,2,3,4]Department of ECE, CMR Institute of Technology Hyderabad, India

ABSTRACT-

This project proposes the development of an Arduino-based medicine reminder and vending machine to assist individuals in managing their medication schedules effectively. The system aims to provide timely medication reminders and automate the process of dispensing the correct dosage at the designated times. By combining hardware components such as an Arduino board, LCD, keypad, and servo motors, the system offers a user-friendly interface for input and feedback. The software components, programmed using the Arduino IDE, enable the system to store and manage medication schedules, display reminders, and control the vending mechanism. Safety measures, including sensors and error detection algorithms, are incorporated to ensure accurate dosage delivery and prevent potential issues such as double dosing or empty compartments. Through rigorous testing, refinement, and the inclusion of an enclosure for protection and easy maintenance, the proposed system aims to enhance medication adherence and provide a reliable solution for individuals in need of medication management.

Keywords – Arduino, Testing, IR Sensor, SD Card, LED, Speaker, Alarm Clock, Servo Motors, LCD Display, Keypad, Custom Audio Clip.

I. INTRODUCTION

The Arduino-based medicine reminder and vending machine is an innovative solution designed to assist individuals in managing their medication schedules effectively. Medication adherence plays a vital role in maintaining health and managing chronic conditions. Still, it can be challenging for individuals to remember to take their medications on time and in the correct dosages. This project aims to address this issue by combining the power of Arduino microcontrollers with a user-friendly interface to create a reliable and automated system. The system utilizes an Arduino board as the central control unit, which interfaces with various hardware components such as an LCD, keypad, and servo motors or stepper motors. The Arduino programming language, based on C/C++, is employed to develop the software that controls the different aspects of the system. The key features of the Arduino-based medicine reminder and vending machine include medication schedule management, timely medication reminders, accurate dosage dispensing, user interface and interaction, safety measures, and enclosure design. By allowing users to input their medication schedules and providing timely reminders, the system helps individuals stay on track with their medications. The vending mechanism, controlled by servo motors or stepper motors, accurately dispenses the correct dosages from designated compartments, eliminating the risk of medication errors. The user-friendly interface enables easy interaction with the system for tasks such as setting up medication schedules or requesting specific medications. Safety measures are incorporated to detect errors and ensure accurate dosage delivery. Sensors may be employed to detect if the correct medication was dispensed or if a compartment is empty, preventing potential risks. The system is thoroughly tested to ensure reliability and undergoes refinement to address any identified issues. To protect the components and facilitate maintenance, an enclosure is designed to encase the system while providing easy access for medication refills and other necessary tasks. Overall, the Arduino-based medicine reminder and vending machine project aims to improve medication adherence, reduce the likelihood of missed doses or medication errors, and provide individuals with a reliable and convenient solution for managing their medication schedules effectively. Medication non-adherence is a prevalent issue that can have significant consequences on individuals' health and well-being. According to the World Health Organization, approximately 50% of patients with chronic illnesses do not take their medications as prescribed. This can result in worsened symptoms, increased healthcare costs, and even life-threatening complications. Therefore, there is a critical need for innovative solutions that can help individuals adhere to their medication regimens. The Arduino-based medicine reminder and vending machine offers several advantages over traditional methods of medication management. Firstly, it provides timely medication reminders, ensuring that individuals do not forget to take their medications at the designated times. The LCD can be programmed to show specific medication names, dosages, and any additional instructions, making it easier for users to follow their prescribed regimens accurately. Additionally, the vending mechanism automates the process of medication dispensing. By using servo motors or stepper motors, the system can accurately release the correct

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 12, Iss 4, 2023**

dosage from the designated compartments. This reduces the chances of human error that may occur during manual medication organization and eliminates the risk of taking the wrong dosage. The user interface plays a crucial role in the system's usability. The keypad or buttons allow individuals to interact with the system, input their medication schedules, and request specific medications if needed. The interface is designed to be intuitive and user-friendly, ensuring that individuals of varying technological proficiency can easily navigate and operate the system. Safety is a top priority in the design of the Arduino-based medicine reminder and vending machine. The system incorporates measures to prevent errors such as dispensing the wrong medication or dosage. Sensors can be implemented to detect the presence of medications in the compartments, ensuring that the correct medication is dispensed and reducing the risk of medication mix-ups. Error detection algorithms can further enhance safety by verifying the dispensed dosage and providing alerts in case of any discrepancies. To ensure the system's durability and protect the components, an enclosure is designed to house the Arduino board, display, keypad, motors, and other relevant parts. The enclosure provides physical protection and minimizes the risk of damage, while also allowing easy access for medication refills and maintenance. In conclusion, the Arduino-based medicine reminder and vending machine project presents a comprehensive and innovative solution to address the challenges of medication adherence and management. By combining the capabilities of Arduino microcontrollers, a user-friendly interface, accurate dosage dispensing, safety measures, and an enclosure design, this system aims to improve medication adherence, reduce errors, and enhance the overall medication management experience for individuals.There is no cure for CoViD-19 yet, although patients are given some medicines by nurses and doctors to ease the pain,increase immunity, and reduce symptoms. But this puts our Healthcare warriors at risk when they give the medicine to patients thus I developed a machine that can take in the Medicine Doses of an Entire week, store them and supply them to the patient at the time set by the doctor once, at the start-up of the machine. This will ensure distancing from patients and nurses won't have to risk their lives to go and give medicine to the infected patient. Once the medicine is on the given rack from where the patient can take it, he/she is alerted via a speaker on the system to take the medicine. The data of when the medicine is taken is stored in an SD card for further reference by doctors to monitor the effect on symptoms by the given doze. This machine can also be used in houses where old patients forget to take medicines on time and need a caretaker to provide them each dose. For using it in households, there is one more feature added- Excercise and Food times of the patient can be stored and act as a reminder. The machine can also act as an alarm clock and store 3 alarms. Food and exercise times help patients since there are certain meds that need to be taken at proper intervals before or after food, thus having food on time is important.

II. METHODOLOGY

The development of the Arduino-based medicine reminder and vending machine follows a structured methodology to ensure the efficient achievement of its objectives, and this innovative system is designed to assist individuals in effectively managing their medication schedules. The step-by-step approach to its creation can be summarized as follows:

Project Planning and Definition:
In the initial phase, a thorough needs assessment is conducted to pinpoint the specific challenges and requirements related to medication management that the system aims to address. This involves gaining insights into individuals' difficulties when adhering to their medication schedules. Subsequently, the project objectives are refined to align with these identified needs. Emphasis is placed on key aspects such as medication schedule management, timely reminders, accurate dosage dispensing, user-friendliness, safety, and rigorous testing.

Hardware and Software Selection: Thoughtful consideration is dedicated to carefully selecting hardware components, a pivotal aspect in ensuring the system's effective functionality. These essential components encompass the utilization of the Arduino board, which takes on the pivotal role of the central control unit. Complementing this, including an LCD, keypad, and the choice between servo or stepper motors is carefully evaluated. Furthermore, the IR sensor, speaker, LED, and any other components identified as crucial are thoughtfully incorporated into the project's hardware framework. Simultaneously, deliberate and informed decisions are made regarding the software platform for the project's programming needs. The Arduino IDE, recognized for its foundation in C/C++, is judiciously selected as the preferred software platform. This strategic choice underpins the development process, laying the foundation for efficient and effective software programming to realize the system's objectives.

System Design: The system's architecture is meticulously planned and documented, outlining how the various hardware components and software modules interact. Each component's role in achieving the project's overarching objectives is clearly defined. The design of the user interface is a focal point, with careful attention devoted to ensuring it is not only user-friendly but also intuitive. This entails meticulous planning for the arrangement of the LCD, keypad, and any essential buttons or controls. The objective is to create a seamless and easily navigable interface that users can interact with effortlessly.

Medication Schedule Management: A robust data structure is developed to facilitate effective medication schedule management. This structure is designed to store comprehensive information about medication schedules, encompassing details such as medication names, dosages, and the times they should be administered. User-friendly interfaces are created to

ISSN PRINT 2319 1775 Online 2320 7876
 Volume 12, Iss 4, 2023

enable users to effortlessly input and modify their medication schedules using the keypad or other designated input mechanisms.

Timely Medication Reminders: The system's logic for generating timely medication reminders is established. This logic ensures that the system can accurately calculate and display reminders on the LCD at scheduled times. Both visual alerts, such as LED blinking, and auditory alerts, which consist of custom audio clips and ringtones, are programmed into the system to notify users to take their medications promptly.

Accurate Dosage Dispensing: Accurate medication dosage dispensing is a critical system component. The design and implementation of the vending mechanism are carefully executed, with the mechanism being controlled by either servo or stepper motors. The primary objective is to guarantee that the system can reliably dispense the correct medication dosage from designated compartments. Moreover, error detection algorithms are developed to prevent issues like double dosing or dispensing from empty compartments.

Safety and Error Prevention: The system incorporates safety measures to enhance reliability and minimize potential risks. This includes integrating sensors, such as IR sensors, which play a crucial role in detecting the presence of medications in designated compartments, thereby ensuring the accurate dispensing of medications. Additionally, the system is equipped with error detection algorithms that meticulously verify the dispensed dosage, promptly notifying users in the event of any discrepancies.

Testing and Refinement: Testing and refinement constitute integral phases of the development process. Rigorous testing procedures are carried out to evaluate the functionality and reliability of the system thoroughly. This comprehensive testing approach examines individual hardware components, interfaces, and the overall system. Any identified bugs or issues are systematically addressed through continuous refinement efforts, ensuring the system operates seamlessly and by its intended purpose.

Enclosure Design: The physical protection of system components is addressed through the design of a protective enclosure. This enclosure houses critical components such as the Arduino board, display, keypad, motors, and sensors. Providing physical protection allows easy access to medication refills and maintenance tasks.

User Manuals and Documentation: User manuals and comprehensive documentation are created to guide individuals on properly using the Arduino-based medicine reminder and vending machine. This documentation includes guidelines for system maintenance and troubleshooting.

Deployment and User Training: A well-defined deployment plan is established to determine how the system will be distributed, whether to individual users, healthcare facilities, or households. User training programs are developed to ensure that individuals can effectively operate the system, set up medication schedules, and interact with the user interface.

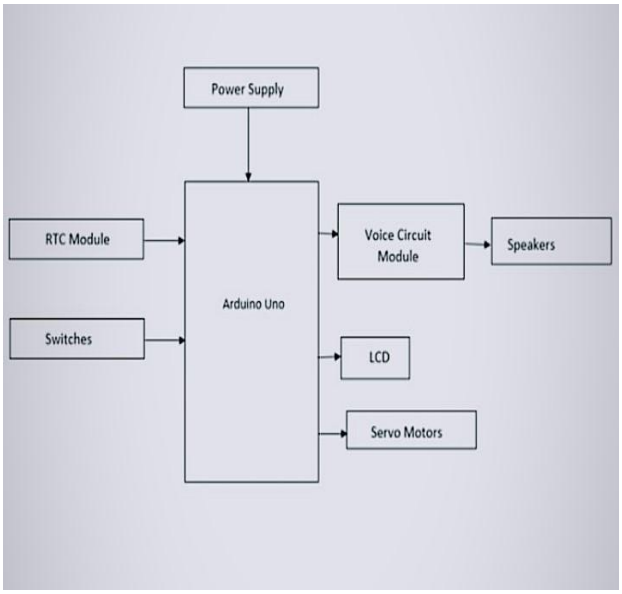
Data Logging and Analysis: The system incorporates data storage mechanisms like an SD card to record critical information about medication dispensing and user compliance. This data has the potential for future analysis to monitor medication adherence and its effects on health outcomes.

Project Evaluation: Performance metrics are defined to evaluate the project's success. These metrics include medication adherence, user satisfaction, and error rates. Feedback from users and healthcare professionals is collected to assess the system's effectiveness and identify areas for improvement.

Iterative Development: Finally, an iterative development approach is adopted to allow for continuous improvement. Ongoing enhancements and updates to the system are based on real-world usage and feedback, ensuring that it remains a reliable and effective solution for medication schedule management.

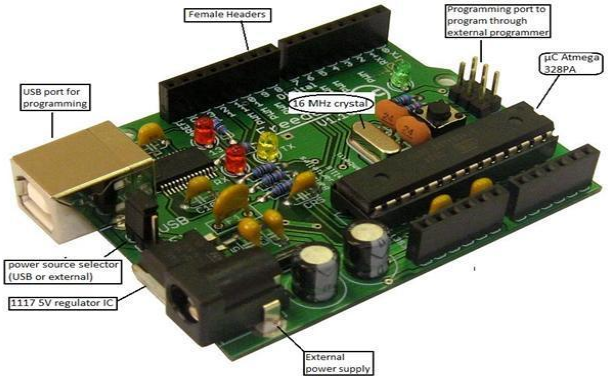
III. BLOCK DIAGRAM

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 12, Iss 4, 2023**



3.1 UNO

Arduino Uno is a versatile microcontroller board designed for electronic design, prototyping, and experimentation. It is favored by artists, hobbyists, hackers, and professionals alike. The board is built around an ATmega microcontroller, which includes a CPU, RAM, Flash memory, and a variety of input/output pins.



It provides a range of digital and analogue pins for connecting various components like sensors, LEDs, motors, and speakers. Digital pins (2-13) are used for general-purpose input/output, with additional pins (0 and 1) for serial communication.

Key special function pins include serial (RX and TX) pins for serial data communication, external interrupt pins (2 and 3) for triggering events based on voltage changes, PWM pins (3, 5, 6, 9, 10, and 11) for precise analog control, and SPI pins (10, 11, 12, 13) for SPI communication. The board also features a built-in LED on pin 13 for basic visual feedback.

Arduino Uno offers six analog input pins (0-5) for analog-to-digital conversion. Some of these pins can be used as digital pins as well.

Power options include USB or an external power supply (9-12VDC) with corresponding pins for power management. Additional pins include AREF for analogue reference voltage and a Reset pin for resetting the microcontroller.

At its core, Arduino Uno is powered by the ATmega328P-AU microcontroller, featuring 32kB of Flash program memory, 1kB of EEPROM, and 2kB of SRAM. It supports various functionalities such as timers, PWM, ADC, USART, SPI, and I2C.

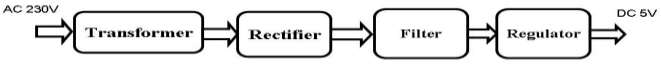
The board operates in a voltage range of 8-5.5V and can run at speeds up to 20MHz. It offers features like PWM channels, an 8-channel 10-bit ADC, serial USART, SPI, I2C, a watchdog timer, and an analog comparator. It has 23 I/O lines for versatile connectivity and can retain data for extended periods, even at high temperatures.

Arduino Uno features 14 digital I/O pins, six offering PWM output, and six analogue input pins. The maximum current per pin is 40mA. This microcontroller board is used in a wide range of applications, including robotics, digital music instruments, home automation, and more. It's known for its user-friendly programming environment in C/C++ and is valued for its accessibility and flexibility.

3.2 Power Supply

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 12, Iss 4, 2023**

Regulated Power supply



Power Requirements: Start by determining the power requirements of your project. You'll need to consider the power consumption of each component, including the Arduino board, display, motors, sensors, and any other peripherals. Make a list of all these components and their voltage and current requirements.

Voltage Regulator: To provide a stable power source to your Arduino and other components, consider using a voltage regulator. A popular choice is the LM7805, which can convert higher input voltages (e.g., from a wall adapter) into a stable 5V output, suitable for most Arduino boards.

Input Voltage Options: You can power your project using various input sources:

a. Battery Power: If you want a portable solution, you can use rechargeable batteries. In this case, you'll need a battery management system to charge and manage the battery's power efficiently.

b. Wall Adapter: You can use a standard wall adapter to power your project. Choose an adapter with an output voltage that matches your voltage regulator's input requirements. Common choices include 9V or 12V adapters.

c. Solar Power: For a sustainable and off-grid solution, consider incorporating solar panels and a charge controller. This requires a deep understanding of power management and energy consumption.

Battery Backup: If it's a medicine reminder system, having a battery backup is crucial to ensure the device continues to work during power outages. You can use rechargeable batteries for this purpose.

Voltage and Current Monitoring: Implement voltage and current monitoring to ensure the system can detect when the power supply is running low or if there are any anomalies in the power source. This can be important for the reliability of a medicine reminder system.

Power Management: Implement a power management system that allows the device to enter low-power or sleep modes when not in use to conserve energy.

Overcurrent Protection: Include circuitry to protect your components from overcurrent or voltage spikes. This can help prevent damage to your electronics.

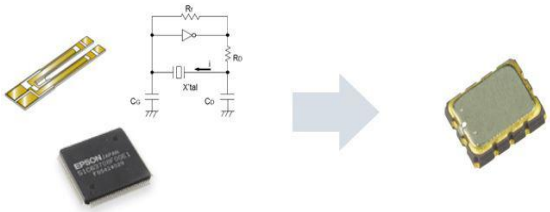
External Power Supply Considerations: If you're using a wall adapter, consider the cable length and its effect on voltage drop. Longer cables can lead to a voltage drop, so use appropriately sized wires.

Enclosure: Ensure that your power supply components are safely enclosed and well-ventilated to prevent overheating and maintain safety.

Safety Considerations: Depending on your project's power supply source, you may need to incorporate safety features like fuses or circuit breakers to protect against electrical faults.

3.3 RTC

RTC stands for Real Time Clock, which is an electronic device designed to measure and keep track of time accurately. RTC modules are specialized components that integrate RTC ICs (Integrated Circuits), oscillator circuits, and master clocks into a single package. These modules eliminate the need for designing oscillator circuits and making frequency adjustments, making them user-friendly and convenient.



Key Features of Epson's RTC Module:

Epson's RTC modules offer several notable features and addresses specific challenges in various applications:

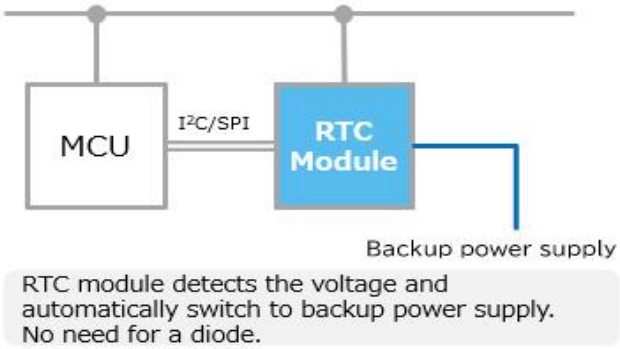
Low Power Consumption: Epson's RTC modules, such as the RX8901CE and RX4901CE, are designed to minimize power consumption, making them suitable for energy-efficient applications like IoT devices. They can take over housekeeping functions at significantly lower power levels.

Extended Data Retention: These modules provide extended data retention capabilities, ensuring that time information is preserved even during power failures. This feature is crucial for maintaining accurate time data in various systems.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 12, Iss 4, 2023

High Accuracy Across Temperature Ranges: Epson's RTC modules are built to maintain high clock accuracy even in extreme temperature conditions. For example, the D-TCXO (Digital Temperature Compensated Xtal Oscillator) function ensures precise timekeeping over a wide operating temperature range, from -40°C to +105°C.
Versatility: The modules support multiple interfaces, including I2C-Bus and SPI-Bus, and offer various functions such as time stamp recording and event pin configurations.

Applications of RTC Modules:



Epson's RTC modules find applications in a range of fields, including:
Utility Smart Meters: RTC modules are utilized in utility smart meters to accurately record and manage power consumption data. Their low power consumption and time stamping capabilities are essential for efficient operation. Surveillance Security Equipment: RTC modules play a role in surveillance systems, ensuring that timestamps on recorded events are precise. This accuracy is critical for security and analysis. Industrial Factory Automation and Industry 4.0: In industrial settings, these modules are used for time-critical applications, where precise timing and data retention are essential for automation and control systems.
3 Reasons for Using RTC Modules:
Reduced Standby Power: RTC modules enable efficient power management by utilizing time stamp functions to put the microcontroller or system into a low-power sleep state. This reduces the overall power consumption of the system.
Efficient Backup Power Management: RTC modules are equipped with features to detect voltage drops in the main power supply and automatically switch to a backup power supply. This ensures efficient use of backup power and prevents power losses.
High Precision Timekeeping: The inclusion of D-TCXO technology in RTC modules ensures high precision timekeeping, even in extreme temperature conditions. This accuracy is crucial for applications that rely on precise time data.
Main Specifications of Epson's RTC Modules (RX8901CE and RX4901CE):
Interface: I2C-Bus (RX8901CE) and SPI-Bus (RX4901CE)
Interface Power Voltage: 1.6V to 5.5V
Backup Power Voltage: 1.1V to 5.5V
Current Consumption at Backup: 240nA (Typical) at 3V
Operating Temperature Range: -40°C to +105°C
Frequency Tolerance: XS: ±3.0 x 10^-6 / -40°C to +85°C (Monthly rate ±8 seconds) for RX8901CE
And More: The modules offer additional features like auto power switching, time stamp recording, event input pins, and more.

3.4 Switches

User Interface Switches: Switches can be used as user input devices to interact with the vending machine. For example: Selection Switches: These switches allow users to select the medication they want to dispense. Confirmation Switches: Users can confirm actions like dispensing or refilling medications. Navigation Switches: These switches help users navigate through the system's menu or options.
Emergency Stop Switch: An emergency stop switch is a crucial safety feature. In case of a critical issue, pressing this switch can immediately halt all machine operations.
Power Switch: A power switch allows users to turn the machine on or off. It's a basic on/off control for the entire system.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 12, Iss 4, 2023**

Limit Switches: Limit switches can be used to detect the position of moving parts, such as the medication dispensing mechanism, ensuring it reaches the correct position.
Door Interlock Switch: If the vending machine has a door for accessing medications, a door interlock switch can be used to prevent operation when the door is open.
Switch Connections: Each switch should have at least two terminals: one common (COM) and one normally open (NO) or normally closed (NC). Connect one terminal of the switch (either NO or NC, depending on your design) to a digital input pin on the Arduino. Connect the other terminal of the switch (COM) to a ground (GND) pin on the Arduino.
3.5 Voice Circuit Module:
Components: The voice circuit module typically consists of a microcontroller or dedicated voice synthesis chip, a speaker, and sometimes a microphone for voice recognition. The microcontroller or chip is programmed to generate human-like speech or pre-recorded audio message.

Text-to-Speech (TTS) or Pre-recorded Messages: The module can generate speech from text using TTS technology or play pre-recorded audio messages. TTS allows you to dynamically generate voice messages based on system conditions, whereas pre-recorded messages are static audio clips.
Speech Playback: The speaker connected to the module is responsible for playing the generated or pre-recorded speech. The quality of the speaker can affect the clarity and volume of the audio output.
Speech Generation: If the system uses Text-to-Speech (TTS) technology, the microcontroller or dedicated voice synthesis chip takes a text input, which typically contains instructions, alerts, or messages to be spoken. The TTS engine processes this text and converts it into synthesized speech, creating a human-like voice message.
Pre-recorded Messages: If the system uses pre-recorded messages, the module stores these audio clips in memory. When it's time to play a specific message, the microcontroller triggers the playback of the corresponding pre-recorded audio clip.
User Interaction: When it's necessary to provide the user with instructions, reminders, or alerts, the Arduino or microcontroller sends a command to the voice circuit module. This command specifies which message to play or generates the necessary text for TTS synthesis.
Speech Playback: The voice module plays the generated or pre-recorded speech through the connected speaker. The quality of the speaker can significantly impact the clarity and volume of the audio output.
Microphone for Voice Recognition: If the project includes voice recognition, a microphone may be used to capture voice commands from the user. The system processes these voice commands, such as "Dispense medicine" or "Confirm dose," using speech recognition software, and takes appropriate actions based on the recognized commands.
Dynamic or Static Messages: Depending on whether you are using TTS or pre-recorded messages, the voice module can either generate dynamic, context-specific messages (TTS) or play predefined, static messages (pre-recorded) to guide the user.
Customization and Adaptation: The module can be programmed to adapt to individual user preferences and medication schedules. For instance, it can provide medication-specific instructions based on the user's medication regimen.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 12, Iss 4, 2023**

Emergency Alerts and User Confirmation: In emergencies or critical situations, the voice module can immediately play attention-grabbing alerts to notify the user. It can also acknowledge user input and confirm actions to ensure the user's requests are correctly understood.

3.6 Speakers

Overview: Speakers play a critical role in the medicine reminder and vending machine project. They are essential for providing audio prompts, alerts, and instructions to the user. In a project as complex as this, speakers help deliver information clearly and audibly, ensuring users receive medication reminders and vending instructions effectively.

Components: A speaker in this context usually consists of a transducer, which converts electrical signals into sound waves, and a diaphragm that vibrates to produce sound. The quality and type of speaker can significantly affect the audio output.

Text-to-Speech (TTS) and Pre-recorded Messages: Speakers in the project can be used to deliver audio messages in two primary ways:

Text-to-Speech (TTS): This technology enables the Arduino or microcontroller to convert text instructions or reminders into spoken words. It allows dynamic generation of voice messages based on the system's conditions. For instance, the system can generate personalized medication reminders for users with different schedules.

Pre-recorded Messages: Alternatively, the project can use pre-recorded audio messages. In this case, specific audio clips are stored in memory. When needed, the Arduino triggers the playback of the relevant message. Pre-recorded messages are suitable for static information or instructions that don't change frequently.

Integration into the System: Speakers are integrated into the system through the Arduino or microcontroller. The system's logic and software determine when and what to speak. For example:

When it's time for a user to take their medication, the Arduino can trigger a TTS message that says, "Please take your medication now."

In a vending machine scenario, if a user selects a particular medication, the system can play a pre-recorded message like, "Dispensing [Medication Name]."

Quality of Audio Output: The quality of the speaker can significantly impact the clarity and volume of audio output. In a project where precise instructions and alerts are crucial, it's essential to choose a speaker that can provide clear and intelligible speech. Factors like speaker size, power, and design should be considered to ensure an optimal user experience.

User Interaction and Accessibility: Speakers are integral to making the system more user-friendly and accessible. They cater to a broader range of users, including those with visual impairments or language barriers. Audible instructions are especially useful for people who may have difficulty reading or using visual displays.

Customization and Personalization: In a medicine reminder and vending machine project, the speaker can be programmed to adapt to individual user preferences and medication schedules. This customization ensures that the reminders and instructions align with the specific needs of each user.

Feedback and Confirmation: Speakers can also serve the purpose of receiving feedback and confirming user input. For instance, when a user selects a medication, the system can confirm the selection by saying, "You have selected [Medication Name]." This feedback reassures the user and minimizes errors.

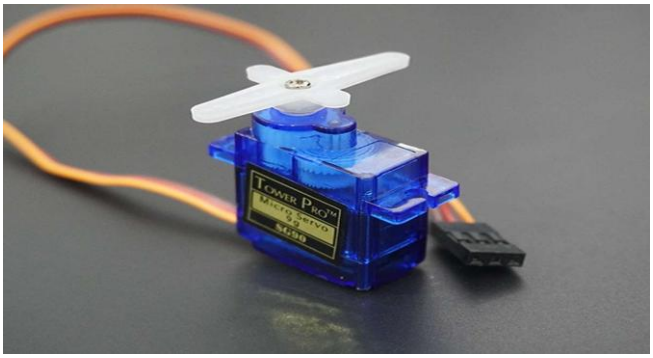
Emergency Alerts: In case of emergencies or critical alerts, the speaker can provide immediate and attention-grabbing notifications. For instance, if there's a critical issue with a medication or a malfunction in the vending process, the system can use the speaker to get the user's attention and provide instructions on what to do next.

Challenges and Considerations: While speakers enhance the user experience, they also come with certain challenges. Ensuring audio clarity in noisy environments, choosing the right speaker size, and addressing power requirements are some of the technical considerations that need to be taken into account during the design and implementation of the project.

3.7 Servo Motors

Overview: Servo motors are a vital component in the medicine reminder and vending machine project, primarily used for dispensing medications. These motors provide precise control over the position of the medication dispenser, ensuring that the correct medication is dispensed to the user.

ISSN PRINT 2319 1775 Online 2320 7876
 Volume 12, Iss 4, 2023



Components: A servo motor consists of a motor, a feedback mechanism (potentiometer or encoder), and a control circuit. It is designed for precise control of angular or linear position. Servo motors are known for their accuracy and ability to maintain a specific position or move to a desired position with high precision.
Medication Dispensing: In the context of the project, servo motors are responsible for dispensing the prescribed medications. When a user selects a specific medication, the servo motor is activated to move the dispenser to the appropriate position, allowing the medication to be released or dropped into a collection area for the user.
Precise Position Control: Servo motors are ideal for this application because they allow precise control over the position of the dispenser. This precision is critical to ensure that the correct medication is dispensed in the right dosage. It minimizes the risk of errors and enhances the reliability of the system.
Integration into the System: Servo motors are controlled by the Arduino or microcontroller as part of the overall system. The system's logic and software determine when and how the servo motor should move. For example:
When a user selects a medication, the Arduino calculates the required angle or position for the servo motor and instructs it to move to that position for dispensing.
Position Feedback: Servo motors provide feedback on their current position, which is crucial for the system's accuracy. The feedback mechanism, typically a potentiometer or encoder, informs the Arduino about the motor's real-time position, allowing for precise control and correction if needed.
Safety and Reliability: Servo motors are known for their reliability, making them a suitable choice for applications where precision and safety are essential. Users can trust that they will receive the correct medication dosage every time.
Challenges and Considerations: While servo motors offer high precision and reliability, they also require careful calibration and maintenance. Proper programming and calibration are necessary to ensure the motors move accurately and consistently.

3.8 LCD
Introduction:
A Liquid Crystal Display (LCD) is a thin, flat display device composed of multiple colour or monochrome pixels arranged in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes and two polarizing filters with perpendicular axes of polarity. The liquid crystals twist the polarization of light entering one filter, allowing it to pass through the other. LCDs are commonly used as output devices for microcontroller-based systems, providing a visual interface for human interaction.
Types of LCDs:
16x1: This type has 16 characters per line and one line.
16x2: It features 16 characters per line and two lines.
20x2: With 20 characters per line and two lines.
Various shapes and sizes of LCDs are available, including line lengths of 8, 16, 20, 24, 32, and 40 characters, in one, two, and four-line versions.
Features:
Interface: Compatible with either 4-bit or 8-bit microprocessors.
Display Data RAM: 80x8 bits (80 characters).
Character Generator ROM: Contains 160 different 5x7 dot-matrix character patterns.
Character Generator RAM: Allows the creation of 8 different user-programmed 5x7 dot-matrix patterns.
Microprocessor Access: Both display data RAM and character generator RAM can be accessed by the microprocessor.
Numerous Instructions: Includes commands like Clear Display, Cursor Home, Display ON/OFF, Cursor ON/OFF, Blink Character, Cursor Shift, and Display Shift.
Built-in Reset Circuit: Triggered at power ON.
Built-in Oscillator: For internal timing.
Data Placement:
Data can be placed at any location on the LCD, for a 16x1 LCD, specific address locations are provided to determine where data is displayed.
Shapes and Sizes:

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **© 2012 IJFANS. All Rights Reserved**, Volume 12, Iss 4, 2023

LCD modules come in various shapes and sizes. Standard line lengths include 8, 16, 20, 24, 32, and 40 characters, available in one, two, and four-line versions. Different LCD technologies exist, such as "supertwist" types, which offer improved contrast and viewing angles compared to older "twisted nematic" types. Some modules also feature backlighting for visibility in dimly lit conditions, which can be either "electro-luminescent," requiring a high-voltage inverter circuit, or simple LED illumination.

Electrical Block Diagram:

An electrical block diagram for an LCD typically includes components like power supply connections, data lines (for communication with a microcontroller), and backlighting components (if applicable).

Power Supply for LCD Driving:

LCDs require a power supply, often +5V, to operate. Additionally, if the LCD has backlighting, it may require a separate power source.

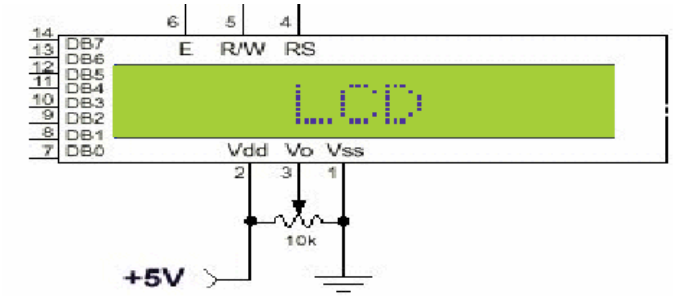
PIN DESCRIPTION (Typically for 14-Pin LCD):

VSS (Ground): Connect to ground.

VDD (Power Supply): Connect to +5V.

VO (Contrast Control): Used to adjust the contrast.

RS (Register Select): Determines whether data or an instruction is being sent.



RW (Read/Write): Indicates whether data is being written or read from the LCD.

E (Enable): Used to latch data and commands into the LCD.

D0-D7 (Data Lines): For 8-bit data communication (if applicable).

A (LED Anode): Anode of the backlight LED (if applicable).

K (LED Cathode): Cathode of the backlight LED (if applicable).

IV. CONCLUSION

The Arduino-based medicine reminder and vending machine offer a versatile and impactful solution to enhance medication adherence, reduce errors, and ensure patient safety, with particular relevance during the COVID-19 pandemic, providing contactless medication distribution while streamlining medication management for individuals and healthcare professionals.

V. REFERENCES

[1] An Intelligent Patient Medicine Reminder System R. Surender Reddy, C. Niharika, Rohit Sharma, A. Bharath Kumar, E.Narayana Assistant Professor, Dept. of ECE, Lords Institute of Engineering and Technology, Hyderabad, Telangana, India1 UG Students, Dept. of ECE, Lords Institute of Engineering and Technology, Hyderabad, Telangana, India.

[2] International Conference on Information Security & Privacy (ICISP2015), 11-12 December 2015, Nagpur, INDIA Medicine Reminder and Monitoring System for Secure Health Using IOT Samir V.Zanjal, Girish. R. Talmale G.H. Raisoni Nagpur, India Asst. Prof. CSE Dept. G.H. Raisoni Nagpur, India.

[3] Fundamental Research On Medication Reminder System AishwaryaChawariya, PrajaktaChavan, AkankshaAgnihotri, Students of Department of Electronics and Telecomm Engineering, SavitibaiPhule Pune University, Pune, Maharashtra, India.

[4] RadhaKrishna Karne, Dr TK. "Review on vanet architecture and applications." *Turkish Journal of Computer and Mathematics Education (TURCOMAT)* 12.4 (2021): 1745-1749.

[5] Karne, RadhaKrishna, S. Mounika, and Dr Nookala Venu. "Applications of IoT on Intrusion Detection System with Deep Learning Analysis." *International Journal from Innovative Engineering and Management Research (IJIEMR)* (2022).

[6] RadhaKrishna Karne, Dr TK. "COINV-Chances and Obstacles Interpretation to Carry new approaches in the VANET Communications." *Design Engineering* (2021): 10346-10361.

[7] Karne, RadhaKrishna, et al. "Simulation of ACO for Shortest Path Finding Using NS2." (2021): 12866-12873.

[8] Karne, RadhaKrishna, and T. K. Sreeja. "Routing protocols in vehicular adhoc networks (VANETs)." *International Journal of Early Childhood* 14.03 (2022): 2022.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **Volume 12, Iss 4, 2023**

[9] Karne, Ms Archana, et al. "Convolutional Neural Networks for Object Detection and Recognition." *Journal of Artificial Intelligence, Machine Learning and Neural Network (JAIMLNN) ISSN: 2799-1172* 3.02 (2023): 1-13.
[10] Karne, Radhakrishna, and T. K. Sreeja. "Clustering Algorithms and Comparisons in Vehicular Ad Hoc Networks." *Mesopotamian Journal of Computer Science* 2023 (2023): 121-129.
[11] Kumar, A. Arun, and Radha Krishna Karne. "IIoT-IDS Network using Inception CNN Model." *Journal of Trends in Computer Science and Smart Technology* 4.3 (2022): 126-138.
[12] Bompelli, Nagaraju, Ramadevi Manchala, and RadhaKrishna Karne. "IoT Based Smart Sensor Soc Architecture for The Industrial Internet of Things." *The International journal of analytical and experimental modal analysis* 12: 491-496.
[13] RadhaKrishna Karne, Dr TK. "ROUTING PROTOCOLS IN VEHICULAR ADHOC NETWORKS (VANETs)." *International Journal of Early Childhood Special Education (INT-JECS) ISSN*: 1308-5581.
[14] Mounika Siluveru, Dharavath Nanda, & RadhaKrishna Karne. (2022). Study and Analysis of OTFS and OFDM. *Journal of Artificial Intelligence,Machine Learning and Neural Network (JAIMLNN) ISSN: 2799-1172*, *2*(06), 13–23. https://doi.org/10.55529/jaimlnn.26.13.23
[15] Radha Krishna Karne and Dr. T. K. Sreeja (2022), A Novel Approach for Dynamic Stable Clustering in VANET Using Deep Learning (LSTM) Model. IJEER 10(4), 1092-1098. DOI: 10.37391/IJEER.100454.
[16] Karne, R. K. ., & Sreeja, T. K. . (2023). PMLC- Predictions of Mobility and Transmission in a Lane-Based Cluster VANET Validated on Machine Learning. International Journal on Recent and Innovation Trends in Computing and Communication, 11(5s), 477–483. https://doi.org/10.17762/ijritcc.v11i5s.7109

[17] R. Mohandas, N. Sivapriya, A. S. Rao, K. Radhakrishna and M. B. Sahaai, "Development of Machine Learning Framework for the Protection of IoT Devices," 2023 7th International Conference on Computing Methodologies and Communication (ICCMC), Erode, India, 2023, pp. 1394-1398, doi: 10.1109/ICCMC56507.2023.10083950.
[18] Vaigandla, Karthik Kumar, S. Bolla, and R. Karne. "A survey on future generation wireless communications-6G: requirements, technologies, challenges and applications." *International Journal* 10.5 (2021).
[19] Vaigandla, Karthik Kumar, Radha Krishna Karne, and Allanki Sanyasi Rao. "A Study on IoT Technologies, Standards and Protocols." *IBMRD's Journal of Management & Research* 10.2 (2021): 7-14.
[20] Vaigandla, Karthik Kumar, et al. "A Survey On Wireless Communications: 6g And 7g." *International Journal Of Science, Technology & Management* 2.6 (2021): 2018-2025.
[21] Vaigandla, Karthik Kumar, Sravani Thatipamula, and Radha Krishna Karne. "Investigation on unmanned aerial vehicle (uav): An overview." *IRO Journal on Sustainable Wireless Systems* 4.3 (2022): 130-148.
[22] Vaigandla, KarthikKumar, Nilofar Azmi, and RadhaKrishna Karne. "Investigation on intrusion detection systems (IDSs) in IoT." *International Journal of Emerging Trends in Engineering Research* 10.3 (2022).
[23] Vaigandla, Karthik Kumar, RadhaKrishna Karne, and Allanki Sanyasi Rao. "Analysis of MIMO-OFDM: Effect of Mutual Coupling, Frequency Response, SNR and Channel Capacity." *YMER Digital-ISSN* (2021): 0044-0477.
[24] Vaigandla, Karthik Kumar, et al. "Millimeter wave communications: Propagation characteristics, beamforming, architecture, standardization, challenges and applications." *Design Engineering* 9 (2021): 10144-10169.
[25] Vaigandla, Karthik Kumar, et al. "Review on Blockchain Technology: Architecture, Characteristics, Benefits, Algorithms, Challenges and Applications." *Mesopotamian Journal of CyberSecurity* 2023 (2023): 73-85.
[26] Vaigandla, Karthik Kumar, et al. "Investigation on Cognitive Radio Networks: Introduction, Spectrum Sensing, IEEE Standards, Challenges, Applications." *International Journal of Engineering Applied Sciences and Technology* 6.9 (2022): 91-103.
[27] Vaigandla, Karthik Kumar, Mounika Siluveru, and RadhaKrishna Karne. "Study and Comparative Analysis of OFDM and UFMC Modulation Schemes." *Journal of Electronics, Computer Networking and Applied Mathematics (JECNAM) ISSN: 2799-1156* 3.02 (2023): 41-50

.