SNS COLLEGE OF ENGINEERING

Kurumbapalayam(Po), Coimbatore – 641 107
Accredited by NAAC-UGC with 'A' Grade
Approved by AICTE, Recognized by UGC & Affiliated to Anna University, Chennai

Department of Information Technology

Course Name – Software Engineering

II Year / III Semester

DESIGN CONCEPTS AND PRINCIPLES

Case Study on Monitoring & Control System and Data Acquisition System

Monitoring and control systems

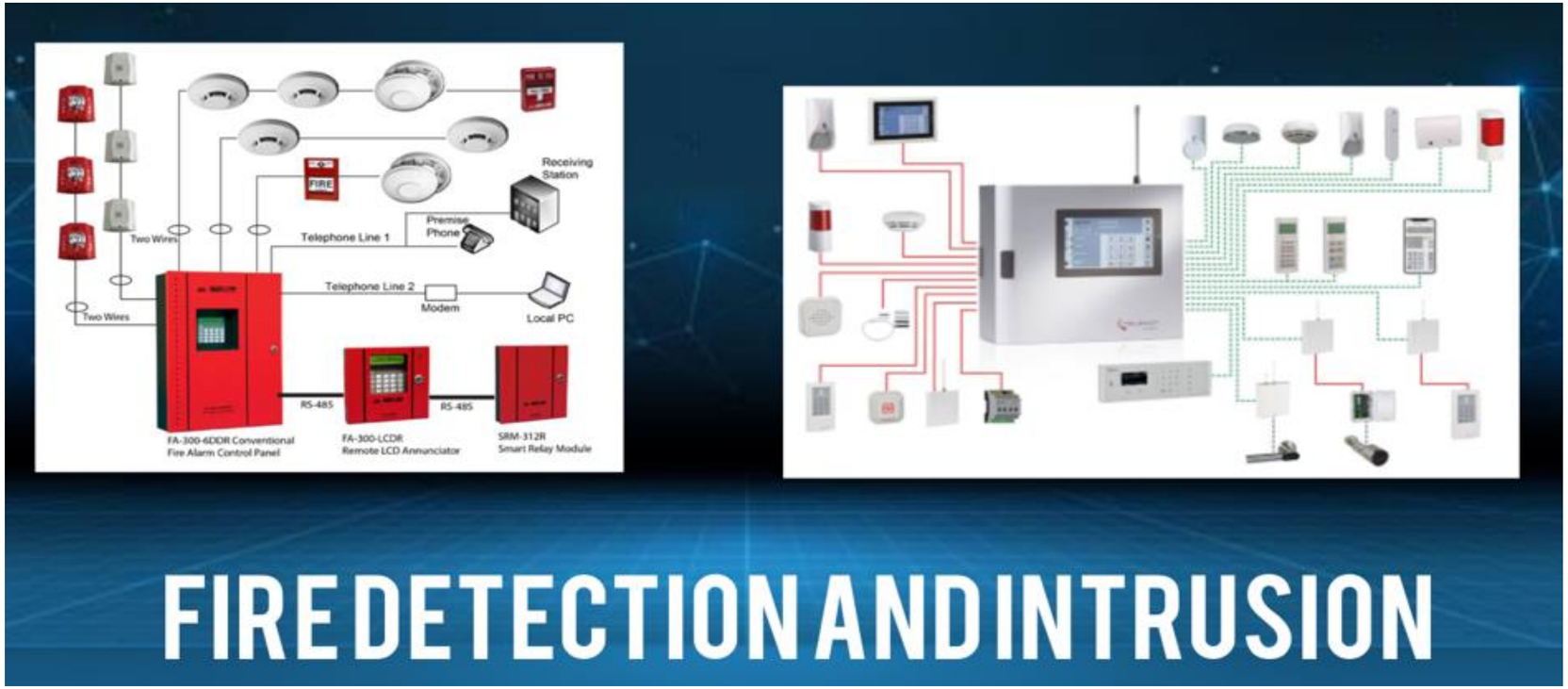
- Important class of real-time systems
- Continuously check sensors and take actions depending on sensor values
- Monitoring systems examine sensors and report their results
- Control systems take sensor values and control hardware actuators

Burglar alarm system

- A system is required to monitor sensors on doors and windows to detect the presence of intruders in a building
- When a sensor indicates a break-in, the system switches on lights around the area and calls police automatically
- The system should include provision for operation without a mains power supply

Burglar alarm system

- Sensors
  - Movement detectors, window sensors, door sensors.
  - 50 window sensors, 30 door sensors and 200 movement detectors
  - Voltage drop sensor
- Actions
  - When an intruder is detected, police are called automatically.
  - Lights are switched on in rooms with active sensors.
  - An audible alarm is switched on.
  - The system switches automatically to backup power when a voltage drop is detected.


Receiving Station
Premise Phone
Telephone Line 1
Telephone Line 2
Modem
Local PC
Two Wires
Two Wires
RS-485
RS-485
FA-300-6DDR Conventional Fire Alarm Control Panel
FA-300-LCDR Remote LCD Annunciator
SRM-312R Smart Relay Module
FIRE DETECTION AND INTRUSION

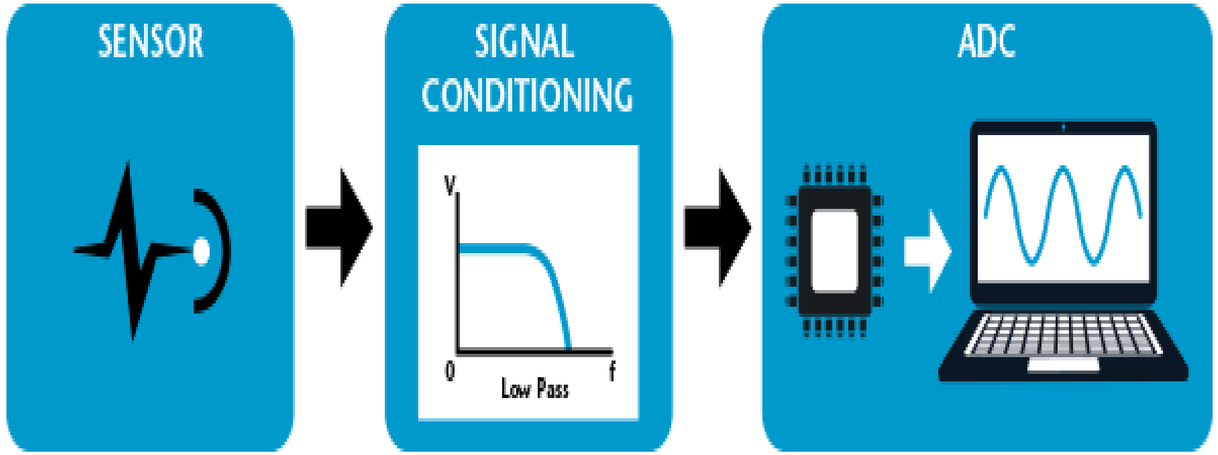

Example: Burglar Alarm System
PIR
Siren
Smoke sensor
Human Body Influence
Fire
Gas detector
The house is intrueled.....!
Unclench door/window
Emergent Button
Gas leak out!
Telephone
Thief
Host
Telephone
Mobile-phone
Pager
Alarm Receipt Center

Introduction

Data acquisition is the process of sampling signals that measure real-world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer. Data acquisition systems, abbreviated by the acronyms *DAS*, *DAQ*, or *DAU*, typically convert analog waveforms into digital values for processing. The components of data acquisition systems include:

- Sensors, to convert physical parameters to electrical signals.
- Signal conditioning circuitry, to convert sensor signals into a form that can be converted to digital values.
- Analog-to-digital converters, to convert conditioned sensor signals to digital values.

DAS SYSTEM



BLOCK DIAGRAM

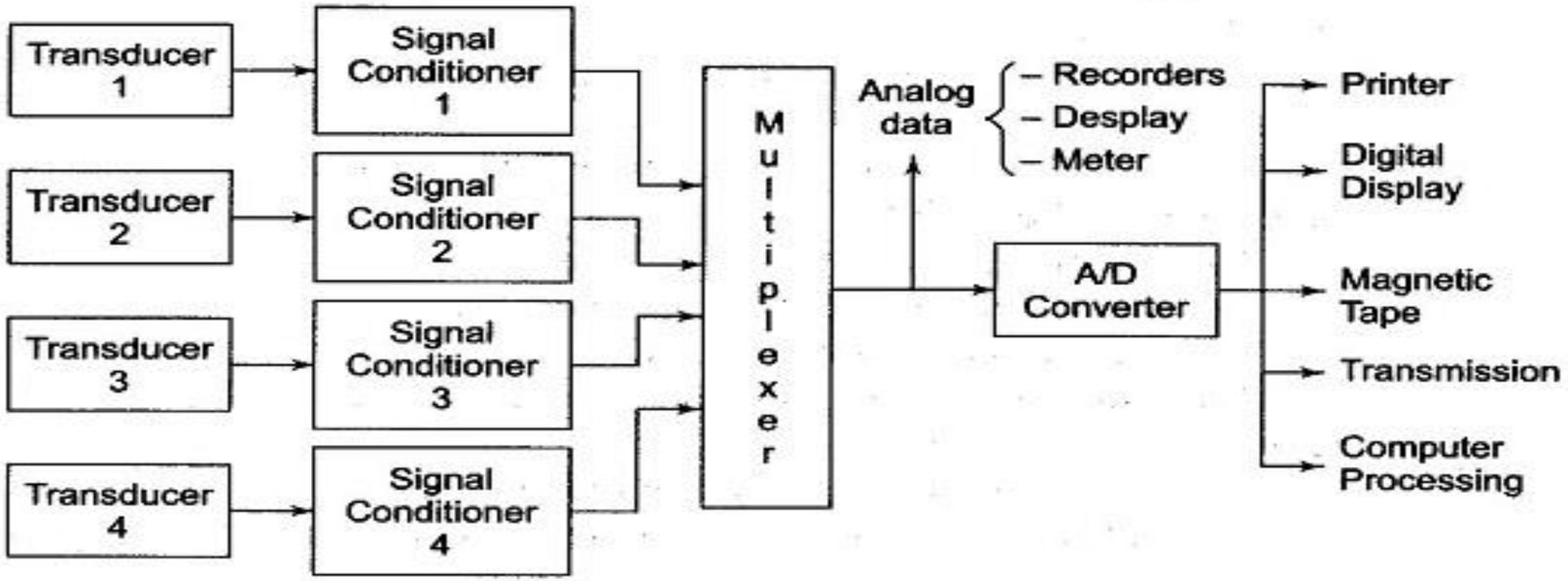


Fig. 17.1 Generalised Data Acquisition System

Real time data acquisition system

- A leading scientific research organization required a high-speed real-time data acquisition system. The organization is best known for having the largest neutron source in the world - created using a high-speed proton accelerator.

- In order to generate the high magnetic fields required to accelerate the protons to the required speeds, they use specialized power supplies. The acquisition system was needed to monitor the signals inside the power supplies.

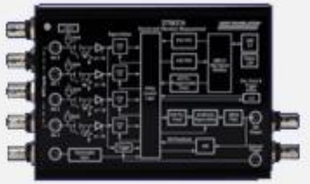
- The neutrons generated inside the accelerator can be fired into solid objects such as turbine blades and welds to give a microscopic view of the stresses operating on these critical engineering components. This enables gas turbines as used on jumbo jet aero planes to be built to a very high quality.

- It also enables failure rates to be accurately predicted allowing maintenance schedules to be optimized.

COMPONENTS

TEMPERATURE

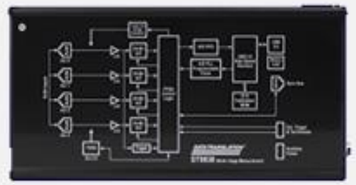
SOUND AND VIBRATION



UNIVERSAL

ANANLOG OUTPUT

COUNTER/ ENCODER



STRAIN AND LOAD CELL

Software Design Principles

Problem Partitioning

- For small problem, we can handle the entire problem at once but for the significant problem, divide the problems and conquer the problem it means to divide the problem into smaller pieces so that each piece can be captured separately.
- For software design, the goal is to divide the problem into manageable pieces.

Benefits of Problem Partitioning

1. Software is easy to understand
2. Software becomes simple
3. Software is easy to test
4. Software is easy to modify
5. Software is easy to maintain
6. Software is easy to expand

Software Design Principles

Abstraction

An abstraction is a tool that enables a designer to consider a component at an abstract level without bothering about the internal details of the implementation. Abstraction can be used for existing element as well as the component being designed.

Here, there are two common abstraction mechanisms

1.Functional Abstraction

2.Data Abstraction

Functional Abstraction

i.A module is specified by the method it performs.

ii.The details of the algorithm to accomplish the functions are not visible to the user of the function.

Functional abstraction forms the basis for **Function oriented design approaches**.

Data Abstraction

Details of the data elements are not visible to the users of data. Data Abstraction forms the basis for **Object Oriented design approaches**

Software Design Principles

Modularity

- Modularity specifies to the division of software into separate modules which are differently named and addressed and are integrated later on in to obtain the completely functional software.
- It is the only property that allows a program to be intellectually manageable.
- Single large programs are difficult to understand and read due to a large number of reference variables, control paths, global variables, etc.

The desirable properties of a modular system are:

- Each module is a well-defined system that can be used with other applications.
- Each module has single specified objectives.
- Modules can be separately compiled and saved in the library.
- Modules should be easier to use than to build.
- Modules are simpler from outside than inside.

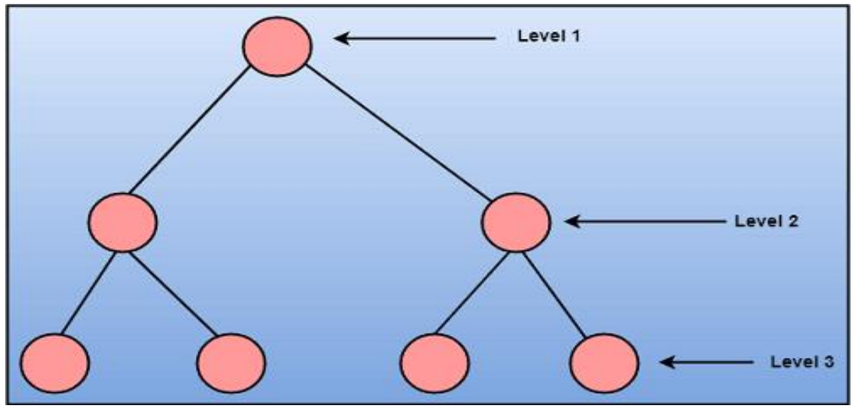
Software Design Principles

Strategy of Design

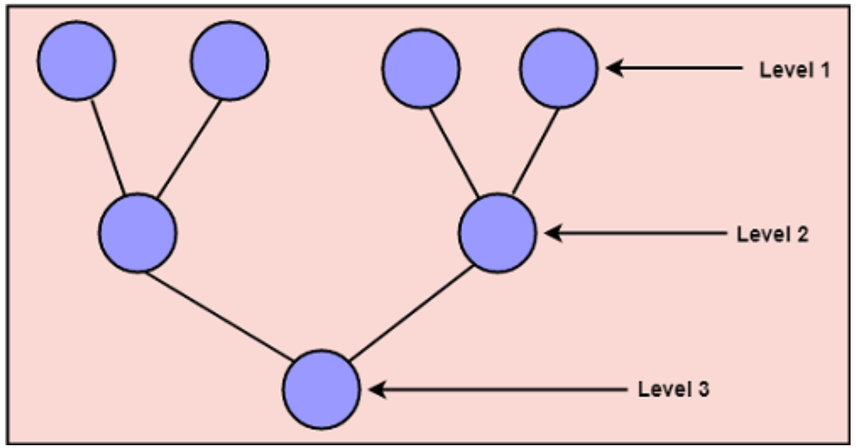
- A good system design strategy is to organize the program modules in such a method that are easy to develop and latter too, change.
- Structured design methods help developers to deal with the size and complexity of programs.
- Analysts generate instructions for the developers about how code should be composed and how pieces of code should fit together to form a program.
- To design a system, there are two possible approaches:
    1. **Top-down Approach**
    2. **Bottom-up Approach**

Software Design Principles

1. Top-down Approach: This approach starts with the identification of the main components and then decomposing them into their more detailed sub-components.



2. Bottom-up Approach: A bottom-up approach begins with the lower details and moves towards up the hierarchy, as shown in fig. This approach is suitable in case of an existing system.



THANK YOU