Ayurveda Healthcare Portal Case Study

Amar Dave, Dhanush, Ian Chuang, and Kanad Bhagat

Westcliff University

Professor: Eve Thullen

June 23, 2024

Abstract

As part of this case study, we had to create an online tool that will support Ayurveda in the coming years: an Ayurvedic Healthcare Portal. This is a customary medical practice in India that is knowledgeable about homeopathic remedies and comprehensive care. This helps users improve their health by giving them access to expert Ayurvedic drugs, principles, and health regimens; this is also the portal's primary objective. We provide individualized health treatments through this gateway, depending on bodily kinds and imbalances. Modern community services on this portal will promote information sharing and user interaction. Innovative community service on this portal will promote user involvement and information sharing. This will provide consumers with high-quality Ayurvedic products that include herbal supplements, natural elements in cosmetics, and wellness accessories. Strong stack technology, including many coding languages including HTML, CSS, and JavaScript, will power this portal. Modern security technologies that ensure user privacy and data safety will also be available on this portal. We have anticipated user traffic therefore the portal will be equipped with cloud-based infrastructure that will enable users to access Ayurvedic practices with reliability and serve as a channel for meeting their needs. This will encourage users to create a worldwide Ayurveda community and come together to make the world a better place with more life changing principles. Utilizing data from textbooks, research journal articles, and personal experience, Ayurveda Healthcare Inc. is dedicated to offering holistic healthcare based on Ayurvedic principles. It ensures seamless patient care through comprehensive operational support, optimized workflows, modern IT infrastructure, and a commitment to quality.

Acknowledgement

We would like to express our sincere gratitude to Professor Eve Thullen for her invaluable guidance, expertise, and unwavering support throughout this project. The direction and execution of this project have been greatly influenced by her deep knowledge and perceptive recommendations. Our sincere gratitude goes out to Professor Eve Thullen for her kind sharing of her knowledge, her helpful criticism, and her creation of a learning atmosphere. Her mentoring has improved my grasp of Systems Engineering tremendously. We also appreciate the cooperation, support, and idea sharing from our classmates and coworkers throughout the project. Their assistance has made learning more enjoyable and helped the project reach its goals more quickly. In addition, we thank the academic institutions, research facilities, and technical assistance that have contributed to this project and improved its caliber and scope. This paper is written under the observation of Professor Eve Thullen to discuss the Ayurveda Healthcare Portal Case Study on the concepts of Engineering Management Process and Conclusion. All the information discussed in this paper is based on online research, LIRN, textbook, and available hands-on information.

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

Introduction

In this paper, we have selected a hypothetical organization called “Ayurveda Healthcare Inc.” for the Engineering Management case study. The company information is as follows. Ayurveda Healthcare Inc. is in the Healthcare business, and it is a public limited company from the USA. It is a Multinational Organization with a presence in 14 countries, and it has headquarters in the USA (Los Angeles). The company has a total of more than 50,000 employees across the globe. Ayurveda Healthcare’s slogan is “Living Healthy in the Lap of Nature.” It mainly provides services like Health Insurance, Medical Insurance, Medicare Benefits, Telemedicine Support for Remote (members and beneficiaries), drugs, medicines, Doctor’s support, Nurses Support, Hospital Support, Laboratory support, Clinic Support and other Healthcare equipment for its customers worldwide. All these services are rendered by Ayurveda Healthcare Inc. through its AyurvedaHealthcare portal. The major competitors of Ayurveda Healthcare Inc. are Healthcare/Pharma companies like MERCK, NOVARTIS, and GlaxoSmithKline. Ayurveda Healthcare is also known as Ayurvedic, Homeopathic, & Allopathic Healthcare Research and Development Lab. The Ayurveda Healthcare website is www.ayurveda healthcare.com.

As per 2024 financial year, the projected financial information of the company is as follows.

- Revenue– US$-36.27 billion
- Operating Income– US$- 15.49 billion
- Net Income– US$- 10.053 billion
- Total assets– US$- 67.13 billion
- Total Equity– US$- 33.41 billion
- Overall Net worth– US$- 1.5 Trillion
- Total Investment in {IT Infrastructure Setup and Ongoing Engineering IT Management}--US$- 460 Millions
- IT Resources and DBMS -US$ 50 Millions
- Revenue Loss due to Mismanagement of IT/Engineering Resources–US$- 150 Millions as per 2023

The above financial projection showcases how big is the organization, what kind of IT Infrastructure Setup investment it has, and how much revenue loss the organization has made due to mismanagement of IT and Engineering Resources. Even though the Ayurveda Healthcare Portal has made a huge investment of $460 Million on IT Infrastructure Setup and maintenance, the organization has also made an investment of $50 million on IT Resources and DBMS, and still it has incurred a revenue loss of $150 million because of the mismanagement of IT/ Engineering resources. From the Cost Benefits Analysis point of view, the organization is at a loss of $150 million, which is half of the total investment amount. These are the following issues which have drawn Upper management's attention to rethink the existing IT Infrastructure and Engineering Management process.

- Mismanagement of IT and Engineering Resources across the organization.

- Lack of Hardware Resources to support services across the organization
- Lack of Software Resources to support services across the organization
- Lack of Network Resources to support services across the organization
- Lack of Database management and Data security resources to support services
- Inadequate Claims processing application support
- Inadequate Billing, Security, and Compliance applications support
- No dedicated HealthPortal to support Tele-medicine services.

To overcome these issues, the Ayurveda Healthcare Inc. has hired a team of expert consultants in the field of Engineering Management. As Engineering Management consultants, our Group-1 team members (Amar Dave —Project manager, Kanad Bhagwat—Business System Analyst, Ian Chuang–Project Solution Architect, and Dhanush Chanda–Project Developer) have revisited the existing IT infrastructure and other resources. And based on the industry specific requirements, we have provided these following recommendations to the upper management of the Ayurveda Healthcare Inc. to restructure their organization's IT and Other resources as per the Engineering Management's best practices.

Concept Development

The concept of building an online healthcare portal system that caters to the demands of Ayurveda Healthcare Inc users. This web portal will serve as a gateway for Ayurveda Healthcare's customers to access various services provided by the organization. Developing the initial concept of this healthcare portal will focus on developing the preliminary system architecture as well as agreeing on the strategies to use for evaluation, division making, risk identification, risk mitigation. This document will focus on System Design, System Integration,

Test and Evaluation, Production, and Operation and Support. To determine the intended cases support and scope of the system in development, it is essential to first identify to perform stakeholder analysis and identify internal and external stakeholders and work with them to perform Functional Analysis.

Stakeholder Analysis

For the development of our online healthcare portal we have identified the following Internal as well as External Stakeholders and captured in the system boundary diagram below.

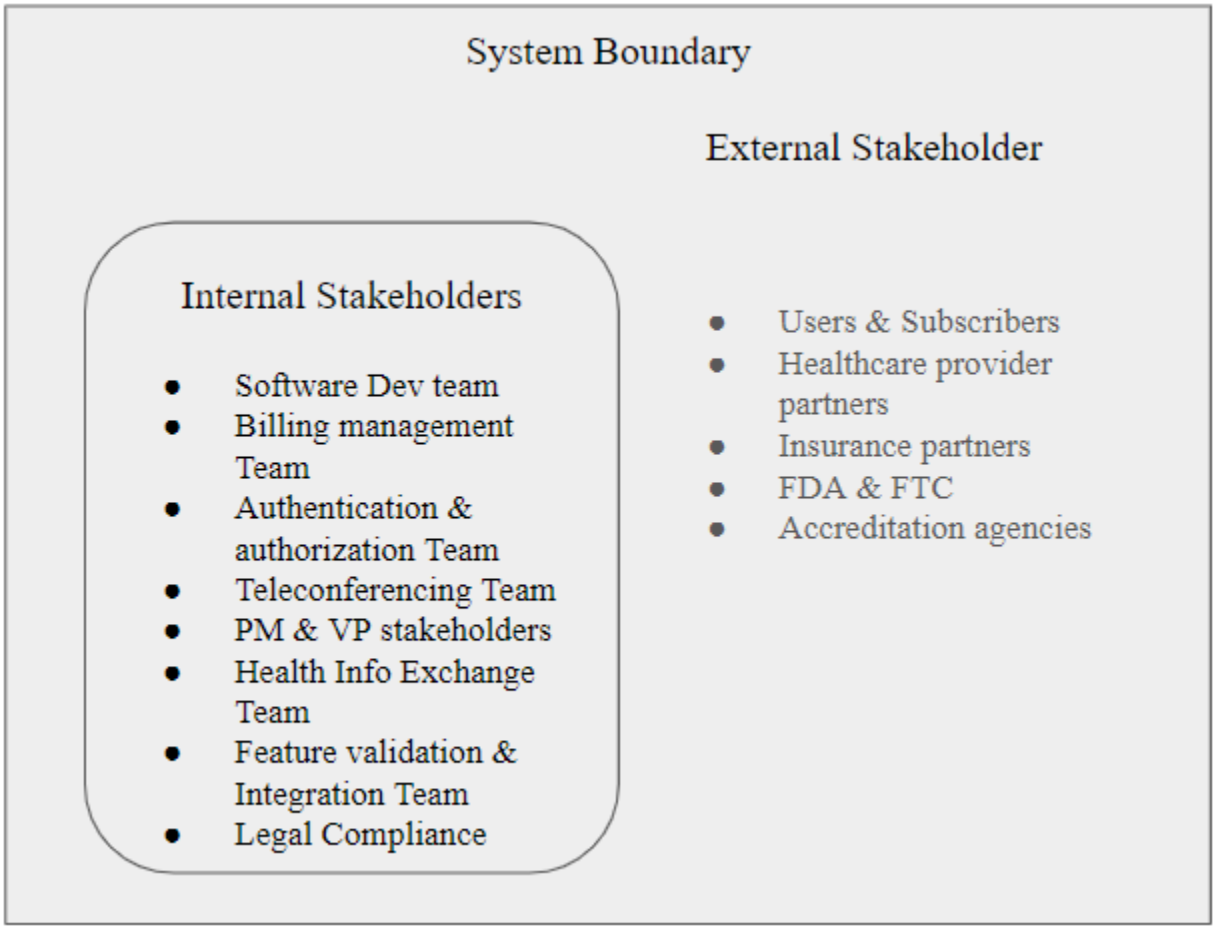


Image 1

Internal Stakeholders identified are classified per department and are as follows:

- Telemedicine Health unit: Subject Matter Experts and Business Representatives
- Claim Processing unit: Subject Matter Experts and Business Representatives
- Security unit: Subject Matter Experts and Business Representatives
- Compliance unit: Subject Matter Experts and Business Representatives
- Billing unit: Subject Matter Experts and Business Representatives
- Network Team: Network Architect, Network Admin, Network Engineers, & Support staff
- Hardware Team: Hardware Architect, Hardware Engineers & Support staff
- Software Team: Software Architect Software Engineers & Support staff
- DMS Team: Database Administrator, Data Manager, Data Engineer, & Data Entry staff
- MIS Team: Security Architect, Security Manager, Cyber Security Engineers, Security Analysts

Identification of cross functional and inter departmental stakeholders internal stakeholders is critical to performing functional analysis and accurately defining the scope of the system in focus.

We have also identified the following external stakeholders related to this online healthcare portal, as listed below:

- Insured Member, existing and future customers.
- Government & Regulatory Agencies.
- Third party vendors including Insurance & Healthcare Companies.

- Partnering healthcare providers including Hospitals, Clinics, Labs, Individual practitioners.

Needs Analysis and Requirements

In order to identify and define the business expectations from the system being developed, the following core functional blocks are identified:

- The Ayurveda Healthcare organization shall have a Health Portal
- The Ayurveda Healthcare organization shall have Telli-conference portal
- The Ayurveda Healthcare organization shall have Network Application
- The Ayurveda Healthcare organization shall have a Security Application
- The Ayurveda Healthcare organization shall have Claims Processing Application

These functional blocks also need to have individual core requirements to drive their individual development. Some of the fundamental requirements identified related to these functional blocks are as follows:

- The Ayurveda Health portal shall support the following services: Telemedicine, Insurance claims processing.
- The Ayurveda Healthcare organization's Insured members and Customers shall have access to the Ayurveda Health Portal.
- The Ayurveda Healthcare organization's Insured members shall be able to schedule Telemedicine appointments to receive remote virtual medical support.
- Members shall be able to use Claims-Processing Application to file Insurance claims on the insured services.
- Members shall have uninterrupted 24/7 access to the Healthcare portal.

- Members shall have compliance application support to secure their PII Data and Healthcare related information.
- Internal stakeholders shall be able to use the Health portal to support customers needs.
- External stakeholders shall be able to use the Healthcare portal to receive all operational help and documentation through the secured portal.

Functional Analysis

Once fundamental needs and requirements are identified, the next step in defining the system architecture is performing Functional Analysis to define the scope, data, and interface requirements. The expected outcome of performing functional analysis on identified functional blocks is to identify more refined sub functional groups that are essential for successful implementation of the core functional blocks. Some of the features that we have identified as an outcome of functional analysis are as follows:

- User Authentication and Authorization : The portal must allow users to log in securely by implementing Password management and Multi factor authentication.
- Electronic Health Records (EHR) Management: The portal must keeps track of users health records and Integrate with interoperability standards (e.g., HL7, FHIR) to facilitate secure data exchange between different healthcare systems
- Telehealth and Telemedicine Capabilities: The portal must allow users to attend sessions virtually and consult healthcare professionals in real time.
- Using Appointment Scheduling and Calendar Management services: The portal must allow users to schedule appointments and send reminders.

- Billing using Revenue Cycle Management services: The portal must have the capabilities to charge individual users as well as insurance companies.
- Health Information Exchange (HIE) service: The portal must exchange information with other healthcare professions and facilities.
- Patient Portal and Engagement Tools: The portal must support self serve features for record inquiry and commonly asked questions
- Analytics and Reporting: The portal must generating insights on user interactions to identify area of improvement of the portal
- Compliance and Security Features: The portal must comply with healthcare and data regulations.

(The Functional and Nonfunctional Requirement for HMS, n.d.)

After identifying the individual functional groups, as well as the sub functional blocks and core requirements related to the system, we have all the necessary blocks in place to define the architecture that is accurately bounded and scoped to meet the system needs. This same approach of system architecture development will be used across all levels to define subsystem architectures and guide the system structure from top down.

Decision Analysis, Evaluation, and Risk Management

Having a clear system architecture in the early design stages is one of the most important aspects of successfully developing a complex multidisciplinary system. It is also essential to ensure that all key internal stakeholders involved in the development are aligned and agree on the decision making process and guidelines. The guidelines will be used to ensure all cross functional teams are working with a unified approach towards the same goals. Having a unified

approach for decision making across all departments and levels ensures that consistency in approach is maintained which also results in improved efficiency. To make data driven decisions, we have decided to use the waterfall model of structured decision making. In this approach, we will first identify key evaluation metrics which will be guided by the core requirements pertaining to the system level. The available options are scored based on their compliance with the agreed upon metric and weighted against each other to identify the best possible path forward (Brunski, 2021). This approach will ensure all downstream decisions are in accordance with the upstream core requirement.

Risk Management

A crucial component of making sound decisions and developing a robust system is to have a strategy to identify risks and manage them. Some of the areas that need special attention include Operational risk, such as network & network security Risks, risk of violating regulatory compliance needs, risk of failing to track, associations and matches data to appropriate customers and links them with appropriate services, which may have a negative impact on the users' health, etc.All these potential sources of Risk can have damaging effects to the system being developed as well as the stakeholders involved. Our plan is to utilize Risk registers to identify all potential sources of risk and develop plans to contain and mitigate them.

Risk Register

Risk	Description	Likelihood	Impact	Mitigation
Data breaches and Leaks	Compromised security leading to hacks, unauthorized personal accessing confidential information	Medium	High	• Implementing End to End encryption, • using secure development approach, • promoting strong password policies, • using multi factor authentication • Strong access control
Incorrect Healthcare record	Healthcare records mapped to incorrect Users	low	High	• Secure dictionary service. • Robust feature and unit testing.
Incorrect Bills generated	Miscalculation, miscoding, incorrect bills generated for users and insurance partners	Medium	High	• Secure dictionary service, EHR system. • Robust feature and unit testing. • Eliminating manual inputs
Regulatory compliance	Failing to comply with all regulatory requirements	Low	High	• Dedicate legal compliance team working with individual teams to ensure compliance

UI/UX failure	Bad User experience navigating the portal	Low	Medium	• User experience studies • Engagement surveys • Setup feedback pipeline • Feature and functional verification and validation
Loss of Patient information	Unable to query and or retrieve User information	Low	High	• Secure dictionary service, EHR system. • Robust feature and unit testing. • Maintaining secure Cloud Storage and backup
Failure to schedule appointments	Failing to schedule on one of the ends or both ends.	Low	Medium	• Feature and functional validation during development

Table 1

System Architecture

Methodology used for Architecture development

System Architecture development focuses on identifying all the individual components and their interdependence as well as the governing principles and key foundational guidelines that dictate the fundamental structure and organization of the system's development (Kang, 2023). System architecture helps in identifying and visualizing the system boundary and scope of the system. Our approach for System Architecture development is based on a six-step approach that focuses on:

- Determining the intended use of the system.
- Determining the intended scope of the system.
- Understanding the data requirements to support Architecture development.
- Processing the identified data for Architectural development.
- Evaluate prototype/initial concept architecture based on data.
- Make data driven Architecture decisions that satisfy the system's purpose.

System architecture diagram

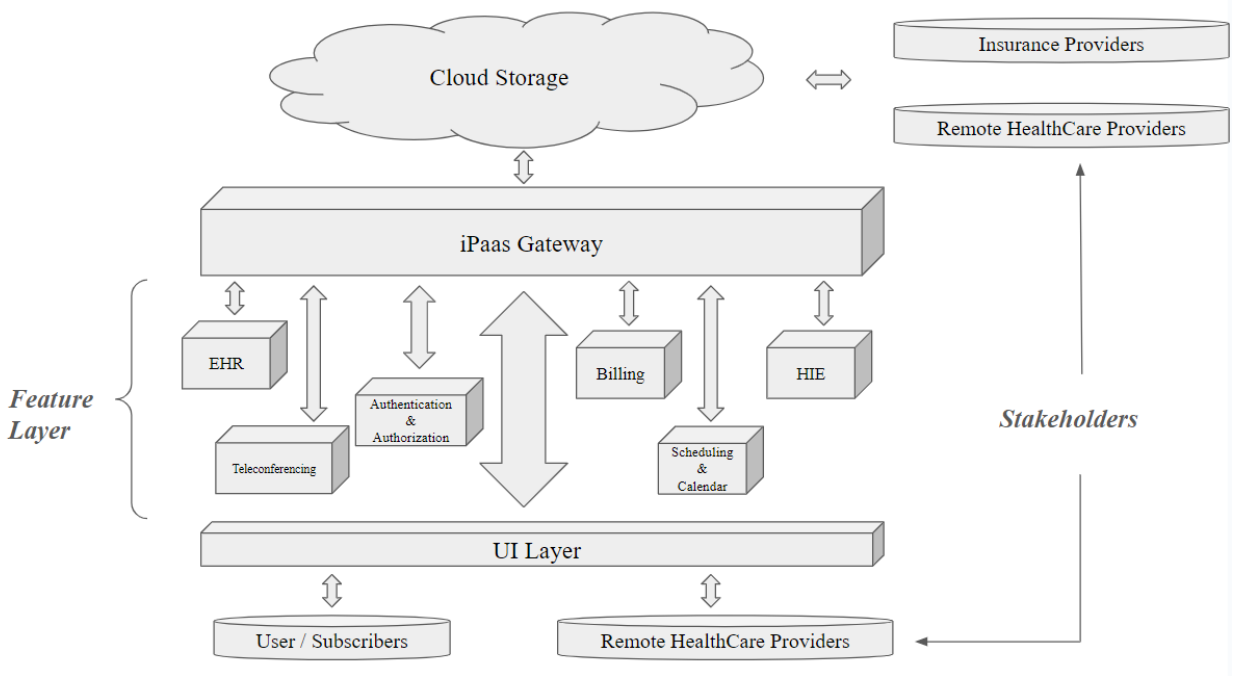


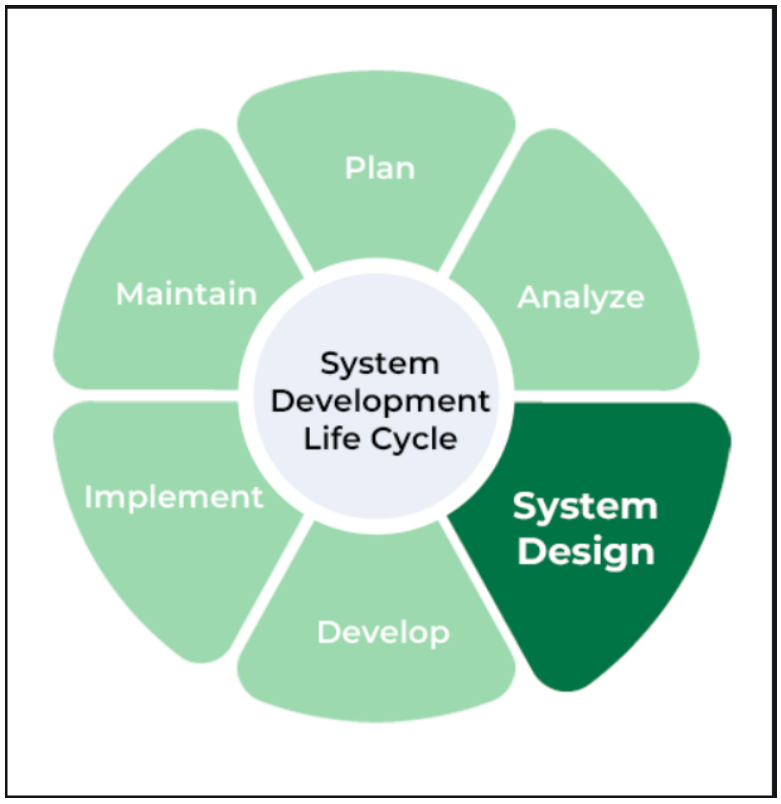
Image 2

System Architecture Breakdown from Integration Perspective

The system in focus is an online healthcare portal for Telemedicine that can be accessed from multiple platforms on the website.It will also focus on the application format and support real time interaction for its users. The engineering design solution that we have evaluated for the implementation of this system is based on Integration platform as a service (iPaaS) over cloud. Within this architecture, individual functional blocks act as service nodes that interact with other nodes and services in real time via the iPaaS cloud platform. The iPaaS gateway acts as the facilitator for the healthcare portal and handles responsibility of aggregating data over various interfaces supported by individual nodes, as well as converting the aggregated data to and from a canonical format to specific formats supported by individual node requirements (Editor, 2021)

System Design

In System Engineering Management, System Design plays a vital role. Basically, it is a formal conceptual model based on which the complete blueprint of the system shall be prepared. As per Kang (2023), system design entails planning a system's structure, parts, modules, interfaces, and data such that it can meet explicit requirements. By the end of this stage, the user requirements have been transformed into a detailed blueprint that will be used to guide the implementation phase. By keeping things like scalability, maintainability, and performance in mind, the goal is to design a structure that is both efficient and effective in its job. Whether it is Software Development engineering management, or if it is related to any other stream related Engineering management, the System Design is very important, for it provides clarity on what to design, how to design, what shall be included in design, and how the design shall function. The following Image-1 shows the System Design is an integral part of the SDLC (Software Development Life Cycle).



(*Engineering Management*, 2022)

Image 3

Every other process of Engineering Management System Design also has a Life Cycle. Any system, whether it software, hardware, or an integrated whole, may be planned and built according to the steps outlined in the System Design Life Cycle (SDLC). Engineers are guided through a series of steps in the process of creating a system that meets both the needs of the user and the goals of the business. The final product's dependability, scalability, and maintainability are the goals of the software development life cycle (SDLC). The following Image–2 represents the different phases of the System Design Life Cycle.

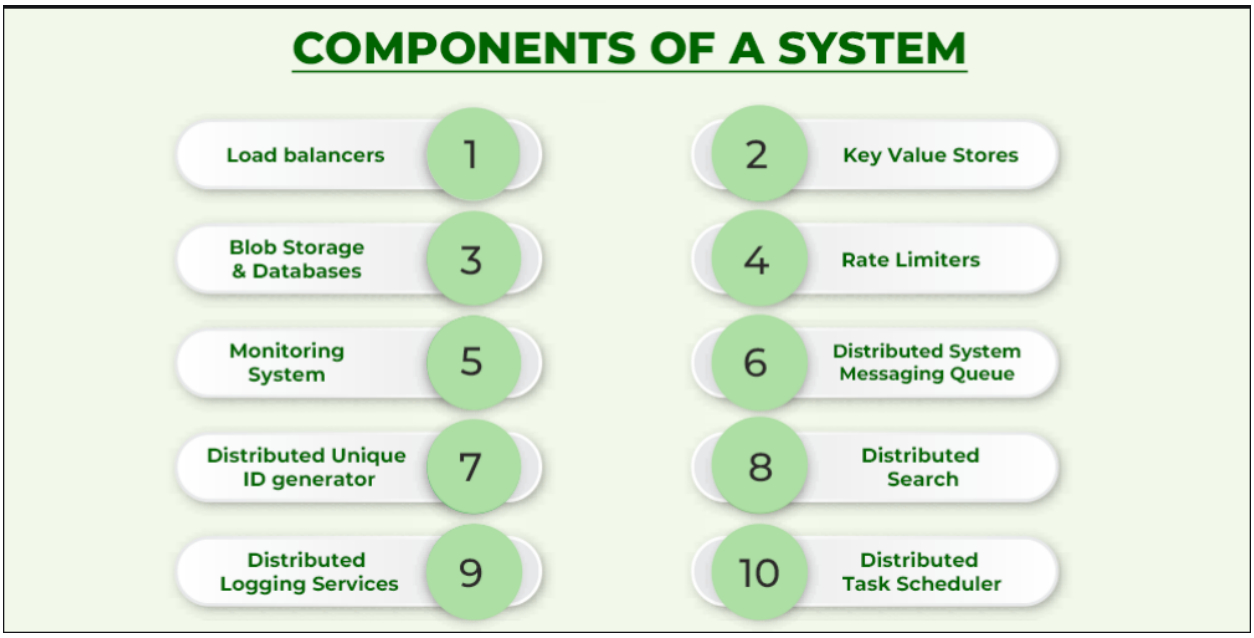
(*Systems Design*, 2023) *Image 4*

There are several components to System Design which helps Engineers identify the overall System Design concept. These components are as follows.

- When measuring system performance, availability, and scalability, load balancers are the most important component.
- Distributed hash tables serve as key-value stores in this storage system that are otherwise comparable to hashtables.
- Unstructured data, like that seen on YouTube and Netflix, may be stored in Blob Storage, which stands for binary big objects.
- To put it simply, a database is a structured collection of data that allows for easy access and modification.
- The maximum number of requests that a service can fulfill is defined by rate limiters.
- System administrators use monitoring systems, which are essentially pieces of software, to keep tabs on infrastructure metrics like CPU use, bandwidth, routers, switches, etc.
- Production and consumption are mediated by the Distributed System Messaging Queue.

- Distributed A generator for unique identifiers: in big distributed systems, several jobs are running at once, hence it is important to provide a tag to each event.
- The term "distributed search" refers to the practice of populating search bars with relevant results from all available websites.
- Services for Distributed Logging: Following Event Sequences End-to-End. Computing resources (CPU, RAM, storage, etc.) are managed via a distributed task scheduler.

The following Image–3 displays the components of System Design in Engineering Management.



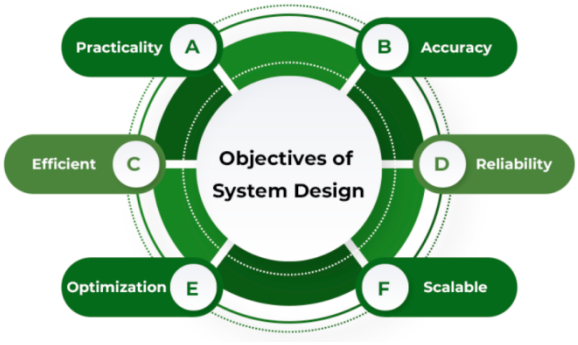
(*The Functional and Nonfunctional Requirement for HMS*, 2019)

Image 5

System Design in Engineering Management has several objectives to cover. According to Brunski (2021) these are the following objectives of a System Design.

- A system that makes an effort to cater to the specific group of people for whom it is being developed.

- Punctuality: The aforementioned system architecture needs to be crafted in a manner that satisfies almost all criteria, whether they are functional or non-functional.
- A fully functional system would cater to every need of its users.
- The system's architecture should be such that it neither uses more resources than it costs nor uses less, which will lead to poor throughput (output) and less reaction time (latency).
- Reliability: For a certain amount of time, the planned system should be in an environment free of failures.
- Optimization: Probably basically perform time and space-related things for code chunks so that individual components may function in a system.
- Our system's architecture should be scalable, meaning it may change and evolve over time to meet the evolving demands of our clients. The well-known corporation, Nokia, is the best example this time. For example, GeeksforGeeks, the most successful company in this market, was able to accomplish this by focusing on one critical aspect of system architecture.
- The following Image–4 depicts all the objectives of the System Design.



(*The Functional and Nonfunctional Requirement for HMS*, 2019)

Image 6

There are several benefits of System Design in the Engineering Management process. A few of the important benefits are as follows.

1. Reduce the product's design expense.
2. Quick procedure for creating software
3. Minimizes overall SDLC processing time
4. Helps programmers be more efficient and consistent.
5. Conserves materials

System Integration

System Integration Strategy

To integrate the individual functional blocks of our healthcare system, we have opted for a hybrid approach combining elements of integration with the stream and functional chain integration approach. Our System Integration process focuses on an iterative continuous integration, an approach starting with early testing by assembling system subsets based on their staggered delivery timelines while simulating blocks that are in development. Each incoming subset, which is an aggregation of subsystem blocks contributing to a functionality, will be added to the integration test platform replacing simulated elements until the entire system is assembled and tested for data flow and integration requirements (System Integration - SEBOK, n.d.).Preconditions for establishing this test integration platform include the capacity to emulate individual portions of the system. The Functional Architecture and feature breakdown identifies individual Functional elements and their associated systems that enable the healthcare Portal.

Functional Architecture & Feature breakdown

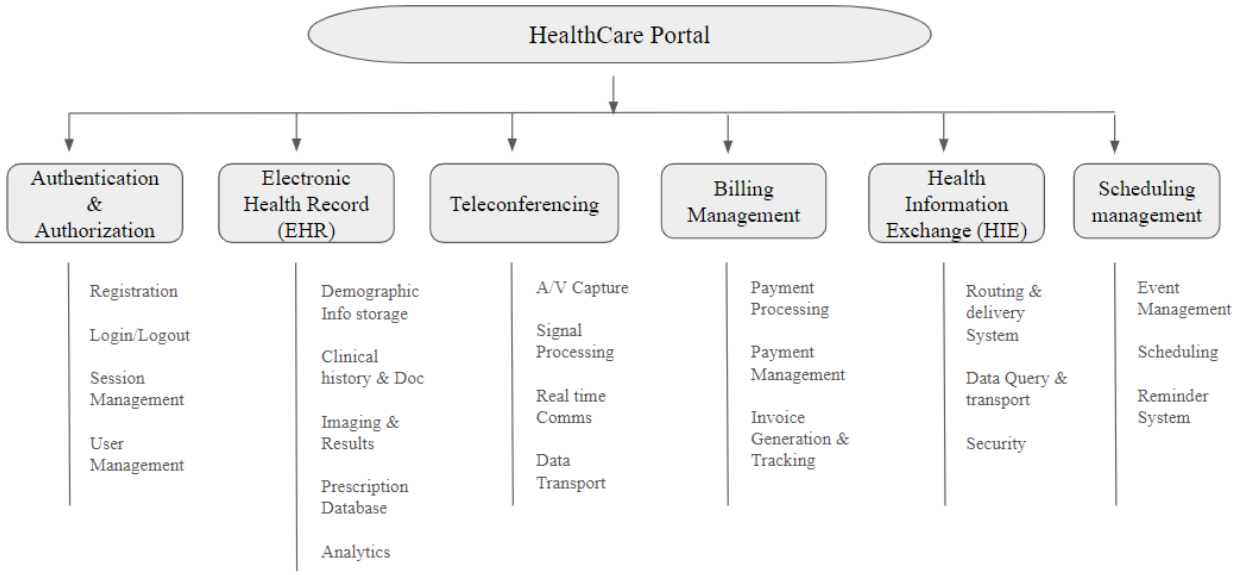


Image 7

These individual systems that are part of higher level functional blocks captured by the Functional Architecture diagram need to interact with each other for successful orchestration of features that are supported by our healthcare portal. This communication is enabled via various interfaces that are specifically designed to meet system spec and needs captured by system design requirements. The table below captures the mapping of individual functional blocks and the interfaces that enable interaction with other functional blocks that are part of the healthcare portal.

Subsystem & Interface Identification

Functional Block	Interfaces in Scope
User Authentication & Authorization	• Data APIs • Directory services • Security and encryption protocol • Authorization engine • Multifactor support • UI
Electronic Health Records (EHR) Management	• Data APIs • System/platform APIs • UI • Cloud APIs • Security and encryption protocol

Teleconferencing	• Device APIs • Network protocol • UI • Scheduling, streaming, telephony APIs • Cloud storage APIs
Calendar Management and scheduling	• Device API • UI • Scheduling API
Billing Management	• Device API • Cloud API • Payment Gateway API • Security and encryption protocol • UI
Health Information Exchange (HIE)	• Data APIs • EHR API,Directory

Table 2

Once all the required interfaces are defined and associated requirements are established, the next step in the process of ensuring all these interfaces are exchanging data. This is achieved by mapping all individual interfaces with their primary connecting interface as well as their adaptability specification per interface. This mapping can then be individually tested to ensure end to end data communication. The table below captures the System interface mapping for our healthcare portal as well as the adaptability conditions they have to support throughout the lifecycle of the portal.

Interface dependency mapping for Integration

Interface	Primary Interoperable Interfaces	Adaptability
Data APIs	Cloud Storage, EHR, Security and Encryption, Payment Gateways, Authorization	Should be able to translate data to and from a canonical format to system specific format at the iPaas gateway layer
UI	Acts as the entry point for users to interact with available features. Needs to integrate with all functional blocks	Support for all leading web browsers Apps running on Android, iOS active versions
Platform/Device APIs	UI, Payment gateway, MFA, Authorization, Scheduling, Telephony & streaming.	Support users to access portal from devices running on Mac, windows, Android, iOS
Cloud Storage API	Security & encryption, Authorization, EHR, Directory, Data API	Operates in backend transparent to the users and interacts/supports feature layer systems via iPaas gateway.
Security & Encryption	Has to secure all layers of data exchange internally and externally.	Should provide secure data abstraction capabilities
Authorization	Cloud API, Security & Encryption, Payment gateway, UI	Regulate privileged access control for all services.
Payment Gateway API	UI, Platform/Devices, Security & encryption, Authorization	Supports accepting payments from all major banking/ credit providers

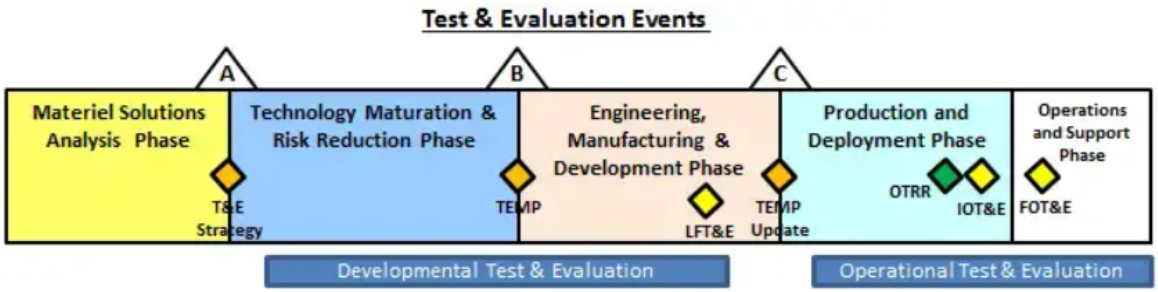
Multi Factor Authentication (MFA)	UI, Platform and device	Support multi factor authentication via email, call, sms, device biometrics.
Directory Services	Authorization, Cloud, Data	Support internal functional blocks
EHR API Exchange (HIE)	Cloud, Security & encryption, Authorization, Data	Support internal functional blocks
Scheduling Services	UI, Platform/device, Telephony & streaming	
Telephony & Streaming	UI, Platform/device, Security & encryption, Scheduling	Support telemedicine applications via providing teleconferencing services across supported platforms agnostic to the end point operating system.

Table 3

Test and Evaluation

In Engineering Management, like every other phase of the Life Cycle, the Test and Evaluation phase is also a very crucial phase of System Engineering Management. In general, Test and Evaluation is the process to test, confirm, and validate the System design requirements against the build System functionalities. As per Editor (2021), the Test and Evaluation process evaluates the security, dependability, and efficiency of different systems, goods, or technology. It entails checking these components for functionality and conformance to standards in a

methodical way. The purpose of testing and evaluation is to find bugs and other issues so that developers may fix them before the final release. In order to acquire data and evaluate the item's functioning, durability, and efficacy, it is necessary to plan and execute experiments, simulations, and evaluations. Several sectors rely on T&E to guarantee that their goods and systems are up to par in terms of quality and performance. These sectors include aerospace, defense, automotive, and technology. The following Image–5 shows the Test & Evaluation Development & Operational process.



(*Test and Evaluation*, 2024) *Image 6*

As per Editor (2021), the Test & Evaluation Life Cycle has the following phases in System Engineering Management.

1. Approach to Testing and Evaluation (TES)
2. Evaluation and Testing for Development (DT&E)
3. Evaluation and Initial Operational Test (IOT&E)
4. Functional Assessment and Verification (FT&V)
5. Assessment and Review of Subsequent Operations (FOT&E)
6. Master Plan for Testing and Evaluation (TEMP)
7. Evaluating Operations (OA)

8. Testing and Evaluation with Live Fires (LFT&E)
9. Examining Competence and Performance (QTV&P)
10. The ST&E process for software

The primary goal of test and evaluation is to aid in risk management throughout the process of creating, implementing, and maintaining systems and capabilities. According to"(Editor,2021)," the following items shall be addressed during the Testing & Evaluation process to improve the quality of the project outcome.

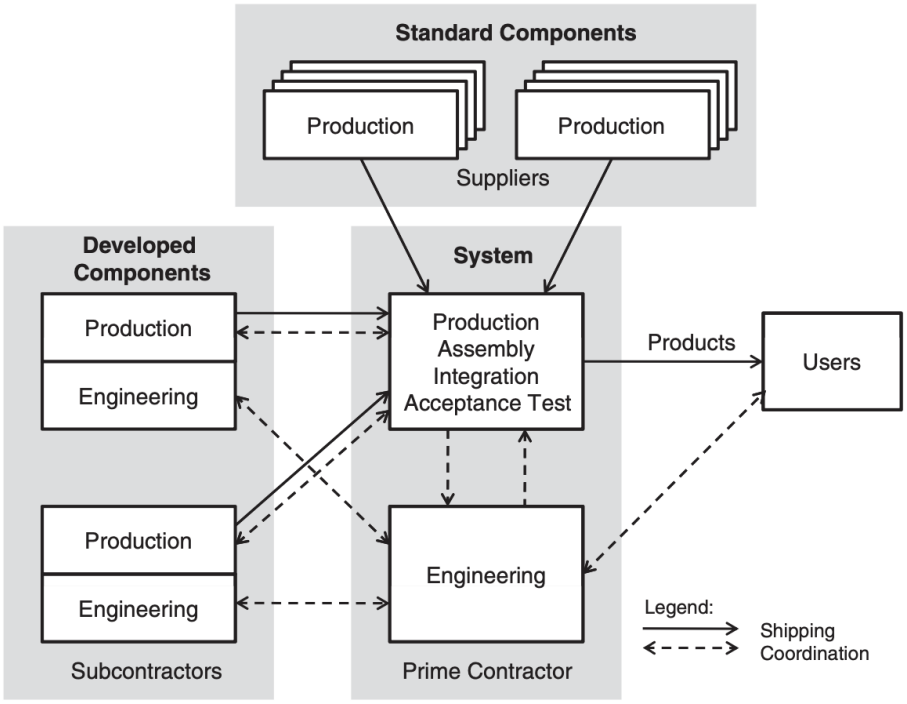
- Include Testers and Business Stakeholders from within the organization as well as external stakeholders to clarify the stakeholders expectations and Resource requirements.
- Confirm that Testing & Evaluation Strategies are in sync with the System Architecture. And they are within the Scope Boundaries of System Architecture.
- Broadly use the Development Testing Activities, to test the System Hardware, Software, Networking, or Security related functionalities.
- To eliminate manufacturing and technical risks from the system, design the test assessment with reliability, capabilities, and satisfy results of Critical Operational Issues.
- Try to test the System performance in the most realistic environment, to improve the test real time success scenario.
- Conduct the System Stress Testing to identify and remove the future threats from the system.
- Use the STLC (System Testing Life Cycle) methodologies like Waterfall and RUP for the Discovery project System. And for Rapid Action Development use the Agile Testing

framework. Usually, the selection of the testing method is based on the System Architecture and components of the system.

In ideal situations as per “Kang (2023),” one component of the Systems Engineering Process (SEP) that helps developers fix flaws is the Testing and Evaluation (T&E) phase. During testing and evaluation, the acquisition community learns about the system's strengths and weaknesses, which helps to enhance the system's performance, optimize its usage, and maintain it in operations. With the help of testing and evaluation, the program manager may find out about the system's COIs, or critical operational issues, and fix them before the system is produced and deployed.

Production

The Production Phase is the first step of the post development stage of the system life cycle. As we develop a production operation system, we have to monitor the different components of the system. In the current Ayurveda Healthcare system, Standard components include external data such as patient info from Electronic Health Records (EHR) Management and Health Information Exchange (HIE). Developed Components are the subsystems that we developed, including User Authentication & Authorization, Video conferencing, Calendar Management and scheduling and Billing Management. Lastly, the overall Ayurveda Healthcare system incorporates all these subsystems to provide value to our customers. During the production phase, we have to (1) have sufficient funding for production preparation (2) have funds for unexpected problems (3) conduct enough testing of production prototypes and (4) maintain a flexible schedule to ensure a smooth transition from development to production.



Another key factor we would like to incorporate into the production phase is regulatory compliance. Healthcare is a highly regulated industry and here are some notable regulations that Ayurveda Healthcare complies with.

- HIPAA (Health Insurance Portability and Accountability Act) - the federal law that establishes standards to protect personal medical records and health information.
- HITECH Act (Health Information Technology for Economic and Clinical Health Act) - the federal law that promotes the use of electronic health records (EHR) and privacy and security.

To comply with these regulations, we have to ensure that our subsystems such as Electronic Health Records (EHR) Management and Health Information Exchange (HIE) meet these federal standards.

In addition to regulations, these are some of the key action items that we should focus on during the production phase: Implementation, Documentation, Regulatory Compliance, and Deployment.

Implementation is the phase that the platform is actually being developed. Now that we have a rigorous design of the Ayurveda Healthcare Portal, we can start building during this phase. Key features that we discussed previously include user authentication and authorization, Electronic Health Records (EHR) Management, Telehealth and Telemedicine Capabilities, Appointment Scheduling and Calendar Management, Health Information Exchange (HIE) service, etc. These features are key components of our portal.

Documentation is a key step in production as it offers guidelines and references for future operations and support. It is important to keep documentation up-to-date during the production phase as it is the best way for knowledge transfer so that maintenance and further enhancements can be implemented. Additionally, it is especially important in the healthcare industry to keep track of sensitive information and comply with regulatory requirements.

Health Insurance Portability and Accountability Act (HIPAA) is a federal law that establishes national standards for healthcare information, and as a healthcare platform, Ayurveda must comply with its regulation. Additionally, several other data-related regulations such as General Data Protection Regulation (GDPR) are also important to comply with. Breaching these regulations can cause dire consequences and we should make sure our platform complies with them during the production phase.

Lastly, deployment is the last step in the production process where we make the system available to our customers. Do note that the biggest difference between deployment and implementation is that implementation is the process of building and developing a system whereas deployment is the phase where our final product (system) is released and made available to our customers.

Production Strategy

Phase	Action	Results
Implementation	● Building features ● Creating Platform	Creating functions that reflect the requirements
Documentation	● Record Keeping	Providing guidelines for future references and maintenance
Regulatory compliance	● Ensuring compliance with regulations	Avoid regulatory punishments
Deployment	● Make system available to users	Getting users feedbacks

Table 4

The table lists the essential elements of the production plan for the Ayurveda Healthcare Portal, outlining certain tasks, their goals, and the stages involved in putting them into practice. The tasks titled "Building Features" and "Creating Platform" concentrate on creating and integrating necessary features to satisfy user needs and provide a reliable and easy-to-use system. Creating Functions that Reflect the Requirements focuses on matching these functionalities with stakeholders' specific demands in order to effectively handle real-world healthcare concerns. Maintaining the system's sustainability and accessibility for future changes requires extensive record-keeping and the provision of maintenance instructions, which are handled through documentation. The platform's credibility is preserved by regulatory compliance, which guarantees adherence to legal requirements to safeguard patient data and avert regulatory fines. As a last step, the deployment phase entails putting the system online and obtaining user input so that the platform can be continuously improved. Collectively, these components establish an all-encompassing structure for creating, introducing, and sustaining a superior healthcare portal.

Operation and Support

Ayurveda Healthcare Inc. is dedicated to offering patients a smooth and customized healthcare experience by providing holistic services that are based on age-old Ayurvedic principles. The company values patient care management and provides extensive operational support, including treatment tracking, appointment scheduling, and follow-up services. Ayurveda Healthcare Inc. enhances clinical operations to deliver prompt, personalized treatment by automating workflows, controlling inventory, and effectively allocating resources. Its IT infrastructure, which includes electronic health record (EHR) systems and telemedicine platforms, is continuously being modernized to increase accessibility and facilitate accurate medical decision-making (Bezbaruah, 2022). The company is committed to performance monitoring and high-quality control. It fosters a culture of excellence and responsibility while continuously working to improve the experiences of patients by utilizing modern methods and instruments.

Patient Care Management and Operational Support

To smoothly provide comprehensive healthcare services based on traditional Ayurvedic principles, Ayurveda Healthcare Inc. needs operational help. With a focus on patient care management, the organization provides full support, including appointment scheduling, treatment monitoring, and follow-up services. This guarantees that during their entire course of therapy, patients get the consideration and care they require.

Optimizing Workflow and Managing Resources

Clinical operations are expedited by Ayurveda Healthcare Inc. through efficient resource allocation, inventory management, and workflow optimization. This method ensures that patients receive attentive, customized care in a welcoming environment. The organization will be able to deliver high-quality care more efficiently and guarantee a smooth experience for both patients and healthcare professionals by optimizing these processes.

Network Architecture and Usability

By maintaining and updating its IT infrastructure, which consists of electronic health records (EHR) systems and telemedicine platforms, Ayurveda Healthcare Inc. increases access to healthcare services. These developments in technology empower healthcare professionals to make educated decisions and raise the standard of treatment as a whole. The easy access and secure management of patient information is guaranteed by the integration of contemporary IT technologies.

Assurance of Quality and Performance Evaluation

Ayurveda Healthcare Inc. employs quality assurance and performance assessment as two strategies to maintain high treatment standards and encourage continuous improvement. Regular assessments and feedback mechanisms ensure adherence to medical standards and Ayurvedic principles, fostering a culture of accountability and excellence throughout the organization. Sustaining the trust is contingent upon this ongoing process of reform.

Dedication to All-Around Health

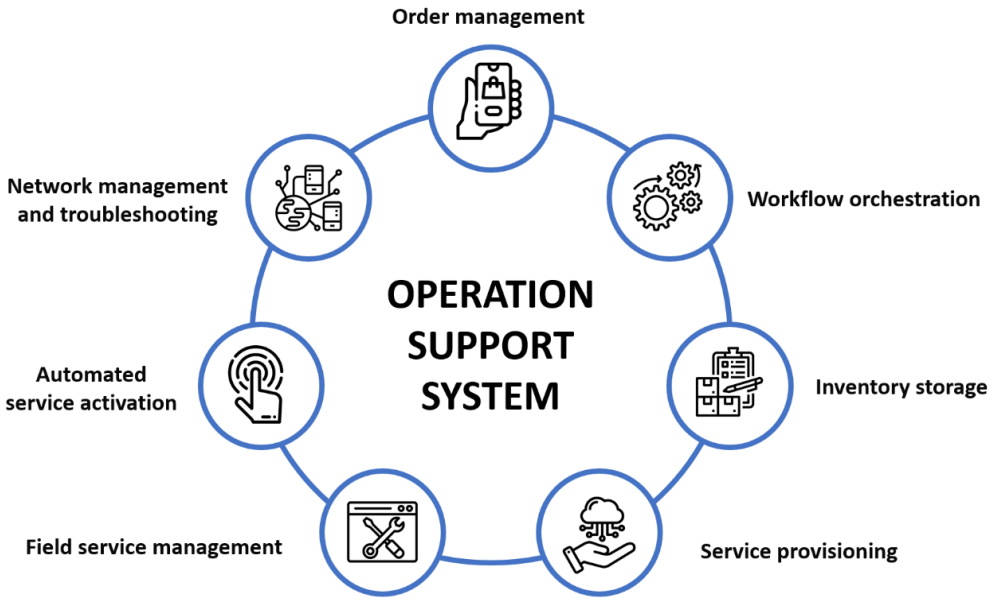
Clinical operations are improved by Ayurveda Healthcare Inc. through workflow optimization and productivity gains through the use of state-of-the-art tools and technologies like EHR systems, telemedicine platforms, and inventory management software (Bezbaruah, 2022). The organization is still dedicated to delivering effective, personalized healthcare services and encouraging overall wellness. These calculated steps, all intended to improve the health of its patients, show how committed it is to this goal.

Operational Support Pros and Cons

Functionality	Pros	Cons
Patient Care Management and Operational Support	Streamlines processes such as making appointments and treatment tracking, leading to improved healthcare delivery	Integrating many technologies and systems can be hard and time-consuming.
Optimising Workflow and Managing Resources	Ensures patients have specific and timely care, thereby enhances their overall happiness and outcomes.	Staff may require extensive instruction to learn how to use new systems and processes efficiently.
Network Architecture and Usability	Efficient stock and resource management reduces waste and expenses.	Establishing and maintaining solid operational support systems can be expensive.

Assurance of Quality and Performance Evaluation	Patients now have better access to healthcare because of modern IT infrastructure like telemedicine platforms and EHR systems.	Digital systems are subject to cybersecurity threats, requiring the introduction of strong security measures.
Dedication to All-Around Health	Real-time data and cutting-edge innovations assist healthcare workers to make educated decisions.	Due to the reliance on technology, system failures or downtime may disrupt medical care and activities.

Table 5



(OSS Functions and Implementation Goals, 2023)

Image 7

Elements of Operational Support

Functionality	Cons
Essential Elements of Operational Support	All-inclusive patient care assistance, encompassing treatment monitoring, appointment scheduling, and follow-up services.
Management of Clinical Operations	optimizing workflow, inventory control, and resource allocation to streamline clinic operations.
Infrastructure for Information Technology	upkeep and modernization of IT infrastructure to enable telemedicine, data analytics, and electronic health records (EHR) for well-informed decision-making.

Table 6

The table, which focuses on three key areas—management of patient care, management of clinical operations, and infrastructure for information technology—describes the fundamental components of operational support that are necessary for a healthcare system to operate effectively. Every component's primary purposes and significance are highlighted in a thorough description. Coordinated care improves patient results and satisfaction. Management of patient care involves all-encompassing support like treatment monitoring, appointment scheduling, and follow-up services. To ensure streamlined and effective clinic operations, management of clinical operations places a strong emphasis on inventory control, resource allocation, and workflow optimization. Information technology infrastructure includes updating and maintaining IT

systems to enable telemedicine, data analytics, and electronic health records (EHR), all of which are essential for better decision-making and healthcare delivery. When combined, these components create a strong foundation for providing effective, patient-centered healthcare.

Conclusion

To conclude, as mentioned in the above case study of the Ayurveda Healthcare Inc. with the use of Best practices of Engineering Management, any Organization can increase the profit margin as well as can improve the overall quality of its services for business. This also gives insight into the improvement of the usage of Ayurvedic products and the growth in the user interface portal as well.

Contribution

Name	Assignment Contribution	Sign & date	
Amar Dave	System Design, Test and Evaluation, Introduction, Conclusion, Abstract	**AD**	06/23/24
Dhanush Chanda	Operation and Support, Table of content, Formatting	**DC**	06/23/24
Ian Chuang	Production, Functional & Needs analysis	**IC**	06/23/24
Kanad Bhagwat	System Integration & System Architecture, System Boundary Diagram, Functional Architecture Diagram, Risk Register, Table formatting	**KB**	06/23/24

Table 7

References

Architecture Development. (n.d.). dod cio.defense.gov. Retrieved June 3, 2024, from https://dodcio.defense.gov/Library/DoD-Architecture-Framework/dodaf20_arch_development/

Bezbaruah, R. (2022, April 1). *An Ayurgenomics Approach: Prakriti-Based Drug Discovery and Development for Personalized Care*. NCBI. Retrieved June 12, 2024, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9011054/

Brunski, J. (2019, August 15). *Chapter 15 — Concept Selection. Killing your babies and selecting the… | by Jeff Brunski | Product Development Distillery*. Medium. Retrieved June 3, 2024, from https://medium.com/product-development-distillery/chapter-15-concept-selection-1581bb7caa10

Engineering Management. (2022, 12 2). SDLC. Retrieved June 3, 2024, from https://www.google.com/search?

sca_esv=bb932b014846ff27&q=what+is+SDLC+in+Engineering+Management%3F&uds=ADvngMgRhqLryTAGKU-tEzlNhJZtVVlH6Rx0Zy5UVlFHrweYns5mzdN1Q0REJYewfQqyVPKf0YET3b9ZfbuoPCZnEoXSC2yBE15b1zmkstrBljbFwXShDg7D5NbhHRkDwMQoJDCq7YKGYgQv-E9l7Hslt

Kang, B. (2023, june 10). *System Design and System Architecture*. system design bootcamp. Retrieved June 3, 2024, from https://bootcamp.uxdesign.cc/system-design-and-system-architecture-e963d030bc7b

Sanjana. (2019, 8 14). *The Functional and Nonfunctional Requirement for HMS*. The Functional and Nonfunctional Requirement for HMS. Retrieved June 3, 2024, from https://mocdoc.com/blog/the-functional-and-nonfunctional-requirement-for-hms

Snoderly, J. (2024, May 6). *System Integration*. Guide to systems engineering. Retrieved June 3, 2024, from https://sebokwiki.org/wiki/System_Integration

Systems Design. (2023, May 22). Learn Systems Design. Retrieved June 3, 2024, from https://www.geeksforgeeks.org/what-is-system-design-learn-system-design/

System Integration. (n.d.). System Integration: Types, Approaches, and Implementation Steps. Retrieved June 3, 2024, from https://www.altexsoft.com/blog/system-integration/

Test and Evaluation. (2024, 11 2). Test and Evaluation Overview. Retrieved June 3, 2024, from https://acqnotes.com/acqnote/careerfields/test-and-evaluation-overview

The Functional and Nonfunctional Requirement for HMS. (2019, 08 14). The Functional and Nonfunctional Requirement for HMS. Retrieved June 3, 2024, from https://mocdoc.com/blog/the-functional-and-nonfunctional-requirement-for-hms