Shiraz University

Project Report

Micro Processor

Prepared for

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Introduction

In this project, we should design a simple CPS with "Atmega32". This project, contains three parts: 1. Security 2. Temperature control 3. Lightning control

The challenge in the project is to get all sensors and input devices with master atemga32 and implement all our functions and all the output devices in the salve atmega32. So, as I mentioned indirectly before we are using "SPI" user interface for data communication between the two Atmega32 devices.

Part1 (Security):

In this part, I handle following features as mentioned in the project:

- Password Checking with Hardcoded password
- Submitting the password with '*' key
- Deleting with '#' key
- Toggling password (*I used int. button for handling this part*)
- Display appropriate message after submitting on LCD
- **Bonus Part:** Password Encryption

For handling this part, we need to work with keypad. As the keypad doesn't have any voltage itself, so, we need to send some voltage from the columns and with some loop check for the pressed row and receive it in the atemga32. Then we should transmit the data to the slave. There, we should save the entered password. I

handle this, with a buffer and I do the needed works on it to implement the mentioned functionalities.

For the encryption before sending the data, I "XOR" the data with an "Encryption Key". And, then in the slave I decrypt them with that key.

I implement the data representing with the LCD(LM018).

Note: The other parts of the project must have work after the true password submitted.

Part2 (Temperature control):

The second part, has two phases: reading from the sensor (LM35) – appropriate action in the slave side

Phase A)

- Set ADC register and other appropriate registers
- Read analog value and convert it to the temperature
- Set registers needed for transmitting
- Transmit the data

Phase B)

- Set register for receiving
- Receive the data
- Turn on the LEDs and motor based on what mentioned in the doc

Challenge: For this part I only used Timer Counter Zero. But I designed and used a decoder with "AND" and "NOT" gates for decoding the motors and each duty cycle.

Part3 (Lightning control):

Working with LDR sensor and sending the scaled value of 100 to the slave. Then, set the duty cycle as mentioned in the doc. And, I used Timer Counter 2 for creating the square waves pulses.

Data sending trick:

As you know the SPDR we use for data communications is 8-bit register. So, we can cover numbers from 0 to 255. So how can I understand if the value "2" is from the LDR sensor, LM35 Sensor or it is from the keypad?

I divide the number ranges to handle this problem:

- Keypad number range: 0 – 30
- LM35 number range: 40 – 140
- LDR number range: 150 – 250

In hence, before transmit I add some value based on which data is that. And, in the receive data I subtract the received data with that value.

LDR challenge:

LDR is a sensor that the growth of that is not linear.

Time for one cycling	Duty Cycle	Range in percent	Range on the LDR
9 sec	25	[377, 1000]	$75 < x < 100$
5 sec	50	[156, 376]	$50 < x < 75$
3 – 4 sec	75	[52, 155]	$25 < x < 50$
2 – 3 sec	100	[0.1, 51]	$0 < x < 25$

Bonus (Speaker):

Raising a sound when the temperature is very high. (Greater than 55)

I used "Buzzer" device for this part.

Conclusion:

The implemented smart home system successfully addresses the objectives of security, temperature control, and lighting control. It showcases the utilization of embedded systems and cyber-physical systems principles, employing microcontrollers to sense the environment, process data, and take appropriate actions. The system demonstrates the potential of smart homes and provides a foundation for further enhancements and expansions.

For more detail you can check the code. All the steps are commented.

The project files with doc are also available on my GitHub.

Thanks for your time

Ali Maher