DIGITAL PAYMENT TRANSACTION TRENDS DASHBOARD

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Abstract

Patient waiting time is an important operational measure used to understand the efficiency of healthcare services. Long waiting periods may occur because of high patient volume, appointment delays, registration procedures, limited staff availability, or inefficient service workflows. Analyzing waiting-time information can help healthcare facilities understand where delays occur and identify areas that require improvement.

The **Patient Wait-Time Analysis** system is designed to collect, process, analyze, and visualize patient-flow and waiting-time information. The system can use data such as patient arrival time, registration time, appointment time, consultation start time, department, doctor, and service completion time. These records are processed to calculate individual and overall waiting durations.

The system analyzes important measures such as average waiting time, minimum waiting time, maximum waiting time, patient volume, service duration, and department-wise performance. Waiting-time trends can be examined across different dates, time periods, departments, doctors, and service stages. Peak hours can also be identified by analyzing patient arrival patterns and waiting-time variations.

An interactive dashboard can present the analyzed information using charts, graphs, tables, and key performance indicators. Users can apply filters to examine specific departments, doctors, dates, or service stages. This makes it easier to identify departments or periods where patients experience longer waiting times.

Overall, the project demonstrates how data analytics and visualization can support healthcare operational management. The system provides a centralized method for understanding patient-flow patterns and service delays. The insights generated from the analysis can support better scheduling, staff allocation, resource planning, and service monitoring. Therefore, the Patient Wait-Time Analysis system provides a useful analytical approach for improving healthcare service efficiency and reducing unnecessary patient waiting.

I. Introduction

Patient waiting time is an important aspect of healthcare service management because it directly reflects how efficiently patients move through different stages of a healthcare facility. Patients may need to wait during registration, consultation, laboratory services, pharmacy services, or other medical procedures. When waiting

times become long, it may indicate problems related to patient volume, resource availability, scheduling, or service processes.

Traditional healthcare facilities may record patient information through registers, spreadsheets, appointment systems, or hospital management applications. Although these methods can store important information, analyzing large amounts of patient-flow data manually can be difficult. Administrators may need to calculate waiting times and compare departments or time periods separately. This can make it difficult to identify operational delays quickly.

The **Patient Wait-Time Analysis** system provides a structured approach for analyzing patient waiting information. The system uses patient arrival, registration, appointment, consultation, and service-related timestamps to calculate waiting durations. The collected information can be categorized according to departments, doctors, dates, and time periods to provide a detailed understanding of patient-flow behavior.

Data visualization plays an important role in presenting the results of the analysis. Charts can show patient arrival trends, waiting-time distributions, department-wise waiting times, and peak-hour patterns. KPI cards can display total patients, average waiting time, maximum waiting time, and other important indicators. Interactive filters allow administrators to examine specific parts of the healthcare service process.

The main purpose of the project is to transform raw patient-flow information into meaningful operational insights. By identifying periods and departments associated with longer waiting times, healthcare administrators can better understand service bottlenecks. The system can support decisions related to scheduling, staff allocation, and resource planning. Overall, the project demonstrates how analytical dashboards can contribute to more efficient patient-flow management and improved healthcare service operations.

II. Literature survey

Previous studies on healthcare service management have identified patient waiting time as an important indicator of operational efficiency. Researchers have examined waiting times in outpatient departments, emergency services, registration counters, laboratories, pharmacies, and consultation areas. These studies generally focus on understanding the relationship between patient demand, service capacity, and waiting duration. Measuring waiting time provides healthcare organizations with useful information for evaluating the performance of their service processes.

Research on **patient-flow management** has examined how patients move through different stages of healthcare delivery. Patient arrival patterns, appointment schedules, service duration, staffing levels, and department capacity can influence waiting times. Studies have used patient-flow information to identify periods of high demand and areas where service capacity may be insufficient. Such analysis can help organizations understand bottlenecks and improve the movement of patients through healthcare facilities.

Several studies have focused on **queue management and waiting-time reduction** in healthcare environments. Queue-based approaches are used to understand the relationship between arrival rates and service rates. When the number of arriving patients is greater than the available service capacity, waiting times may increase. Analysis of historical patient records can help identify recurring periods of congestion and support better scheduling and resource allocation.

Healthcare researchers have also applied **statistical and data analytics techniques** to analyze waiting-time patterns. Measures such as average waiting time, minimum waiting time, maximum waiting time, service duration, and patient volume can be calculated from historical records. Comparing these measures across departments, doctors, weekdays, and time periods can reveal differences in service performance. Data quality is important because missing or incorrect timestamps can affect the accuracy of waiting-time calculations.

The use of **business intelligence and data visualization** has provided another approach for healthcare performance monitoring. Dashboards can combine patient volume, waiting time, service duration, and department performance into a single interface. Graphs, charts, tables, and KPI cards make operational information easier for administrators to interpret. Interactive filtering also allows users to examine specific departments, dates, doctors, and service stages without manually preparing separate reports.

Based on these developments, the **Patient Wait-Time Analysis** system combines patient-flow analysis, waiting-time calculation, performance comparison, and data visualization into one analytical platform. The system can help identify peak periods, departments with longer waiting times, and variations in service performance. By presenting these findings through an interactive dashboard, healthcare administrators can obtain a clearer understanding of operational conditions. The project therefore demonstrates the practical application of data analytics for systematic patient waiting-time monitoring and healthcare service management.

III. System Analysis

System analysis is an important stage in developing the Patient Wait-Time Analysis system for monitoring healthcare service efficiency. The system focuses on analyzing patient arrival, registration, consultation, and service completion times. Patient records are collected and organized into a structured dataset for further processing and analysis. Waiting time is calculated by determining the difference between patient arrival or registration and service start time. Average, minimum, and maximum waiting times are calculated to understand overall service performance. Patient volume is analyzed across different dates, departments, doctors, and time periods. Peak hours are identified by examining periods with high patient arrivals and longer waiting times. Department-wise analysis helps identify healthcare areas experiencing higher delays. Charts, graphs, tables, and KPI cards are used to present the analyzed information clearly. Interactive filters allow users to examine waiting-time patterns based on dates, departments, doctors, or service stages. The system helps healthcare administrators understand patient flow and identify operational bottlenecks. Overall, the system provides a centralized approach for analyzing patient waiting time and supporting better healthcare service management.

Existing System

The existing system for monitoring patient waiting time commonly depends on manual records, appointment registers, spreadsheets, or basic hospital management reports. Patient arrival and service information may be recorded separately at different stages of the healthcare process. Staff members may manually note registration, consultation, and service timings for individual patients. Calculating the waiting time for each patient can require additional manual effort. Healthcare administrators generally review records or basic reports to understand service delays. Identifying peak hours with high patient volume may be difficult when data is stored as raw records. Comparing waiting times across different departments or doctors can also require repeated calculations. Traditional systems may provide limited graphical representation of patient-flow information. Long waiting periods may therefore not be identified quickly or consistently. Manual data entry can result in missing information, incorrect timings, or calculation errors. Preparing daily, weekly, or monthly waiting-time reports requires additional time and effort. Therefore, a centralized dashboard-based system can provide a more efficient approach for analyzing patient waiting times.

Disadvantages of Existing System

- Heavy dependence on manual patient records.
- Time-consuming calculation of waiting times.
- Limited visualization of patient-flow trends.
- Difficult to identify peak waiting periods quickly.
- Difficult to compare department-wise waiting times.
- Manual recording may result in missing or incorrect data.
- Higher possibility of calculation and data-entry errors.
- Manual preparation of reports requires additional effort.
- Limited interactive filtering and data exploration.

Proposed System

The proposed system provides an interactive Patient Wait-Time Analysis platform for monitoring and analyzing healthcare service performance. The system collects patient arrival, registration, appointment, consultation, and service completion information. The collected data is cleaned and organized into a structured format before analysis. Waiting time is calculated for individual patients and different stages of the healthcare process. Average, minimum, maximum, and overall waiting times are calculated to measure service efficiency. Patient volume is analyzed across different dates, departments, doctors, and time periods. Peak hours are identified by examining patient arrival and waiting-time patterns. Department-wise analysis helps identify areas where patients experience longer delays. Key performance indicators such as total patients, average waiting time, maximum waiting time, and service duration are displayed on the dashboard. Charts, graphs, tables, and KPI cards provide a clear visual representation of patient-flow information. Interactive filters allow users to explore waiting times based on dates, departments, doctors, and service stages. The system helps administrators identify delays and understand the factors affecting patient flow. Overall, the proposed system provides a centralized and visual approach for improving patient wait-time monitoring and healthcare service planning.

Advantages of Proposed System

- Provides centralized patient wait-time analysis.
- Calculates average, minimum, and maximum waiting times.
- Helps identify peak patient-flow periods.
- Supports department-wise waiting-time analysis.
- Enables doctor-wise service performance analysis.
- Provides clear charts and visualizations.
- Displays important healthcare performance KPIs.
- Helps identify operational delays and bottlenecks.
- Reduces manual calculation and report preparation.
- Supports better scheduling and resource allocation.

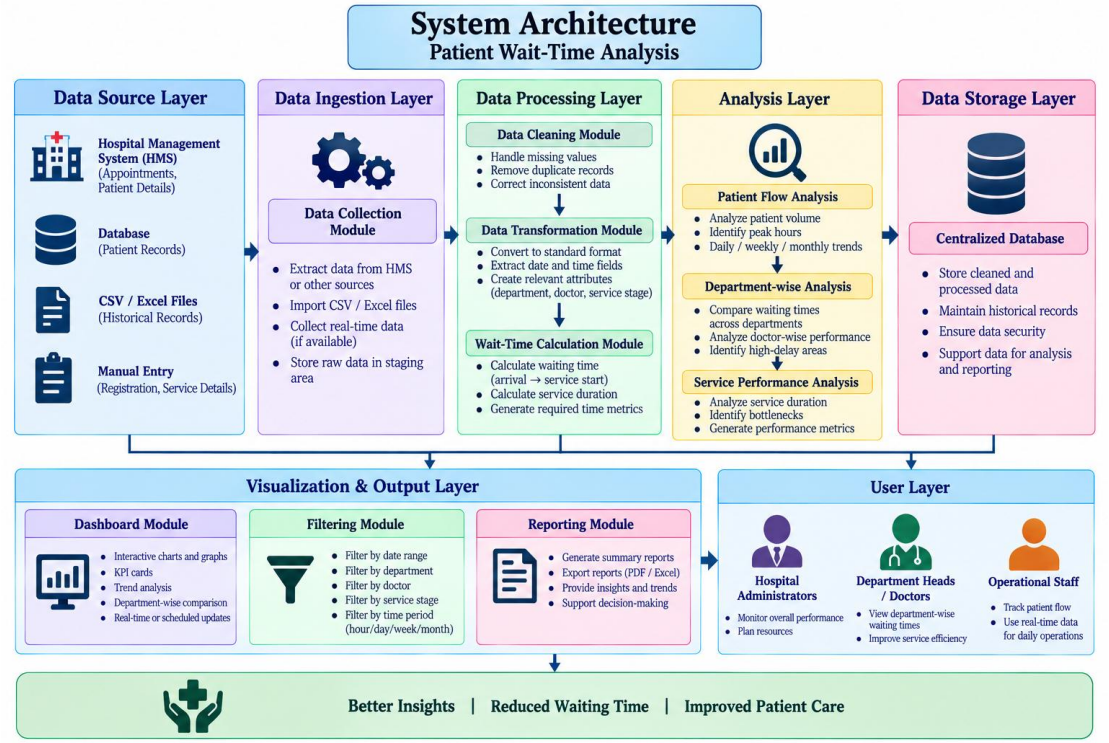
IV. Methodology

The methodology begins with collecting patient service data from available healthcare records or datasets. The collected information includes patient arrival time, registration time, appointment time, consultation start time, service completion time, department, and doctor details. The dataset is examined to identify missing, duplicate, or inconsistent records. The data is cleaned and transformed into a structured format suitable for analysis. Waiting time is calculated by comparing patient arrival or registration time with the corresponding service start time. Service duration and total patient-processing time are also calculated where the required information is available. The processed data is grouped according to dates, departments, doctors, and different time periods. Average, minimum, maximum, and other relevant waiting-time measures are calculated. Peak hours are identified by analyzing patient volume and waiting-time patterns throughout the day. Suitable charts, graphs, tables, and KPI cards are selected to present the analyzed information. An interactive dashboard is developed to provide a clear view of patient waiting-time performance. Filters are added to allow users to analyze specific dates, departments, doctors, and service stages.

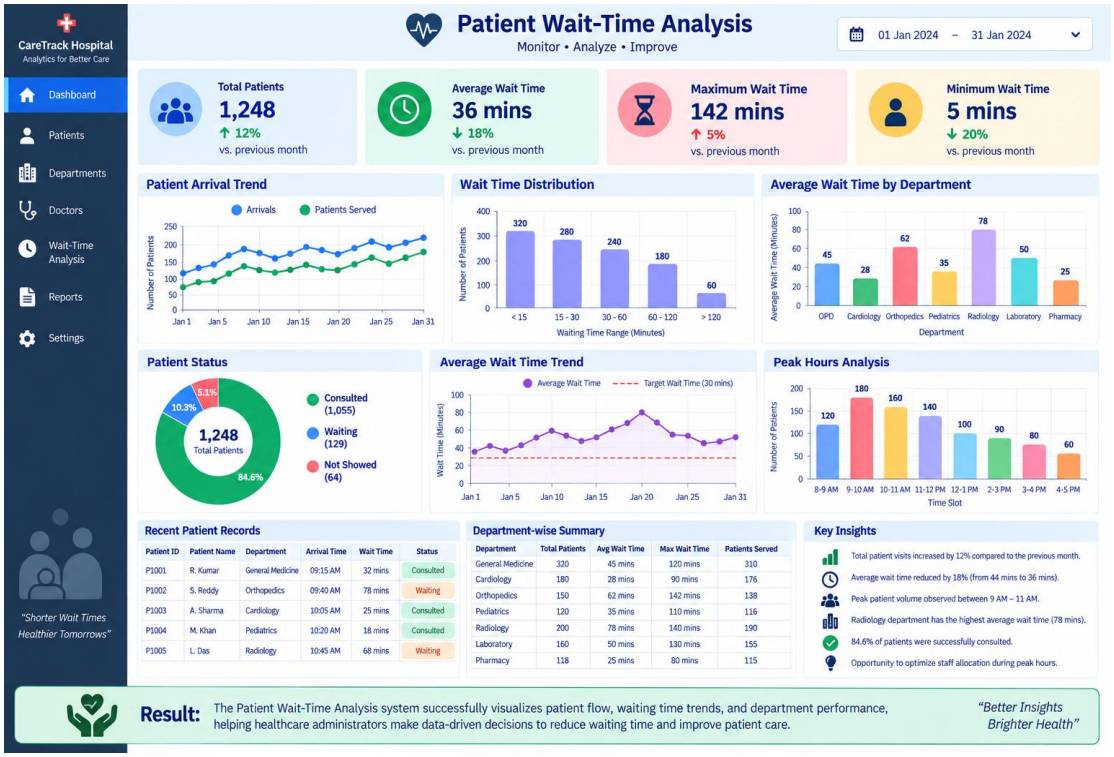
System Architecture

The system architecture represents the complete workflow of the Patient Wait-Time Analysis system from healthcare data collection to final visualization. The process begins with the Patient Data Source, containing arrival, registration, appointment, consultation, department, doctor, and service information. The Data Collection Module gathers the required patient-flow records from the available data source. The Data Cleaning Module removes duplicate, incomplete, and inconsistent records to improve data quality. The Data Transformation Module organizes the cleaned information into suitable fields and time formats. The Wait-Time Calculation Module calculates individual and overall patient waiting durations. The Service Analysis Module evaluates consultation duration and service-processing times where applicable. The Patient Flow Analysis Module analyzes patient volume across dates, departments, doctors, and time periods. The Peak-Time Analysis Module identifies periods with high patient volume and longer waiting times. The processed information is provided to the Dashboard Visualization Module for graphical representation. The KPI Module displays total patients, average waiting time, maximum waiting time, and other service indicators. Finally, the Reporting and Output Module presents charts,

tables, trends, and summarized healthcare service insights. Overall, the architecture follows the workflow **Patient Data → Data Collection → Data Cleaning → Data Transformation → Wait-Time Calculation → Service Analysis → Patient Flow Analysis → Peak-Time Analysis → Visualization → KPIs & Filters → Reports → Final Dashboard**.



V. Result and Output



VI. Conclusion

The Patient Wait-Time Analysis system successfully provides an efficient approach for monitoring and analyzing patient waiting times in healthcare facilities. The system organizes patient arrival, registration, consultation, and service-related information for detailed analysis. Waiting-time calculations help determine the average, minimum, and maximum time patients spend waiting for services. Patient-flow analysis helps identify periods with high patient volume and increased waiting times. Department-wise and doctor-wise analysis can be used to identify areas experiencing longer delays. Peak-hour analysis provides useful information for understanding periods of high patient demand. Charts, graphs, tables, and KPI cards present the analyzed information in a clear and understandable format. Interactive filters allow users to examine specific dates, departments, doctors, and service stages. The dashboard reduces the effort required for manual calculations and report preparation. The generated insights can support better scheduling, staff allocation, and resource planning. Overall, the project demonstrates how data analytics and visualization can improve the monitoring of patient-flow and waiting-time performance. The proposed system can support healthcare administrators in making informed decisions to reduce unnecessary delays and improve the efficiency of patient services.

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