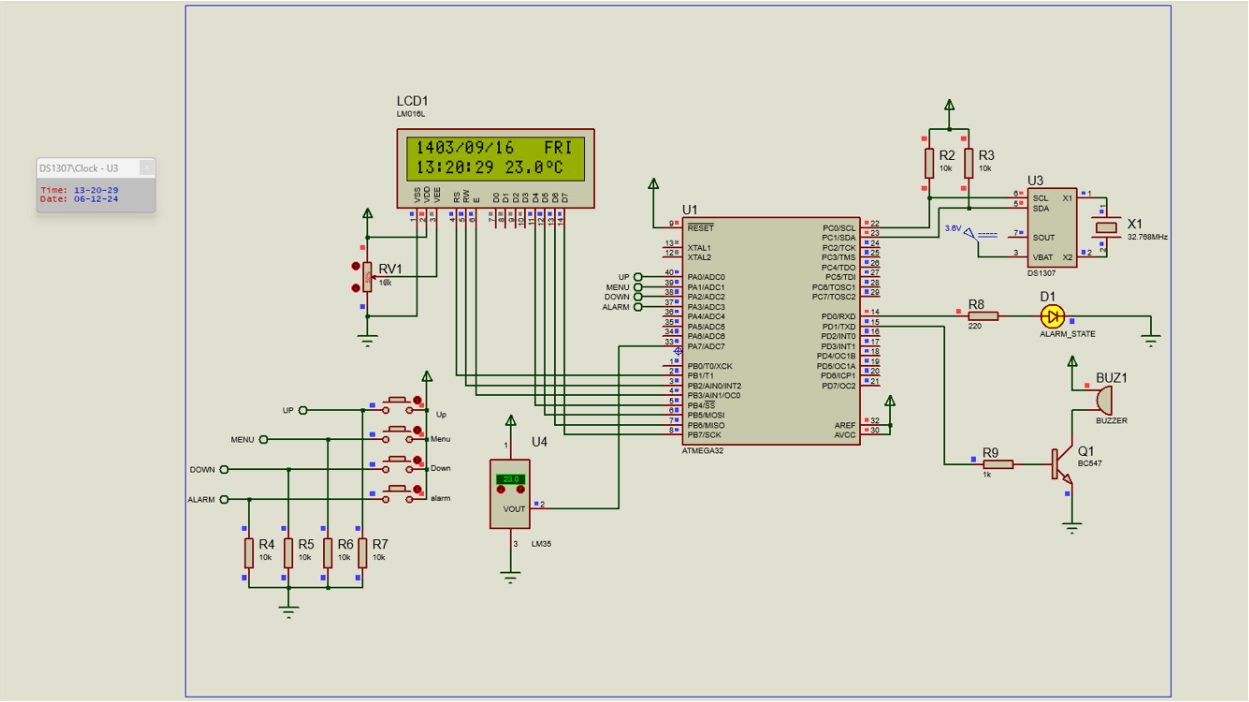
Final output:



DS1307\Clock - U3

```
Time: 13-20-29
Date: 06-12-24
```

```
1403/09/16   FRI
13:20:29 23.0°C
```

Main Components of the Circuit

1. **Display (LCD)**
   - **Component**: LCD1 (LM016L)
   - **Function**: Used to display information such as temperature, time, and settings.
   - **Connections**: Power and data pins are connected to the microcontroller.
   - **RV1**: A 10kΩ potentiometer used to adjust the contrast of the display.
2. **Microcontroller**
   - **Component**: ATMEGA32 (U1)
   - **Function**: The core of the circuit, handling processing and control.
   - **Inputs**:
     - Buttons: UP, MENU, DOWN, ALARM (connected to ports PA0 to PA3).

   - **Outputs**:
     - LCD control.
     - Activating LEDs or alarms.
     - Controlling the buzzer.

3. **Buttons (Push Buttons)**
   - **Components**: UP, MENU, DOWN, ALARM.
   - **Function**: Used for manual user adjustments.
   - **Connections**: Each button is connected to the microcontroller, and their signals are grounded through 10kΩ resistors (R4 to R7).
4. **RTC (Real-Time Clock)**
   - **Component**: DS1307 (U3).
   - **Function**: Keeps track of time and date.
   - **Connections**: SDA and SCL pins are connected to the microcontroller.
   - **Additional Features**:
     - A 32.768 kHz crystal (X1) ensures accurate timing.
     - External 3.6V battery for backup during power outages.
5. **Temperature Sensor**
   - **Component**: LM35 (U4).
   - **Function**: Measures temperature.
   - **Connections**: Output is connected to ADC0 pin of the microcontroller.
6. **Buzzer**
   - **Component**: BUZ1.
   - **Function**: Provides audible alarms.

  - **Control**: Managed via BC547 transistor (Q1), with a 1kΩ resistor (R9) to limit the base current.

7. **Diode and LED**
   - **Component**: D1.
   - **Function**: Acts as an alarm status indicator.
   - **Connections**: Series resistor R8 (220Ω) limits LED current.
8. **Resistors and Power Supply**
   - **Resistors R2 and R3 (10kΩ)**: Used for I2C connections between DS1307 and the microcontroller.
   - **Power Supply**: The circuit is powered by a 5V source.

Overall Functionality of the Circuit

This code is written for a real-time clock (RTC) and alarm control system using an AVR microcontroller (ATMEGA32A). The system includes the following features:

1. Setting and displaying time and date using RTC (DS1307).
2. Displaying temperature, time, and settings on the LCD.
3. Managing and storing alarm settings in EEPROM.

Code Descriptions

1. **Importing Libraries**

   ```
   #include <mega32a.h>
   ```

   A library for configuring and utilizing the hardware of ATMEGA32A.

```
#include <i2c.h>

#include <ds1307.h>
```

i2c.h: Functions for I2C communication with DS1307.

ds1307.h: Functions to manage and configure the DS1307 chip.

```
#include <alcd.h>
```

Functions for controlling and displaying text on the character LCD.

```
#include <delay.h>

#include <math.h>

#include <stdio.h>

#include <m2s.h>
```

delay.h: For creating time delays.

math.h: Mathematical functions like power and root.

stdio.h: For string formatting using functions like sprintf.

m2s.h: Specific configurations.

2. **Global Variables**

- **Time and Date Variables**:

```
float Temp;              // Current temperature

char lcd_buff[16];       // Buffer for displaying text on LCD

unsigned char Hour, Minute, Second = 0;  // Current time

unsigned char Year, Month, Day, Weekday = 0;  // Current date

int sYear = 0;           // Set year

int sMonth, sDay = 0;   // Set month and day
```

- **Alarm Variables**:

```
unsigned char menu_selector = 0;  // Current menu index
unsigned int A_Year = 0;          // Alarm year
unsigned char A_Month=0, A_Day = 0;  // Alarm month and day
unsigned char A_Hour=0, A_Minute=0;  // Alarm time
unsigned char alarm_selector = 0;   // Current alarm menu index
unsigned char alarm = 0;            // Alarm status (on/off)
```

- **EEPROM Storage**:

```
eeprom unsigned char E_alarm = 0;       // Alarm status in EEPROM
eeprom unsigned int AE_Year = 0;        // Stored alarm year
eeprom unsigned char AE_Month=0, AE_Day = 0;  // Stored alarm month and day
eeprom unsigned char AE_Hour=0, AE_Minute=0;  // Stored alarm time
```

- **Special Characters for LCD**:

```
flash char degreeSymbol[8] = {
    0b000110,  // Definition for degree symbol (°)
    0b001001,
    0b001001,
    0b000110,
    0b000000,
    0b000000,
    0b000000,
    0b000000
};
```

3. **Global Functions**

- **Time and Date Function**:

```
void time_date_functions();
```

  - For setting or reading time and date from DS1307.

- **Leap Year Check Function**:

```
int isLeapYear(int _year, int _type);
```

  - Checks if the given year is a leap year.

- **Button Functions**:

```
void up_sw();

void menu_sw();

void down_sw();
```

  - Manages physical buttons (UP, MENU, DOWN) for menu navigation and settings.

- **Menu Functions**:

```
void showMenu();

void alarmMenu();
```

  - showMenu: Displays the main menu for setting time, date, and alarm.
  - alarmMenu: Menu for alarm settings.

- **Alarm Functions**:

```
void A_up_sw();

void A_menu_sw();

void A_down_sw();
```

    - Manages alarm settings for hour, minute, date, and status.

- **EEPROM Functions**:

  ```
  void read_eeprom();
  ```

    - Reads stored alarm settings from EEPROM.

- **Custom Character Definition**:

  ```
  void define_char(char flash *pc, char char_code);
  ```

    - Defines custom characters (e.g., degree symbol) for LCD display.

4. **ADC Voltage Reference Definition**:

   ```
   #define ADC_VREF_TYPE ((1<<REFS1) | (1<<REFS0) | (1<<ADLAR))
   ```

   Configures ADC reference voltage.

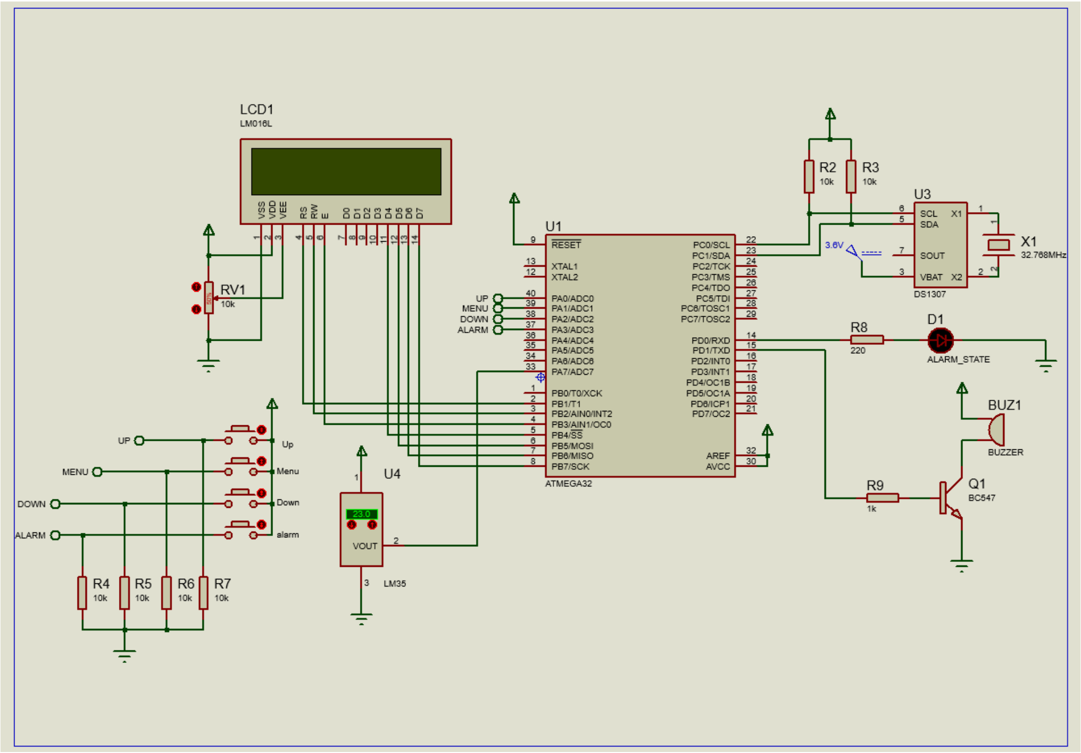
   REFS1 and REFS0: Set the internal voltage reference.

   ADLAR: Enables left alignment for ADC result.

Key Functions in the Code

1. Setting the clock and date using DS1307 and displaying them on the LCD.
2. Reading temperature (using the temperature sensor).
3. Configuring alarms with EEPROM storage.
4. Managing user input for navigation and changes.
5. Displaying values (like temperature and time) and special symbols (like °) on the LCD.

Final circuit:


LCD1
LM016L
VSS VDD VEE RS RW E D0 D1 D2 D3 D4 D5 D6 D7
1 2 3 4 5 6 7 8 9 10 11 12 13 14
RV1
10k
UP
MENU
DOWN
ALARM
Up
Menu
Down
alarm
R4
10k
R5
10k
R6
10k
R7
10k
U4
23.0
VOUT
1
2
3
LM35
U1
RESET
XTAL1
XTAL2
PA0/ADC0
PA1/ADC1
PA2/ADC2
PA3/ADC3
PA4/ADC4
PA5/ADC5
PA6/ADC6
PA7/ADC7
PB0/T0/XCK
PB1/T1
PB2/AIN0/INT2
PB3/AIN1/OC0
PB4/SS
PB5/MOSI
PB6/MISO
PB7/SCK
PC0/SCL
PC1/SDA
PC2/TCK
PC3/TMS
PC4/TDO
PC5/TDI
PC6/TOSC1
PC7/TOSC2
PD0/RXD
PD1/TXD
PD2/INT0
PD3/INT1
PD4/OC1B
PD5/OC1A
PD6/ICP1
PD7/OC2
AREF
AVCC
ATMEGA32
R2
10k
R3
10k
U3
SCL
SDA
SOUT
VBAT
X1
X2
DS1307
3.6V
X1
32.768MHz
R8
220
D1
ALARM_STATE
BUZ1
BUZZER
R9
1k
Q1
BC547