Department of Computer Engineering
Digital Hardware Systems
CpE 3104 - Microprocessors

Progress Report #1

Group Name:	Intelligent Power Control in Air Conditioning with 8086 Logic	**Date Submitted:**	December 4, 2023
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I. Introduction

Efficient energy consumption is a paramount concern in today's world, and one area where optimization can significantly impact power usage is air conditioning units. Our project aims to enhance the power efficiency of air conditioning systems by integrating our proposed technological solution. Through the integration of the 8086 microprocessor and a suite of carefully selected components, our solution seeks to intelligently regulate temperature settings while incorporating a scheduled activation feature. This innovation not only addresses the issue of the potential overworking of air conditioning units but also contributes to a more sustainable and cost-effective use of energy.

II. Background

Modern air conditioning units, while essential for maintaining indoor comfort, often operate without a fine-tuned consideration for power consumption. This can lead to unnecessary energy usage and increased utility costs. Furthermore, some systems lack the capability of supporting multiple thermostats and varying AC models in terms of monitoring voltage at an AC's minimum voltage power source. Our project recognizes this challenge and proposes a solution that leverages the capabilities of the 8086 microprocessor to optimize the operation of air conditioning units.

III. Proposed Solution/Changes

The main idea behind our proposed solution is to improve the power efficiency of air conditioning units. We achieve this by directly embedding the desired temperature parameters into the 8086 assembly code, which helps the unit maintain the preset temperature more efficiently. Moreover, our system comes with a scheduling feature that enables the unit to turn on at specific intervals, like every 8 hours, which helps to optimize power consumption during periods of lower demand. This

comprehensive approach not only enhances the overall efficiency of air conditioning units but also promotes a more sustainable and eco-friendly energy usage model. The system is also able to support varying types of AC systems such and supports three thermostats. It is capable of reading voltage inputs via the ADC to decide whether or not to turn off the air conditioning unit. If the minimum voltage requirement is satisfied, then the 8086 will allow the air conditioning unit to turn back on.

IV. System Overview

The Smart Thermostat project has made significant progress in implementing core features. The integration of various components along with scheduled aircon activation and temperature monitoring.

The overview of the system is shown in the following figure:

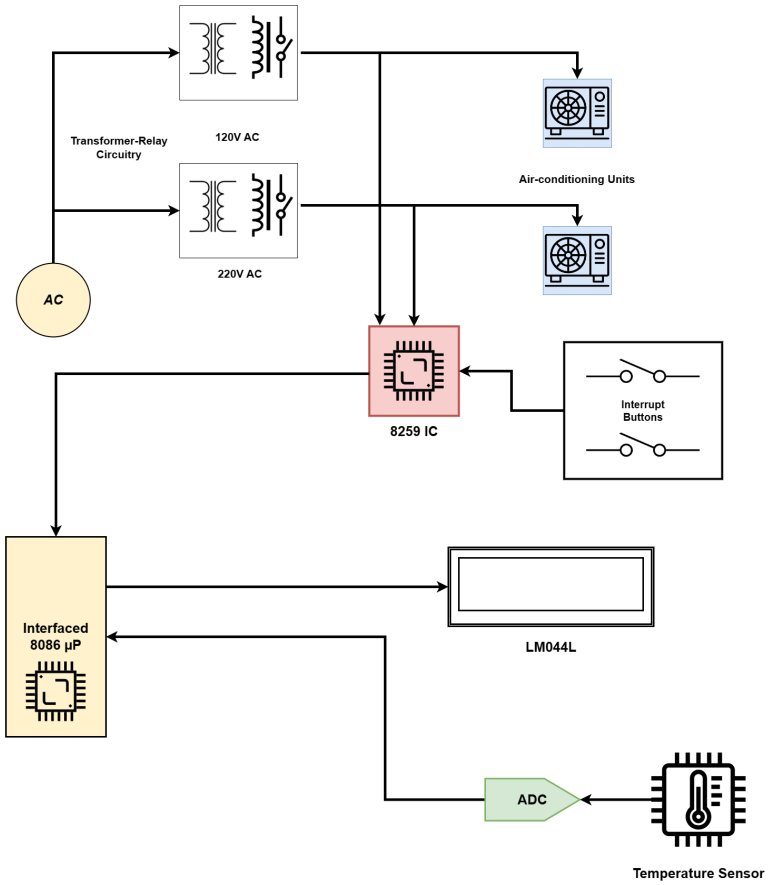

Figure 1.0 - System Diagram

For testing purposes, the air conditioning units will be supplied with different levels of AC voltages(120V & 220V AC). The output of the transformer-relay circuitry will be fed to a comparator circuit, and if the reference voltage of the comparator is not equal to the output of the transformer-relay circuitry, the 8259 IC will trigger an interrupt that will halt the operations of the air conditioning units. The interrupt buttons will toggle the air conditioner units on and off. The temperature sensor will be fed through an analog-to-digital converter, and depending on the readings from the sensor-ADC input, the 8086 microprocessor will adjust the temperatures on the air conditioning units. The LM044L will serve as the interface between the user and the system.

V. Components Used

- 1N4007 Silicon Diode
- Transformer 2P2S
- Polar Capacitors
- LM324 Operational Amplifier
- BC547 Transistor
- 2N2222 Transistor
- Relay
- Lamp 220V
- Lamp 200V
- 8255 PPI
- 8253 PIT
- 8259 PIC
- ADC0808
- LM45 Temperature Sensor
- LCD

V. Features

- Timer Display
- 2x Air Conditioners (220v & 120v)
- Toggle Air Conditioners (On or Off)
- Faulty Voltage Detection
- Temperature Reader
- Air Conditioner Scheduler

VI. Hardware Design

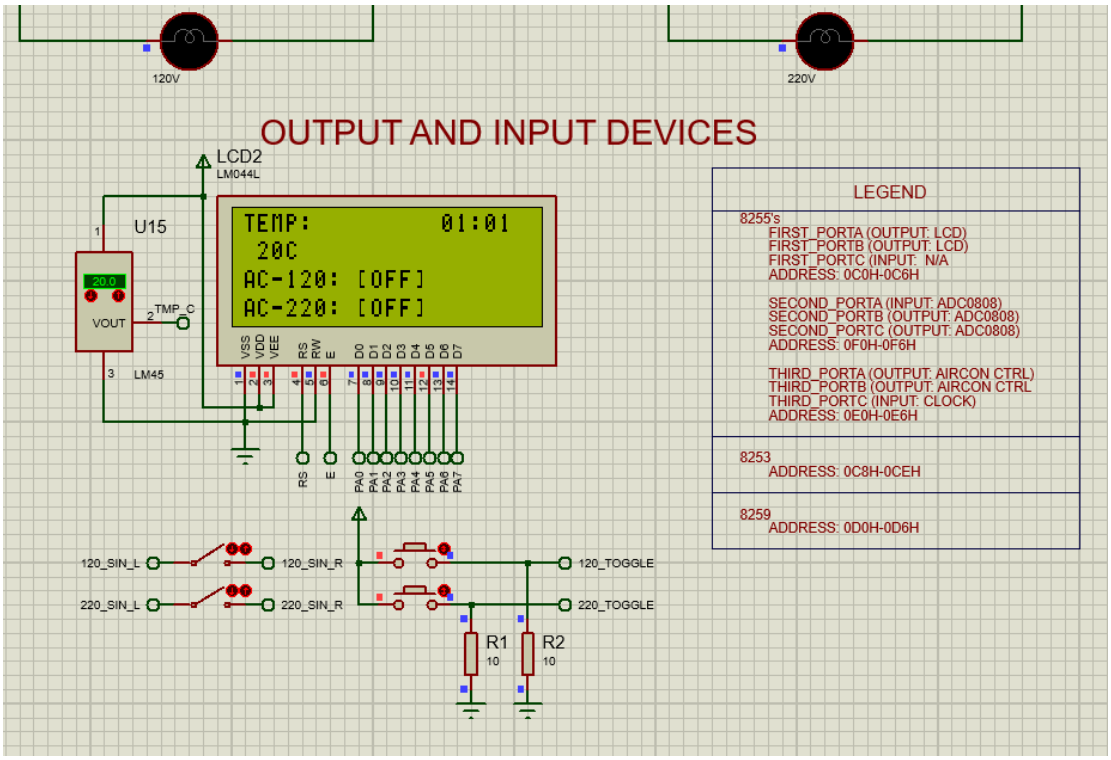

Figure 2.0 - Input and Output

To achieve the objectives of this project, we have divided the hardware design into four parts, consisting of the I/O devices, the project implementation, and the simulations of the air conditioning units and their power supplies. In **Figure 2.0**, we see the overall output of the project, which features an LCD that shows the status of the AC units and two push buttons and switches for the input. The switches allow the user to give power to the simulated AC units while the push buttons toggle the units on/off.

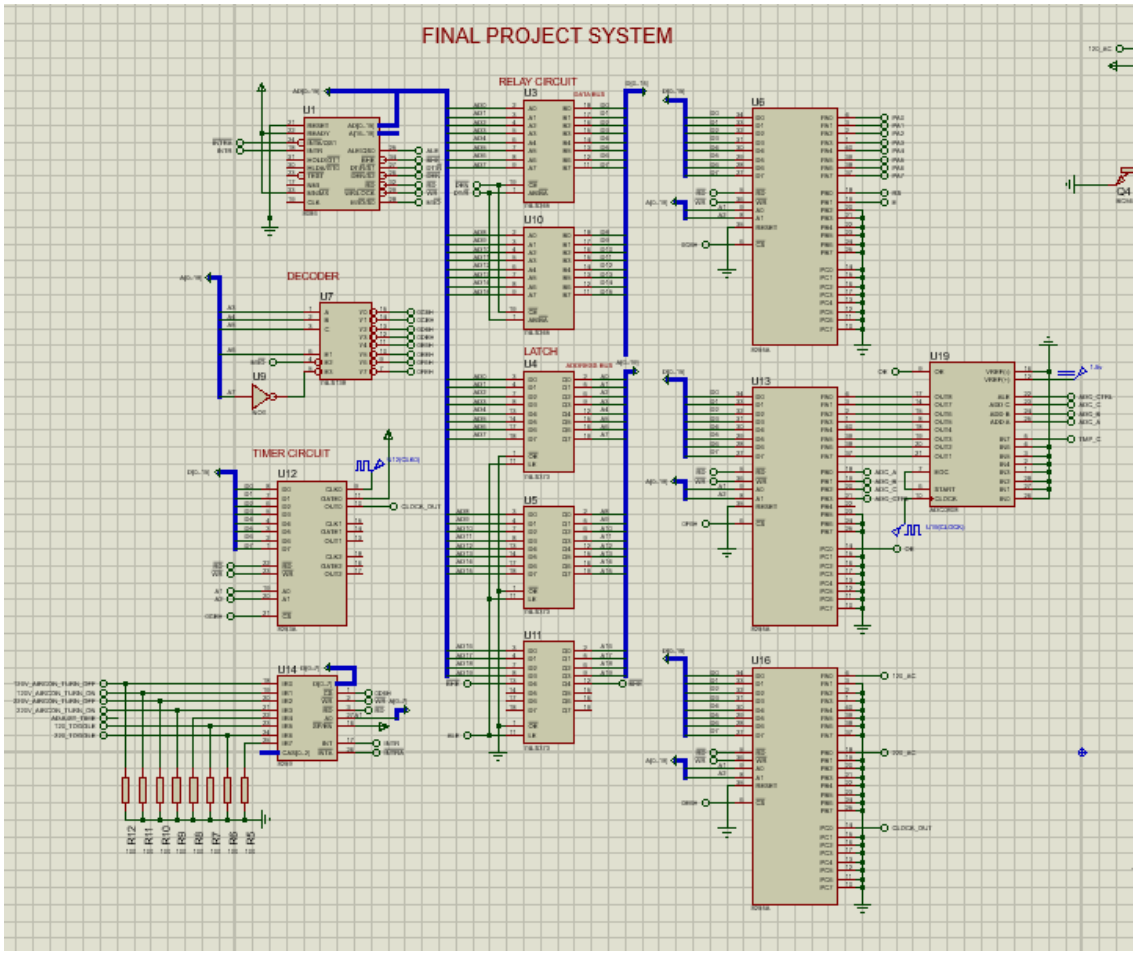

Figure 3.0 - Project Implementation

Figure 3.0 features the implementation of the project. It has all the components related to the 8086. The 8259 uses six edge-triggered interrupts, which helps accurately detect faulty voltage.

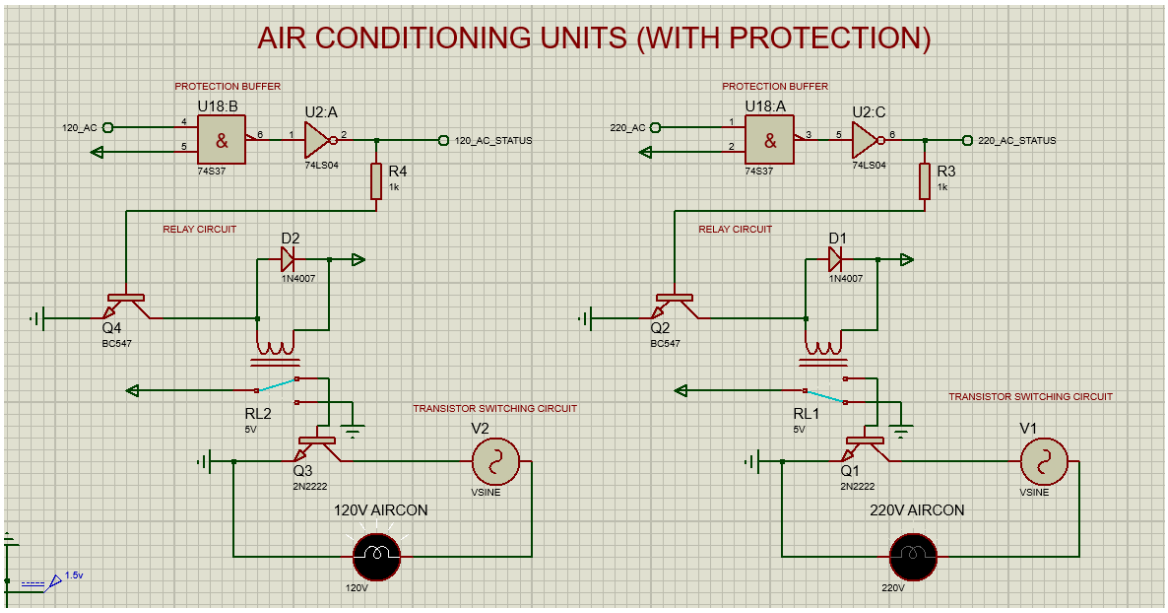

Figure 4.0 - Simulation of Air Conditioning Units

Figure 4.0 features the circuit for the simulation of our AC units. They serve as the testing components for the project's logic.

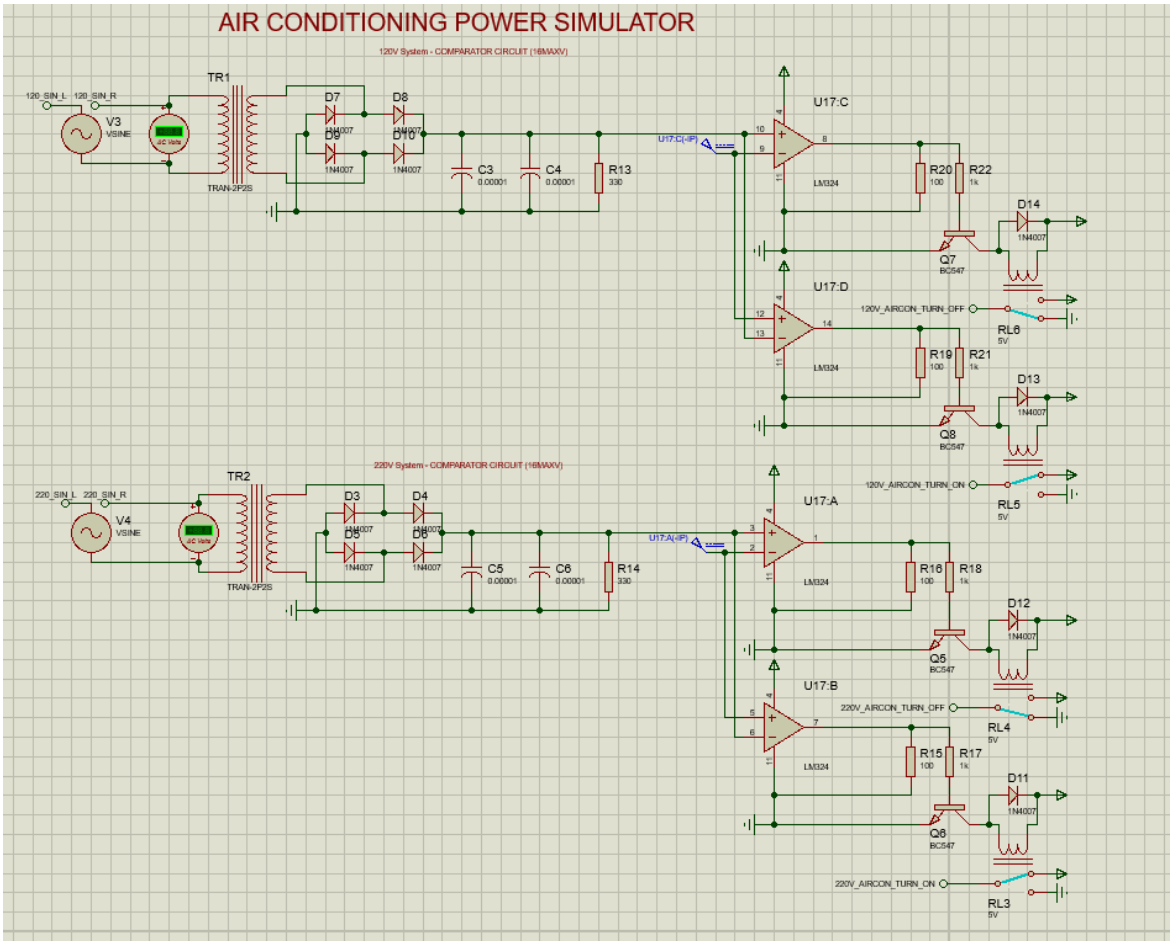

Figure 5.0 - Simulation of Power Sockets

Figure 5.0 features the power supplies for our AC units. We had to step down the voltage to adjust to the LM324 to avoid shorting it.

VII. Limitations

- As seen in **Figure 4.0**, the lamps (simulating the aircons) are driven with a BJT transistor. In an actual scenario, an inverter with relay circuitry is necessary to drive the circuit safely. However, due to proteus limitations, this inverter relay circuit was not achievable.
- The Proteus SPICE setting has a negative effect on the seamless simulation.
- ADC0808 cannot endure voltage inputs greater than 6V, so a circuitry of comparators was necessary for faulty voltage detection.
- LM324 Operational Amplifier's maximum operational voltage is around 36V. Due to this, we have to step down the AC voltage and ratio the voltages into comparators.

VIII. Conclusion

In conclusion, the project strives to offer a practical and effective solution for optimizing the power efficiency of air conditioning units. Through the integration of the 8086 microprocessor and carefully selected components, it directly addresses the challenge of inefficient energy consumption in air conditioning systems. By incorporating precise temperature regulation and a scheduling feature, our solution not only enhances overall efficiency but also contributes to sustainable and cost-effective energy usage.

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