ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY
KUZEY KIBRIS KAMPUSU • NORTHERN CYPRUS CAMPUS

Department of Electrical Electronics | Computer Engineering

Introduction to Microprocessors | Embedded Systems Development

EEE 347 | CNG 336

Module 4 : FINAL PROJECT

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RFID-Enabled Smart Attendance Verification System Using ATmega128 Microcontroller

Abstract

The instructors of the majority of educational institutions are worried about students' inconsistent attendance. An attendance system based on radio frequency identification (RFID) is one way to solve this issue. RFID cards are one of the radio frequency technology products. Not only attendance systems, RFID program is valid everywhere. Bank accounts, Bank cards, contactless payment, security and such. The project's main aim is to take attendance using personalized RFID cards for each individual. In this way, data can be controlled more efficiently so that attendance system will be more accurate and the incosistent attendance problem will be solved.

Description

I will connect an power suplly to the cpu, cpu will have connection with LCD display & RFID reader. The RFID reader shows the data and forwards to CPU. USART is the communication protocol and RFID part will use this protocol for transmission. LCD display the the taking data process. Our microcontroller will take the data and compare with our code. According to the code, data will be processed on it. After the evaluation, LCD shows the request will happen or not. Then the attendance operation will be done with the help of the RFID card.

INTRODUCTION

RFID Reader is a reading system and a device used to transmit specified frequencies. Rfid reader has the ability to detect RFID Tag. In our simulation, the RFID Reader is actually a Virtual Terminal.

FIGURE 1. RFID READER

RFID Tag is actually an IC chip and carries a unique hexadecimal value. The uniqueness here is actually different for each tag. The tag is made here to act as a key and open a certain lock.

FIGURE 2. RFID TAG

EXPLANATION

We need a few components to realize the RFID system. The main ones are one MCU (atmega128), one RFID reader, RFID card and an LCD screen where we can observe them. First, we determined 2 specific RFID Tags in our code. These are my and my partner's student numbers and we determined them as the 3 letters of our first names. Any code we have not specifically added will respond on our LCD as 'INVALID ATENDANCE'. Since we are doing it using simulation, we are doing it by copying and pasting the codes into the virtual thermal, but in real life it can actually correspond to the same thing as bringing an RFID card closer to the RFID reader.

FLOWCHART

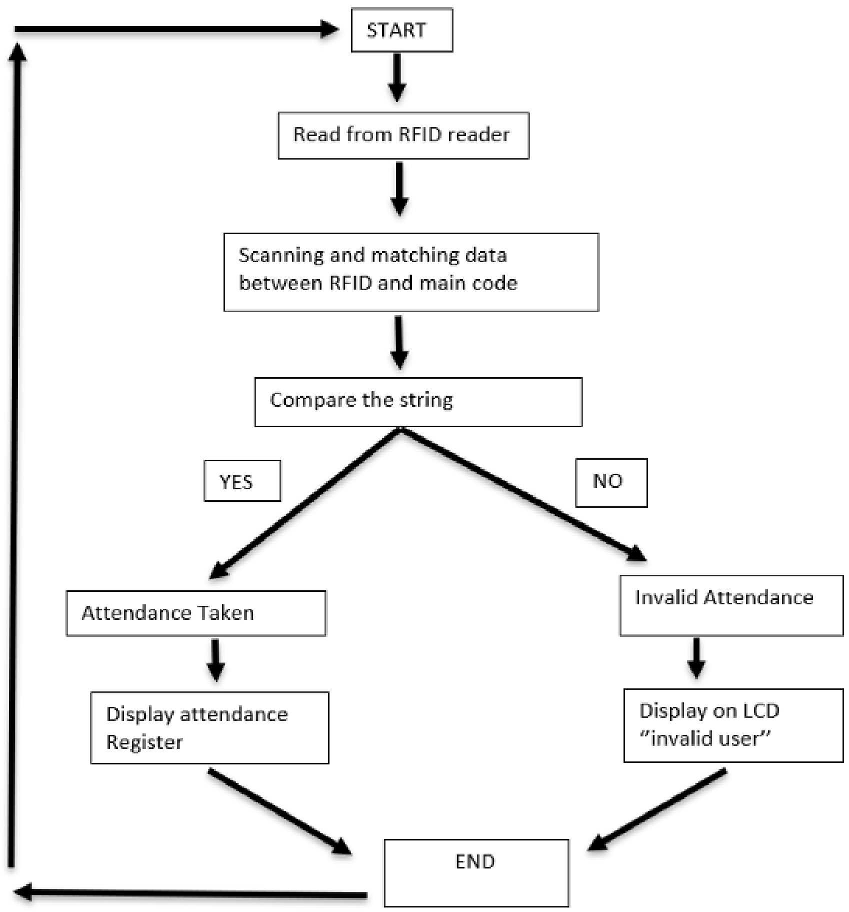


Figure 1.1
Flowchart

C CODE(1)

```
#define F_CPU 16000000
#include <avr/io.h>
#include <util/delay.h>
#include <string.h>
#define BAUD 9600
#define MYUBRR F_CPU/16/BAUD-1
#define LCD_PORT PORTD
#define LCD_DDR DDRD
#define LCD_RS 0
#define LCD_E 1
#define RFID_DATA_LENGTH 10

void USART_Init(unsigned int ubrr) {

	UBRR0H = (unsigned char)(ubrr>>8);
	UBRR0L = (unsigned char)ubrr;
	UCSR0B = (1<<RXEN0)|(1<<TXEN0);
	UCSR0C = (3<<UCSZ00);
}
void USART_Transmit(unsigned char data) {
	while (!(UCSR0A & (1<<UDRE0)));
	UDR0 = data;
}
unsigned char USART_Receive(void) {
	while (!(UCSR0A & (1<<RXC0)));
	return UDR0;
}
void lcd_command(unsigned char cmd) {

	LCD_PORT &= ~(1 << LCD_RS);
	LCD_PORT = (LCD_PORT & 0x0F) | (cmd & 0xF0);
	LCD_PORT |= (1 << LCD_E);
	_delay_ms(1);
	LCD_PORT &= ~(1 << LCD_E);
	_delay_ms(1);
	LCD_PORT = (LCD_PORT & 0x0F) | (cmd << 4);
	LCD_PORT |= (1 << LCD_E);
	_delay_ms(1);
	LCD_PORT &= ~(1 << LCD_E);
	_delay_ms(1);
}
void lcd_data(unsigned char data) {

	LCD_PORT |= (1 << LCD_RS);
	LCD_PORT = (LCD_PORT & 0x0F) | (data & 0xF0);
	LCD_PORT |= (1 << LCD_E);
	_delay_ms(1);
	LCD_PORT &= ~(1 << LCD_E);
	_delay_ms(1);
	LCD_PORT = (LCD_PORT & 0x0F) | (data << 4);
	LCD_PORT |= (1 << LCD_E);
	_delay_ms(1);
	LCD_PORT &= ~(1 << LCD_E);
	_delay_ms(1);
}
```

C CODE (2 REST)

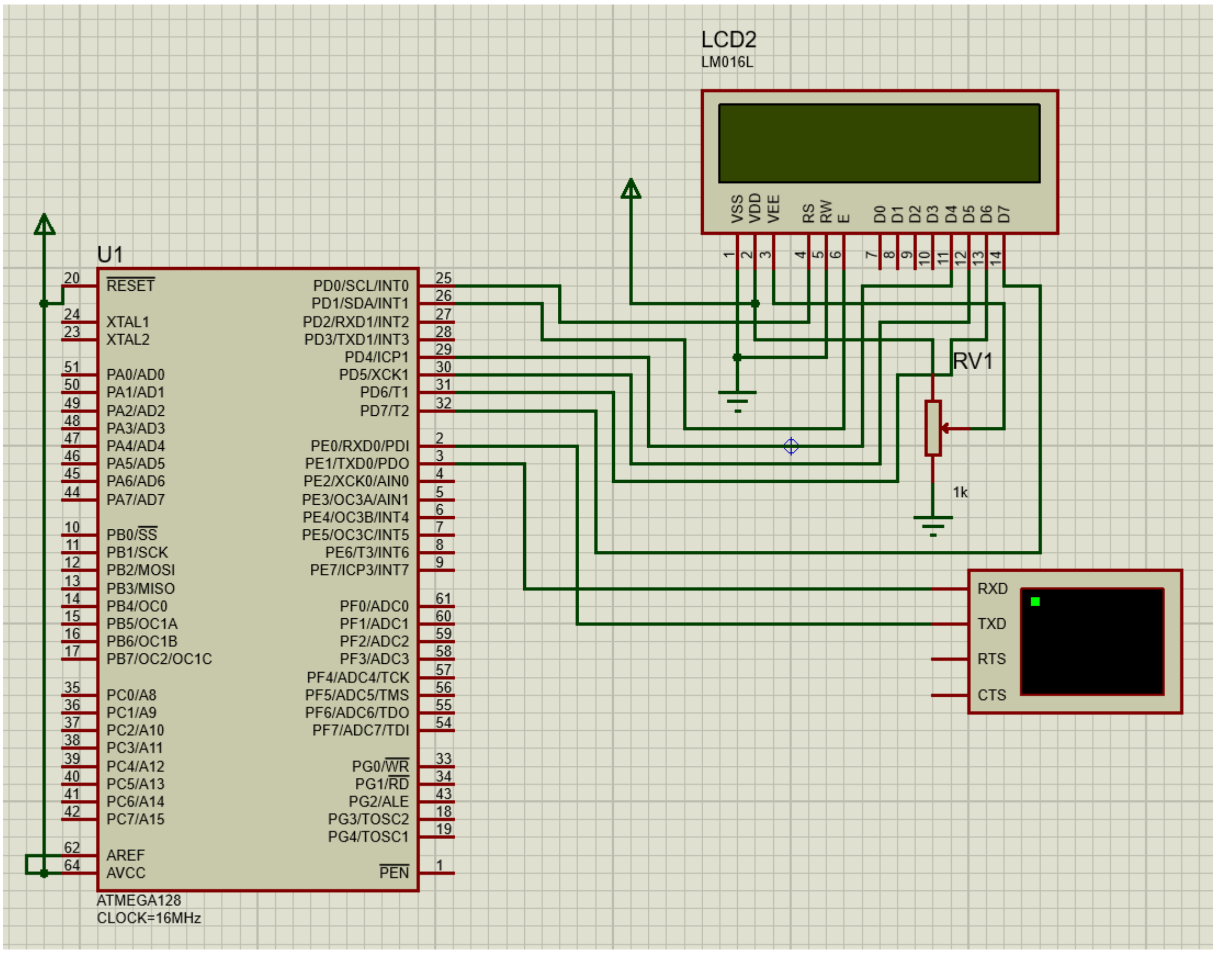
```
void lcd_init() {
	LCD_DDR |= (1 << LCD_RS) | (1 << LCD_E) | (1 << 4) | (1 << 5) | (1 << 6) | (1 <<
7);
	_delay_ms(15);
	lcd_command(0x02);
	lcd_command(0x28);
	lcd_command(0x0C);
	lcd_command(0x06);
	lcd_command(0x01);
}

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

int main(void) {
	lcd_init();
	USART_Init(MYUBRR);
	lcd_print("SCAN RFID CARD");

	while(1) {
		char rfid_data[RFID_DATA_LENGTH + 1];
		memset(rfid_data, 0, sizeof(rfid_data));

		if (UCSR0A & (1<<RXC0)) {

			for (int i = 0; i < RFID_DATA_LENGTH; i++) {
				rfid_data[i] = USART_Receive();

			}
			lcd_command(0x01);
			rfid_data[RFID_DATA_LENGTH] = '\0';



			if (strcmp(rfid_data, "2527109BAR") == 0 ||
strcmp(rfid_data,"2315943BER") == 0){
				lcd_print("ATTENDANCE TAKEN");
				} else {
				lcd_print("INVALID ATENDANCE");
			}

			memset(rfid_data, 0, sizeof(rfid_data));
			_delay_ms(2000);
		}
	}
	return 0;
}
```

COMMENT

First, we defined our library and port. Started with usart initialization; this function provides communication between components in our project. In the usart transmit section, we read the RFID and send the data, and in the receive section, I receive the data. I wrote our lcd commands in the lcd command section, I control the lcd with these commands. The steps I take until reach the main function show the journey of the data and the commands of the LCD in our project. I used loops in our main function to take the bits of the data one by one and compare them with the data in our code. I used strcmp to make this comparison. Thanks to this function, our data is compared and if the difference is 0, it prints. With the clear command I delete the previous message and see the new message.

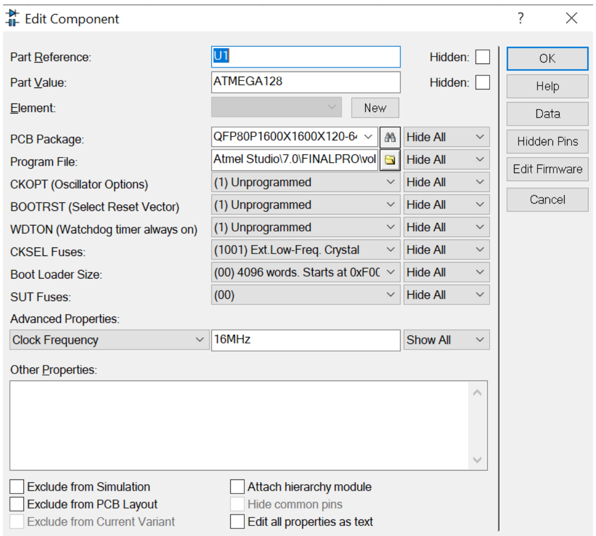
SIMULATIONS

INITIAL SIMULATION

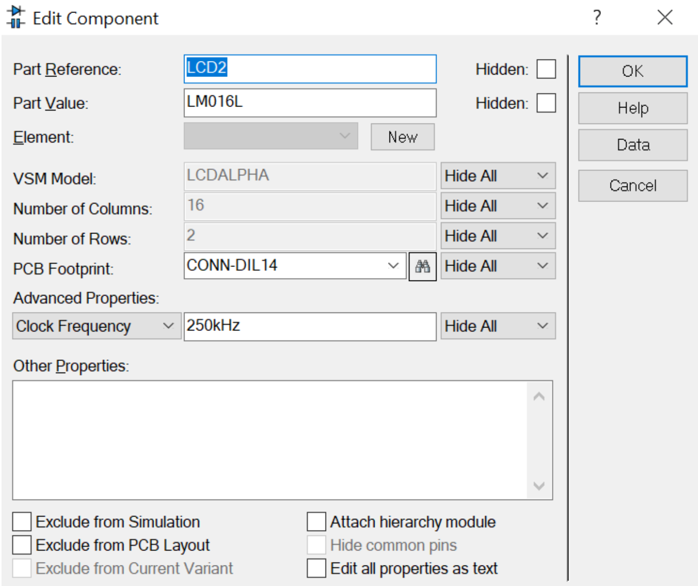


SPECIFICATIONS

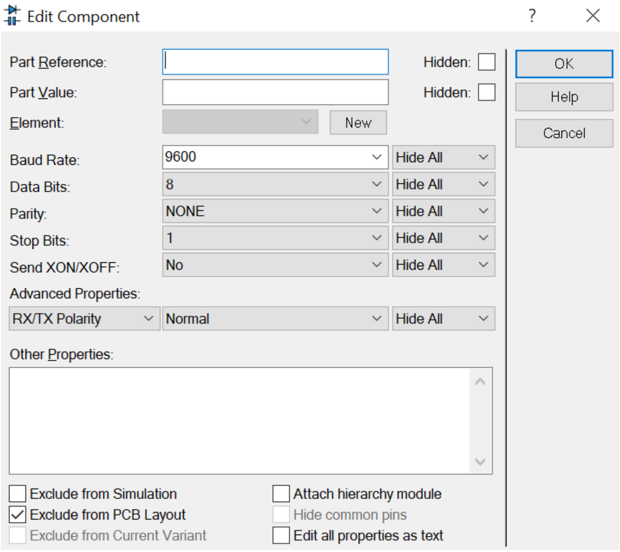
ATMEGA 128 CHIP SPECIFICATIONS



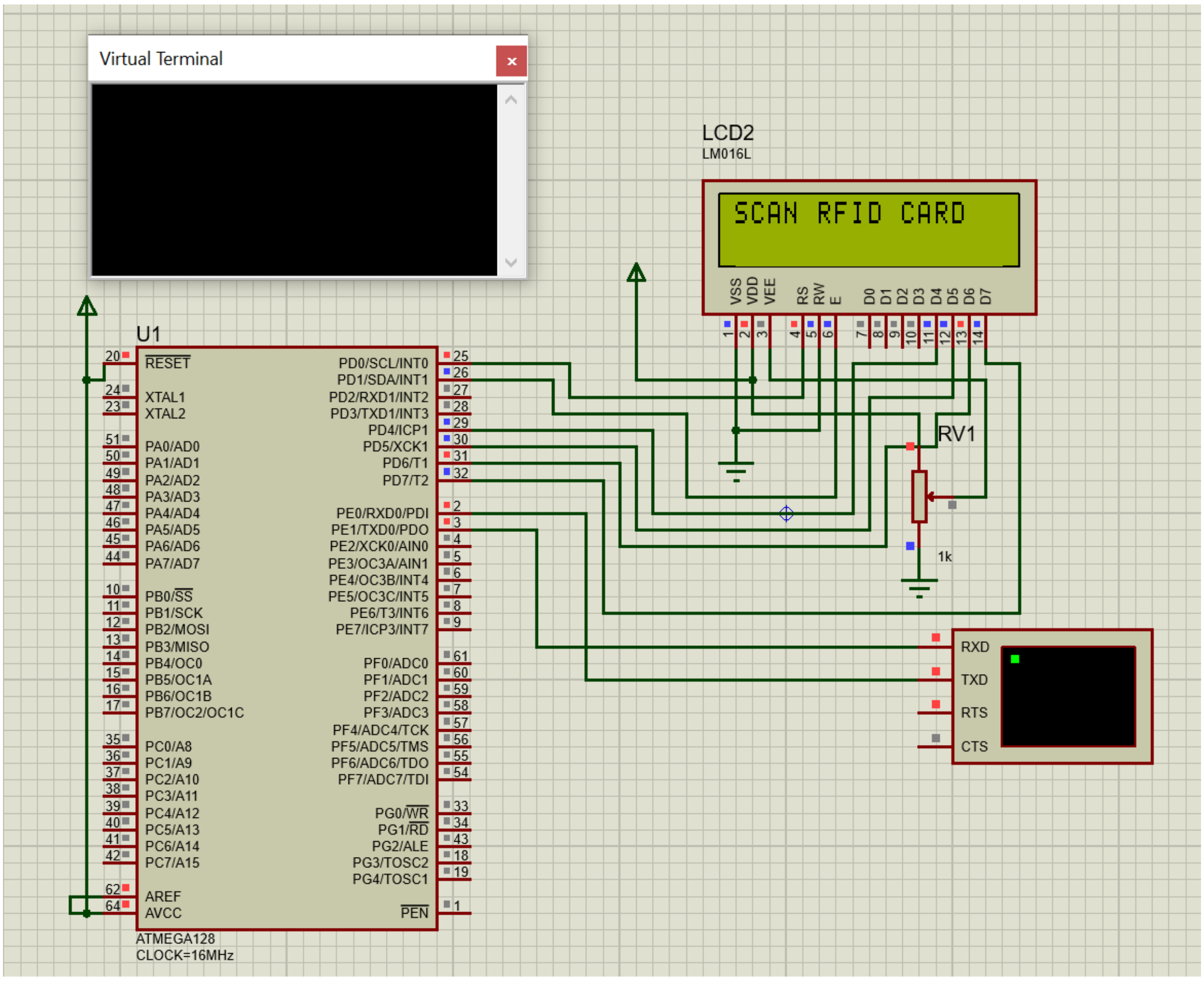
LCD SPECIFICATIONS



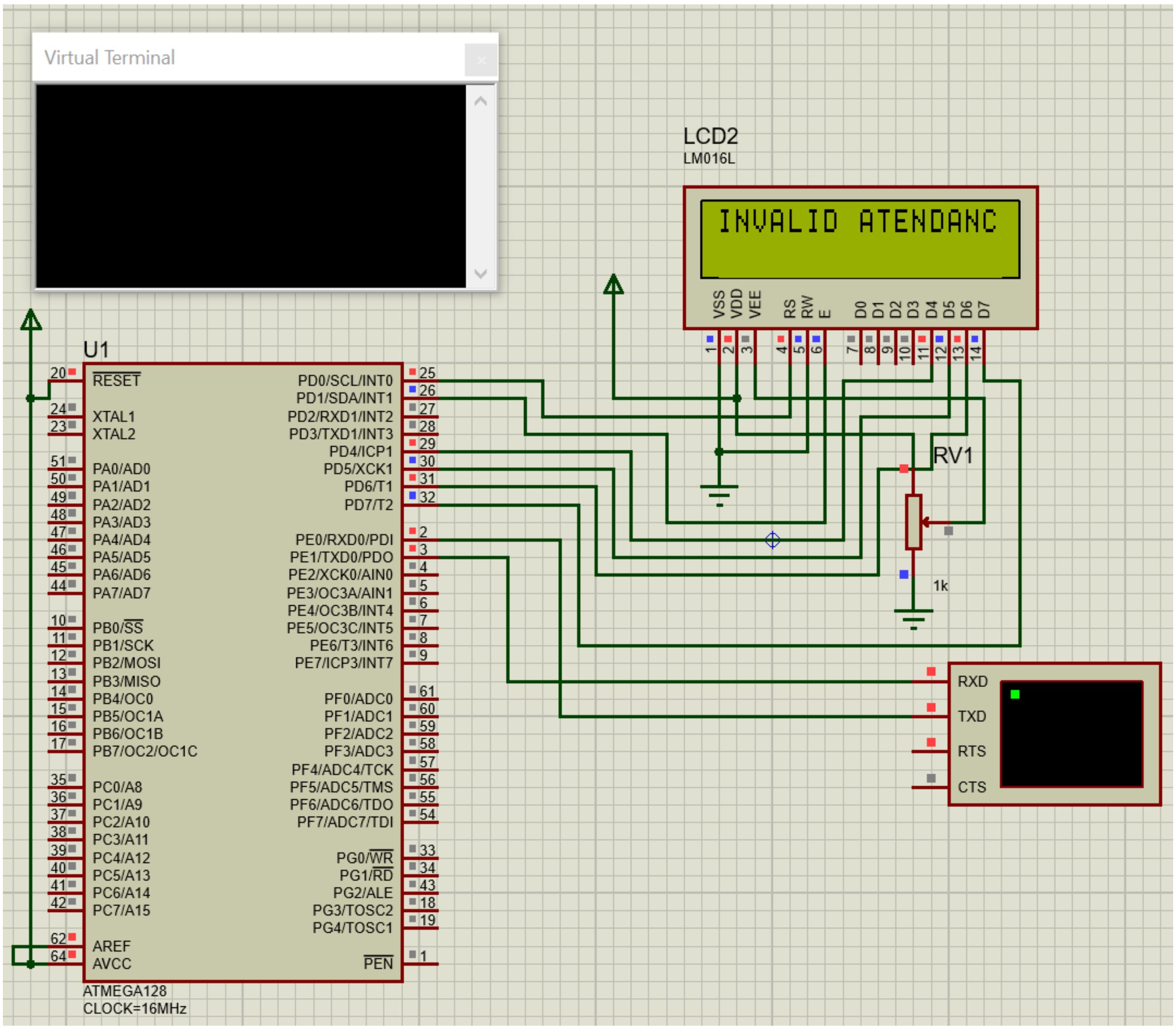
VIRTUAL TERMINAL SPECIFICATIONS



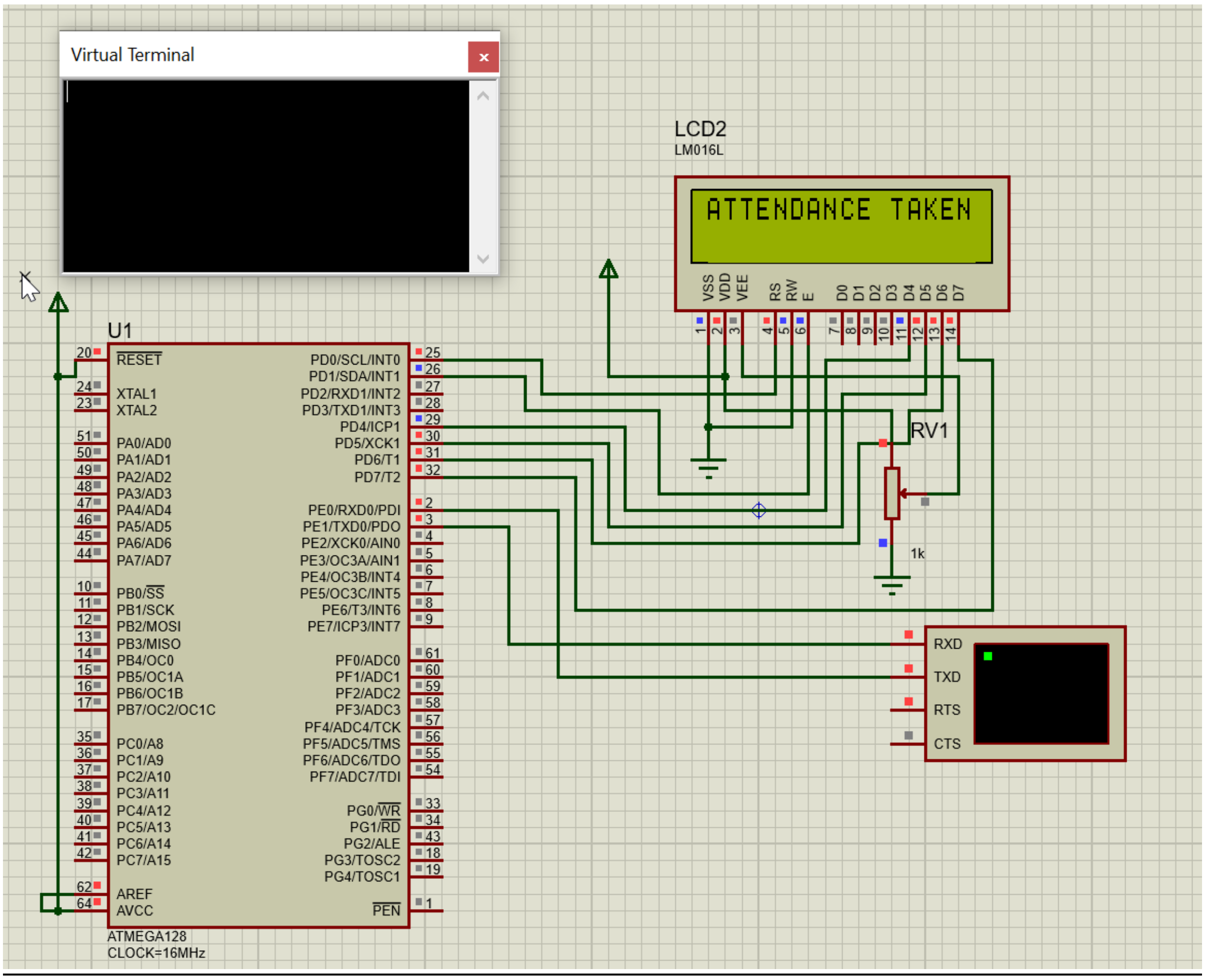
INITIAL SIMULATION WHEN WE RUN IT :



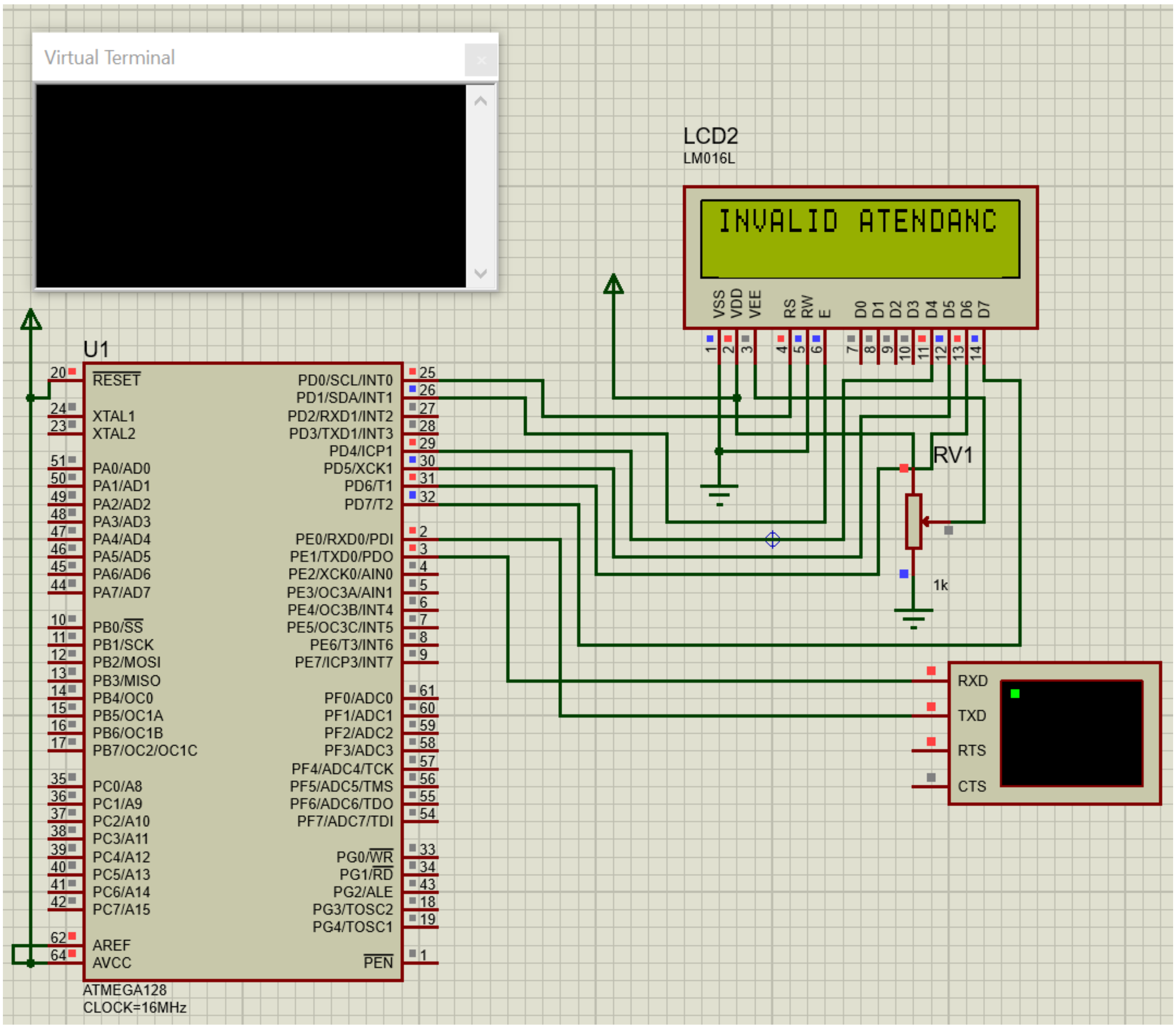
WHEN WE PUT ANY 10 DIGIT RFID TAG THAT HAS BEEN NOT REGISTERED INTO SYSTEM



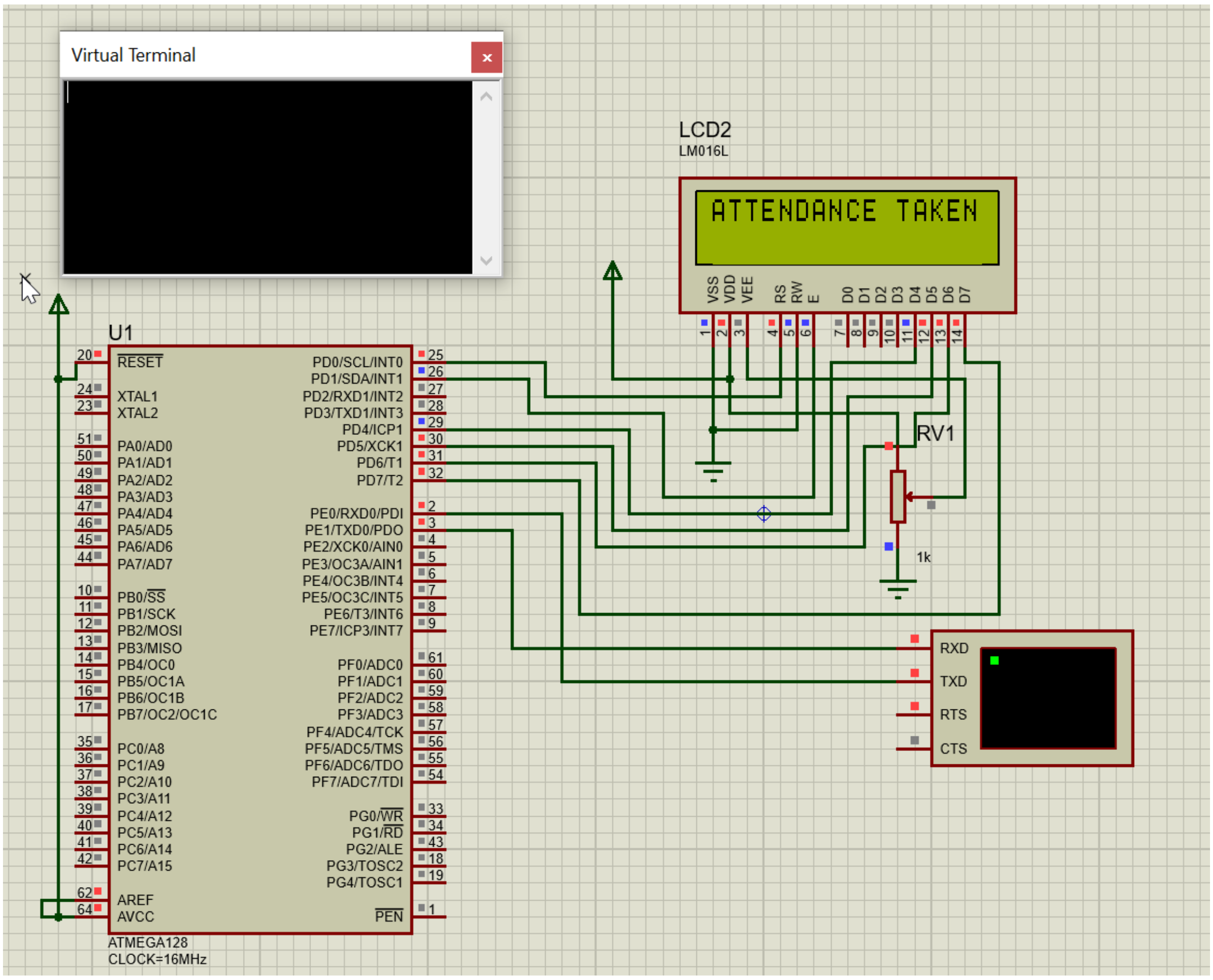
WHEN WE PUT "2527109BAR " TAG :



Again, when any tag other than the tag I specified is tried:



TRYING THE OTHER SPECIFIED TAG, WHICH IS "2315943BER" :



Conclusion / Result

The RFID-Based Attendance System developed in this project successfully demonstrates a reliable, automated, and user-friendly method for recording attendance using unique RFID tags. By integrating an ATmega128 microcontroller with an RFID reader, USART communication, and an LCD display, the system is able to receive tag data, process it in real time, and validate attendance with high accuracy. During testing and simulation, only the predefined and authorized RFID identifiers were accepted, while all other inputs triggered an "INVALID ATTENDANCE" response, confirming that the system can distinguish registered users effectively. The LCD interface provided clear and immediate visual feedback, making the process intuitive for end-users. Overall, the project proves that RFID technology can significantly improve the efficiency, accuracy, and security of attendance tracking systems, reducing manual errors and offering a scalable solution that can be easily adapted for educational institutions, workplaces, or access-control applications. This implementation lays a strong foundation for future enhancements such as database connectivity, timestamp logging, or wireless communication modules.