Ahsanullah University of Science and Technology

Department of Electrical and Electronic Engineering

Open Ended Lab Report

Course No : EEE 3210

Course Title : Microprocessor, Interfacing and System Design Lab

Section : B2

Group No : 01

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Arduino-based Time Controlled LED System with SM, LCD, and Buzzer

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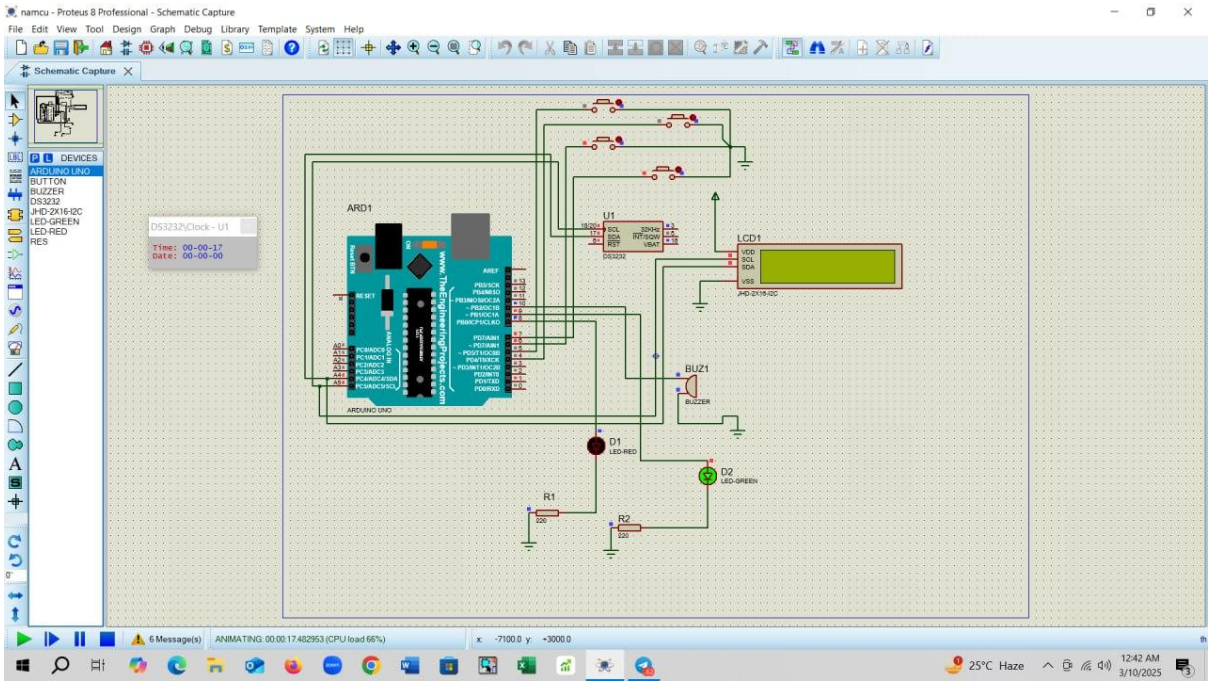
Problem Definition

In Islamic practices, there are specific periods during the day known as "Makruh times" when prayers should be avoided. These times vary daily, making it difficult to remember. This project aims to design a microcontroller-based system that allows users to set and monitor these times efficiently. The system integrates a Real-Time Clock (RTC), an LCD, LEDs, and a buzzer to notify users about Makruh times**.**

Equipment List

Component Name	Quantity	Description
Arduino Uno	1	Microcontroller board
RTC Module (DS3231)	1	Real-time clock module for time tracking
16x2 LCD Display + I2C Module	1	To display time and LED status
Red LED	1	Turns on during Makruh time
Green LED	1	Turns on at other times
220Ω Resistor	2	Limits current to LEDs
Buzzer (Piezo)	1	Alerts during Red LED activation
Push Button	4	Manual override for LED control
Breadboard & Jumper Wires	1 Set	Circuit connections

Circuit Diagram (Proteus Simulation)



Working Principle

The system operates as follows:

1. The DS3231 RTC module keeps track of the current time.
2. The LCD continuously displays the real-time clock data.
3. The user can set Makruh times using four push buttons (hour/minute for start and end time).
4. The set values are stored in EEPROM to retain data even after a power cycle.
5. The system checks the current time against the stored Makruh time range.
6. If the current time falls within Makruh time:
    - The red LED turns on.
    - The buzzer is activated as an alert.
    - The LCD displays "Restricted Time".
7. If the current time is outside Makruh time:
    - The green LED turns on.
    - The buzzer remains off.

    - The LCD displays "Prayer Allowed".
8. Users can reset or modify the stored Makruh time using the serial monitor or push buttons.

Implementation & Validation

- **Hardware Testing:** The RTC module is checked for accurate timekeeping.
- **LED & Buzzer Functionality:** Ensuring they activate correctly at predefined times.
- **LCD Display:** Checking that it correctly shows real-time updates.
- **Push Button Testing:** Ensuring it properly overrides automatic control.

Conflicting Requirements

- **Accuracy vs. Power Consumption**: The system uses an RTC module (DS3231) for accurate timekeeping while minimizing power consumption.
- **Cost vs. Functionality**: Using an Arduino Uno ensures affordability, but limits memory and processing speed.
- **User Convenience vs. Complexity**: The system balances ease of use (simple button interface) with configurability (EEPROM storage for saved settings).

Depth of Knowledge

- **Real-Time Clock (DS3231)**: Chosen for its high accuracy and battery backup capability.
- **Liquid Crystal Display (LCD 16x2, I2C)**: Provides clear and efficient time display with reduced wiring complexity.
- **EEPROM Storage**: Saves user-set Makruh times, ensuring retention even after power loss.
- **Push Buttons**: Used for easy time adjustment.
- **LEDs and Buzzer**: Provide visual and audible alerts during restricted times.

Multi-disciplinary Integration

- **Electronics**: Utilizes RTC, EEPROM, and LED indicators.
- **Software**: Implements time checking, EEPROM storage, and button-based input handling.
- **System Design**: Ensures reliability, low power consumption, and ease of use.

Project Management & Ethical Considerations

- **Resource Allocation**: Efficient use of affordable components while ensuring functionality.
- **Ethical Considerations**:
    - Supports religious practices without bias.
    - Designed for accessibility and ease of use.
    - Energy-efficient to minimize environmental impact.
- **Milestones**:
    - Phase 1: Component selection and circuit design.
    - Phase 2: Software development and debugging.
    - Phase 3: System integration and testing.
    - Phase 4: Documentation and final demonstration.

Conclusion

This project implements an Arduino-based time-controlled LED system to prevent prayers during prohibited times in the campus mosque. The circuit setup in Proteus and coding in Arduino IDE were completed. Initially, we attempted a Bluetooth-based system, but we opted for this simpler and more reliable alternative due to its complexity. Using an RTC module (DS3231), the system accurately tracks time, controlling LEDs and a buzzer to indicate prayer status. An LCD provides real-time updates, while a push button allows manual control.