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Intelligent Power Saver Alarm Clock with Digital Thermometer

Kevin Johny Joseph[1], Helena Babu[2] and Jithin Jose K[3]

[1]UG Student [EEE], Dept. of Electrical and Electronics,
Mar Athanasius College of Engineering, Kothamangalam, India
[2]UG Student [EEE], Dept. of Electrical and Electronics,
Mar Athanasius College of Engineering, Kothamangalam, India
[3]UG Student [EEE], Dept. of Electrical and Electronics,
Mar Athanasius College of Engineering, Kothamangalam, India

Abstract

The purpose of this project is to create a micro-controller based power saver alarm clock with digital thermometer. Energy scarcity is one of the major problems in the present world. Future without energy is beyond imagination. For this we need to use energy wisely .The project is aimed in developing a power saver alarm clock during studying with an automatic shut off of the lighting in the study room when triggered after a certain predetermined time. The major component used in the project is ATMEGA microcontroller, one of the most user friendly microcontrollers. This project also incorporates the functionality of a digital thermometer. A thermometer is a device that measures temperature .Here to read the value, we convert surrounding temperature to digital value by the help of a temperature sensor. Sensors, from their name convey that they sense the temperature in the surroundings. The sensors give the output in relation to the centigrade scale.

Keywords: Intelligent Power Saver Alarm Clock, Digital Thermometer, Microcontroller, LCD Display Interface.

1. Introduction

The system comprises of a push button keypad connected to the 8 bit microcontroller ATmega328P. This is one of the popular Microcontrollers. It has only 20 pins and there are 15 input/output lines. The microcontroller has a flash memory of 32Kbytes, 1 Kbyte EEPROM and 2 Kbytes RAM. The project is aimed in developing a power saver alarm clock during studying with an automatic shut off of the lighting in the study room when triggered after a certain predetermined time. The basic idea behind the project is that a predetermined time is entered into the microcontroller. A relay driven by the output of the microcontroller controls the supply. Thus it controls the lighting. This project also incorporates the functionality of a digital thermometer. A thermometer is a device that measures temperature .Here to read the value, we convert surrounding temperature to digital value by the help of a temperature sensor. Sensors, from their name convey that they sense the temperature in the surroundings. The sensors give the output in relation to the centigrade scale. These sensors are easily available. These sensor output can be used in measuring the temperature, Hence these sensors are used in digital thermometers.

2. ATMEGA 328P Architecture

The ATmega328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328P achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega328P provides the following features: 32K bytes of In-System Programmable Flash with Read-While-Write capabilities, 1K bytes EEPROM, 2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In-System through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot pro- gram running on the AVR core. The Boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega328P is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications.

3. LCD Display Interface

The dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4 or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver. A single HD44780U can display up to two 8-character lines (16 x 2). Pin no 3 of the LCD is used to control the contrast by using preset PR1.

Pin No. Name Description
Pin no. 1 D7 Data bus line 7 (MSB)
Pin no. 2 D6 Data bus line 6
Pin no. 3 D5 Data bus line 5
Pin no. 4 D4 Data bus line 4
Pin no. 5 D3 Data bus line 3
Pin no. 6 D2 Data bus line 2
Pin no. 7 D1 Data bus line 1
Pin no. 8 D0 Data bus line 0 (LSB)
Pin no. 9 EN1 Enable signal for row 0 and 1 (1stcontroller)
Pin no. 10 R/W 0=Write to LCD module 1=Read from LCD module
Pin no. 11 RS 0=Instruction input 1=Data input
Pin no. 12 VEE Contrast adjust
Pin no. 13 VSS Power supply (GND)
Pin no. 14 VCC Power supply (+5V)
Pin no. 15 EN2 Enable signal for row 2 and 3 (2ndcontroller)
Pin no. 16 NC Not Connected

4. Working and Circuit Diagram

After the program is burned, LCD displays "SET TIME". Time is set using the push buttons (tactile switches) in the circuit. After the time is set, LCD displays "SET

ALARM". Alarm is also set with the help of push buttons. Alarm goes on for that particular time at which the alarm has been set. If the alarm is not snoozed then the relay is cut off and the supply is shut off. If it is snoozed the microcontroller starts its next cycle of counting. The LCD also displays the temperature of the surroundings at bottom right of the screen. We can introduce a lighter fire or any heat source near the LM-35 temperature sensor for observing this.

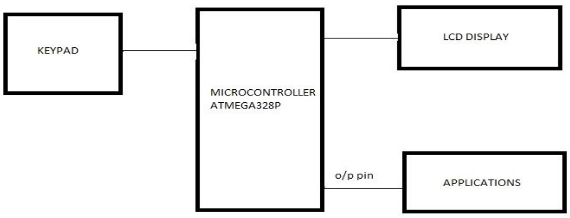
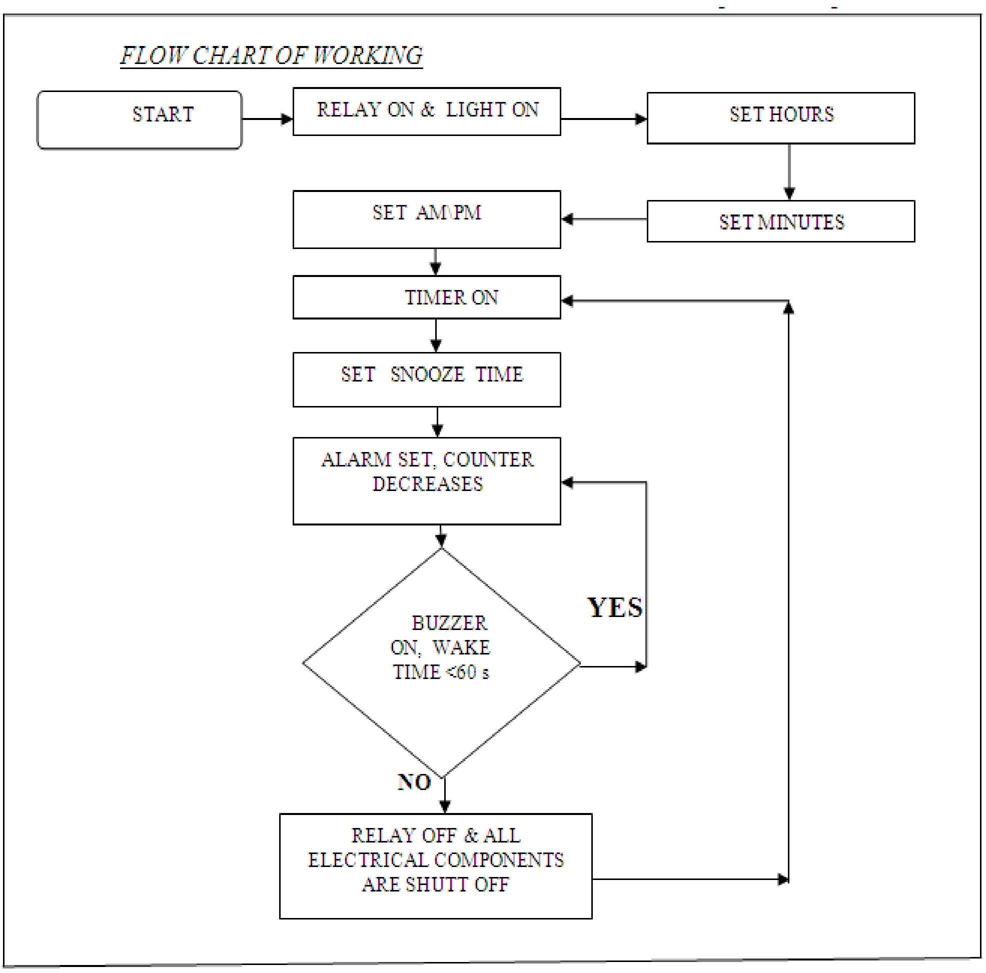


Fig. 1: Block Diagram



The Main Part of the above Circuit diagrams is the Microcontroller ATmega328P. The push button keypad is the input device wherein one button acts as an up button(number gets incremented with each press 1,2,3,etc), second button acts as a down button and the third one is the set button(sets a digit and moves to the next digit).). A predetermined time is set on the microcontroller(say 30 mins). An alarm (worked by interfacing to the microcontroller) will be triggered after every 30 mins during the study period. A student who is awake can snooze the alarm, so that the microcontroller starts it counting for next cycle. If the student is asleep the alarm won't be snoozed(which means that the student is either asleep or he is not in the room).Hence the lighting in the room is shut off by using a controlling relay.

The power supply section is very important. It should deliver constant output regulated power supply for successful working of the project. Regulated 5 volt supply is taken through the USB port of a laptop/desktop.

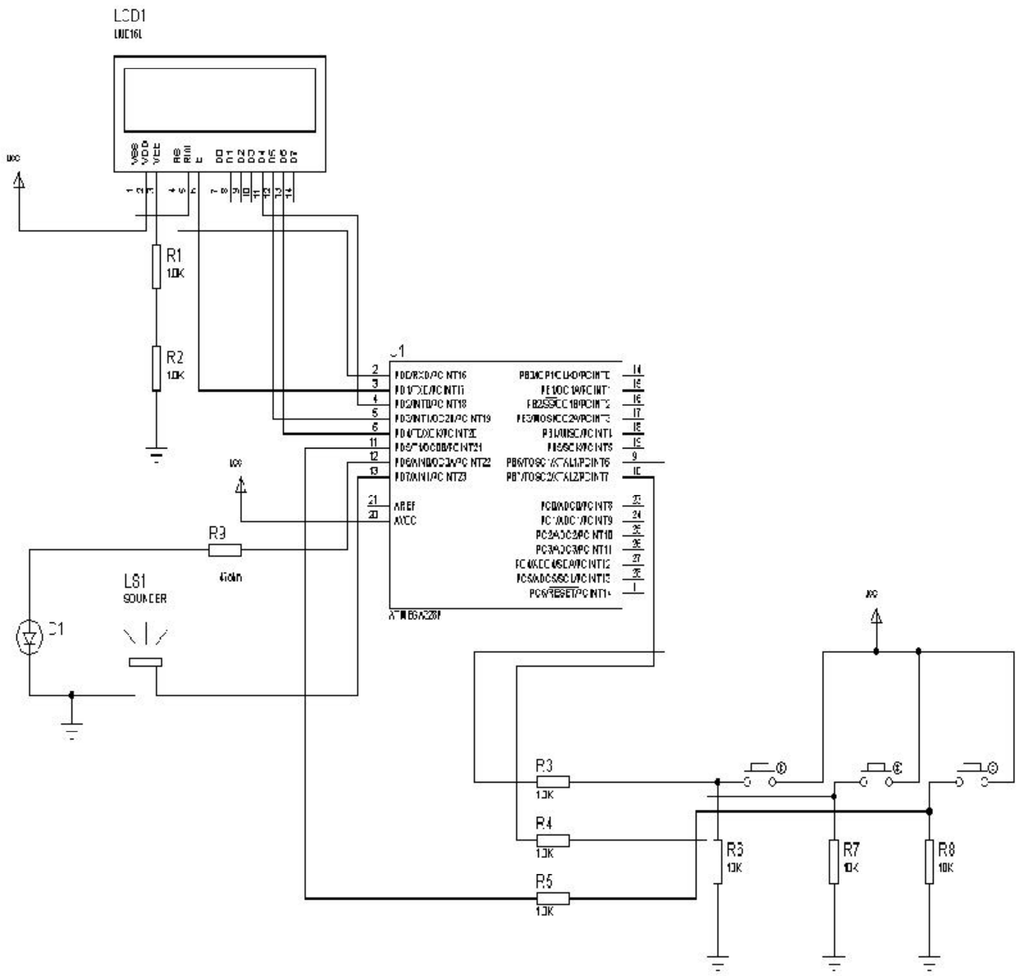


Fig. 2: Circuit Diagram.

5. Conclusion

The desired output for student anti sleep alarm clock with digital thermometer is obtained. The system worked as per the requirements specified. As the relay automatically shuts off the power supply, a lot of energy can be saved helping to reduce the extent of energy scarcity. As an extended application, the system can be incorporated in the student hostels were energy wastage is at its peak. . We were able to implement all the functions specified in our proposal. The biggest hurdle we had to overcome with this project was interfacing the micro controller with the hardware components. We feel that this power saver alarm is very marketable because it is easy to use, comparatively inexpensive due to low power consumption, and highly reliable. This power saver alarm is therefore particularly useful in applications such as student anti sleep alarms.

6. Acknowledgment

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