Project Proposal: Mobile Alarm Clock for Oversleep Prevention

1. Project Concept / Use Case

This project proposes an innovative mobile alarm clock designed to help students who struggle to wake up early. Traditional alarms are limited by their fixed position: if placed near the bed, they're too easy to turn off and fall back asleep; if placed farther away, they become inconvenient to set up each night. This mobile alarm clock effectively addresses both issues. Users can conveniently set it up bedside before sleep, and when it goes off in the morning, it automatically moves to the other side of the room, forcing the user to get out of bed and turn it off. This approach combines ease of setup with an effective way to prevent oversleeping.

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2. Solution Overview

This mobile alarm clock provides a practical solution for oversleeping by making it difficult for users to turn off the alarm without fully waking up. The clock includes a built-in motor, distance sensor, and wheels that allow it to move around as the alarm time approaches. One minute before the set alarm time, the motor activates, causing the clock to move away from the user. When the alarm rings, the user must chase it to turn it off, promoting alertness and preventing falling back asleep. This mobile functionality, paired with a user-friendly interface, ensures that the alarm clock is effective and easy to operate.

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3. Key Features and Technical Topics

1. **Movement System**:
   - **Objective**: Make it challenging to snooze the alarm by having it move around the room before and as it sounds, requiring the user to physically get up to turn it off.
   - **Components**:
     - **Motors and Wheels**: The motor-driven wheels provide mobility, allowing the alarm clock to navigate around the room.
     - **Distance Sensor**: Used to detect obstacles and adjust movement patterns accordingly.
   - **Technical Focus**:
     - **Motor Control**: Utilizing Pulse Width Modulation (PWM) to adjust motor speed and control the movement.
     - **Distance Sensing**: The sensor helps avoid obstacles, using feedback to guide the movement direction and prevent collisions.
2. **Alarm System**:
   - **Objective**: Create a loud, persistent alarm sound that stops only once the user turns it off after catching the clock.
   - **Components**:

- - ■ **Buzzer or Speaker**: Generates the alarm sound to wake the user.
    - ■ **LCD Display**: Displays current system time, alarm time, and time-setting indicators.
  - ○ **Technical Focus**:
    - ■ **Timers**: Used to precisely control the alarm sound scheduling.
    - ■ **Buzzer Control**: Ensures a continuous sound at sufficient volume to wake the user, utilizing PWM for sound adjustments as necessary.
3. **User Interface** (Lead by Yuhe Zhang):
   - ○ **Objective**: Offer a clear, intuitive interface for setting and adjusting the alarm.
   - ○ **Components**:
     - ■ **LED Indicator**: Displays system status, particularly when the LCD is off, to save battery.
     - ■ **Buttons**: Four buttons enable time adjustment, system reset, and mode switching.
       - ■ **Increment/Decrement Buttons**: For setting time values.
       - ■ **Reset Button**: Used to power the system on/off or reset settings.
       - ■ **Mode Button**: Allows switching between system time setting and alarm time setting.
     - ■ **LCD Display**: Shows system and alarm times, as well as indicators to help the user understand which time is being set.
   - ○ **Technical Focus**:
     - ■ **User Interface Programming**: Includes button debounce logic, transition handling for modes, and display functionality on the LCD.
     - ■ **Power Management**: LCD display remains off during standby mode to conserve battery, with the LED acting as the primary system status indicator.

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4. Project Requirements and Specifications

- ● **Input Device**: Distance sensor to guide and adjust the clock's movement.
- ● **Output Devices**: LCD display for time and mode display, buzzer for alarm sound, and LED for system status.
- ● **Complexity Requirement**: This project involves a higher level of integration and functionality beyond basic alarm clocks, combining real-time alarm scheduling, user interaction, and movement. The design ensures a functional, standalone device that effectively addresses the problem of oversleeping by making the alarm clock physically evasive.

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5. Project Deliverables

- ● **Software Requirements Specification (SRS)**:
  - ○ **Description**: The SRS will define software components and interactions required for alarm scheduling, user interface control, movement logic, and power management.
  - ○ **Primary Features**:

- - ■ Switching modes between system and alarm time settings.
    - ■ Control of motor and timing logic for movement.
    - ■ Button debounce, LED control, and LCD display toggling for user feedback.
  - ● **Hardware Requirements Specification (HRS)**:
    - ○ **Description**: The HRS will provide an outline of necessary physical components, configurations, and specifications for optimal performance.
    - ○ **Primary Specifications**:
      - ■ **Microcontroller**: ATmega328PB, providing overall system control.
      - ■ **Motor and Sensor**: Specifications for motor power requirements, speed control, and sensor detection range.
      - ■ **Display**: LCD to show both system and alarm times, with user-friendly labels for setting modes.

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6. Implementation Timeline

- ● **Phase 1 (Weeks 1-2)**: Develop core functionalities, including timekeeping, alarm scheduling, and user interface setup with button and LED functionality.
- ● **Phase 2 (Weeks 3-4)**: Implement motorized movement system with distance sensing for navigation and integrate it with the alarm scheduling.
- ● **Phase 3 (Weeks 5-6)**: Test and fine-tune integration among the alarm, movement, and interface to ensure all parts work cohesively and reliably.