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Alarm and Switching Controller for Air Condition Units

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ABSTRACT

Alarm and Switching Controller for Air Condition Units project aims to controlling the air condition units by arrangement the time of running between two units or more, above that the electronic system can detect three alarm situations (fire, fluid and door), all that features make this project so useful to use in a different applications of Telecommunications and Food Industrial.

Keywords— Temperature Controller unit; microcontroller; Driver unit; Indicator unit; Power supply unit.

I. INTRODUCTION

Telecommunication towers are used for communication purposes among the people. All the wireless communication, mobile networking, radio broadcasting and television antennas are connected via these towers. So there is a huge need to protect the devices inside the power transmission station (PTS) [1-3]. The electronic devices inside the (PTS) working continuously, which causes temperature rises, so the electronic devices inside the (PTS) must be cooling at a certain limited temperature to be working efficiently and must be protected against the liquids leakage ,opening door and fire. So this electronic system designs to control the cooling units inside the (PTS) to operate it within a certain temperature and discover the cases of fires and fluid leaks to protect the (PTS) and cooling units [4, 5].

II. RELATED STUDY

In the past, the power transmission station used classic systems to cool internal devices, where it relies on relays, mechanical timers and analogue heat sensors, that to regulate the internal cooling processes to ensure about their continuity. These classic systems have a number of problems: Frequent breakdowns and the difficulty of conducting maintenance operations. The electronic system takes a large area and the size of the system increases as it becomes more complex. High cost and the difficulty of making modifications or additions to the system.

The advancement of the electronic systems and the wide use in various applications of life, the need increase to design this system using electronic circuits for several reasons [6]; Characterized by high accuracy in the results and calculations and their feasibility of reprogramming, which means the addition or modification of the functions of the system, cheap price, small size, and easy to maintenance.

III. METHODOLOGY

The main steps to design the Alarm and Switching Controller for Air Condition Units comes in 8 steps as follow: Collecting all data concern about the main functions which the system supposed to do it. Start design the flow chart for the electronic system, where specify all the entrances and exits of the electronic system and the data flow. Start programming all the functions and repeat the process of testing and modification of the program until the desired output is reached. Accumulating the software as the last step in programing code, then burn it in the Microcontroller using programmer to retest it on the Evaluate Kit. Design electronic circuit. Using software simulator and use it to test the hardware and software. Design the Printed Circuit Board (PCB) for the electronic system. Complete the Prototype Design Through assembling the electronic card and outer cover.

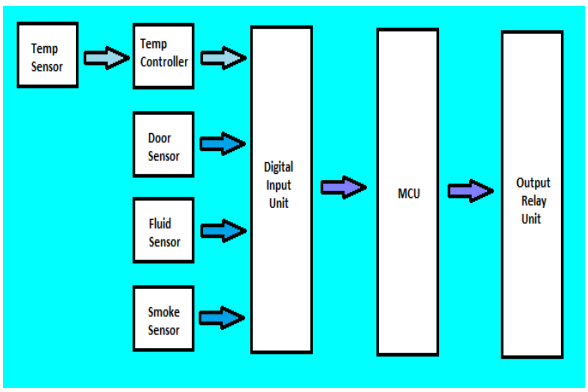

Figure 1. Flow chart of the Alarm and Switching Controller

IV. REQUIREMENTS FOR DESIGN ALARM AND SWITCHING CONTROLLER FOR AIR CONDITION UNITS:

A. *Temperature Controller Unit:*

This is device used to measuring the temperature using different types of Thermocouple; it has a display unit and four buttons to set the internal parameter [7].

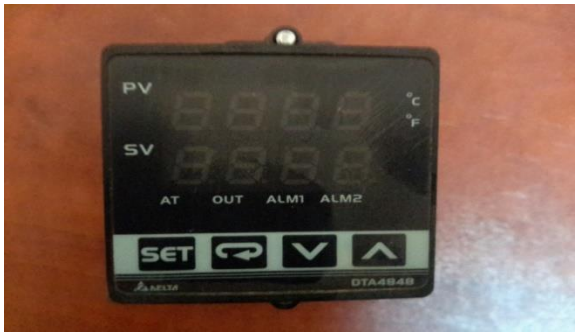

Figure 2. DELTA Temperature Controller Devices

B. *Microcontrollers (ATMEGA32):*

The microcontroller is a small controller on a single integrated circuit. A Microcontroller contains one or more CPUs (Processor Cores) along with memory and programmable Input/output Peripherals. It can be neither used to program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for Embedded Applications.

Uses of a Microcontroller:

- Automobile engine control system.
- Automatic medical devices.
- Remote controlled devices.
- Various Embedded systems.

ATmega32 is an 8-bit high-performance microcontroller of Atmel's Mega AVR family. Atmega32 is based on enhanced RISC (Reduced Instruction Set Computing) Architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. It consumes low power and gives high performance.

A JTAG interface for boundary-scan and on-chip debugging/ programming, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a universal serial interface (USI) with start condition detector, an 8-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, SPI serial port, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

Figure 3. Microcontroller (ATMEGA32)

C. *DRIVER UNIT*

It is an electronic component or electronic circuit intermediary responsible by controlling another element or electronic circuit, depending on the received electronic control signal comes from the first circuit.

This electronic system contain of two kinds of drivers:

- Relays: A relay is a device which is used to provide connection between two or more points or device in response to the input signal applied.
- ULN2003A IC DRIVER: The ULN2003A is an array of seven NPN Darlington transistors capable of 500 mA, 50 V outputs.

D. *indicator UNIT*

This unit is responsible for the displaying of the current state of the electronic system making it easier to detect faults within power transition station room and that reduce the maintenance time.

The most common used electronic component for displaying the internal status is LEDs.

A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it. The light is not particularly bright, but in most LEDs it is monochromatic, occurring at a single wavelength. The output from an LED can range from red (at a wavelength of approximately 700 nanometers) to blue-violet (about 400 nanometers)

E. *power supply unit*

This unit is responsible for supplying the electronic system with the electrical power needed to start work. This is system need to be supply by 12V DC to operate the drivers, after that reduce the voltage to 5V DC to operate the microcontroller and the rest of electronic components. The main power is 220V AC so to reduce it to 12V DC must be used transformer 220vac to 12v ac [5], after that use the bridge to rectifier the sign wave and then use Capacitors 100uf to filtering the rebels.

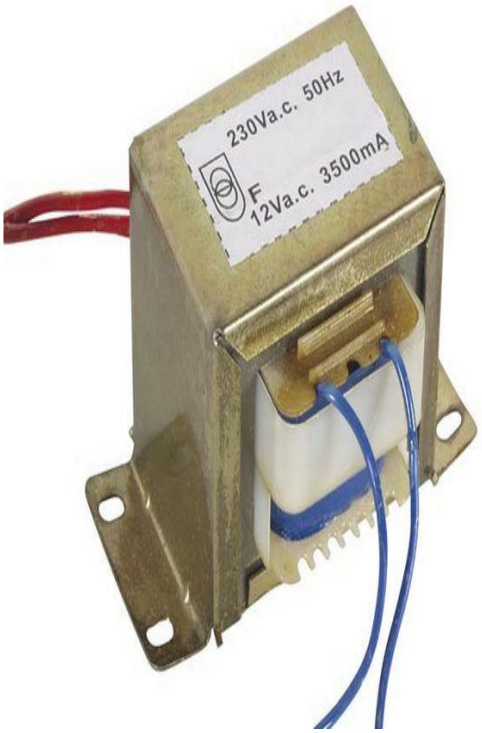

Figure 4. Transformer 220V AC to 12V AC

V. Result and Discussion

This system designed to offer two modes manual and auto mode:

F. Manual mode

In this mode the operator can control the air conditions (ON/OFF) through the Push Button for each one.

G. Auto mode

In this mode the air conditions operation comes in three cases depend on the temperature degree of the (PTS) room:

- Temperature degree in between the desired target, in this case the system operates each of the two air condition alternately for 6 hours.
- Temperature degree up of the desired target, in this case the system shutting down each of the two air condition.
- Temperature degree under of the desired target, in this case the system operates each of the two air condition at the same time.

The sensors can read the states of the door, smock and the fluid leakage and send the signal directly to the microcontroller to process then send the output result through the free contact of relays to another electronic communication unit.

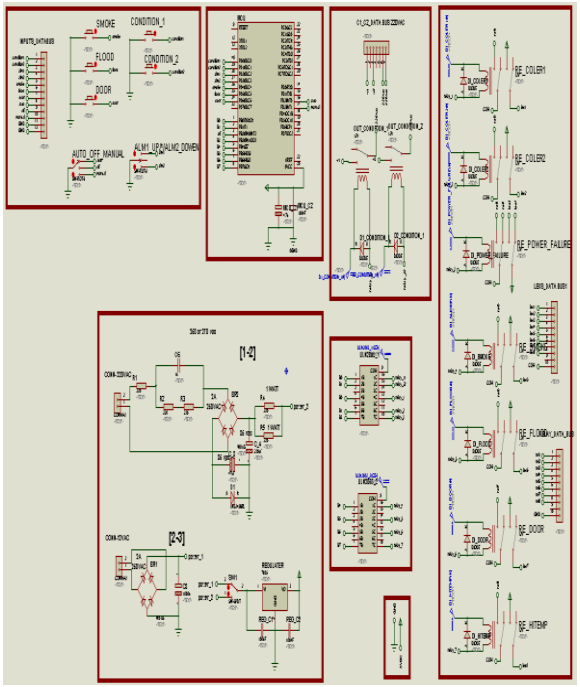

Figure 5. Alarm and Switching Controller for Air Condition Units Schematic

Display alarm unit usually add to the case of control system to help the Maintenance Technician during his job. After the simulation for electronic circuit of the electronic system and make sure that the process going correct "debugging" for the hex code. The system now is ready to Printed Circuit Board (PCB). After debugging the software by running the system at one of the simulator programs to making sure that the process going correct we start design the Printed Circuit Board (PCB) the display unit and main control unit.

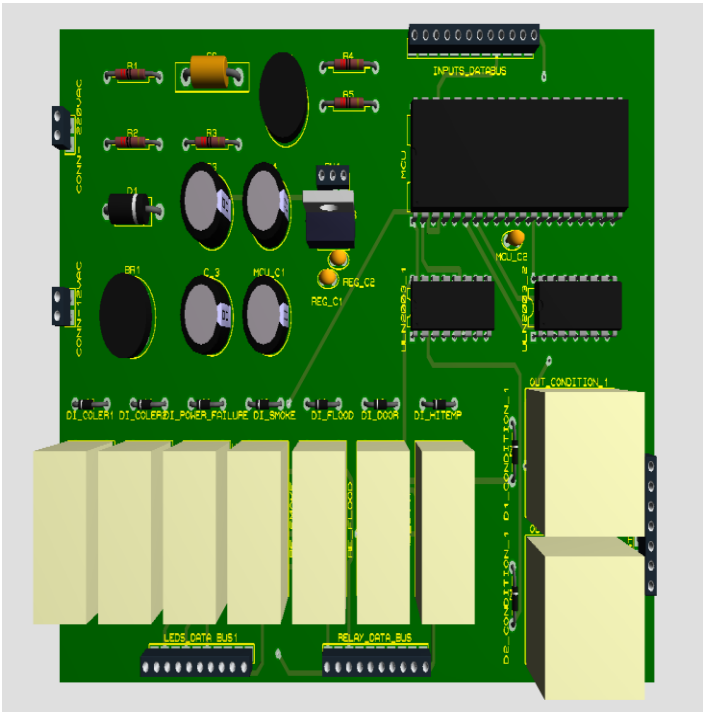

Figure 6. 3D Layout of Main Control

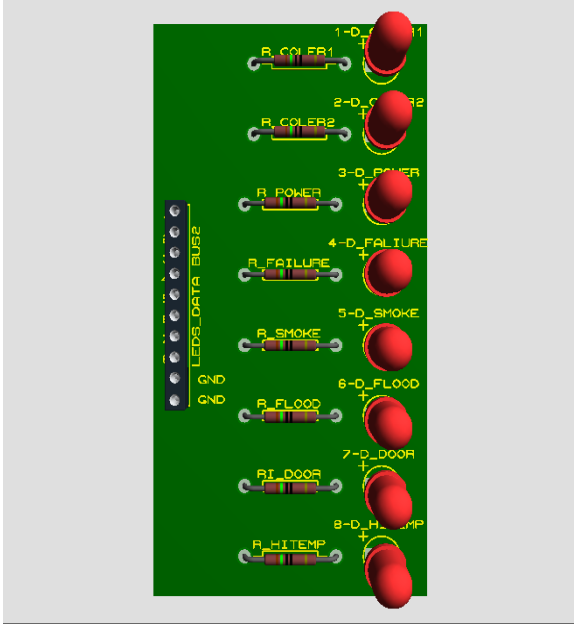

Figure 7. 3D Layout of Display Unit

The final step comes after that which is assembly the electronic circuit, outside case, contactors and wires.

Figure 8. Prototype Outlook

Figure 9. Prototype Outlooks from inside

The system was tested for six months at one of the sites belonging to Zain Telecom and the results were excellent. There were no system failures at all

VI. Conclusion

The electronic system has proved to be well-deserved over six months of continuous operation inside the (PTS) room and the results were very satisfying. In this system the possibility of failures and maintenance lower compare with many faults and repeated maintenance of classical systems.

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