 Marwadi University Marwadi Chandarana Group	NAAC A+	Marwadi University Faculty of Technology Department of Information and Communication Technology	
Subject: Microcontroller and Interfacing (01CT0403)	Aim: AVR Microcontroller LCD Programming In C.		
Session Assignment :- 03	Date:- 18-02-2024	Enrollment No:- 92200133030	

Objective: AVR Microcontroller LCD Programming In C.

Task-1:- Interface 16x2 LCD with ATMEGA32 in 8-bit mode. Write a program to display your name. Your first name should be displayed from the 5th position of the 1st ROW and your surname from the 3rd position of the 2nd row.

Code:-


```
#include <avr/io.h>
#include <util/delay.h>

#define F_CPU 1000000UL

void LCD_Command(unsigned char Command) {
    PORTB = Command;
    PORTC &= ~(0x01);
    PORTC &= ~(0x02);
    PORTC |= (0x04);
    _delay_ms(1); // Increased delay for commands
    PORTC &= ~(0x04);
}

void LCD_Data(unsigned char Data) {
    PORTB = Data;
    PORTC |= (0x01);
    PORTC &= ~(0x02);
    PORTC |= (0x04);
    _delay_ms(1); // Increased delay for data
    PORTC &= ~(0x04);
}

void LCD_Init() {
    _delay_ms(50); // wait for LCD to power up
    LCD_Command(0x38); // Initialize 8-bit mode
    LCD_Command(0x0C); // Display ON, Cursor OFF
    LCD_Command(0x06); // Increment cursor
    LCD_Command(0x01); // Clear LCD
    _delay_ms(2); // Delay for LCD to clear
    LCD_Command(0x80); // Move cursor to beginning of first line
}
```

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```

void LCD_SetCursor(uint8_t row, uint8_t column) {
    uint8_t position = 0x80; // Base address for the first line

    if (row == 1) // If second row
        position = 0xC0; // Base address for the second line

    position += column - 1; // Adjust position for the desired column
    LCD_Command(position); // Set cursor position
}

int main(void) {
    DDRB = 0xFF;
    DDRC = 0xFF;
    LCD_Init();
    char First_Name[5] = "ARYAN";
    char Last_Name[10] = "LANGHANOJA";


    LCD_SetCursor(0, 5);
    for (int i = 0; i < 5; i++) {
        LCD_Data(First_Name[i]);
    }

    LCD_SetCursor(1, 3);
    for (int i = 0; i < 10; i++) {
        LCD_Data(Last_Name[i]);
    }

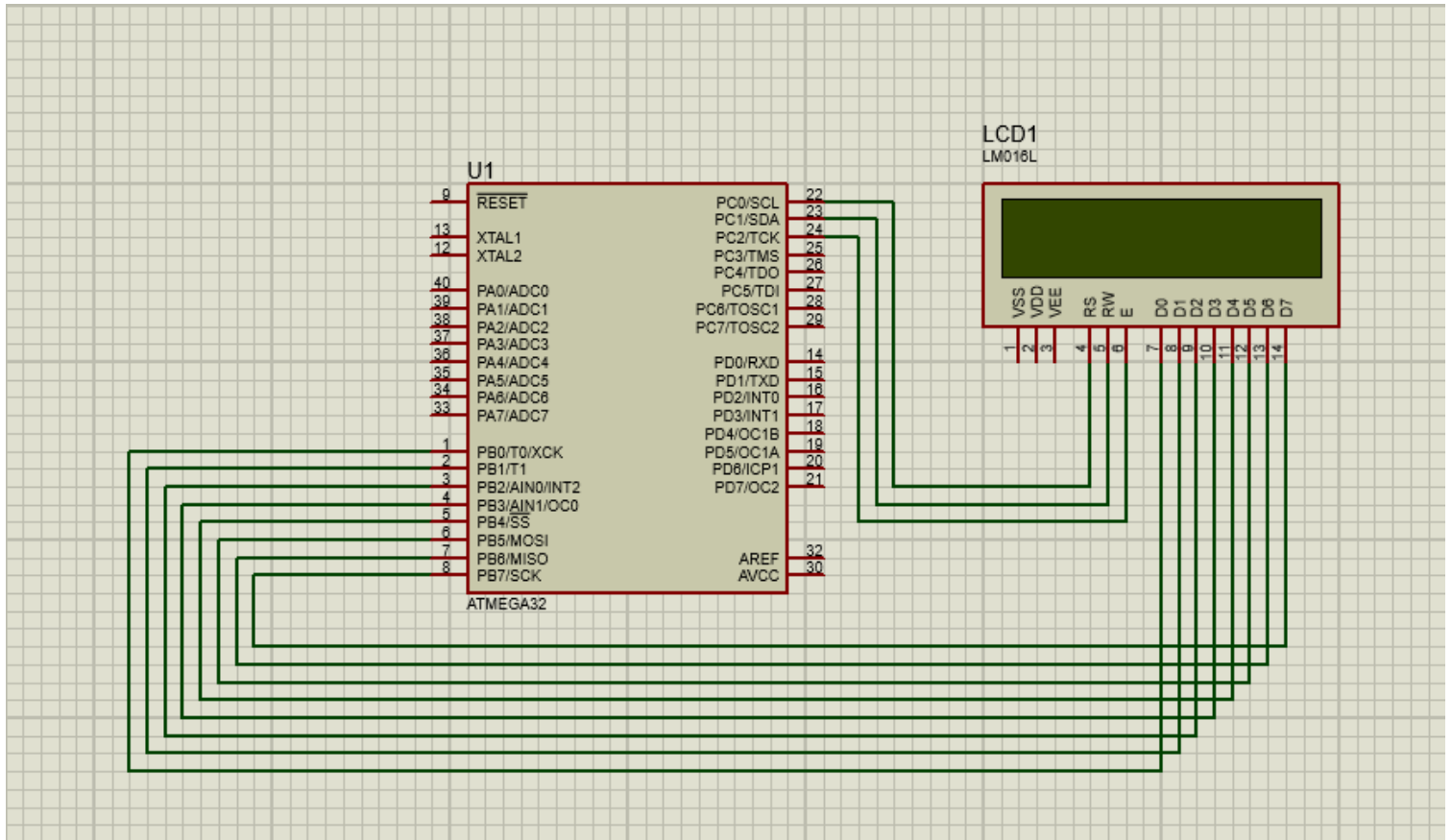
    while (1);



    return 0;
}

```

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Task-2 :- Interface 16x2 LCD with ATMEGA32 in 4-bit mode to do the same task as mentioned in problem 1.

Code :-

```
#include <avr/io.h>
#include <util/delay.h>

#define F_CPU 1000000UL

void LCD_Command(unsigned char Command) {

    unsigned char A , B ;
    A = Command & 0xF0 ;
    PORTB = A | 0x04 ;
    _delay_ms(100);
    PORTB &= ~(0x04) ;

    B = Command << 4 ;
    PORTB = B | 0x04 ;
    _delay_ms(100) ;
    PORTB &= ~(0x04) ;
}


void LCD_Data(unsigned char Data) {

    unsigned char A,B ;
    A = Data & 0xF0 ;
    PORTB = 0x05 | A ;
    _delay_ms(100) ;
    PORTB &= ~(0x04) ;

    B = Data << 4 ;
    PORTB = 0x05 | B ;
    _delay_ms(100) ;
    PORTB &= ~(0x04) ;
}

void LCD_SetCursor(uint8_t row, uint8_t column) {
    uint8_t position = 0x80;

    if (row == 1)
        position = 0xC0;
```

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```

        position += column - 1;
        LCD_Command(position);
    }

int main(void) {
    DDRB = 0x0F ;

    LCD_Command(0x02);
    LCD_Command(0x28);
    LCD_Command(0x0E);
    LCD_Command(0x06);
    LCD_Command(0x01);
    LCD_Command(0x80);

    char First_Name[5] = "ARYAN";
    char Last_Name[10] = "LANGHANOJA";

    LCD_SetCursor(0, 5);
    for (int i = 0; i < 5; i++) {
        LCD_Data(First_Name[i]);
    }

    LCD_SetCursor(1, 3);
    for (int i = 0; i < 10; i++) {
        LCD_Data(Last_Name[i]);
    }

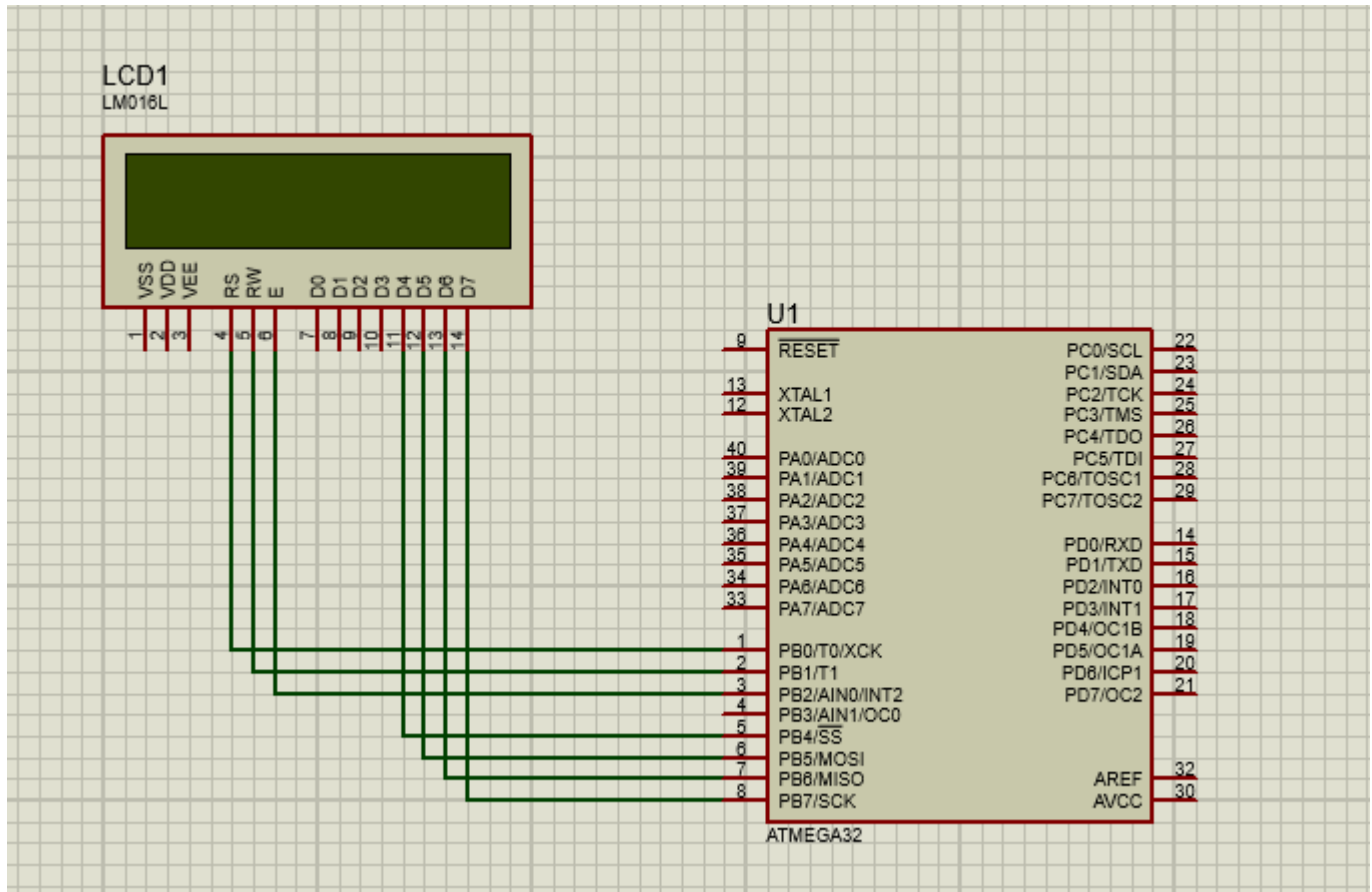
    while (1);



    return 0;
}

```

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Task-3 :- Write a program to display scrolling text in 16x2 LCD. Assume the string to displayed as per your choice.

Code :-

```
#include <avr/io.h>
#include <util/delay.h>


#define LCD_DATA_PORT PORTD
#define LCD_CTRL_PORT PORTC
#define LCD_RS PC0
#define LCD_RW PC1
#define LCD_EN PC2

void LCD_Command(unsigned char Command) {
    LCD_DATA_PORT = (LCD_DATA_PORT & 0x0F) | (Command & 0xF0);
    LCD_CTRL_PORT &= ~(1 << LCD_RS); // RS low for command
    LCD_CTRL_PORT &= ~(1 << LCD_RW); // RW low for write
    LCD_CTRL_PORT |= (1 << LCD_EN); // Enable high
    _delay_us(1);
    LCD_CTRL_PORT &= ~(1 << LCD_EN); // Enable low
    _delay_us(100);

    LCD_DATA_PORT = (LCD_DATA_PORT & 0x0F) | ((Command << 4) & 0xF0);
    LCD_CTRL_PORT |= (1 << LCD_EN); // Enable high
    _delay_us(1);
    LCD_CTRL_PORT &= ~(1 << LCD_EN); // Enable low
    _delay_ms(2);
}

void LCD_Data(unsigned char Data) {
    LCD_DATA_PORT = (LCD_DATA_PORT & 0x0F) | (Data & 0xF0);
    LCD_CTRL_PORT |= (1 << LCD_RS); // RS high for data
    LCD_CTRL_PORT &= ~(1 << LCD_RW); // RW low for write
    LCD_CTRL_PORT |= (1 << LCD_EN); // Enable high
    _delay_us(1);
    LCD_CTRL_PORT &= ~(1 << LCD_EN); // Enable low
    _delay_us(100);

    LCD_DATA_PORT = (LCD_DATA_PORT & 0x0F) | ((Data << 4) & 0xF0);
    LCD_CTRL_PORT |= (1 << LCD_EN); // Enable high
    _delay_us(1);
    LCD_CTRL_PORT &= ~(1 << LCD_EN); // Enable low
```

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```

    _delay_ms(2);
}

void LCD_Init(void) {
    LCD_DATA_PORT = 0xFF; // Initialize LCD data port as output
    LCD_CTRL_PORT |= (1 << LCD_EN) | (1 << LCD_RW) | (1 << LCD_RS); // Initialize control port pins as
output
    _delay_ms(20);

    LCD_Command(0x33); // Initialization sequence
    LCD_Command(0x32); // Initialization sequence
    LCD_Command(0x28); // 4-bit mode, 2 lines, 5x8 font
    LCD_Command(0x0C); // Display on, cursor off, blink off
    LCD_Command(0x06); // Increment cursor
    LCD_Command(0x01); // Clear display
    _delay_ms(2);
}

void LCD_Clear(void) {
    LCD_Command(0x01); // Clear display
    _delay_ms(2);
}

void LCD_GotoXY(unsigned char x, unsigned char y) {
    unsigned char address = 0;
    if (y == 0) {
        address = 0x80 + x; // Line 1
    } else if (y == 1) {
        address = 0xC0 + x; // Line 2
    }

    LCD_Command(address);
}

void LCD_Puts(const char *str) {
    while (*str) {
        LCD_Data(*str++);
    }
}

// right to left
void LCD_Scroll_Text(const char *text) {
    int len = 0;

```


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```

while (text[len] != '\0') {
    len++;
}

// Calculate the starting position
int start_position = len > 16 ? len - 16 : 0;

// Add spaces at the beginning to adjust the starting position
char scrolled_text[2 * len + 6]; // Double the length of the text for scrolling effect
for (int i = 0; i < start_position; i++) {
    scrolled_text[i] = ' ';
}

// Copy the text to scrolled_text
for (int i = 0; i < len; i++) {
    scrolled_text[start_position + i] = text[i];
}

while (1) {
    for (int i = 0; i < len + start_position + 3; i++) {
        LCD_Clear();
        LCD_GotoXY(0, 0);
        LCD_Puts(scrolled_text + i);
        _delay_ms(500); // Adjust the delay as needed for desired scrolling speed
    }
}

int main(void) {
    DDRD = 0xFF; // Port D as output
    DDRC |= (1 << LCD_EN) | (1 << LCD_RW) | (1 << LCD_RS); // Control pins as output

    LCD_Init();
    LCD_Clear();

    LCD_Scroll_Text("HELLO FROM ARYAN LANGHANOJA");

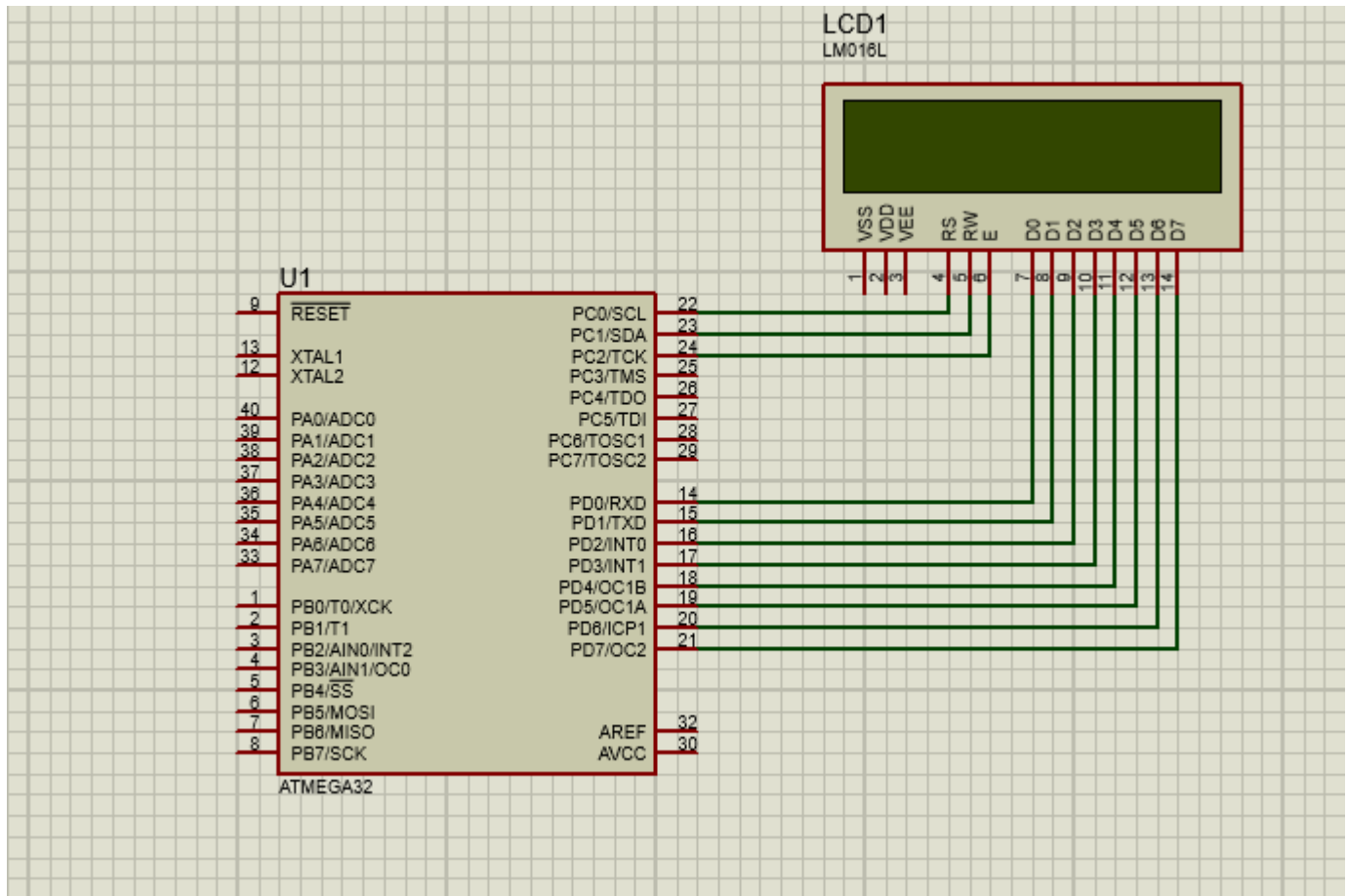
    while (1) {
    }


    return 0;
}

```

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Task-4 :- In continuation with problem 3, take an input from two switches connected on PD0 and PD1, and show the scrolling of text from right to left and left to right.

Code :-


```
#include <avr/io.h>
#include <util/delay.h>

#define LCD_DATA_PORT PORTD // Data port connected to PORT D
#define LCD_CTRL_PORT PORTC // Control port connected to PORT C
#define LCD_RS PC0 // Register select pin
#define LCD_EN PC1 // Enable pin

void lcd_command(unsigned char cmnd) {
    LCD_DATA_PORT = cmnd;
    LCD_CTRL_PORT &= ~(1 << LCD_RS); // RS = 0 for command
    LCD_CTRL_PORT |= (1 << LCD_EN); // EN = 1 for H-to-L pulse
    _delay_us(1);
    LCD_CTRL_PORT &= ~(1 << LCD_EN); // EN = 0 to latch command
    _delay_us(100);
}

void lcd_data(unsigned char data) {
    LCD_DATA_PORT = data;
    LCD_CTRL_PORT |= (1 << LCD_RS); // RS = 1 for data
    LCD_CTRL_PORT |= (1 << LCD_EN); // EN = 1 for H-to-L pulse
    _delay_us(1);
    LCD_CTRL_PORT &= ~(1 << LCD_EN); // EN = 0 to latch data
    _delay_us(100);
}

void lcd_init() {
    LCD_CTRL_PORT |= (1 << LCD_RS) | (1 << LCD_EN); // Set RS and EN as output
    LCD_DATA_PORT = 0xFF; // Set data port as output
    LCD_CTRL_PORT &= ~(1 << LCD_RS); // RS = 0 for command
    LCD_CTRL_PORT &= ~(1 << LCD_EN); // EN = 0
    _delay_ms(20); // Initialization routine
    lcd_command(0x38); // 2 line, 5x8 matrix
    lcd_command(0x0E); // Display on, cursor blinking
    lcd_command(0x01); // Clear LCD
    _delay_ms(2);
}
```

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```

void lcd_string(char *str) {
    while (*str)
        lcd_data(*str++);
}

void lcd_scroll_left(char *str) {
    int i, len;
    len = strlen(str);

    for (i = 0; i < len; i++) {
        lcd_command(0x1C); // Shift display left
        _delay_ms(500);
    }
}

void lcd_scroll_right(char *str) {
    int i, len;
    len = strlen(str);

    for (i = 0; i < len; i++) {
        lcd_command(0x18); // Shift display right
        _delay_ms(500);
    }
}


int main() {
    DDRB &= ~(1 << DDB0) & ~(1 << DDB1); // Set PB0 and PB1 as input
    PORTB |= (1 << PB0) | (1 << PB1);    // Enable pull-up resistors for PB0 and PB1
    DDRD = 0xFF;                          // Set PORTD as output
    DDRC = 0xFF;                          // Set PORTC as output

    lcd_init();

    char message[] = "Scrolling Text";

    while (1) {
        if (!(PINB & (1 << PB0))) {
            // If PB0 is high, scroll text
            lcd_scroll_left(message);
        } else if (!(PINB & (1 << PB1))) {
            // If PB1 is high, scroll text in the opposite direction
            lcd_scroll_right(message);
        } else {

```

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```
// If neither PB0 nor PB1 is high, display static text
lcd_command(0x01); // Clear LCD
lcd_command(0x80); // Set cursor to the beginning of the first line
lcd_string(message);
```

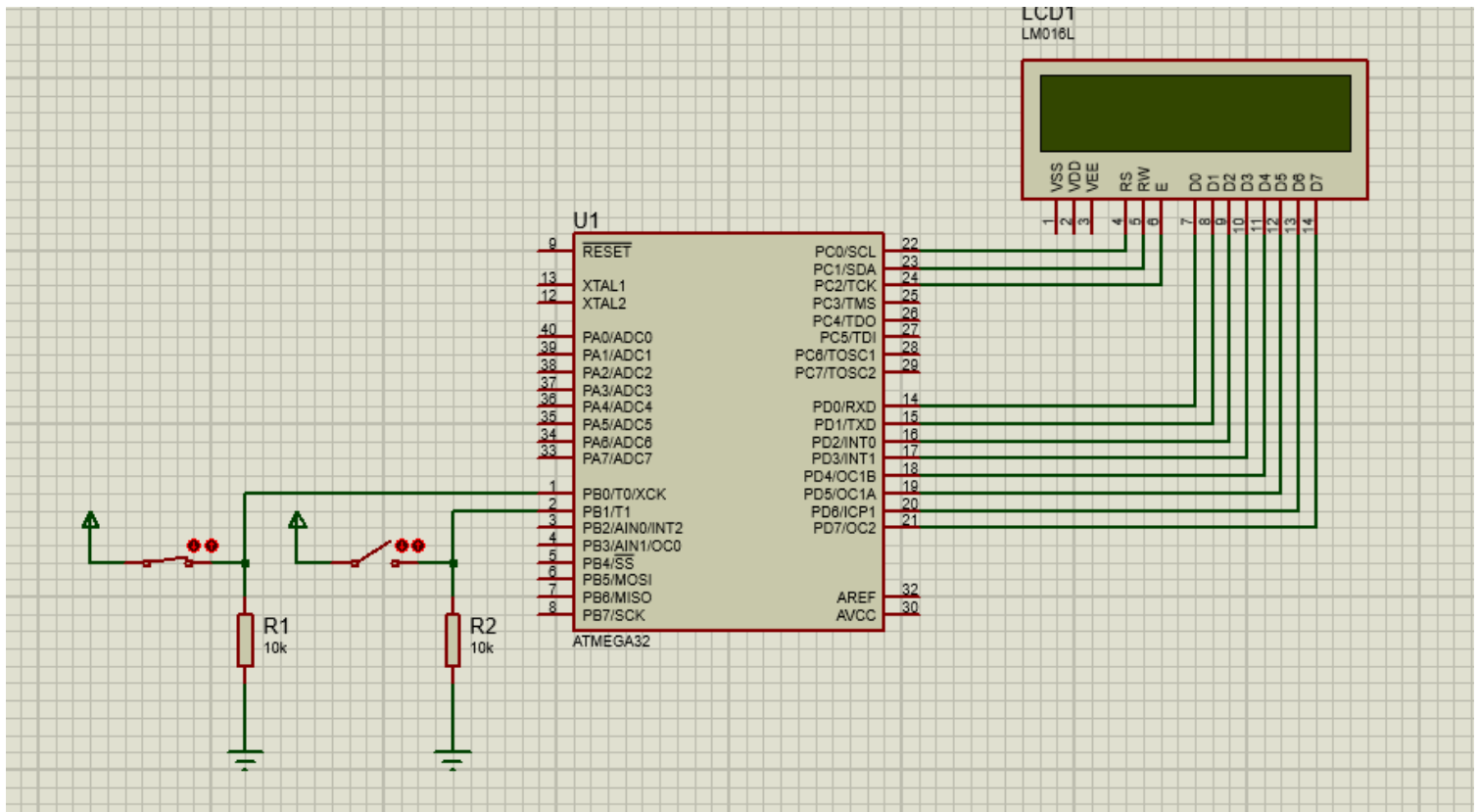
```
}
```


```
}
```

```
return 0;
```

```
}
```

Circuit :-



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Task-5 :- Display the coustom characters of your choice using 16x2 LCD and ATMEGA32.

Code :-

```
#define F_CPU 8000000UL
#include <avr/io.h>
#include <util/delay.h>
#define rs PB2
#define en PB3

void lcd_init();
void dis_cmd(char);
void dis_data(char);
void lcdcmd(char);
void lcddata(char);
void lcd_create_custom_char();
void lcd_display_custom_char();


int main(void)
{
    DDRB = 0xFF;
    lcd_init();

    lcd_create_custom_char();
    lcd_display_custom_char();

    while (1)
    {
        // Your main code here
    }
}

void lcd_init()
{
    dis_cmd(0x02);
    dis_cmd(0x28);
    dis_cmd(0x01);
    dis_cmd(0x0C);
    dis_cmd(0x06);
    dis_cmd(0x80); // Set DDRAM address to 0 (cursor at home position)
}

void dis_cmd(char cmd_value)
```

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```

{
    char cmd_value1;
    cmd_value1 = cmd_value & 0xF0;
    lcdcmd(cmd_value1);

    cmd_value1 = ((cmd_value << 4) & 0xF0);
    lcdcmd(cmd_value1);
}

void dis_data(char data_value)
{
    char data_value1;
    data_value1 = data_value & 0xF0;
    lcddata(data_value1);

    data_value1 = ((data_value << 4) & 0xF0);
    lcddata(data_value1);
}


void lcdcmd(char cmdout)
{
    PORTB = cmdout;
    PORTB &= ~(1 << rs);
    PORTB |= (1 << en);
    _delay_ms(1);
    PORTB &= ~(1 << en);
}

void lcddata(char dataout)
{
    PORTB = dataout;
    PORTB |= (1 << rs);
    PORTB |= (1 << en);
    _delay_ms(1);
    PORTB &= ~(1 << en);
}

void lcd_create_custom_char()
{
    // Set CGRAM address to 0
    dis_cmd(0x40);

    // Define custom character pattern (Heart shape)

```

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```

dis_data(0b000000);
dis_data(0b01010);
dis_data(0b11111);
dis_data(0b11111);
dis_data(0b01110);
dis_data(0b00100);
dis_data(0b000000);
dis_data(0b000000);

```

```

// Set DDRAM address to 0x80 (cursor at home position)

```

```

dis_cmd(0x80);
_delay_ms(100);

```

```

}

```

```

void lcd_display_custom_char()

```

```

{

```

```

// Display the custom character at the beginning of the first line

```

```

dis_data(0); // Display custom character at position (0, 0)

```

```

}

```

Circuit :-

