Embedded Systems Report
ES_Lab_Exam
Voltage Controller

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➢ Learning Objective:

- ❖ The main objective is to interface an Analog-to-Digital Converter (ADC) with a microcontroller 8051 to read analog signals, convert them into digital values, and display the corresponding voltage on an LCD. Additionally, based on the voltage level.

➢ Input and Output:

Inputs:

- ❖ Analog signal from a potentiometer.
- ❖ Control signals for ADC (ALE, OE, START).

Outputs:

- ❖ Digital value representing the analog input voltage.
- ❖ Voltage value displayed on the LCD.
- ❖ LEDs indicating the voltage level.

➢ Logic:

Initialization:

- ❖ LCD is initialized to display the voltage.
- ❖ ADC control and LED control pins are configured.

Main Loop:

- ❖ Continuously read the analog input, convert it to a digital value using the ADC, and then map this digital value to a voltage using a lookup table.
- ❖ Display the voltage on the LCD.

Control LEDs based on the voltage level:

- ❖ If the voltage is greater than 3.0V, both LEDs are turned on.
- ❖ If the voltage is between 2.0V and 3.0V, only one LED is turned on.
- ❖ If the voltage is less than 2.0V, both LEDs are turned off.

Detailed Steps in the Code:

- ❖ LCD Initialization (lcd_initialize function):

- Sends commands to the LCD to set it up in 8-bit mode, turn on the display, and set the cursor position.

ADC Reading (adc_get_value function):

- Controls the ADC to start the conversion, waits for the conversion to complete, and then reads the digital value from the ADC.

Voltage Display and LED Control:

- Converts the ADC digital value to the corresponding voltage using a predefined lookup table.
- Displays the voltage on the LCD.
- Based on the voltage value, controls the state of the LEDs.

Results:

- The LCD displays the converted voltage with four decimal places.
- The LEDs indicate the voltage level:
- When the voltage is above 3.0V, both LEDs are on.
- When the voltage is between 2.0V and 3.0V, only one LED is on.
- When the voltage is below 2.0V, both LEDs are off.
- This setup effectively demonstrates the process of interfacing an ADC with a microcontroller, reading and converting analog signals, and providing visual feedback through an LCD and LEDs. The simulation in Proteus confirms the correct operation of the system, as shown by the voltage display and LED status corresponding to the input voltage from the potentiometer.

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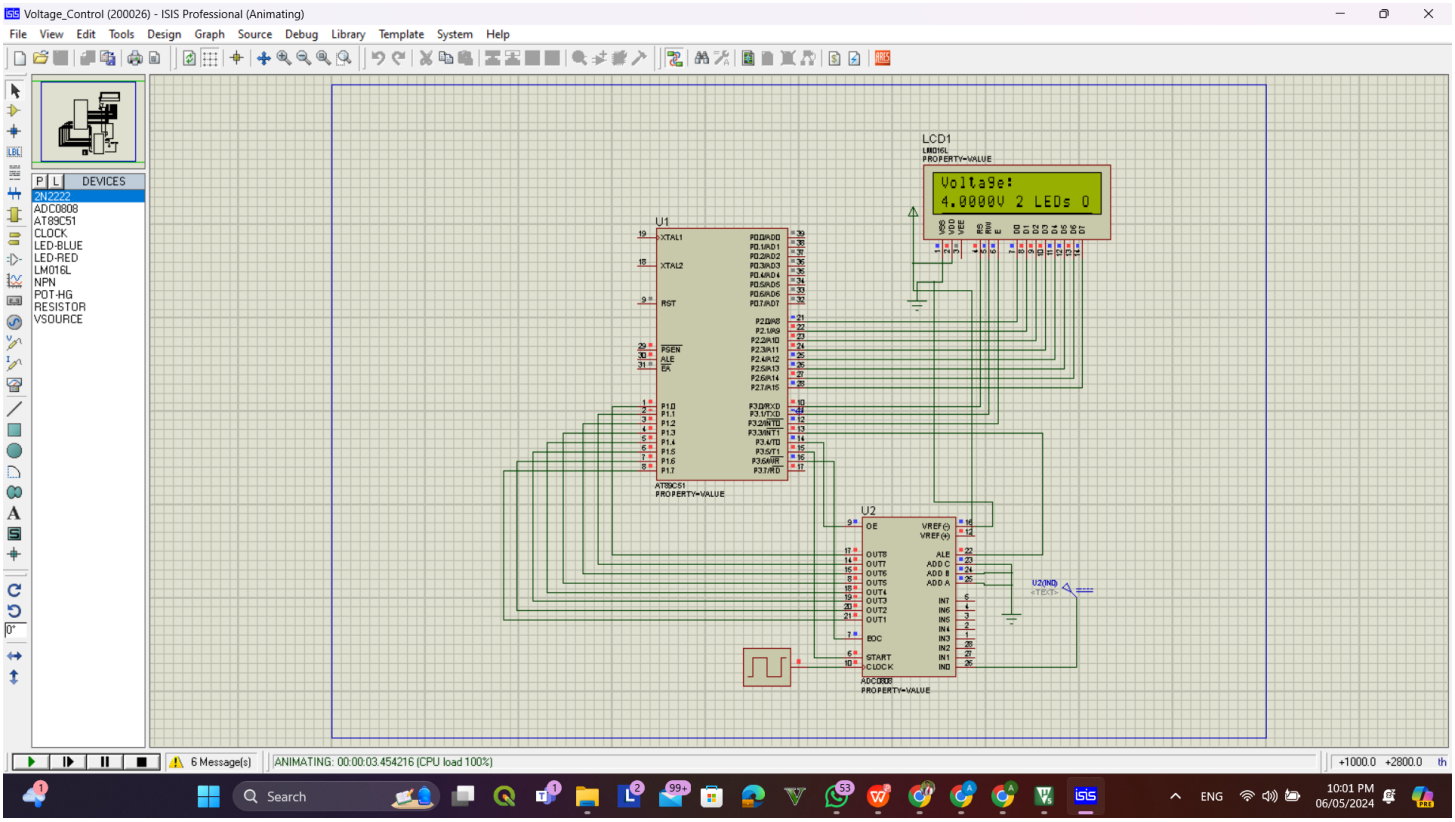
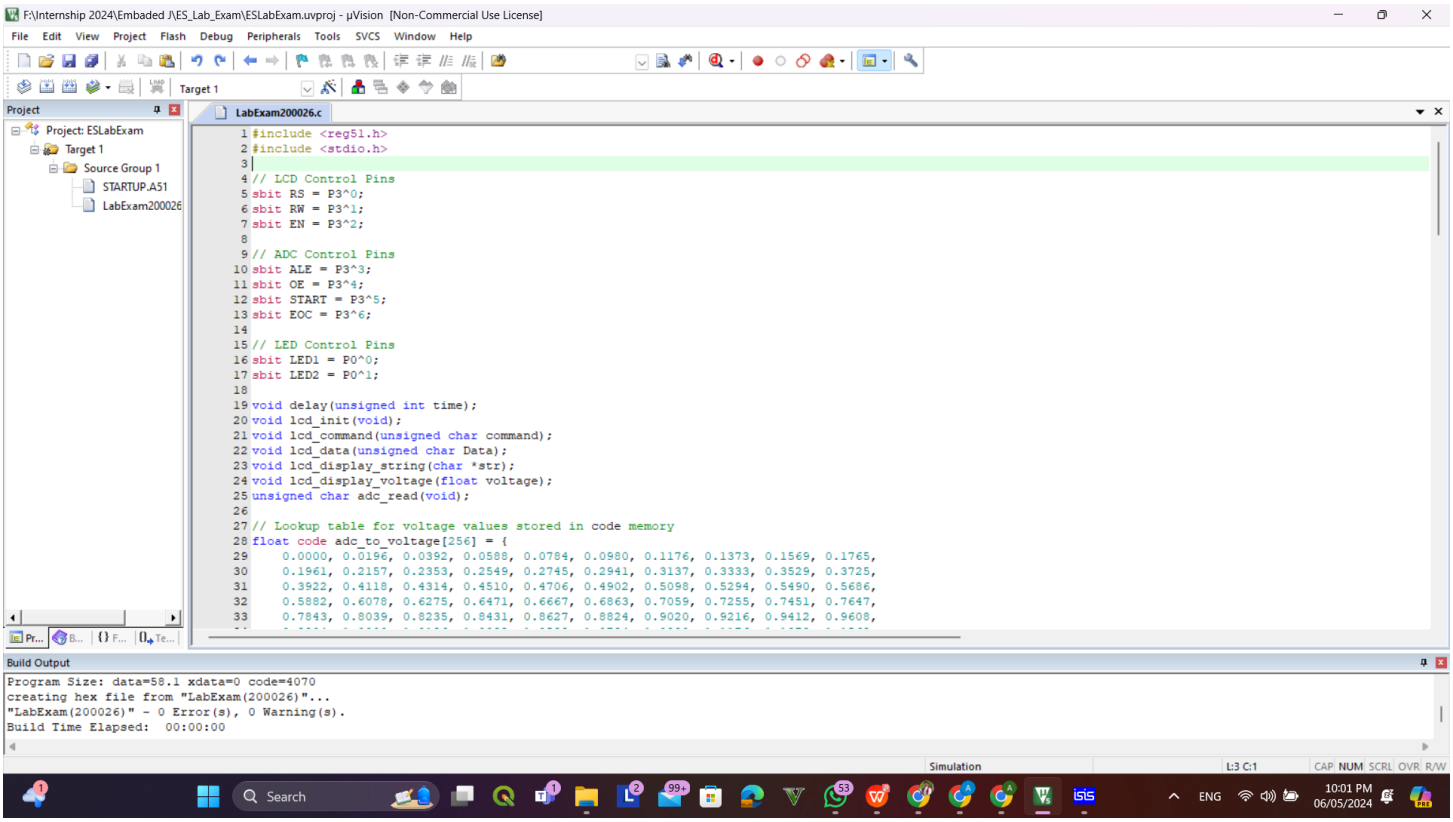
➢ Screenshots:



Proteus Simulation



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