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Digital Clock Using FND (Fixed Numeric Digit) for Temperature and Humidity Indicator

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Abstract: ***In this modern era, the smart technologies presently working on how fast does it work and how small it is? To overcome the problem of size and speed, embedded system plays a vital role. It incorporates both speed and the problem of size, as they are quite fast and small in size. The system is generally based on the working module on which a microcontroller is being mounted and the functionality is being described by the user as per according to the function that he wants to perform. The embedded system has been of unfathomable importance to the field of control systems, data processing, real time data acquisition and the applications are countless. The digital clock using Fixed Numeric Digits (FND) can be fundamentally used in the field of display boards where the display of data or digit is required for the interfacing of the clock with certain sensors and can help in reading the parameters of the surrounding nature and display it . The device can also be further interfaced with suitable sensors to work as control system, monitoring system and data collection for an observer and manage the parameters of interest quite persistently and efficiently without any error.***

Keywords: Fixed Numeric Digits (FND,digital clock using LCD ,1. Sensors used for getting analog data from the environment and displaying on the system

1. Introduction

The project is based on the display of time using a digital clock using LCD as a test bench along with a seven segment display for display of finite number so that the hours and minutes can be easily displayed on the LCD and can be simultaneously be displayed on the seven segment display without any delay or even a minute delay while interfacing both of them together. The digital clock is not a real time clock as it has no power supply which is continuously attached to the counter to feed it with uninterrupted power supply. Which in the case of modern computer is a lithium ion battery but in this case we use a external power supply to connect it to the device which needs to be set time and again when power supply is being switched on. The clock will then display the time which is being set and along with that it will also display the humidity and the temperature of the surrounding or the device on which it is mounted that to in real time so that the parameters can be noted correctly and efficiently. The same data can be sent to the seven segment display by interfacing the LCD and Seven Segment all together for display of time and hours as well

The project is primary based in two phase's .Firstly the test bench which mainly consist of the LCD framework being worked upon microcontroller atmega8 and the temperature sensor along with humidity sensor is also being subjected onto the same test bench. Secondly, the second phase consist of the seven segment display which is being interface with the atmega32 [1,2] which is further being interfaced with the test bench circuit to pick up the data from it and display it on the seven segment display . The data transfer from the test bench to the atmega32 [2] is done in the form of serial data transfer and the time and temperature along with the humidity can be easily displayed on the seven segment display . The transition from the time to temperature and humidity a can be easily done by a push button. There is sufficient delay given to the temperature and humidity display so that they are displayed for certain period of time after which the time is again displayed on the seven segment. The device can be easily interfaced with the system where the temperature and humidity monitoring is required and the controlling process is also of prime concern.

Features in the Project

1) Sensors used for getting analog data from the environment and displaying on the system
2) Time display and value of parameter can be display after fixed time for observation
3) Display of parameter after fixed duration for observation and controlling
4) Display of time and controlling parameter on the same system
5) Can be also used as a controlling unit for a given system

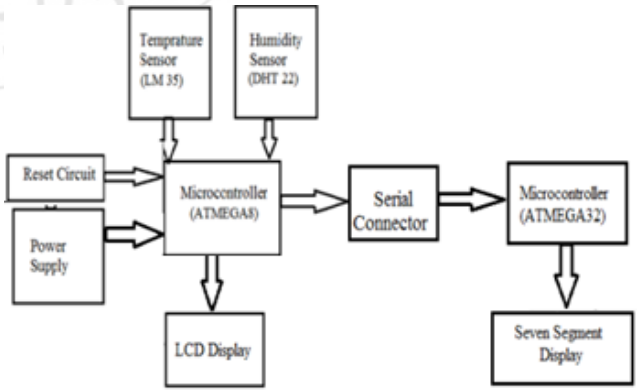

Figure 1: Block diagram FND

2. Design Details

The projects design details are as follows and it consists of the following devices:

1. ATMEGA8 Microcontroller

It is CMOS which is of low power and is architecturally based on the AVR RISC [1]. It has a capability of performing powerful instructions in a single clock cycle given by the oscillator. The processing speed and power consumption can be efficiently, anaged by the users as the ATmega8 has throughputs approaching 1MIPS per MHz[1]

It has an instruction capability of which is quite rich has a set of 32 working registers which are general purpose in nature. These registers are directly interlinked or interfaced with the to the Arithmetic and Logic Unit (ALU) [1], which allows the accessibility of two independent register in one single clock cycle .hence enabling the system to be up to 10 times faster than the CISC microcontroller [1].

Features:

1) 8 kb of In -System Programmable Flash along with capabilities of Read while Write.
2) 512 of EEPROM.
3) SRAM of 1Kb.
4) There are 23 I/O lines which are general purpose [1].
5) Working registers which are 32 in number and are general purpose.
6) Three flexible counters which have the compare mode.
7) Internal and external interrupts
8) Single programmable USART [1].
9) There is a 6 channel ADC with up to 10 bit accuracy [1].

The microcontroller is being manufactured by a process called High density volatile memory technology which is prevalent in the Atmel. The SPI serial interface is used to transfer the Flash program memory by a conventional non-volatile memory programmer or it can be even done by an on chip boot program running on the AVR core .The combination of In-System Self-Programmable Flash and 8-bit RISC CPU on a monolithic chip makes the microcontroller a powerful and high flexibility along with cost efficient controller, having ample amount of control applications [1].

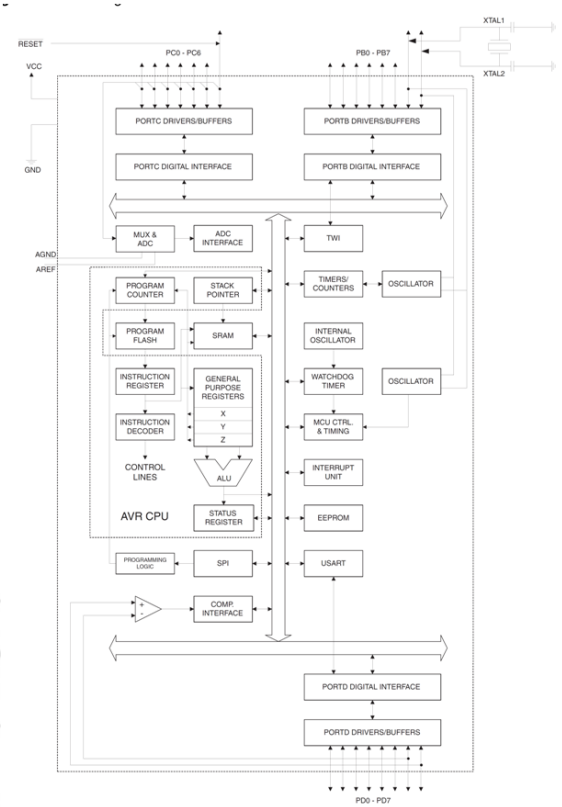

Figure 2: Block diagram ATmega8

2. ATMEGA32

The ATmega32 has 32 general purpose registers and which are directly connected to the ALU of the chip in the microcontroller. Enabling the accessibility of the 2 independent registers in one single instruction and being executed in one clock cycle [2]. The throughputs are almost 10 times as much faster as that of the CISC microcontrollers [2].

Features:

- 32 kb of Read and Write capabilities which are actually In-System Programmable Flash memory [2].
- 1024 kb of EEPROM [2].
- 2kb of SRAM.
- 32 I/O lines which are general purpose in nature.
- For boundary scanning purpose there is a JTAG interface [2].
- Debugging and programming support is there on the chip.
- 3 counters with compare mode.
- Internal as well as external interrupts
- 1 byte oriented two wire serial interfacing.

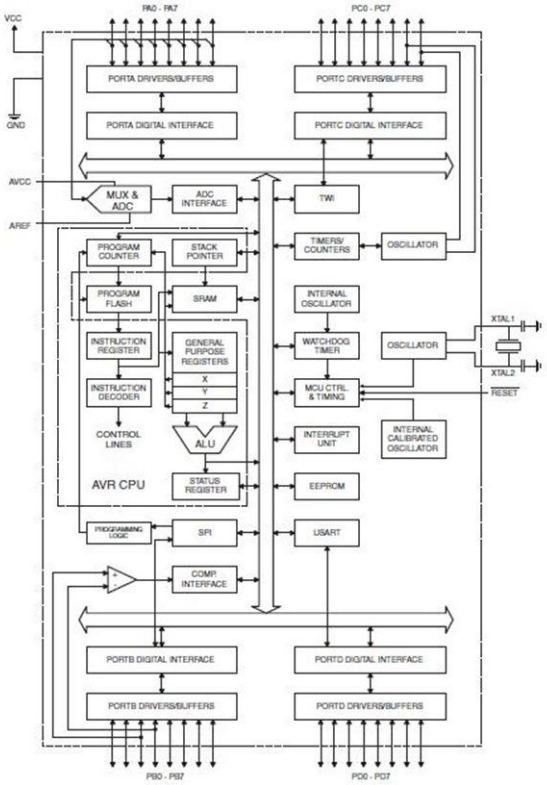

Figure 3: Block diagram ATmega32.

3. Seven Segment Display

The seven segment display is extensively used to display data in the form on fixed digit .The representation of digit in Seven Segment Display is quite easy as in comparison to the more complex dot matrix sort of display board. The Seven Segment Display has 7 LED for bar marking to display digit and a dot for separation digits [3]. The segment can display easily any digit from 0 to 9 and multiple digits in any number can be displayed by connecting these segments adjacent to each other .It a very primitive and basic kind of display board only suitable for displaying of the digits. The most commonly used is LDS-C303RI and the LED in it are forming a bar which are adjusted in such a manner that they form a structure of 8 in nature [4]. The segment also have the capability to display alphabets that to from A-F only rest of alphabets are to complex to considered to be displayed on the segment

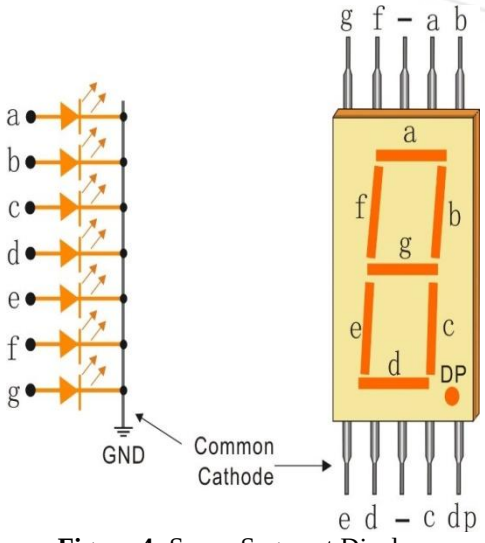

Figure 4: Seven Segment Display

4. LM-35 Temperature Sensor

The LM-35 is a integrated circuit temperature sensor whose output voltage is linearly proportional to the temperature applied at the sensitive end. The LM -35 provides the output in Celsius as in compared to its counterparts its is more desirable as no calculations need to be done to convert the Kelvin to centigrade [5]. This device does not require any sort of calibration or trimming to be done and the typical accuracy of the ±1⁄4˚C at room temperature and ±3⁄4˚C over a full expected range of −55 to +150˚C temperature range[5]. The basic characteristics like linear output ,precise calibration and low output impedance make it quite useful in the control industry.

It has capabilities to work with supplies with single polarity as well as both the polarities [5]. The device works on merely 60 µA and due to which it has low self heating of less than 0.1˚C in still air .The LM-35 is able to be functional over −55˚ to +150˚C temperature range, while the LM35C is for −40˚ to +110˚C range[5] .

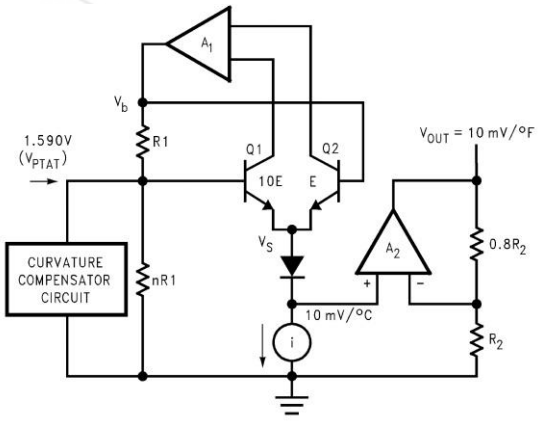

Figure 5: Architecture of LM-35

5. Humidity Sensor DHT-22

The DHT22 output calibrated is in form of digital signal .It utilizes the humidity sensing with the help of digital signal making it more stable and reliable in nature. The sensing element in the DHT22 is being connected to with the *bit single chip computer for processing the parameter in it which is of prime concern [6]. In the case of the DHT22, the sensor is temperature compensated and calibrated in accurate calibration chambers and is saved in a OTP memory, when the sensor detects the variation in the humidity in the surrounding it with tend to grab the coefficient from the memory [6].

DHT22 pins	
1	VCC
2	DATA
3	NC
4	GND

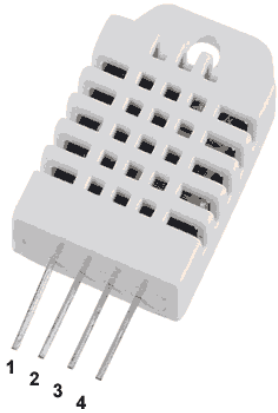

Figure 6: pin configuration DHT22

3. Project Methodology

The project is primary divided into two segments:
1) Hardware implementation.
2) Software implementation.

1. Hardware Implementation.
The hardware part consist of the interfacing of the devices ATmega8 and ATmega32 with the LM35 and DHT22. The PCB layout is first drawn over which the components are mounted and are interfaced with each other the hardware implementation is done over with the help of proteus to check whether the connections are proper or not in functionality.

2. Software Implementation.
The part of software implementation consists of the project being run on Proteus to check whether circuit works properly as per the connections. The coding of the microcontroller is being done in C language and the code is burn to the controller using Keil and AVR Studio .The software implementation is quite significant along with the hardware thus making it the embedded system.

4. Observations and Experiments

It was observed that during the display of the time , temperature and humidity .The transition from the LCD display which is being linked to the ATmega8 Along with the LM35 and DHT22 the data is being serially transferred to the other section of the project which is the ATmega32 Which is linked to the Seven Segment Display .The data is taken from ATmega8 and transferred to the ATmega32 and when the display of the time is being done there is certain delay between the time shown in the LCD test bench and the Seven Segment Display.

5. Summary and Conclusion

The project on the Digital Clock using FND (fixed numeric digit) using temperature sensor(LM35) and humidity sensor(DHT22) is a very versatile project which is used to display the temperature and humidity along with time. This can be easily further used to display time and other parameters which can be interfaced with it and can be used primarily in the field of controlling by connecting it with a controller to control the particular parameter in the permissible limit of the coefficient being decided. The FND can also be extensively used in display board as they are cheap and are easy as compared to the complex display boards that are available in the market.

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