# Smart Hospital and Healthcare: Hospital Management System

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**Abstract** The smart hospital system operation starts from the patient using their medical to schedule an appointment on our app. This step involves doctor's unique ID and patient's unique ID which can be stored and separated by the hybrid cloud system. Hybrid cloud system will help us to store the patient's information in the private cloud and contain BFF and ERF module in the private cloud but ERF files in the form of microservice are transferred to the public cloud containing mobile BFF for the smooth flow of transmission between private and the public cloud. The doctors can store patient's history in the private cloud and can't get accessed by anyone else meanwhile the patient can also upload the history of their previous and present report in it through their ID. Doctor can easily access for further reference this will help in easy diagnosis. NFC tag will help to send any patient to the doctor of other department for diagnosis and can help the doctor to get the detail of the patient through one tap if this sticker is stuck on the wall, clipboard near their bed. Without disturbing the patient, the Doctor will get to know the history of the patient that will make it very hassle free and saves a lot of time. NFC tag will be coded earlier. ML and AI has a major role to play if the patient needs to be hospitalised or wants to book appointment, he/she can check for the availability of the bed and its price on our app online. AI and ML can obtain the calendar or schedule date from the patient's phone and crosscheck with Doctor's schedule. Once this gets done it would be able to identify a slot which would be comfortable for both patient and in sync with the availability of the Doctor. The patient can upload their prescription in our app under medical inventory section through their unique ID which will also link the physician. AI will check if the medicine prescribed by the physician is available or in the dispenser, if not it will immediately send a notification to prescribe alternate medicine. AI will also inform the Inventory management team about its shortage. This would help many old people who must go to the hospital alone and don't

have to run to the market for medicine. To make the record keeping procedure easy and simple both for the patient and Doctor. To make the appointment and medicine buying procedure easier. This would help in the early detection of the disease and an affordable and accurate treatment can be given to the patient. In our system we help the patients to use their ID to schedule appointment and store their records in safe and secure way. The Doctor's can store patient's information too and even their research work through their ID. This would be done through hybrid cloud server which contains the public cloud with AI and ML based algorithm and hospital database contained in private cloud. NFC tags can also help in storing information of the patient. AI and ML also helps in inventory management. I would like to thank the department for giving us this opportunity to do a research work because this helped us a lot to explore about technology and gave us the idea of finding solution to real life problem.

**Keywords** Hybrid cloud, ML, AI, NFC tag

## 1. Introduction:

The healthcare sector has undergone a technological transformation in recent years, opening new possibilities for patient diagnosis and treatment that is quicker and more precise. As an illustration of how technology can be utilised to enhance healthcare services, consider the introduction of smart hospital systems. Patients can book appointments, store and manage their medical information, and even purchase medication through an app as part of this system, which seeks to offer hassle-free and economical healthcare services.

The hybrid cloud server that powers the smart hospital system enables secure patient data storage and smooth data transfer between private and public clouds. The hospital database, which is maintained in the private cloud and uses a unique ID for every patient, contains the patient's medical history, diagnosis, and therapy. Contrarily, the public cloud leverages AI and ML-based algorithms to support inventory management and appointment scheduling, ensuring that patients receive prompt and correct care.

In addition, the smart hospital system uses NFC tags to make it easier for clinicians to store and access patient information. Doctors may quickly and readily access a patient's medical history and other pertinent information with the use of NFC tags, which helps to speed up diagnosis and increase diagnostic accuracy.

In this paper, we'll go into detail on the implementation and advantages of the smart hospital system, emphasising the contribution that hybrid cloud technology, AI, ML, and NFC tags have made to raising the standard and effectiveness of healthcare. This system not only offers consumers a practical and economical option, but it also facilitates doctors' workflow, ensuring that patients get the finest care possible.

## 2. Proposed Model:

The smart hospital system operation starts from the patient using their medical to schedule an appointment on our app. This step involves doctor's unique ID and patient's unique ID which can be stored and separated by the hybrid cloud system. Hybrid cloud system will help us to store the patient's information in the private cloud and contain BFF and ERF module in the private cloud but ERF files in the form of microservice are transferred to the public cloud containing mobile BFF for the smooth flow of transmission between private and the public cloud. The doctors can store patient's history in the private cloud and can't get accessed by anyone else meanwhile the patient can also upload the history of their previous and present report in it through their ID, this feature will help the patients a lot because they won't have to carry their report every time, there is no tension of forgetting the report at home or getting misplaced. Doctor can easily access for further reference this will help in easy diagnosis. Further doctor can also share their research work (not accessible by the patient) they will help them to form a community and help them know more about their achievements which will help them to send any patient to the doctor of other department for diagnosis.

### 2.1 NFC Tag

NFC tags can be used to store the patients ID no. which can help the doctor to get the detail of the patient through one tap if this sticker is stuck on the wall, clipboard near their bed. Without disturbing the patient, the Doctor will get to know the history of the patient that will make it very hassle free and saves a lot of time. NFC tag will be coded earlier

### 2.2 Appointment and Medical Inventory

ML and AI has a major role to play if the patient needs to be hospitalised or wants to book appointment, he/she can check for the availability of the bed and its price on our app online. AI and ML can obtain the calendar or schedule date from the patient's phone and crosscheck with Doctor's schedule. Once this gets done it would be able to identify a slot which would be comfortable for both patient and in sync with the availability of the Doctor. The patient can upload their prescription in our app under medical inventory section through their unique ID which will also link the physician. AI will check if the medicine prescribed by the physician is available or in the dispenser, if not it will immediately send a notification to prescribe alternate medicine. AI will also inform the Inventory management team about its shortage. This would help many old people who must go to the hospital alone and don't have to run to the market for medicine.

### 2.3 Detection and Treatment of disease

AI will assist in detecting the problem in human body by enabling faster and more accurate analysis of the medical data. Detection and treatment of diseases are two of the most important applications of AI and machine learning in the healthcare industry. With the increasing amount of medical data being generated every day, machine learning algorithms can be used to analyse and interpret this data to detect diseases early and develop effective treatment plans.

One of the key areas where AI is being used for disease detection is in medical imaging. Machine learning algorithms can analyse large amounts of medical images like X-rays, CT scans, and MRI scans to detect signs of disease that may be difficult for human healthcare professionals to detect. For example, deep learning algorithms can detect subtle changes in medical images that may indicate the presence of cancer, helping healthcare professionals make a more accurate diagnosis.

# 3. Working

## 3.1 Cloud Computing

One of the main benefits of using hybrid cloud technology in hospitals is the ability to store and backup vast amounts of patient data securely. Hospitals generate large amounts of data every day, such as patient records, medical images, and test results. The hybrid cloud can provide a scalable and secure infrastructure for storing and backing up this data, allowing hospitals to access and manage it more efficiently. In addition, the hybrid cloud can provide hospitals with a reliable disaster recovery solution that ensures critical patient data and healthcare services are always available. Community cloud computing can also be used to link hospital, laboratory and blood banks. Multi cloud can be used collect and store report from all over the world which the doctor can go through the history of other patients. We will use Joukuu, Mozy, and Box. com for data storage and back up service application.

## 3.2 NFC Healthcare System Model

Typically, during the registration period, many hospitals throughout the world employ a paper-based flow chart to collect patient information that is eventually passed on to numerous other people over the course of various shifts of time. Even while hospital staff members attempt to update the paperwork every time a patient arrives, because it is handwritten, it is not always accurate.

One of the most significant new technologies that offers a better solution to this is NFC because it can help automate processes and also enable precise tracking of patient identity. Each NFC tag or wristband has a Unique Identification Number (UIN) that may be programmed and is also password-protected.

At the time of registration at the hospital, each patient may receive an NFC smart tag or wristband. This can be used to keep track of a patient's information while they are in the hospital as well as to save some crucial information about them, such as their blood type, allergies, the tests they need to have done, the medications they need to take, etc. Without the patient experiencing any inconvenience, this information can be read from an NFC encoded device at any moment. NFC can be used to send and receive data from patient smart tags to the systems of healthcare professionals.

Each NFC technology primarily comprises of a reader and a low power smart tag (smart tag). A microprocessor and a tiny antenna make up this tiny tag. By transforming the radio waves reflected by the smart tag into digital information, the reader can identify the data in the smart

tag by transmitting electromagnetic rays that are picked up by the antenna in the smart tag. This data can be kept on any device, although it is primarily kept in the hospital patient management system. We can also access databases from other hospitals online. These days, NFC smart tags known as pokes are available, allowing users to exchange data like business cards and other items. When the reader and smart tag are brought together, the token will display some sign that a reader is there. If the data transmission is successful, it will display a green light; otherwise, it will display a red light. In this approach, we can even prevent many trees from being cut down for paper because the patient can use it at each hospital he visits.

## 3.3 AI and Machine Learning

AI and machine learning (ML) are transforming the healthcare industry, and smart hospitals are leveraging these technologies to improve patient care and operational efficiency. One of the ways in which supervised learning algorithms like regression can be used is to predict bed availability. By training the learning algorithm on historical data, the hospital staff can optimize bed allocation and ensure that patients receive the care they need. Unsupervised learning algorithms like clustering can be used to classify patients based on prescription information and prioritize appointments based on urgency. This can help allocate appointment slots more efficiently, reducing wait times and improving patient experience. Narrow AI algorithms can also be used to optimize staff scheduling and resource allocation in the hospital.

AI-powered chatbots can help patients communicate with the hospital in multiple languages and run basic diagnostics. These chatbots are powered by natural language processing (NLP) and can help reduce the burden on hospital staff while improving patient experience.

AI can also help patients with speech problems by using advanced text-to-speech technology. This can help them communicate with healthcare professionals more effectively and ensure they receive the care they need. Computer vision algorithms can also be used to analyse medical images like X-rays and MRI scans more accurately, helping healthcare professionals diagnose conditions more quickly and accurately.

The hospital can use machine learning to collect data on rare diseases from different sources and store them in a centralized cloud. This can help healthcare professionals diagnose rare diseases more accurately and provide better care for their patients. Cognitive computing solutions can also help healthcare professionals analyse large volumes of data more accurately and quickly, helping them make more informed decisions about patient care and treatment.

Supervised learning algorithms can be used to prioritize emergency admissions based on the severity of the patient's condition. This can help ensure that patients receive the care they need as quickly as possible. Finally, combining image analysis with natural language understanding and text analysis can provide healthcare professionals with a wealth of information and knowledge to help them make the best diagnosis possible.

AI and machine learning have the potential to revolutionize the healthcare industry, and smart hospitals are leveraging these technologies to improve patient care and operational efficiency. From predicting bed availability to prioritizing emergency admissions, these technologies are helping healthcare professionals provide better care for their patient.

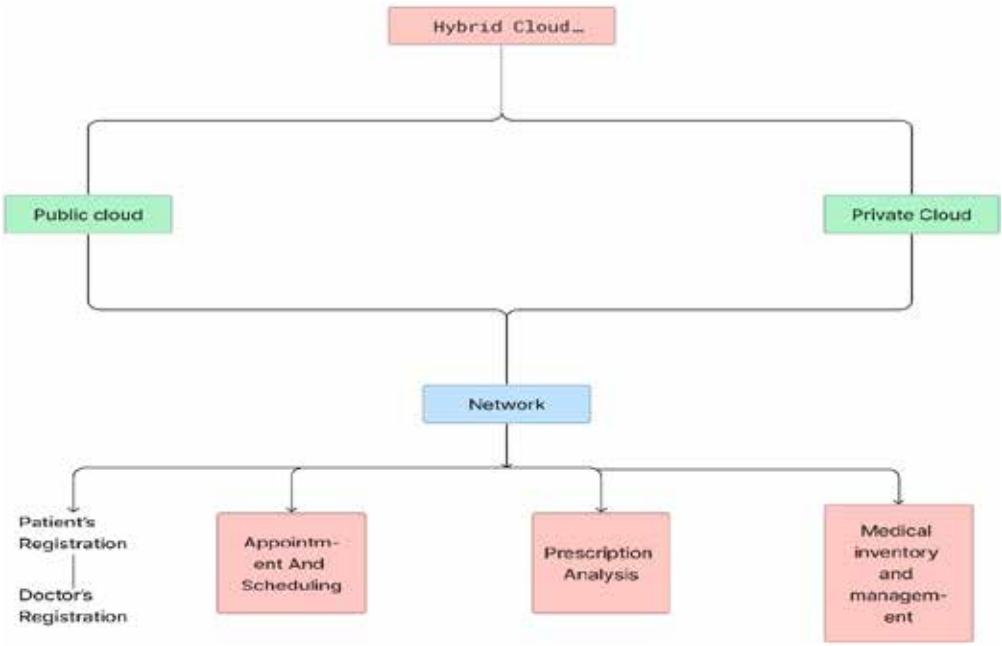


**Fig 27.1** Architectural Block Diagram of Proposed System

## Example:

Tania, an 18-year-old girl, experienced swelling, pain, and discoloration in her left calf, along with a headache and fever. She used the hospital's app to schedule an appointment and register her symptoms and medical history. Using AI, the app linked Tania to an appropriate doctor and booked an appointment that was convenient for both. During the appointment, the doctor used AI and ML to analyse Tania's symptoms and narrow down the possible causes. The AI suggested that Tania may have Deep Vein Thrombosis (DVT), a serious condition that requires prompt treatment. To confirm the diagnosis, the doctor scheduled a series of tests using AI and ML to analyse Tania's medical images, lab results, and genetic information. Once DVT was confirmed, Tania was hospitalized, and an NFC tag was placed on her bed. The tag contained all the details of Tania's treatment, including the medicine given, tests run, and injections administered. The AI helped the hospital staff manage Tania's inventory of medicine and equipment, ensuring that she received the appropriate care. After Tania was discharged, she continued to use the hospital's app for flow-up appointments. The app stored all of her medical history and allowed the doctor to access it easily during each appointment. The AI helped the doctor prescribe the appropriate medicine and dosages based on Tania's medical history, improving her chances of a successful recovery. Overall, this scenario illustrates how technology can improve patient outcomes by streamlining hospital management, improving diagnosis and treatment, and providing personalized care. With the help of AI and ML, hospitals can become smarter, more efficient, and more effective at delivering healthcare services.

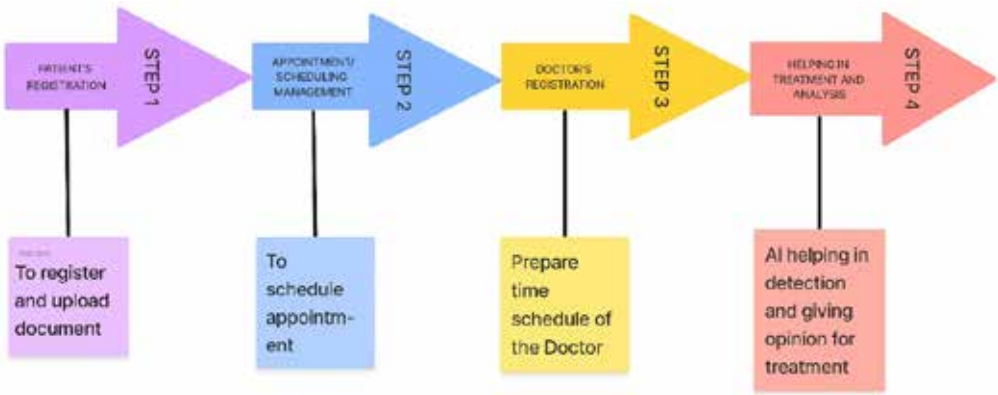


**Fig 27.2** Smart Hospital Flow Diagram

## Future Works:

In a world of digital change, companies are looking to AI to really help them shape the future of work. AI can and inform future results. It enables people to do higher value work and businesses to imagine new models in the medical and health sector. It can automate decisions, processes, experiences. The truth is many organizations can't start because 80% of their data is locked in silos and not business ready. So, how do you turn our expectations into results? Through a (related to giving rules and instructions) set of steps we call the ladder AI, and it starts with (updating with the latest stuff) all your data on a single (raised, flat supporting surface) that runs on any cloud. Then on the ladder itself, there are four steps First, collect the data to make it simple and (easy to get to, use, or understand) Really think about the models you need to train

Second, organize your data to create a business-ready (information-giving's numbers) foundation for those AI models. Third, carefully study our data both for trust and clearness/open honesty Because there's no use in applying and scaling AI if we can't explain the result, detect bias or prove its (quality of being very close to the truth or true number) Fourth, once we can really trust our data and the AI that we end out and use Then we can (understand/make real/achieve) its full value Inside of the apps and processes that control our everyday work. In other words, the last step is to begin to operationalize AI throughout our whole business We help thousands of businesses/projects put AI to work by unlocking the value of their data and this AI and multi-cloud world. By delivering the right set of skills for their people and by building trust and clearness/open honesty into AI. That's the ladder to AI in a nutshell. Let's start climbing.

## Conclusion:

The emergence of the COVID-19 pandemic has brought significant changes in the healthcare industry. The pandemic has accelerated the adoption of digital technology in healthcare, transforming the way healthcare services are delivered. The proposed smart hospital system

is a reflection of this trend. It uses various digital technologies such as AI, ML, NFC tags, and hybrid cloud servers to enhance the efficiency and effectiveness of hospital management and service delivery.

One of the key benefits of this system is its ability to simplify the process of scheduling appointments and managing patient information. Patients can use the app to schedule appointments, and doctors can retrieve patient information from other departments using NFC tags without disturbing the patient. AI and ML help in managing bed availability and crosschecking patient and doctor schedules, ensuring that patients receive prompt and efficient healthcare services.

The system also simplifies the process of medication management. Patients can upload their prescriptions on the app, and AI checks for medicine availability and notifies the inventory management team of any shortages. This eliminates the need for patients to run to the market for medicine, saving them time and effort.

Furthermore, the hybrid cloud server ensures the security and privacy of patient and doctor information. The system provides an easy and simple record-keeping procedure for both patients and doctors, enabling early detection of diseases and affordable and accurate treatment.

In conclusion, the use of technology in healthcare is a significant step towards solving real-life problems. The proposed smart hospital system is an example of this trend, providing patients with convenient, efficient, and hassle-free healthcare services. The system also helps hospital management to improve their services, enabling them to deliver quality healthcare services to patients. Overall, this system can revolutionize the healthcare industry and improve the quality of life of patients.

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