Real Time Systems Design

Lecture (10): Digital Systems

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Introduction to digital systems

Digital systems are designed to store, process, and communicate information in digital form. They are found in a wide range of applications, including process control, communication systems, digital instruments, and consumer products. The digital computer, more commonly called the *computer*, is an example of a typical digital system.
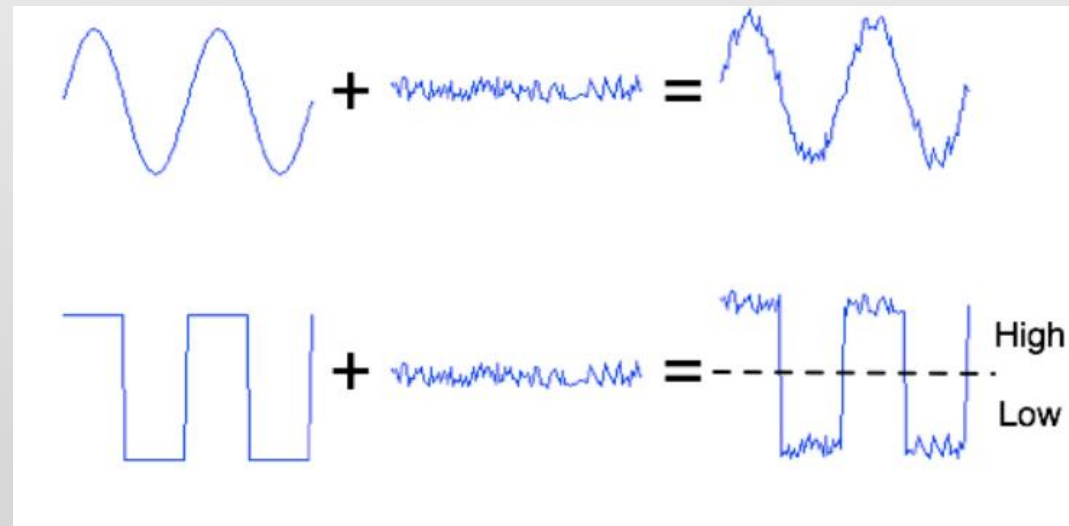

Figure (1): Effect of noise on analog signal and digital signal

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Data Representation

Data is represented in a digital system as a vector of binary variables

0 == False == Low

1 == True == High

The specific definition of logic levels in terms of voltage ranges can vary with different integrated circuit technologies, but for most circuits, can be defined as follows:

Logic 0 : 0 - 0.8 volts

Logic 1 : 2.0 - 5.0 volts

Questions

Define 'digital systems'

What is data representation in digital system?

What is voltage level for each state?

Basic interfacing devices

Interfacing can be defined as transferring data between microcontrollers and interfacing peripherals such as sensors, keypads, microprocessors, <u>analog to digital converters or ADC</u>, LCD displays, motors, external memories, even with other microcontrollers, some other <u>interfacing peripheral devices</u> and so on or input devices and output devices.

Basic interfacing devices

Interfacing is a technique that has been developed and being used to solve many composite problems in circuit designing with appropriate features, reliability, availability, cost, power consumption, size, weight, and so on. To facilitate multiple features with simple circuits, [microcontroller is interfaced](#) with devices such as ADC, keypad, LCD display and so on.

Analog to Digital Converter (ADC)

Most of the environmental parameters such as temperature, sound, pressure, light, etc. are measurable in analog form only. If we consider a temperature monitoring system, then obtaining, examining and handling temperature data from the temperature sensors is unable with the digital measuring system. Therefore, this system requires an intermediate device for converting the temperature from analog to digital data, such that for communicating with the digital system containing microcontrollers and microprocessors therefore the ADCs are used.

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ADC Interfacing with 8051 Microcontroller

SCADA for remote industrial plant is a practical application in which analog to digital converter or ADC interfacing with 8051 microcontroller is used. To continuously monitor the multiple operations of the remote industrial plant, supervisory control and data acquisition (SCADA) is the best technology for achieving control over various operations of industry remotely, thus increases efficiency and saves lot of manpower.

ADC Interfacing with 8051 Microcontroller Project Kit by Edgefxkits.com
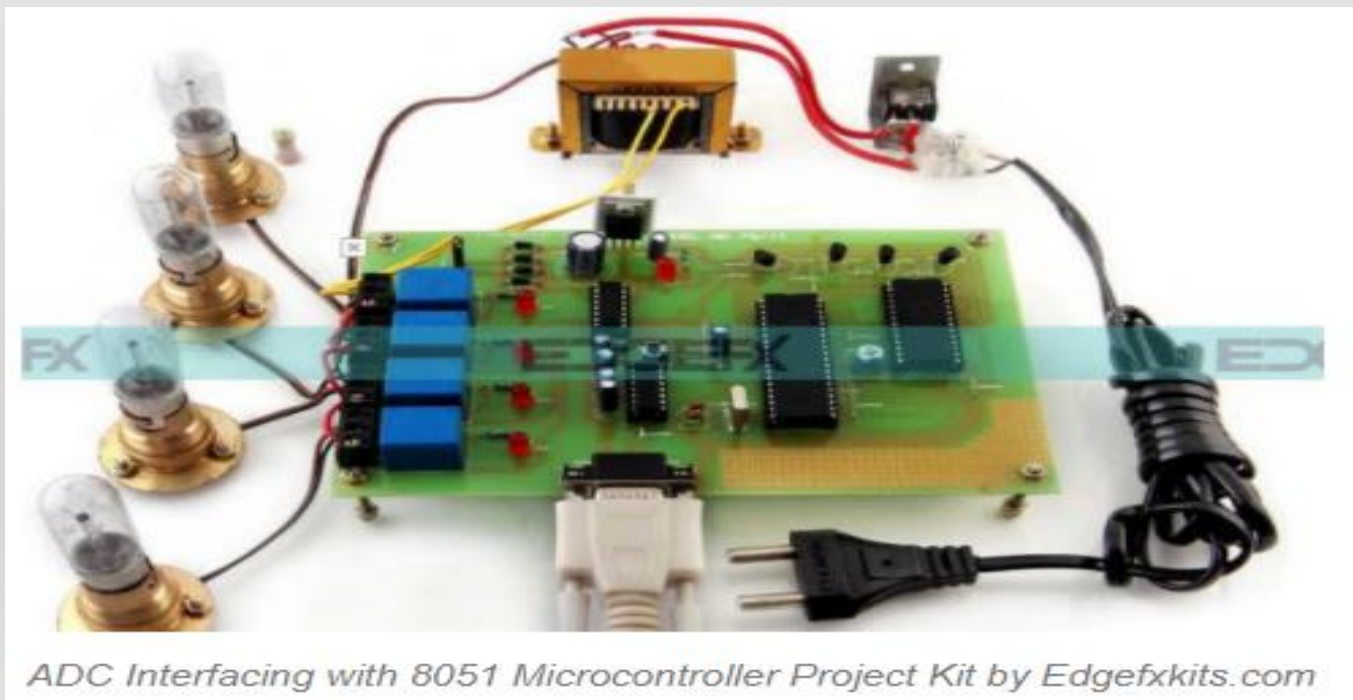
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In this project temperature sensors are interfaced with microcontroller that is connected to a PC. Temperature sensors connected are interfaced to microcontroller with the help of analog to digital converter. As, the signal generated from sensors is analog, so these analog signals are converted into digital and then fed to the microcontroller. For serial communication RS232 is a standard. RS232 interface is used for obtaining communication between the computer and circuit such to transfer data between circuit and computer.

ADC Interfacing with 8051 Microcontroller Block Diagram by Edgefxkits.com
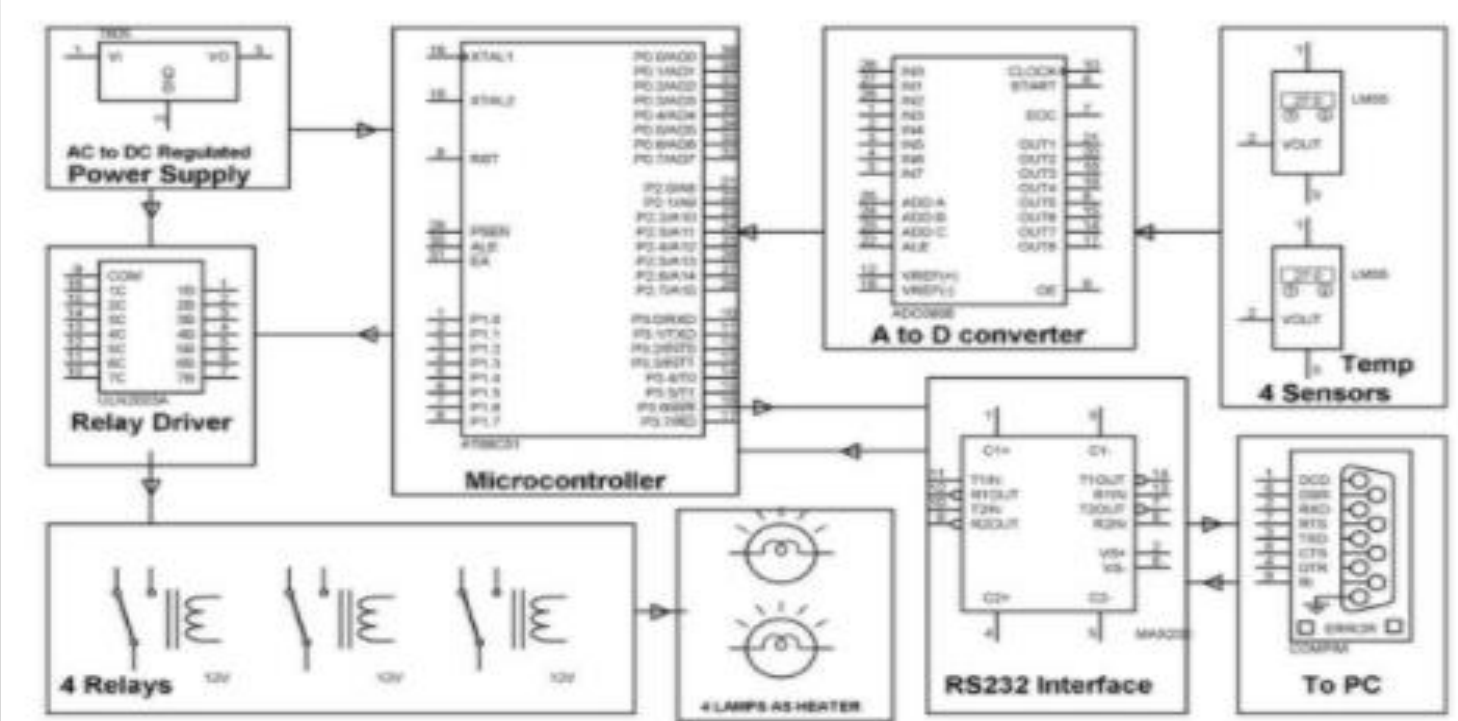
If the temperature exceeds the preset value, then microcontroller activates relay that will turn off the heaters and an AV alarm will be generated if the system fails. Here the heaters are represented with lamps for demonstration purpose.
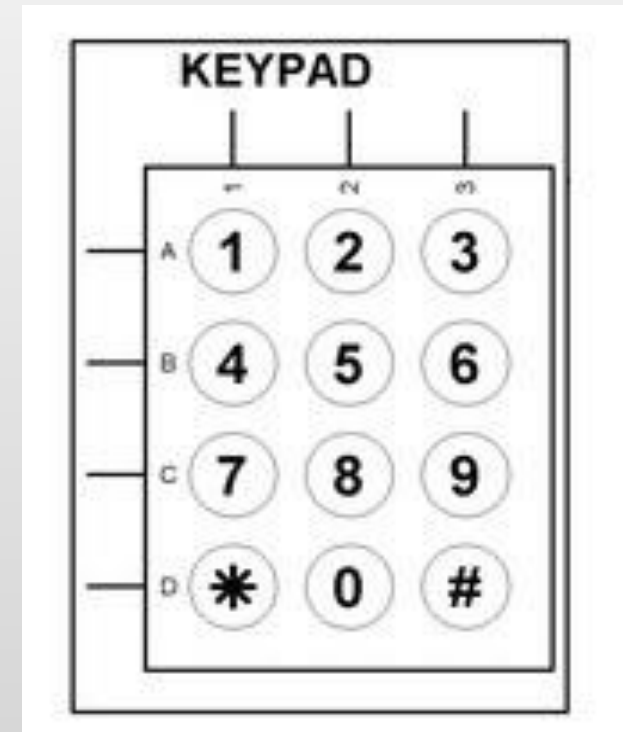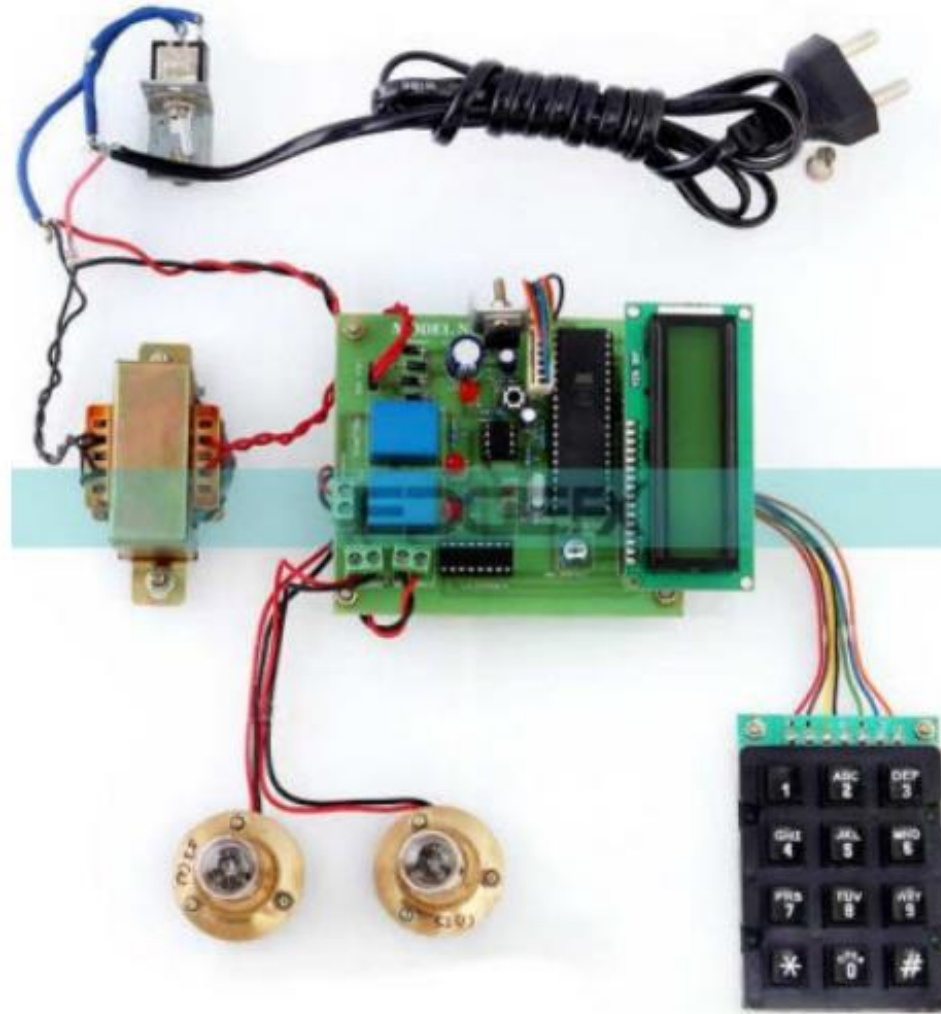
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Examples of interfacing devices:

1. Keypad or Keyboard

In general keypads or keyboards are used as input devices for computers. But, among various types of interfacing devices, keypad is also one type of frequently used interfacing peripheral devices. In general, keypad or keyboard consists of rows and columns, are called as matrix keypads (m rows*n columns keypads). These are interfaced with microcontroller for entering values or names whenever it is required for the circuit. Which used in security systems with user changeable devices.


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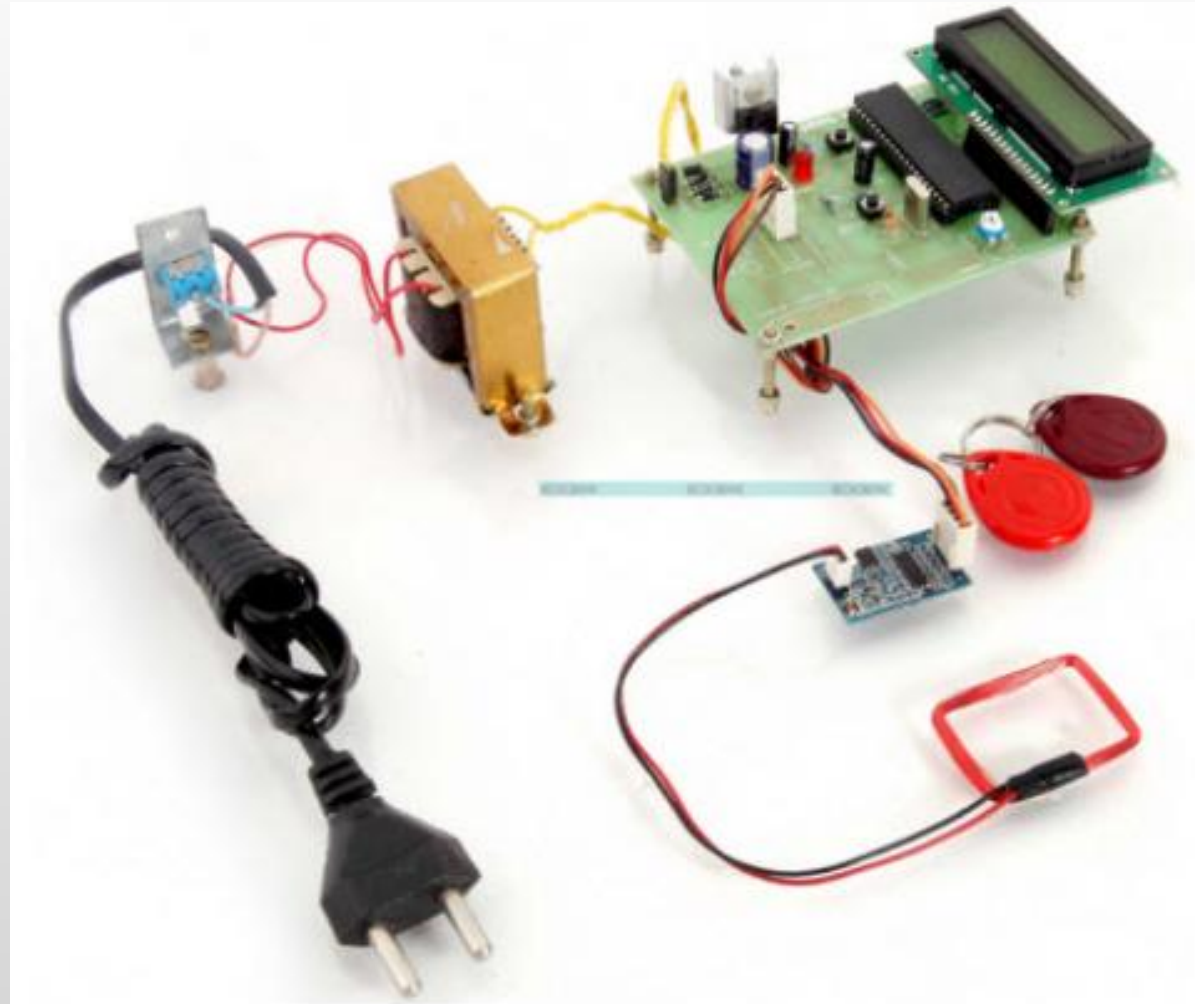Application of Keypad as Interfacing Device Project Kit by Edgefxkits.com

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2- LCD Display

LCD display or liquid crystal display is one of the most frequently used interfacing devices that consist of liquid crystals. These LCD displays utilizes liquid crystals for producing visible images. LCD displays are display screen super thin technology that is being used in cell phones, televisions, portable video games, laptops, computer monitors, portable video games.

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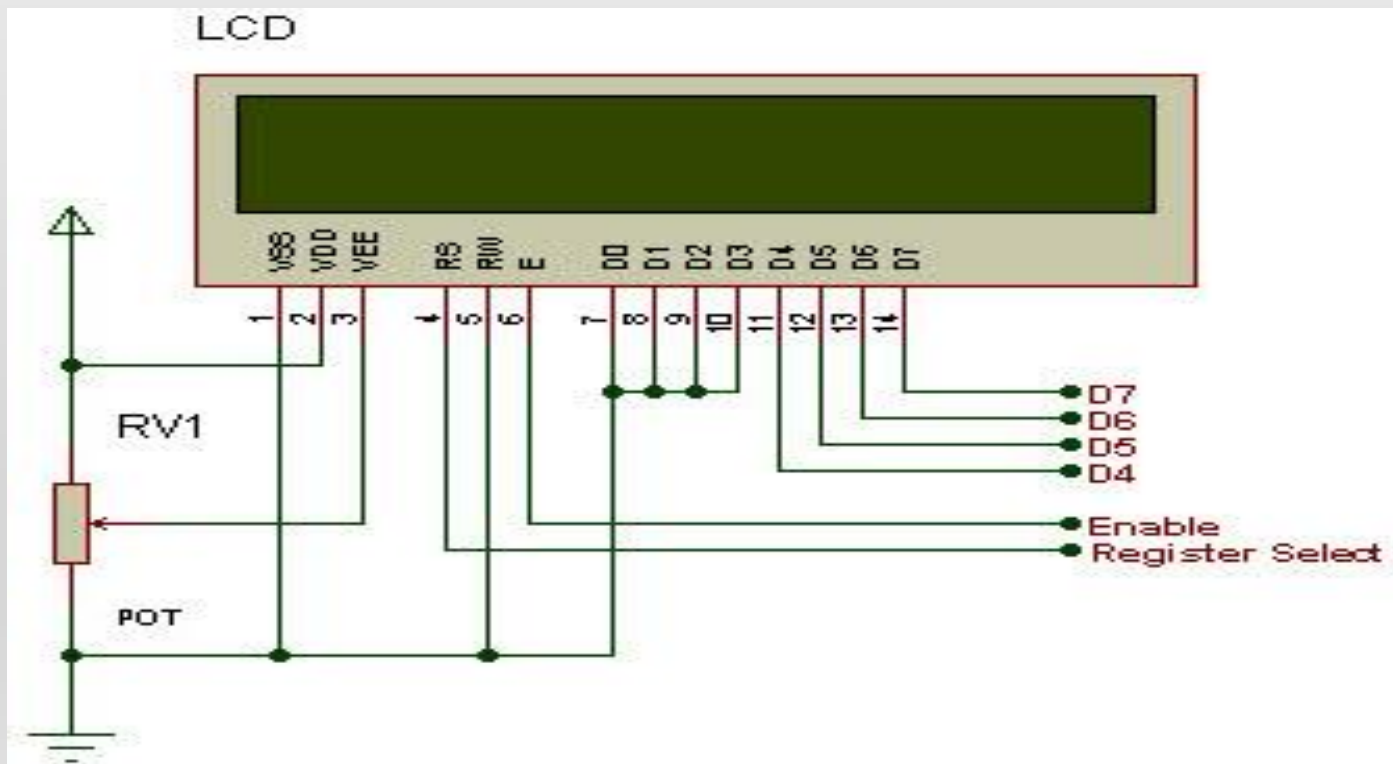
Application of LCD Interfacing with Microcontroller Project Kit by
Edgefxkits.com

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Summary

✓ Introduction to digital systems

✓ Data Representation

✓ Questions

✓ Basic interfacing devices

✓ Keypad or keyboard

✓ LCD Display

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