

DEVELOP AN HOSPITAL MANAGEMENT SYSTEM USING PROGRAMMING SKILL SET

A PROJECT REPORT

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BONAFIDE CERTIFICATE

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INTRODUCTION

A hospital management system (HMS) is a piece of software created to assist healthcare providers in running their businesses more successfully. Everything from patient visits and admissions to invoicing and inventory management may be managed using the system's features.

An HMS's primary goals are to increase hospital operations' general effectiveness and efficiency, improve patient care, and lower costs. It provides capabilities including patient registration and management, appointment scheduling, administration of electronic medical records, management of pharmacies and laboratories, processing of bills and payments, management of inventory, and more.

From little clinics to sizable multi-specialty hospitals, all sorts of institutions can utilise an HMS. Data may be stored locally on the hospital's server or may be accessible via the cloud from any location with an internet connection.

1.1 SCOPE

The scope of hospital management system (HMS) is comprehensive, covering all aspects of hospital operations, including administrative, clinical, and financial. HMS is a software solution designed to streamline hospital operations, automate workflows, and improve patient care. The scope of HMS includes:

1. **Clinical Management:** HMS enables healthcare providers to manage patient care, including electronic medical records (EMR), laboratory information system (LIS), pharmacy management, and clinical decision support tools.
2. **Inventory Management:** HMS provides inventory management tools to manage hospital inventory, including medical supplies, drugs, and equipment.
3. **Billing and Accounting:** HMS enables hospitals to manage patient billing and insurance claims, accounts receivable and payable, and financial reporting.
4. **Reporting and Analytics:** HMS provides reporting and analytics tools to analyze various aspects of hospital operations, including patient care, resource utilization, and financial performance.
5. **Human Resource Management:** HMS enables hospitals to manage employee records, attendance, payroll, and performance.
6. **Quality Management:** HMS provides quality management tools to ensure compliance with regulatory requirements, accreditation standards, and best practices.
7. **Patient Engagement:** HMS enables hospitals to engage patients through patient portals, remote monitoring, and patient education.

The scope of HMS is not limited to hospital operations, but it also includes integration with other healthcare systems, such as electronic health records (EHR) and health information exchanges (HIE), to ensure seamless exchange of patient information. HMS provides hospitals with a centralized system that enables them to improve operational efficiency, enhance patient care, and improve patient outcomes.

1.2 NEEDS

For the following reasons, hospital management systems (HMS) are crucial for contemporary healthcare providers:

1. **Streamlining Operations:** By automating numerous administrative procedures, including patient registration, appointment scheduling, billing and payment processing, and inventory management, an HMS enables hospitals to streamline their operations. As a result, hospitals' workload is decreased, errors are reduced, and efficiency is increased.
2. **Improving Patient Care:** Hospitals may keep accurate and current patient records, including information on medical history, prescriptions, test results, and treatment plans, with the help of an HMS. Doctors and nurses may easily access this information, allowing them to treat patients more effectively.
3. **Enhancing Communication:** An HMS makes it easier for staff members from various hospital departments, such as medical professionals, nurses, and administrators, to communicate with one another. This improves collaboration, lowers the possibility of misunderstandings, and guarantees that everyone

1.3 CONTEMPORARY ISSUE

Despite the benefits of hospital management systems (HMS), there are several contemporary issues that healthcare facilities face while implementing and using them effectively. Some of these issues include:

1. **System interoperability:** One of the biggest challenges with HMS is the lack of interoperability between different systems. Many hospitals use multiple systems for different functions, and it can be challenging to integrate them into a single system, leading to data silos and inefficiencies.
2. **Data security and privacy:** With the increasing use of electronic health records (EHRs), the security and privacy of patient data have become a significant concern. Hospitals need to ensure that the data is secure and comply with the regulatory requirements.
3. **User adoption and training:** Hospitals need to ensure that their staff is trained to use the HMS effectively. User adoption is a significant issue as many healthcare providers are resistant to change and may not be willing to adopt new technology.
4. **Cost and maintenance:** The implementation and maintenance costs of HMS can be high, making it difficult for small healthcare facilities to adopt them. Additionally, the ongoing maintenance and upgrade costs can also be a challenge.
5. **System downtime:** HMS downtime can disrupt hospital operations, leading to delays in patient care and revenue loss. Hospitals need to have backup systems in place to minimize the impact of system downtime.
6. **Regulatory compliance:** Hospitals need to ensure that their HMS complies with the regulatory requirements of the healthcare industry. Compliance issues can lead to penalties and legal liabilities.

Overall, while HMS has the potential to improve the quality of healthcare services, hospitals need to address these contemporary issues effectively to ensure a successful implementation and adoption of the system.

1.4 IDENTIFICATION OF PROBLEM

There are several problems that can arise in a hospital management system, including:

1. **Data security breaches:** Hospital management systems contain sensitive patient information, including medical records, financial data, and personal information. If the system is not properly secured, it can be vulnerable to data breaches and cyber attacks.
2. **Lack of interoperability:** Different hospital management systems may not be able to communicate with each other, making it difficult to share patient data across different platforms and systems. This can lead to delays in treatment and errors in patient care.
3. **Inefficient workflow:** Hospital management systems can be complex, and if they are not designed properly, they can create inefficiencies in workflow. This can lead to delays in patient care, frustrated staff, and increased costs.
4. **Poor user experience:** Hospital management systems need to be intuitive and easy to use. If the system is difficult to navigate or requires extensive training, it can create frustration for staff and result in errors in patient care.
5. **Inadequate support and maintenance:** Hospital management systems require regular maintenance and support to ensure they are functioning properly. If the system is not properly maintained or supported, it can lead to system failures, data loss, and other issues.
6. **Lack of integration with other healthcare systems:** Hospital management systems need to be integrated with other healthcare systems, such as electronic health records and health information exchanges. If the system is not integrated properly, it can lead to delays in treatment, errors in patient care, and reduced efficiency.

1.5 IDENTIFICATION OF TASK

hospital management system involves a variety of tasks, including:

1. **Patient registration:** This involves capturing patient information such as name, address, contact details, medical history, and insurance information.
2. **Appointment scheduling:** This task involves scheduling appointments for patients with doctors, specialists, and other healthcare providers. It may also include rescheduling and cancellation of appointments.
3. **Electronic medical records management:** This task involves managing patient medical records electronically, including documenting patient diagnosis, treatment plans, and prescriptions.
4. **Billing and payment processing:** This task involves generating invoices for patients and processing payments for medical services rendered. It may also involve managing insurance claims and payments.
5. **Pharmacy management:** This task involves managing pharmacy operations, including inventory management, dispensing medication, and managing prescriptions.

6. **Laboratory management:** This task involves managing laboratory operations, including test ordering, sample collection, and result reporting.
7. **Inventory management:** This task involves managing hospital inventory, including medical supplies, equipment, and medication.
8. **Reporting and analytics:** This task involves generating reports and insights on hospital operations, patient outcomes, and financial performance.
9. **Staff management:** This task involves managing hospital staff, including scheduling, payroll, and performance management.
10. **Compliance and regulation management:** This task involves ensuring that the hospital complies with relevant regulations and standards, such as DISHA and JCI accreditation.

LITERATURE REVIEW/BACKGROUND STUDY

2.1 Timeline of the reported problem

Online hospital management solutions became necessary as hospitals and healthcare institutions encountered difficulties with manual management of their operations. Hospitals had to rely on paper-based records, which were time-consuming and prone to error, before computer technology was developed. This made it challenging for healthcare practitioners to effectively manage patient care, inventory tracking, appointment scheduling, and financial management. In order to address these issues and enhance the effectiveness and efficiency of hospital operations, the first online hospital management system was created in the late 1960s and early 1970s.

In a study by Nair et al. (2014), An HMS performs a number of different tasks, including appointment scheduling, patient registration, keeping electronic medical records (EMR), and billing. The authors came at the conclusion that an integrated HMS can significantly raise hospital operational effectiveness and care quality

2.2 Existing solutions

Hospital management systems, according to a 2013 World Health Organization (WHO) report on health information systems, can aid healthcare providers in better managing patient care, resource allocation, and support for evidence-based decision-making. In the midst of a rapidly developing public health disaster, healthcare practitioners around the world faced unprecedented obstacles in managing patient care, resources, and information. The COVID-19 pandemic in 2020 brought attention back to the significance of online hospital management systems. To enhance treatment delivery and guarantee better patient outcomes, the pandemic has expedited the implementation of digital technology in healthcare, particularly online hospital administration systems.

In a recent study, Hassan and Ismail (2021) evaluated the effect of HMS on the standard of treatment in Malaysian hospitals. According to the study, an HMS dramatically increased patient satisfaction and safety. To raise hospital operational effectiveness and care quality, the authors advised healthcare organizations to invest in the creation and application of HMS. These technologies can assist hospitals in enhancing resource allocation, enhancing patient outcomes, and lowering expenses.

2.3 Review Summary

The value of HMS in enhancing patient safety, lowering medical errors, and improving healthcare delivery was underlined in a study by Nair et al. (2014). According to the study, an HMS performs a number of different tasks, including appointment scheduling, patient registration, keeping electronic medical records (EMR), and billing. The authors came at the conclusion that an integrated HMS can significantly raise hospital operational effectiveness and care quality. Aziz et al. (2015) looked into the application of an HMS in a Pakistani hospital in another study. According to the study, the method contributed to shorter wait times, better patient flow, and higher-quality medical services. The report also revealed a number of issues with HMS implementation, including staff training issues, staff reluctance to change, and a lack of technical expertise. The use of HMS in Nigerian hospitals was reviewed in one study by Akande and Oyeleye (2016), who concluded that it considerably increased administrative process efficiency and decreased the time and effort needed for record keeping. Another analysis of the effect of an electronic health record (EHR) system, a kind of HMS, on patient outcomes was

conducted by Adibi et al. (2016). They discovered that it increased drug safety and decreased the incidence of medical errors. In one study, Zolfaghari et al. (2017) assessed the impact of HMS on medication errors and discovered that the incidence of errors was dramatically decreased. The study also found that HMS lowered the time needed for drug administration and increased the accuracy and completeness of prescription recommendations. Furthermore, a study by Ravindranath and Venkatesh (2018) assessed how HMS influenced Indian hospitals' financial performance. The study indicated that HMS reduced the time needed for claims processing, increased revenue cycle management, and considerably enhanced the accuracy and completeness of billing operations. Al-Turki et al. (2019) evaluated the effects of HMS on patient safety and care quality in a review article. The analysis highlighted a number of advantages of HMS, including greater collaboration between medical specialists, better medicine administration, and improved patient monitoring. The authors also emphasized the value of incorporating patients and other stakeholders in the design and implementation of HMS. The factors impacting the adoption of HMS in hospitals in Bangladesh were investigated in a study by Ahmed et al. (2020). According to the study, adoption of HMS was significantly predicted by variables like perceived utility, convenience of use, and organizational support. To increase adoption rates, the authors advised hospitals to give special attention to creating a user-friendly and personalized HMS.

In a recent study, Hassan and Ismail (2021) evaluated the effect of HMS on the standard of treatment in Malaysian hospitals. According to the study, an HMS dramatically increased patient satisfaction and safety. To raise hospital operational effectiveness and care quality, the authors advised healthcare organizations to invest in the creation and application of HMS. These technologies can assist hospitals in enhancing resource allocation, enhancing patient outcomes, and lowering expenses. Machine learning algorithms have the ability to predict hospital readmissions, which can assist hospitals in preventing readmissions and lowering healthcare expenditures, according to a study by Sushmitha et al. (2021). These technologies can assist hospitals in enhancing resource allocation, enhancing patient outcomes, and lowering expenses. Machine learning algorithms have the ability to predict hospital readmissions, which can assist hospitals in preventing readmissions and lowering healthcare expenditures, according to a study by Sushmitha et al. (2021).

2.4 Goals/Objectives

- **Data security:** Hospital management systems can assist in keeping patient information secure and private. Given the delicate nature of healthcare information, this is especially critical.
- **Enhancing Patient Care:** Hospital management systems can enhance patient care by giving medical professionals rapid and easy access to patient data, tracking patient histories, controlling medication schedules, and more. This may result in more accurate diagnosis, more successful therapies, and better patient outcomes.
- **Enhancing Communication:** Hospital management systems can make it easier for patients to, healthcare professionals, and their families to communicate. For instance, healthcare providers can connect with one another using secure messaging platforms, and patients can receive appointment reminders by email or text message.
- **Improve Patient happiness:** FAQs can increase patient happiness by giving patients succinct, unambiguous answers to their inquiries. Patients are more likely to have a favourable hospital experience and return for future medical needs if they feel informed and supported.

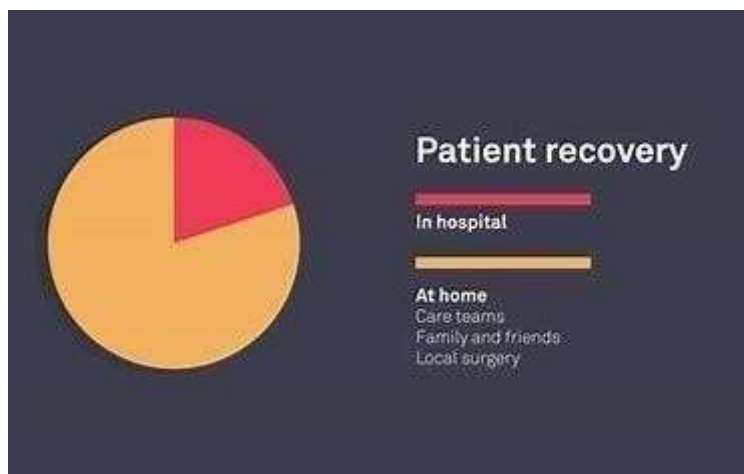


Figure 2.1 Description of a patient recovery

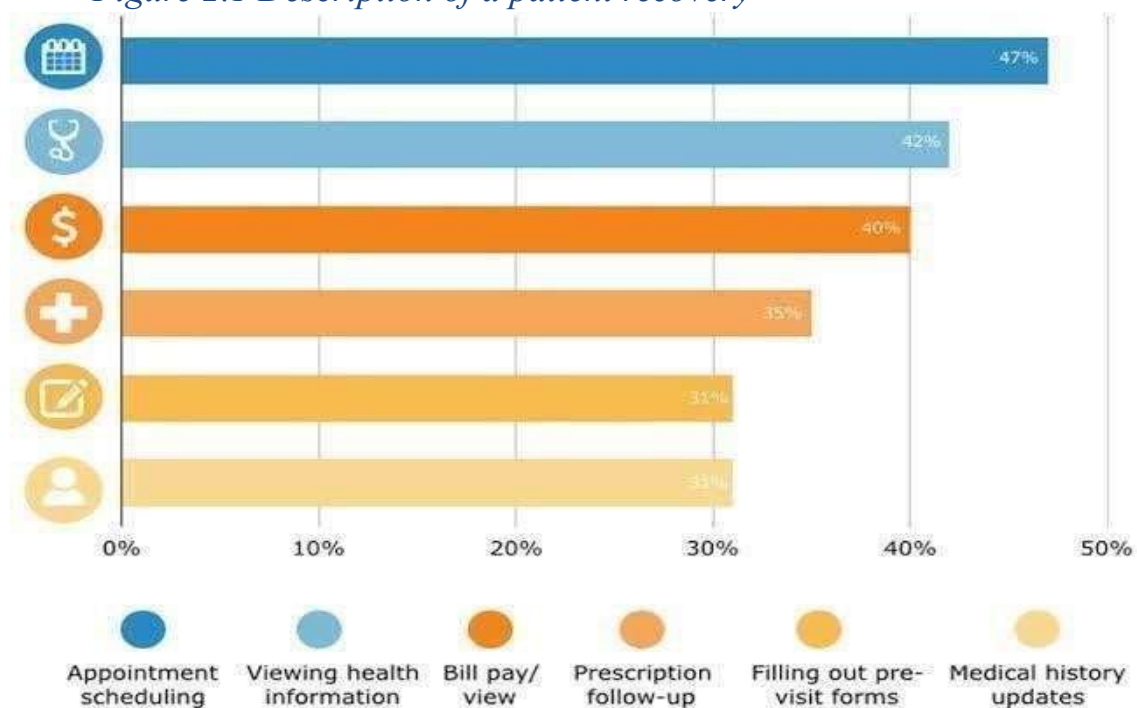
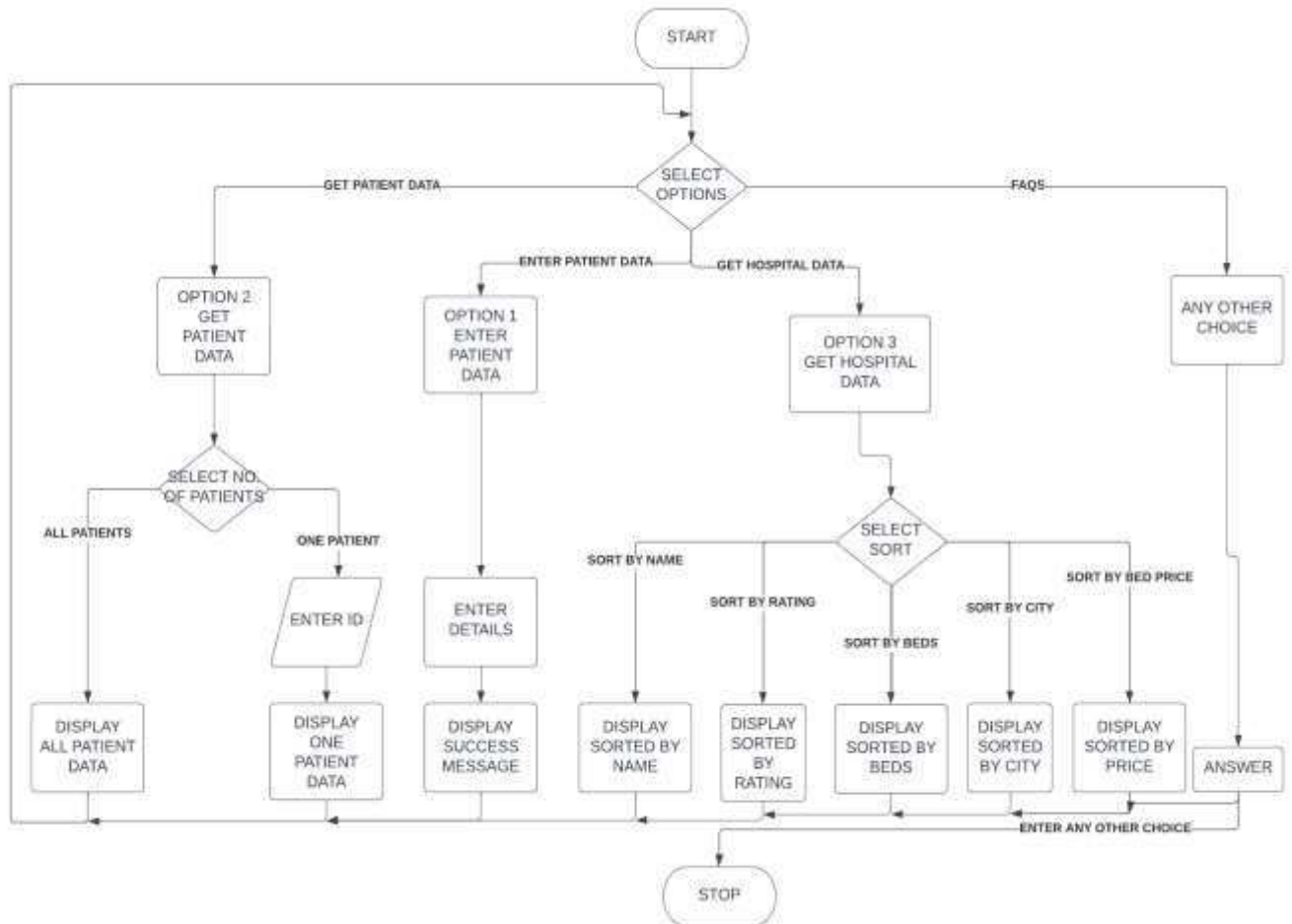


Figure 2.2 For awareness of patients and further diagnosis

FLOWCHART AND ALGORITHM

3.1 FLOWCHART FOR MANAGING HOSPITAL SYSTEM



3.2 ALGORITHM FOR MANAGING HOSPITAL SYSTEM

1. Start
2. Initialize the **hospitals** and **patients** arrays with sample data
3. Set **index** to 1 and **limit** to 4
4. Loop:
 - Print the menu options: Enter Patient's data, Get Patient's data, Get Hospital's data
 - Read the user's choice
 - If the choice is 1:
 - Increment **index**
 - Call the **SetPatientData()** function with **index** as the argument to input patient details
 - If the choice is 2:

- Loop:
- Print options: One patient's data, All patient's data • Read the user's choice
- If the choice is 1:
- Read the serial number **Sin**
- Call the **PrintOnePatientData()** function with **Sin** as the argument to print a specific patient's data
- Break the loop • If the choice is 2:
- Call the **PrintPatientData()** function to print all patient data
- Break the loop • If the choice is 3:
- Print sorting options: Sort by name, Sort by rating, Sort by beds available, Sort by bed price, Sort by city
- Read the sorting option
- Sort the hospitals based on the chosen option using the respective sorting functions
- Call the **PrintHospitalData()** function to print the sorted hospital data
- If the choice is 4 then , the frequently asked questions will be highlighted in front of user.
- If the choice is anything else, exit the program 5.

3.3 WORKING OF FLOWCHART

- The program starts by initializing the arrays and setting the variables.
- It then enters a loop that presents a menu to the user.
- Based on the user's choice, it performs different actions.
- If the user chooses to enter patient data, it increments the index and calls the **SetPatientData()** function to input the patient details and ask user for entering details.
- If the user chooses to get patient data, it presents options to retrieve data for a specific patient or all patients. Based on the user's choice, it calls the respective functions to print the patient data.
- If the user chooses to get hospital data, it presents sorting options. After the user selects a sorting option, the program sorts the hospitals accordingly and calls the **PrintHospitalData()** function to print the sorted data.
- The loop continues until the user chooses to exit the program.

CODE AND RESULT

4.1 CLASS FOR DATA OF HOSPITAL AND PATIENT

For the purpose of storing the data of hospitals and patients, two class are made with names Hospital and Patient which contain the required datatypes like string for hospital name , int for storing the contact number etc.

```
1  // C++ program to implement the Hospital
2  // Management System
3  #include <iostream>
4  using namespace std;
5  int index=1,limit=4;
6  // Store the data of Hospital
7  class Hospital {
8  public:
9      string H_name;
10     string location;
11     int available_beds;
12     float rating;
13     string contact;
14     string doctor_name;
15     int price;
16 }hospitals[4];
17
18 // Stores the data of Patient
19 class Patient : public Hospital {
20 public:
21     string P_name;
22     int P_id;
23 }patients[4];
24
```

figure 4.1 Class for the data of hospital and patient

4.2 PRINTING THE HOSPITAL INFORMATION

```
void PrintHospitalData()
{
    cout << "PRINT hospitals DATA:" << endl;
    cout << "HospitalName      ";
    cout << "Location          ";
        cout << "Beds_Available      ";
        cout << "Rating              ";
        cout << "Hospital_Contact    ";
        cout << "Doctor_Name         ";
        cout << "Price_Per_Bed       \n";

    for (int i = 0; i < 4; i++)
    {
        cout << hospitals[i].H_name;
        for(int a=0;a<17-hospitals[i].H_name.length();a++)
            cout<<" ";
        cout<< hospitals[i].location;
        for(int a=0;a<13-hospitals[i].location.length();a++)
            cout<<" ";
        cout<< hospitals[i].available_beds;
        for(int a=0;a<16;a++)
            cout<<" ";
        cout<< hospitals[i].rating;
        for(int a=0;a<8;a++)
            cout<<" ";
        cout<< hospitals[i].contact;
        for(int a=0;a<21-hospitals[i].contact.length();a++)
            cout<<" ";
        cout<< hospitals[i].doctor_name;
        for(int a=0;a<16-hospitals[i].doctor_name.length();a++)
            cout<<" ";
        cout<< hospitals[i].price;
        cout<< endl;
    }

    cout << endl << endl;
}
```

figure 4.2 Function for printing hospital information

Here For Loops are used to store the data of hospitals in the tabular format. A function named PrintHospitalData() is made to print the information of patient. In which different for loops for printing the contact, rating, doctor name etc.

4.3 PRINTING THE PATIENT INFORMATION

```
void PrintPatientData()
{
    cout << "PRINT patients DATA:";
    cout<< endl;
    cout << "Patient_Name      ";
    cout<< "Patient_Id      ";
    cout<< "Patient_Contact      ";
    cout<< "Alloted_Hospital      ";
    cout<< "Patient_Expenditure\n";

    for(int a=3;a>=0;a--)
    {
        if(patients[a].P_name.length()==0)
            continue;
        else
        {
            limit=a+1;
            break;
        }
    }

    for (int i = 0; i < limit; i++)
    {
        cout << patients[i].P_name;
        for(int a=0;a<17-patients[i].P_name.length();a++) cout<<" ";
        cout<< patients[i].P_id;
        for(int a=0;a<12;a++) cout<<" ";
        cout<< patients[i].contact;
        for(int a=0;a<20-patients[i].contact.length();a++) cout<<" ";
        cout<< hospitals[i].H_name;
        for(int a=0;a<21- hospitals[i].H_name.length();a++) cout<<" ";
        cout<< patients[i].price;
        cout<< endl;
    }
    cout << endl << endl;
}
```

figure 4.3 Printing the data of patient

Another Function is made for the printing of the patient information like contact , expenditure, id .

4.3 SORTING OF HOSPITALS BY NAME , RATING

```
void swap(int x,int y)
{
    string HNAME=hospitals[x].H_name;
    string LOCATION=hospitals[x].location;
    int AVAILABLEBEDS=hospitals[x].available_beds;
    float RATING=hospitals[x].rating;
    string CONTACT=hospitals[x].contact;
    string DOCTORNAME=hospitals[x].doctor_name;
    int PRICE=hospitals[x].price;

    hospitals[x].H_name=hospitals[y].H_name;
    hospitals[x].location=hospitals[y].location;
    hospitals[x].available_beds=hospitals[y].available_beds;
    hospitals[x].rating=hospitals[y].rating;
    hospitals[x].contact=hospitals[y].contact;
    hospitals[x].doctor_name=hospitals[y].doctor_name;
    hospitals[x].price=hospitals[y].price;

    hospitals[y].H_name=HNAME;
    hospitals[y].location=LOCATION;
    hospitals[y].available_beds=AVAILABLEBEDS;
    hospitals[y].rating=RATING;
    hospitals[y].contact=CONTACT;
    hospitals[y].doctor_name=DOCTORNAME;
    hospitals[y].price=PRICE;
}

// data by name
void SortHospitalByName()
{
    // Sort the data
    for(int a=0;a<3;a++)
    {
        for(int b=a+1;b<4;b++)
        {
            if(hospitals[a].H_name.compare(hospitals[b].H_name)>0)
            {
                swap(a,b);
            }
        }
    }
}
```

figure 4.4 Sorting of hospital data by names, rating

As the sorting help the user to find the best hospital according to his requirement and best suitability.

4.5 STORING DATA OF HOSPITAL AND PATIENT

```
hospitals[1].H_name="Aaims";
hospitals[1].location="Delhi";
hospitals[1].available_beds=265;
hospitals[1].rating=4.6;
hospitals[1].contact="6211062110";
hospitals[1].doctor_name="Dr. H.R. Sen";
hospitals[1].price=35000;

hospitals[2].H_name="Fortis";
hospitals[2].location="Chandigarh";
hospitals[2].available_beds=120;
hospitals[2].rating=4.5;
hospitals[2].contact="5266352663";
hospitals[2].doctor_name="Dr. N.A. Mishra";
hospitals[2].price=15000;

hospitals[3].H_name="Aqua";
hospitals[3].location="Kolkata";
hospitals[3].available_beds=206;
hospitals[3].rating=4.8;
hospitals[3].contact="1120511205";
hospitals[3].doctor_name="Dr. P. Banerjee";
hospitals[3].price=40000;

patients[0].P_name="Light Yagame";
patients[0].P_id=265;
patients[0].contact="2378967356";
patients[0].price=35000;

patients[1].P_name="Loid Forger";
patients[1].P_id=152;
patients[1].contact="5238565445";
patients[1].price=23000;
```

Figure 4. 5 Storing information of hospital and patients

4.6 OUTPUT

```
1-Enter Patient's data
2-Get Patient's data
3-Get Hospital's data
4-Frequently asked Questions
Press any other number to EXIT
█
```

Figure 4. 6 Menu for hospital management system

```
1-Enter Patient's data
2-Get Patient's data
3-Get Hospital's data
Press any other number to EXIT
2
  1-one patient's data
  2-all patient's data
2
PRINT patients DATA:
Patient_Name  Patient_Id  Patient_Contact  Alloted_Hospital  Patient_Expenditure
Light Yagane   265          2378967356      RIMS              35000
Loid Forger    152          5238565445      Aims              23000

1-Enter Patient's data
2-Get Patient's data
3-Get Hospital's data
Press any other number to EXIT
█
```

Figure 4. 7 Getting patient data

```
1-Enter Patient's data
2-Get Patient's data
3-Get Hospital's data
Press any other number to EXIT
3
  1 -> Sort by name
  2 -> Sort by Rating
  3 -> Sort by Beds available
  4 -> Sort by bed price
  5 -> Sort by city
2
PRINT hospitals DATA:
HospitalName  Location  Beds_Available  Rating  Hospital_Contact  Doctor_Name  Price_Per_Bed
Aqua          Kolkata   206             4.8     1120511205       Dr. P. Banerjee 48000
Aims          Delhi     265             4.6     6211062110       Dr. H.R. Sen    35000
Fortis        Chandigarh 120             4.5     5266352663       Dr. N.A. Mishra 15000
RIMS          Ranchi    158             4.5     3211932119       Dr. P.K. Das    25000
```

Figure 4. 8 sorting hospital by rating

- 4
- 1- How to get admitted in case of emergency ?
 - 2- How much is the average bed charge for the person with the patient ?
 - 3- What if the prescribed medicines are not available in the medical below ?
 - 4- What if the patient is ill ?
 - 5- What happens once I am admitted?
 - 6- Does the daily hospital fee include doctor and therapist visits?
 - 7- What infection control measures are in place?
 - 8- What does hospital billing cover?
 - 9- Who will have access to my information?

Figure 4. 9 Frequently Asked Questions

CONCLUSION AND FUTURE WORK

5.1 CONCLUSION

1. **Integration with IoT and Wearable Devices:** Incorporating Internet of Things (IoT) technology and wearable devices into the HMS can provide real-time patient monitoring, remote healthcare services, and improved data collection. This would enable healthcare professionals to monitor patients' health conditions continuously, enhance preventive care, and enable early detection of potential health issues.
2. **Telemedicine Integration:** The rise of telemedicine and remote healthcare services has been accelerated by recent global events. Integrating telemedicine capabilities within the HMS would enable healthcare providers to offer virtual consultations, remote monitoring, and follow-ups, ensuring accessibility to healthcare services for patients in remote areas or those with mobility limitations.
3. **Enhanced Data Analytics:** Expanding the data analytics capabilities of the HMS can provide valuable insights for proactive decision-making. Advanced analytics techniques, such as predictive modeling and machine learning algorithms, can help hospitals identify disease patterns, predict patient outcomes, and optimize resource allocation.

The Hospital Management System has revolutionized healthcare facilities by streamlining operations, enhancing patient care, and optimizing resource utilization. It has proven to be an indispensable tool for managing patient records, scheduling appointments, facilitating billing and payments, and improving communication among healthcare professionals.

One of the primary advantages of an HMS is its ability to centralize information, making it easily accessible to authorized personnel. This reduces the chances of errors, eliminates duplicate records, and ensures the integrity and confidentiality of patient data. Additionally, automation of routine administrative tasks allows healthcare professionals to focus more on patient care, leading to improved efficiency and overall patient satisfaction.

Moreover, the HMS facilitates better coordination and communication among different departments within a hospital. This enables effective collaboration between doctors, nurses, laboratory technicians, and other staff members, resulting in improved diagnosis, treatment, and patient outcomes. The system also provides valuable insights through data analytics, helping hospitals make informed decisions, identify trends, and enhance overall performance.

5.2 FUTURE WORK

The Hospital Management System has significantly transformed healthcare management, there are several areas that can be further developed to enhance its capabilities and address emerging challenges. The following are some potential avenues for future work:

1. **Interoperability and Data Exchange:** Promoting interoperability and standardization across different healthcare systems is crucial for seamless data exchange. Efforts should be made to establish common data standards, protocols, and interfaces, enabling efficient sharing of patient information across different healthcare providers and systems, while maintaining data security and privacy.

2. **Security and Privacy Enhancements:** As patient data becomes increasingly digitized, ensuring robust security measures and strict privacy protocols becomes imperative. Future work should focus on implementing advanced security features, such as encryption, access controls, and audit trails, to safeguard patient information from unauthorized access and cyber threats.
3. **Mobile Applications:** Developing mobile applications that integrate with the HMS can provide patients and healthcare professionals with convenient access to healthcare services, including appointment scheduling, prescription refills, lab results, and remote monitoring.

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