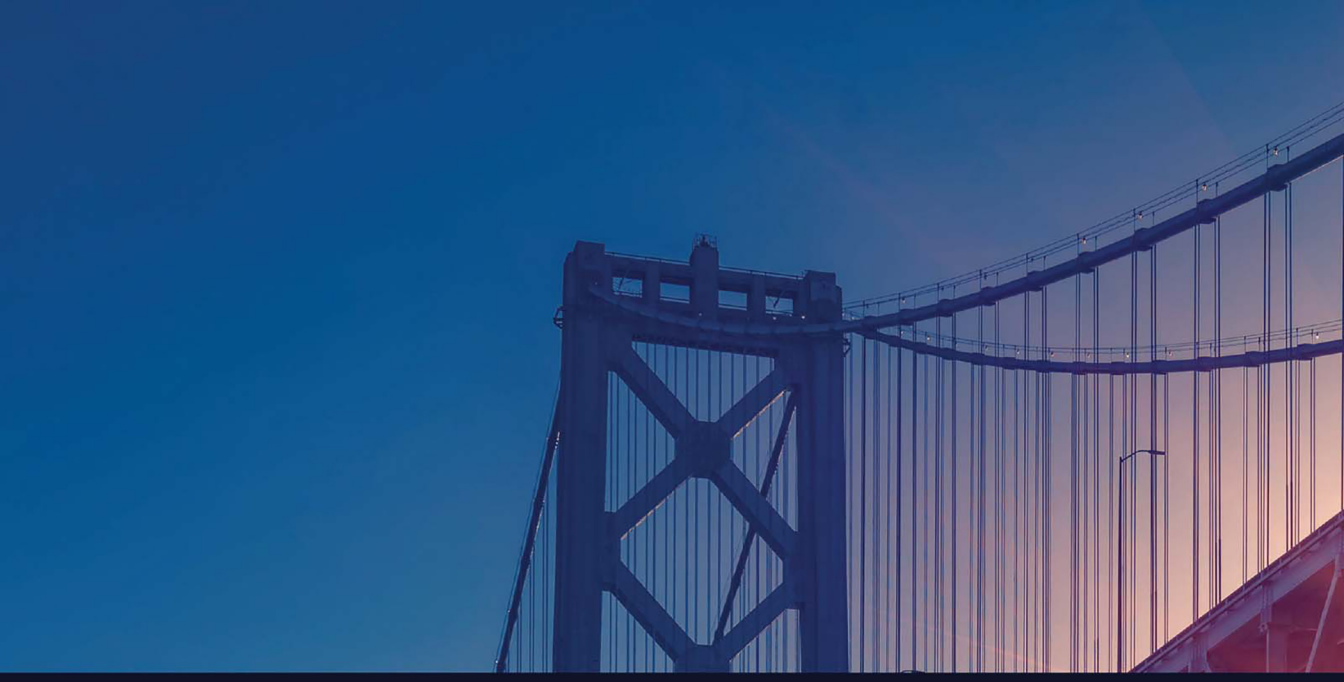

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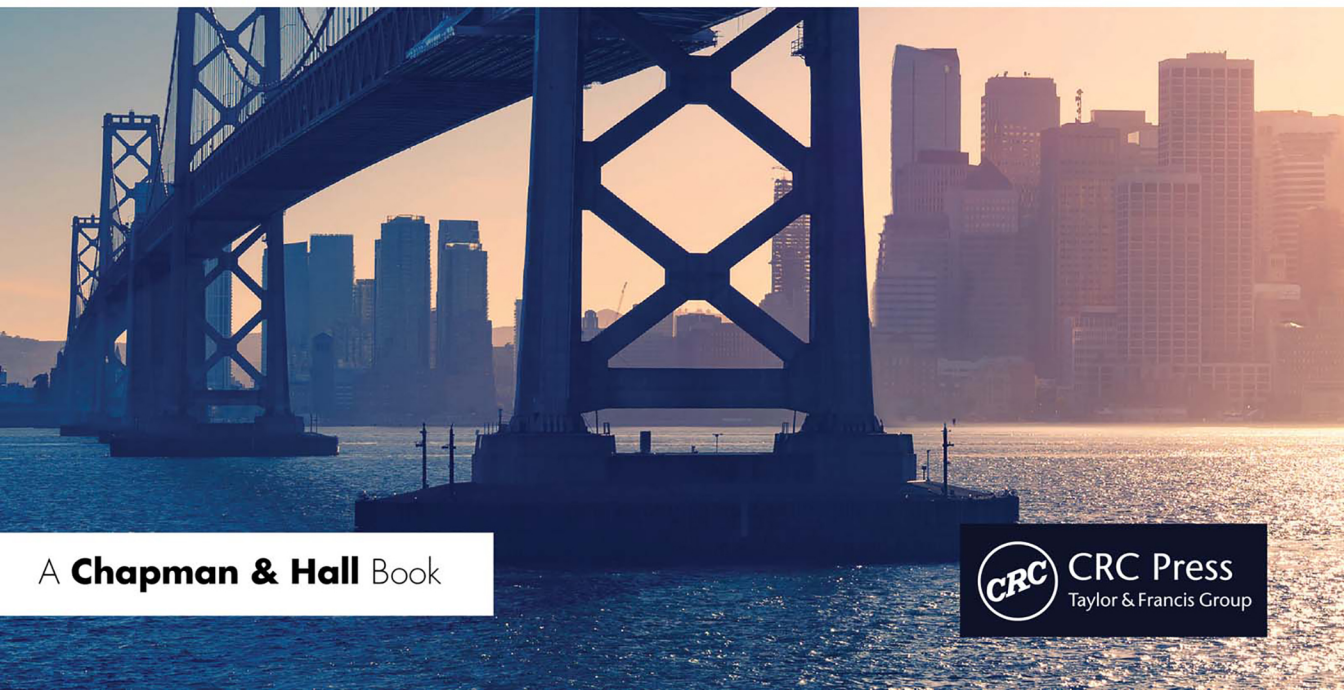

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Computer Applications in Engineering and Management

Parveen Berwal
Jagjit Singh Dhatterwal
Kuldeep Singh Kaswan
Shashi Kant

CRC Press
Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business
A CHAPMAN & HALL BOOK

First edition published 2022
by CRC Press
6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742

and by CRC Press
2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

CRC Press is an imprint of Taylor & Francis Group, LLC

Library of Congress Cataloging-in-Publication Data
Names: Berwal, Parveen, author.
Title: Computer applications in engineering and management / Parveen Berwal, Jagjit Singh Dhatterwal, Kuldeep Singh Kaswan, Shashi Kant.
Description: First edition. | Boca Raton : Chapman & Hall/CRC Press, 2022. |
Series: Chapman & Hall/CRC distributed computing and intelligent data analytics series | Includes bibliographical references and index. |
Summary: "The book Computer Applications in Engineering and Management is about computer applications in Management, Electrical Engineering, Electronics Engineering and Civil Engineering. It covers the software tools for office automation, introduces the basic concepts of database management, and provides an overview about the concepts of data communication, internet, and e-commerce. Additionally, the book explains the principles of computing management used in construction of buildings in Civil Engineering and the role of computers in power grid automation in Electronics Engineering.
Features: Provides an insight to prospective research and application areas related to industry and technology Includes industry-based inputs Provides a hands-on approach for readers of the book to practice and assimilate learning. This book is primarily aimed at undergraduates and graduates in computer science, information technology, civil engineering, electronics and electrical engineering, management, academicians, and research scholars"—Provided by publisher.
Identifiers: LCCN 2021048779 (print) | LCCN 2021048780 (ebook) |
ISBN 9781032078823 (hbk) | ISBN 9781032228716 (pbk) | ISBN 9781003211938 (ebk)
Subjects: LCSH: Engineering—Data processing. | Business—Data processing.
Classification: LCC TA345 .B4824 2022 (print) | LCC TA345 (ebook) |
DDC 620.00285—dc23/eng/20220105
LC record available at https://lccn.loc.gov/2021048779

ISBN: 9781032078823 (hbk)
ISBN: 9781032228716 (pbk)
ISBN: 9781003211938 (ebk)

DOI: 10.1201/9781003211938

Typeset in Times
by codeMantra

Contents

Preface

This book presents the principles and techniques of managing engineering and construction of building from the initial conceptual phase, through design and construction, to completion. It emphasizes computing management during the early stages of development because the ability to influence the quality, cost, and schedule of a project can best be achieved during the early stages. Most books discuss computing management during construction, after the scope of work is fully defined, the budget is fixed, and the completion date is firm. It is then too late to make any significant adjustments to improve the quality, cost, or schedule of the project construction of management. Numerous tables and graphs are presented and discussed throughout this book to provide guidelines for the management of the three basic components of a project: scope, budget, and schedule.

Electronic Circuit Analysis and Design is intended as a core text in electronics for undergraduate electrical and computer engineering students. The purpose of the second edition of the book is to provide a foundation for analyzing and designing both analog and digital electronic circuits.

The majority of electronic circuits today are designed as integrated circuits (ICs), in which the entire circuit is fabricated on a single piece of semiconductor material. The IC may contain over a million semiconductor devices and other elements and may perform many complex functions. The microprocessor is an example of such a circuit. The ultimate objective is to understand the operation, characteristics, and limitations of these ICs.

Initially, discrete transistors are analyzed and designed. The complexity of the circuits studied is then increased. Eventually, the reader should be able to analyze and design the basic elements of ICs, such as digital logic gates.

This text is an introduction to the complex subject of electronic circuits. Therefore, more advanced material is not included. Specific technologies, such as gallium arsenide, which are used in special applications, are also not included, although reference may be made to a few specialized applications. Finally, the layout and fabrication of ICs are not covered, since these topics alone can warrant entire texts.

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1 Introduction of Management, Civil, Electrical and Electronic (MCEE) in Computers

1.1 INTRODUCTION

Many logistical and managerial tasks carried out in the office environment. The joint functions of an agency are preparing, distributing, editing, and reviewing information [1]. These works were done manually or with mechanical and electrical equipment before the invention of computers. The fundamental essence of an office has changed significantly in the past few decades. Automation of works using new techniques improves the overall skills of an office. Civil engineering experiments also require the development of complicated mathematical models to handle the large amount of data generated through a great number of repetitive experimental studies, thus offering a sensor modeling and simulation technology-wide platform. Theory and technology of Human–Computer Interaction is an important trend in computer applications, sound processing is text-friendly, graphical content, its image, and its comfort, its human–machine interface has been vastly improved, civil engineering sampling techniques have been an innovation [2]. CAD is one of the convincing and mature technologies, in which, using external CAD technical drawings, light transitions, surface décor, changes in dimensions, construction, and other environmental impacts can be detected by computer designing using animation techniques. CAD is a method of developing the responsive CAD system, the Optima 1 CAD system, the intelligent CAD system, and ultimately the implementation of integrated CAD interactive intelligence (III CAD) [3].

Coordination on the subject is also a significant aspect. The control and measurement equipment are provided to ensure a proper training workshop standard. Devices that are used regularly must be stable and resistant to harm. The appropriate entry to space seems to be another problem. The time of the research head and their team of an organization is reduced to regular working hours. This is not always practical to carry out experiments at home by students. Therefore, an effective way is needed to access the laboratories all day long. The use of interactive or remote laboratories enables connectivity throughout the research period. Moreover, when experiments are performed electronically, it can also reduce the possibility of contaminations to the patients involved in the research.. The experiments can be prepared and presented in the Internet. Thus, this approach enables many users to simultaneously use the remote laboratory [4].

From Very Large-Scale Integration (VLSI) aspects, the digital circuit and central processer unit have led to the development of digital design and machine planning technologies. In this respect too, logic gates are used. The traditional 5 V to low power CMOS can be built by utilizing various voltages (3.3, 2.5, 1.8 V). Use of CMOS technology is declining in traditional fields because of the problems such as increasing energy usage and leakage. Congestion due to storage of CMOS machines is another problem. Hence, many alternative technologies with high functionality, high integration frequency and non-volatility have been examined to deal with such problems. Meritor Crossbar with NAND—a mobile computer built on flash – has recently gained ground. The conversion of logical page numbers (LPNs) into actual page numbers is suggested to the Flash Translation Layer (FTL) owing to the limitation of deletion before writing. Because of the expenditure of hardware and power usage of the semiconducting material storage unit, there is a very small RAM in it. Computers have been extensively, used and innovation has been developed. We can design and produce electronic devices such as sensors with the help of nanotechnology, which can be used to

DOI: 10.1201/9781003211938-1

create smaller and faster computers. The increasing convergence of the transistor system means that high energy capacity and temperatures circuits have an enormous effect on the center of chip problems which lead to temperature hotspots. This influence will slow down existing speeds and generations of scaling. New methods are now used to eradicate this issue, and the methodology of machine learning (ML) is most helpful.

1.2 MANAGEMENT COMPUTING

1.2.1 Modes of Data Processing

The aforementioned types of information business processes are commonly used by organizations to improve their performance [5]. The programs involved in these programs are as follows:

Batch Processing

This method of processing allows the data to be clustered (in batch form) until they are analyzed on a serial basis, and regular reports are collected.

The batch may be a collection of offline purchase requisitions or purchases.

The package is handled at the defined frequency at a specified length of time and performed in a serial order for each transaction per batch.

The batch processing approach eliminates the computer system's idle time, so there is no operating interference to change work from one task to another.

It is the most suitable mode of treatment in many processes such as accounting or customer statements where information (records) is not required to be updated regularly. The drawbacks of batch production are as follows:

- It prevents timeliness in some cases.
- At every point, one job is waiting in line, and hence, the turning period often increases.
- It is impossible to have the optimum quality timetable.

1.2.2 Online Processing

Online computing is a kind of processing that results from data processing. It makes possible to spread an account's information immediately from the site of generation without sorting them first, thus improving the functionality of storage structures under the CPU. By entering a computer dialog, a user can initiate an inquiry request, and the user can collect updates on their inquiry in a fraction of a second [7].

This fact encourages consumers to carry out purchases one by one to verify that the action of the computer is right. The user also relies on all monitoring to control the device. Examples of online technologies are trading, bourses, inventory management, reporting construction process, and management of inventories.

1.2.3 Real-Time Processing

Real-time processing involves continuous input, process and output of data. Input production and response are so limited that physical activity can be monitored alone. Effective time management requires all facilities' ability to quickly share input (not regularly, as in batch processing) [8].

- Direct (online) connecting to central processor between input/output devices
- Response time is relatively rapid, allowing more contacts throughout the high-definition processing unit. The feature of data processing in real time that makes them truly distinct from the best-known batches and online retrieval devices is the direct response to receiving a letter.

Consequently, computer processing services are not necessarily Internet applications exclusively in real time. It can also have the following applications:

- Account balance inquires can be answered within seconds.
- An instant automatic credit check can be done, using which a sales manager can find information about sales trends.
- The original document for performance analysis can be updated online.
- An efficient schedule for reservations, banks, airlines, and airlines can also be made.
- Radar-related tools can be used for land signalized intersections, security, and ground automation.

1.2.4 Distributed Data Processing

When multiple machines are used, distributed computing connects all the machines by creating a network among them using a computer system. Each control interface is usually chosen to handle the entire system for a specific workload. Databases must be built on many sites to function efficiently and used for numerical computation. The database is split into logical parts and stored somewhere. Users can easily access both physical and virtual databases from any site. Distributed information structures are the cornerstone of distributed database system (DDBS). This type is more useful for organizations having many branches in different locations over long distances. For its operational activities, each division retains information gathered from its homepage. Most of the output can be accomplished locally. A famous app is in banks where intelligent ends are fixed to a big machine in all subsidiaries at the headquarters. The components are transmitted to the master where they are saved [9].

1.2.5 Basic Functions of Data Processing

The information collection shall, for certain purposes, be amended, modified, or documented to maximize its usefulness and significance. The below are the fundamental functions of every information processing [10]:

- **Origination:** Data analysis first involves generating the data to be collected. Generally speaking, the existence, form and content of the primary sources, such as order sales, orders etc.
- **Data capture:** Data must be recorded or collected in one way or another before data can be processed. The type of knowledge is used for input and storage, depending upon the industry and method adopt for data capturing. The data derived from source records in the form of papers and management documents can be:
  - Cravings
  - Automatic directory computers
  - Other machines supporting feedback understandable by the machine.
- **Sorting**

  When ordered in a linear sequence, management of documents is usually smoother. For example, they can be sorted in the following orders:
  - From high to low
  - From the oldest to the latest, and vice versa.

  "Sorting" means arranging hidden records in a sequential order.
- **Merging**

  This function lets you compile many files consecutively so that the files are already ordered. For instance, a new user file could be added to the current client master file in a magnetic disk with a label like a customer number.

- **Calculating**
  Numerical data manipulation is called calculation which is a common task for data analysis to obtain effective data. This is generally the most important part of the procedure since the results mostly occur throughout the manufacturing process.
- **Summarizing**
  Summarizing can be defined as a concise and practical reduction of the quantity of the data. The data are generally summarized in various forms such as charts and diagrams. There are a few graphs like column chart, bar chart, line chart, area chart etc., to view data from a view of several created machines [11].
- **Managing output results**
  Following details are needed, when data are recorded and essential:
  Following the conclusion of diverse statistics procedures, information, or results are to be distributed or transferred by:
  a. The setup monitoring and diffusion of processed results.
  b. Records such as draughts, invoices and reports are unrestricted.
  c. The reclamation of a confident item or articles of well-preserved evidence user application.
  d. An impression that comprises all features that the receivers use output i.e. the system covers evidence.
  e. Interrelate and replication (transmission).
  This is a method that is continuous until the end user can use and additionally conveniently find the information from one place or operation to another. It is also necessary to copy or duplicate output records.
- **Storage**
  Finally, the results of data processing must be stored to make possible use of the document. This aspect is referred to as storage in Figure 1.1.
- **Data hierarchy**
  Below is the hierarchy of details in the ascending order of complexities:

Information structure consists of files and records. And so on, articles [13].

Bit: The word bit is the short form of binary digit. One of the dual terms 0 or 1 could be anticipated.
Byte: In a programming language, the basic knowledge unit is called a byte. An 8-bit mix normally saves a byte of data.
Field or object: One or several more bits of data of an area or data object contain data regarding an individual's personal properties.
Database: A record is a single person's list of fields.
File: A record collection is a disk. The description of a system file is much like the manual file in a repository.

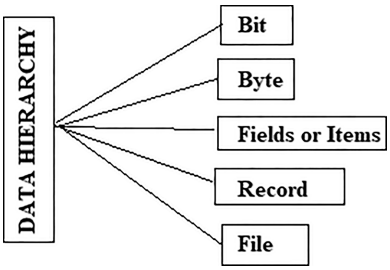

FIGURE 1.1 Data hierarchy.

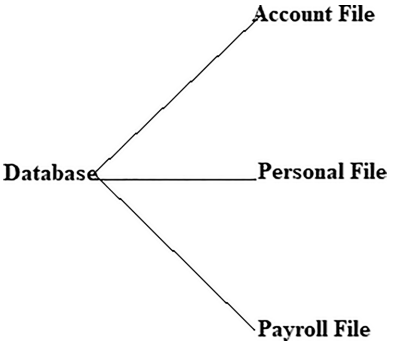

FIGURE 1.2 File record system.

Archive: A database includes all organizational archives arranged and incorporated for updating and collection of files as shown in Figure 1.2.

1.2.6 Application Portfolio Development

- IT-based application is a technology of the company's for collection of knowledge on expenditures by the enterprise. The knowledge is designed to demonstrate how these programs support an organization's mission and facilities, and how the expenditures are ultimately linked to expectations. The approach increases the capacity of policymakers to assess the possible impact of costs on the company's operation and technologies and the overall IT infrastructure. The application's asset allocation management aims to control the major corporate assets. In the tactics of the organization, average performance is key. The approach of portfolio honors the company's maturity [14].
- It also recognizes technological progress, and, given their full activities, the organization's application budget was included to look at future programs. The portfolio provides a mechanism for the organization of new projects within the context of enterprise strategy and evaluate a wider IT technology portfolio.
- This 1996 approach is based on the general policies, guidelines, and procedures needed for education decisions but with high applicability standards. The application portfolio
  - Shows similarities between corporate strategies and strategic initiatives.
  - Promotes identification of risk for application expenditure and contributes to the use of appropriate risk control methods;
  - Creates a structure for reporting corporate effectiveness;
  - Ensures that the whole IT infrastructure of a company is successfully incorporated.

1.2.7 Characteristics of Portfolio-Based IT Management

Management of the IT software maximizes the control process used to construct a specification. These experiences demonstrated the need to discuss the constraints of the process as well as extensive consultations with various stakeholders. The portfolio concept is based on management's philosophy that any big investment requires close monitoring to improve its value and shield it from threats to its integrity. The principle of traditional investment types—usually in portfolios, real estate, business papers, and inventories—is well known. The strategies allow policymakers not only to consider the whole range of investment, but also to take discrete investment into account [15].

The need for an equity investment is less understood, but not less important. Technological business investment requires large public funding; in a global networking world, they are also mission-critical and intertwined.

Request financing can be leveraged very easily if the portfolio is sufficient to meet evolving needs in markets and services. On the other hand, restrictive construction, unreasonable capabilities, productivity claims, and incompetence will undermine their value. Portfolio-based management control is a centralized evaluation of the success of the entire allocation continuum. This ensures that both the company's vast framework and its associated individual department's application portfolios are showing new ventures [16]. It sets out a framework in which

- Detailed decision-making information is accessible in light of an entity's operations.
- Application development and implementation are guided by the clear business needs of an organization to serve its citizens and fulfill its regulatory mandate. Tools for the administration of their statutory responsibilities.
- A comprehensive analytical mechanism is available for the determination of the best form of monitoring to conduct a project based on a quantitative risk study.
- Big projects are separated into equal, easier-to-use projects in any phase.
- Simply apply value without accepting the financing authorities' accompanying procedures.
- Portfolio-based IT is based on organizational knowledge about all instruments from the standpoint of an investment company. A wide range of decision-makers are responsible for this portfolio including ministry officials, specialist organization managers, and program managers. The experience is structured to identify trends, problems, and prospects and to analyze solutions to a company's total costs. In the program portfolio, information about an individual company is included:
  - Engineering and personnel capacity
  - Business- and corporate software development
  - Task, regulations, structures, and procedures within the company
  - Designed hardware, technologies, and physical network and operation
  - Other frameworks
  - Continuous
  - Cost of current and potential expenses and advantages
  - Difficulties and opportunities of the application.

1.2.8 Management of Data Processing Systems in Business Organizations

In a standard corporation, the measurement system can be very complex. Structural management is the key to the entire company's success. The management structure depends on the size and efficiency of the organization. Systems can occur so simply that one manager and even an entire organization involved in such contexts has retained. The information processing system is configured in a typical scenario:

1. Electronic data processing (EDP) chief
2. Software programming
3. Application for programmer
4. Controllers
5. Repair and maintenance engineers
6. Lists of management.

The data processing manager normally has the following duties:

1. Acquires new technology, including applications and hardware.
2. Same assessment.
3. Accomplishes approved innovations.

4. Provides EDP services in line with the requirements of the company's customers.
5. Adds new functionality and removes old functionality.
6. Implements new industry regulations and provides required interfaces for consumers.
7. Conducts resource accounting.
8. Maintains the system's functionality by inspection and remedial intervention in every collapse scenario.

1.2.9 Computerized Financial Accounting System (FAS)

The finance and accounting scheme is at the forefront of the whole supply chain. Like a traffic cop, he records financial documents or accounts. Financial planning is a process of capturing and handling all transactions within an institution involving operations affecting the financial standing of the corporation. The financial statements and the business balance sheet are prepared every year [16].

- **Why computerized FAS?**
  An organization's financing needs to be controlled, and computers are used to control this more efficiently. There is a considerable amount of quantitative accounting information obtained using the same instrument. The calculations are very simple and more accurate. Reports can be forwarded more quickly and occasionally [17].

1.2.10 Computerized Inventory Control System

- **What is inventory?**
  - Inventory refers to the buffer inventories of the items used to minimize the harm caused by the company's non-accessible supplies.
  - Varying stocks of different commodities shall be retained based on use, cost, and other characteristics.
- **Why control inventory?**
  - In most businesses, stock accounts for total operating costs between 50% and 70%. Although keeping stocks is unavoidable, it should be remembered that the inventory is an idle resource that adds additional costs. The company's profitability will be reduced by excess stockpiles in Figure 1.3.
  - Inventories can also be tightly monitored and supervised. Stock objectives can also be controlled.

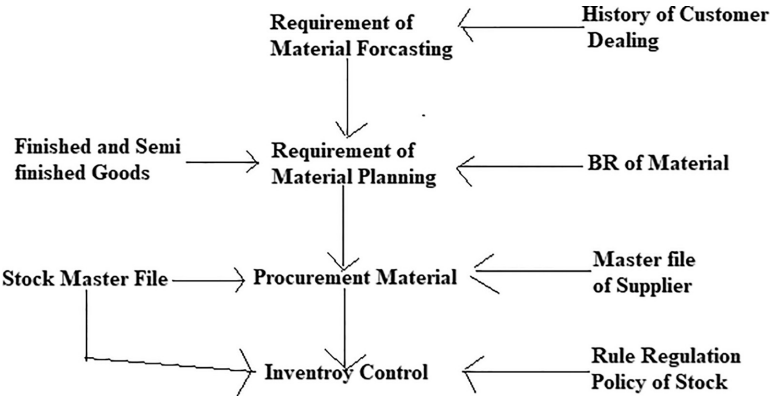

FIGURE 1.3 Inventory control and material management.

- It reduces the depletion of the consumer where necessary supplies cannot be used, and also reduces the total cost of products, covering the cost of sourcing, storage, and handling, in line with appropriate service requirements [18].
- Scope of quest inventory
- Supply preparation
- Supply-demand
- Goods receipt and testing
- Stocking machinery

1.2.11 Computerized Payroll System

The payroll system ensures that a precise and prompt calculation of pay is provided for each employee.

The payroll approach also generates essential inputs for financial reporting and accountability in Figure 1.4.

The system of payment is designed to calculate payments and manage documents [19].

1.2.12 Computerized Invoicing System

Billing is an integral part of a wide variety of procedures, including order scheduling and invoice processing. The issue with method is:

- Customer Receipts Ordering
- Customer Receipts Confirmation
- Control of order
- Invoice generation.

When the payment is made, the accounts payable method will take over [20]. The new invoice file was transformed into a deferred revenue system output in Figure 1.5.

1.2.12.1 Processing Steps

Consumer purchase orders are used in different formats in the computer system by fax in type of a request form. Applications are checked by checking product prices and customer credit ratings. Right instructions are saved in the order register.

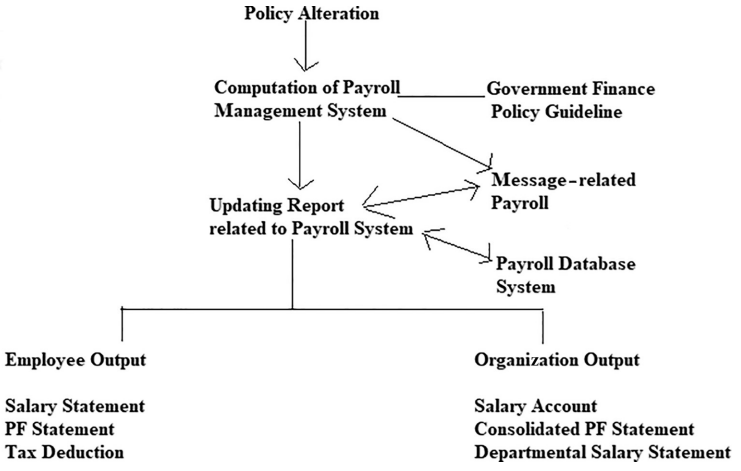

FIGURE 1.4 Payroll system.

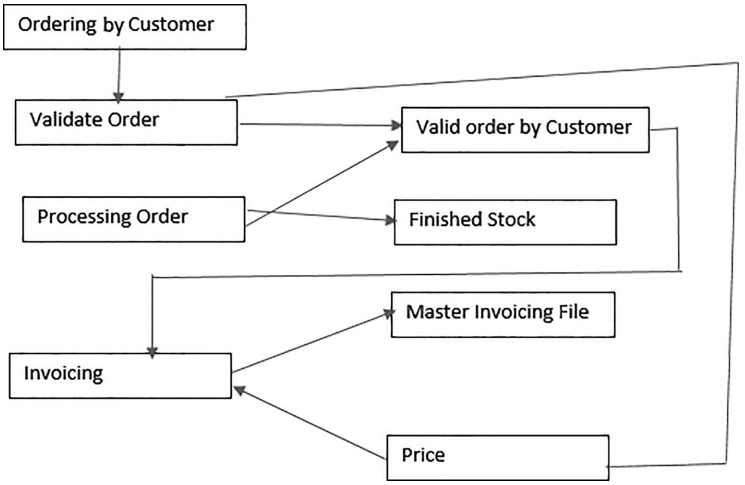

FIGURE 1.5 Invoicing system.

Transactions are performed by checking the functionality of goods from the finished inventory register. In this stage, three results are created: select list, slide, and sale booklet. After the order has been authorized, the relevant invoice will be created with reference to the expense master file. A checkbook is drawn up, and the required copy number is made during this phase. The most recent invoices will be transferred to the invoice master file.

1.3 CIVIL COMPUTING

Civil engineering is a professional engineering discipline that deals with the design, construction, and maintenance of physically and naturally built environments, including public works such as roads, bridges, canals, dams, airports, sewerage systems, pipelines, structural components of buildings, and railways.

A. **Strengthening being comprehensive and professional**
   The creation of specific and interrelated irregularities extends from an construal of the objective world to the renovation of the objective world. To achieve structural reforms and societies, on the one hand, an analytically minded environment is expected, and the science and technologies are strategically divided; on the other hand, technologies have to be mixed so a lot of work alone cannot be solved. The development of modern and advanced technology thus infiltrates national life to prevent great disturbance or incomprehension.
B. **Infiltrate many components such as economic, social environment, and trade**
   Engineering was the first complete reliability both in the past and in the present. Computer knowledge and technologies will also increase the complexities and costs of adapting to the progress of science and technology, which is a physically removing used in the computing technologies field, in the spirit of financial and cultural activity.
C. **Circulation in new products of modern science and technology**
   After the development of an electric tube in 1904, it took just 42 years for the first unit to be opened in 1946. The dielectric transistor was designed to create a semiconductor for around 10 years. The integrated circuit interface only took less than 2 years to reach fine computer microprocessors. Ultra-fine computer development simulation software can be described as a coordinated performance in the fourth generation. Innovations and "device production" engineering is gradually giving room for technological development.

1.3.1 Computing Simulated Simulations Engineering Application

A computer virtual numerical simulation shall identify and integrate the core content frameworks of the system model and simulator testing methods. Computer technology that draws similar technical domains may use simulation system architecture. Systems and materials modeling and research are key civil engineering scientists. Numerical computing is included as a lifetime or validated instrument in new simulation software technologies for the promotion of simulations and computing technologies. A series of parameters and the corresponding text will now be dynamically generated for the interactive simulator estimation mechanics. In specific, the following are the advantages:

A. **Mathematical patterns may frequently answer the tough or impossible reality of civil engineering in a computer simulation environment, compositional relationship, etc.**
   Therefore, theoretical analysis of strength and durability is complicated in practice since many real component relationships are established, but several failure measures are also available. Each criterion has a certain size and, along with experimental outcomes, each requirement has a constitutional relationship.
B. **Virtual simulation software may model circumstances, alterations to the environment, and development of construction knowledge**
   We may, for example, conveniently evaluate performance with bridge or prototype construction tools to apply the properties of materials in several forms (including shapes, and combinations of steel) and calculate dynamic simulation.

1.3.2 Application of CAD System

Highly qualified technologies are also an attractive field for computers. He is a simulator expert, mostly based on a basic body of knowledge, an inference system, and user experience, and extra information for computer solving and analytical skills. The regular project typesetting is shown in Figure 1.6.

Information and knowledge storage experience is a static collection. A powerful knowledge base can very well articulate and store expertise in the body of knowledge. The machine of logic is

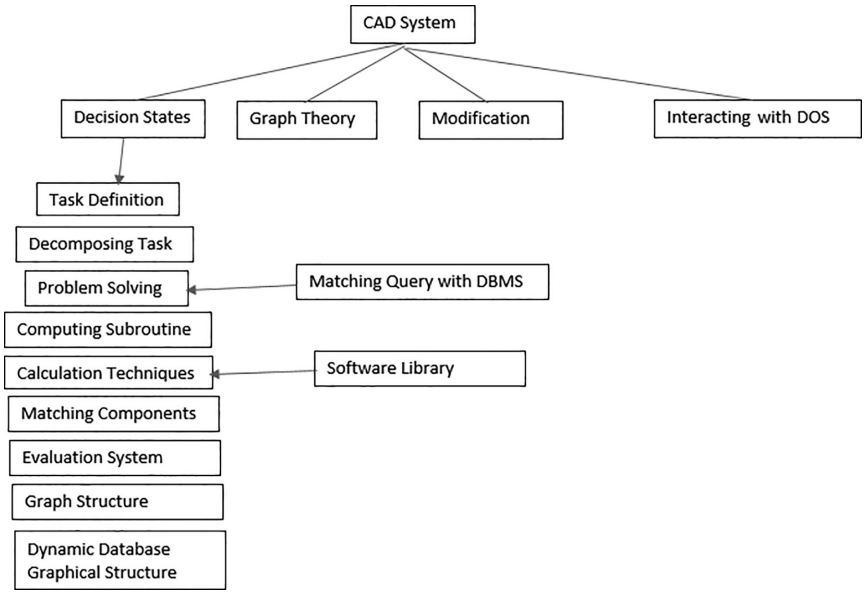

FIGURE 1.6 CAD system diagram.

an expert system technique used to improve parameter of problems. There is generally positive, cynical, and contradictory logic. The consequence of the reasoning process is based on the existing facts and rules, positive argument, and data orientation. The interpreter is a mechanism to answer questions of users in the thought process. Application in the context of reasoning is the context of complex information in the database to answer customer concerns such as why, how, and others. The graphical frame and the interface are peculiar to the technology expert system. They also culminate in the matured bounds, the CAD software kit is fused into the system, and the expert system is fully automated and intelligent.

1.4 ELECTRICAL COMPUTING

1.4.1 Remote Control Structures

A. Direct control

Direct access means that you can interface with the hardware directly. The network system is shown in Figure 1.7. The server, infrastructure, and security witch computer control module are included in this framework. Both stages including the HTTP or the short Ethernet layer can be achieved by network modules.

Final control involves prompt completion of the necessary system procedures. One drawback is the minimal resources available from the built-in computer, which has two roles: the database and a process management system WWW (World Wide Web). A single control system is included with the 8-bit microcontroller and Ethernet controller. The entire user interface will be included in the programming memory chip as a static HTML script. The use of technology would have digital components that carry out all consumer experiences. JavaScript can be used for this purpose [3]. Another task for a microcontroller control unit is to the detriment of the presented structure solution. This paradigm is recommended for basic frameworks that need a direct response from customers. Please note, these services are only managed by a small number of users as shown in Figure 1.8.

B. Control via a dedicated server

As seen in Figure 1.8, the form extended from point A. The system has been connected to various online services specifically related to the control system.

The system offers all the advantages of direct control, including additional costs during deployment and operation. The dedicated server manages a web server's complicated websites. Meta description depends on the condition of the control system. Only the processor with a microcontroller performs certain required functionality on the computer. For the entire bandwidth of the user interface, a physical server is used. The server and control unit must be physically integrated. Due to the larger measurements of the server, the connection

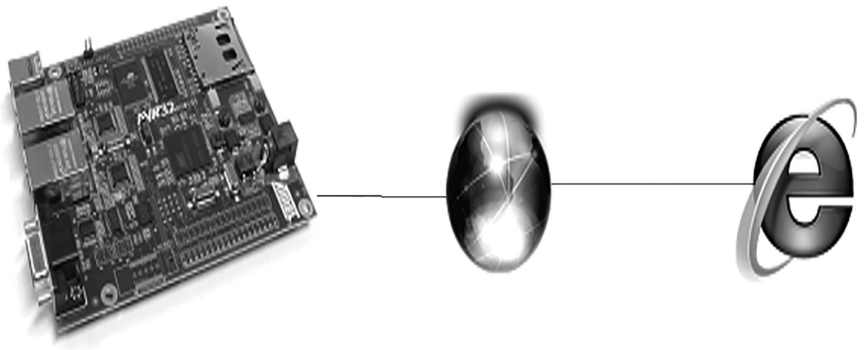

FIGURE 1.7 Structure of system in direct control.

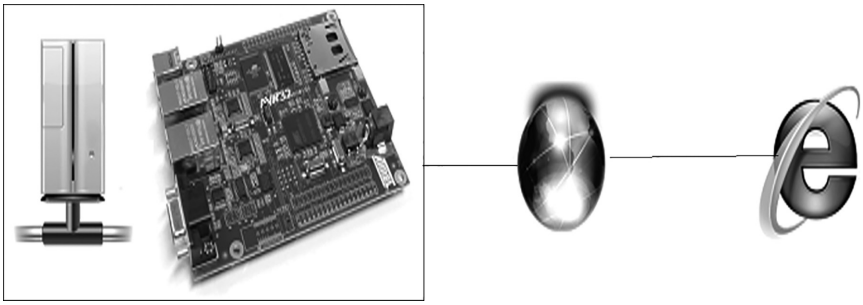

FIGURE 1.8 Structure of dedicated server.

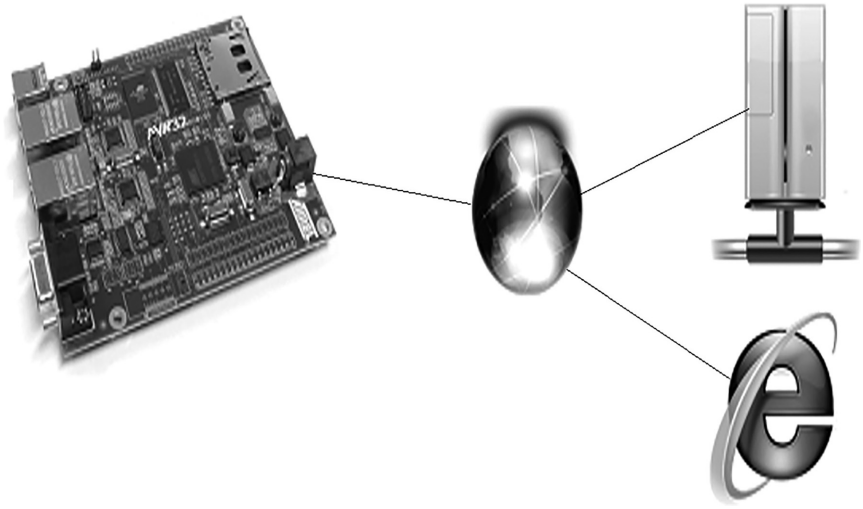

FIGURE 1.9 Structure of virtual server.

is not always possible in terms of the controller height. It raises delays to link a device to a controller on long routes.

The wireless network assists in building and placing the history of the control strategy in a folder. All networking facilities, including that of the fixing and setup of the essential applications, may also be presented.

C. Control via the virtual server

The system architecture on a virtual server is shown in Figure 1.9. The framework provided has all the assistances of straight supervision, but delivers extra budgets during execution and amenity. The client is linked to the computing cloud as with dedicated machines. The disparity is not apparent for the buyer.

For Internet access to the microcontroller-driven controller, a network adapter should be mounted. The implanted computer can communicate with the computer system in two ways: request and continuous communication. The global solution is the Customer and Server Request-Answer mode. For this requirement, no regional static IP (Internet Protocol) address should be assigned. Any free server provided by an infrastructure network is an innovation in virtualization. The XML-RCP (Extensible Markup Language) is recommended for data transmission (Figure 1.10).

The method of data sharing is XML-RCP structured. It helps to simplify customer queries on the server. The driver specifies the suitable methods in the remote desktop: bring