PROJECT REPORT

ON

### HEALTH EASY- OPTIMIZING DOCTOR AVAILABILITY AND APPOINTMENT ALLOCATION IN HOSPITALS: A DIGITAL- AI SOLUTION TO REDUCE PATIENT WAIT TIMES

**20CBTE301**-**LIVEIN LAB1**

***Submittedby***

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***inpartialfulfillment****forawardofthedegreeof*

### BACHELOROFTECHNOLOGY

IN

### COMPUTERSCIENCEANDBUSINESSSYSTEMS

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### INTERNALEXAMINER EXTERNALEXAMINER

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"Letouradvanceworryingbecomeadvancethinkingandplanning."-WinstonChurchill.

Such a successful personality is our beloved founder Chairman, Thiru. MJF. Ln. LEOMUTHU.At first, we express our sincere gratitude to our beloved chairman throughprayers, who in the form of a guiding star has spread his wings of external support withimmortalblessings.

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### ABSTRACT

Optimizing Doctor Availability and Appointment Allocation in Hospitals:ADigital-AISolutiontoReducePatientWaitTimes

Healthcare systems struggle with inefficient appointment scheduling, leading to long waittimes and patient dissatisfaction. Our project proposes a digital system powered byArtificial Intelligence (AI) to optimize doctor availability and appointment allocation inhospitals,significantlyreducingwaittimesandimprovingthehealthcareexperience.

Real-time doctor availability tracking, predictive demand forecasting, and dynamicappointment optimization algorithms work together to create a flexible and efficient system.Patientsreceivereal-timeupdatesand alternativeoptions,enhancingtheirexperience.

Thebenefitsaresubstantial:

~ **Reduced Patient Wait Times**: Dynamic allocation minimizes patient wait times,improving satisfactionandhealthcare experience.

~ **Improved Doctor Utilization**: Optimized schedules increase doctor availability forpatient care,maximizingresources.

~ **Enhanced Operational Efficiency**: Streamlined processes and reduced paperworkdecreaseadministrativeburden,improvingresource allocation.

~ **Data-Driven Decision Making**: Real-time and historical data provide valuable insightsforoptimizingstaffing,scheduling,and resourceallocation strategies.

This AI-powered system has the potential to revolutionize healthcare delivery by reducingpatient wait times, improving doctor utilization, and enhancing operationalefficiency,ultimatelyleading toamorepositiveandefficientpatientexperience.

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### INTRODUCTION

### OVERVIEW

# OptimizingDoctorAvailabilityandAppointmentAllocationinHospitals

## **Problem**: Long patient wait times in hospitals due to inefficient appointmentscheduling,resultinginfrustrationandpoorhealthcare experience.

**Solution**: Develop a digital system powered by Artificial Intelligence (AI) todynamically allocate appointment slots based on real-time doctor availability andpatientdemand.

# KeyFeatures:

1. **Real-time Doctor Availability Tracking**: Sensors or employee check-in systemsupdatedoctor presence inreal-time.
2. **Predictive Demand Forecasting**: Machine learning models predict patientdemandfor specificspecialties and timeslots.
3. **Dynamic Appointment Optimization**: AI algorithms allocate slots based ondoctoravailability,predicteddemand, andpatienturgency.

## **Smart Patient Management**: Real-time updates and alternative options areprovidedto patientsregarding delaysorchanges.

### SCOPEOFTHEPROJECT

The project aims to enhance hospital appointment scheduling through a digital systememploying Artificial Intelligence (AI). The system will optimize doctor availability andallocate appointments by integrating AI to consider the doctor's presence and the number ofwaitlisted patients. This initiative seeks to improve efficiency and convenience inappointment scheduling, ultimately reducing patient waiting times. The scope includes thedevelopment of a user-friendly digital platform that streamlines the scheduling process,benefiting bothhealthcareprovidersandpatients.

### MOTIVATIONTODOTHISPROJECT:

The motivation behind initiating the development of an Intelligent Appointment Schedulerfor Hospital Optimization stems from a deep-seated commitment to enhancing the overallhealthcare experience for both medical practitioners and patients. Recognizing thepersistent challenges in traditional appointment scheduling systems, such as inefficienciesin doctor availability management and prolonged patient waiting times, our aspiration is topioneer a transformative solution. By harnessing the power of Digital Technology andArtificial Intelligence, we seek to revolutionize the scheduling process, ensuring a seamlessand dynamic allocation of appointments. This project is motivated by the belief thatleveraging cutting-edge technology will not only streamline administrative processes forhealthcare providers but will also significantly reduce the stress and inconvenienceexperienced by patients waiting for medical consultations. The overarching goal is tocontribute to a healthcare environment where precision, efficiency, and patient well-beingare at the forefront, ultimately fostering a paradigm shift towards a more responsive andpatient-centrichealthcaresystem.

### BENEFICIARYOF THEFINALPROJECT:

The primary beneficiaries of the final project, the Intelligent Appointment Scheduler forHospitalOptimization,arehealthcareproviders,patients,andtheoverallhealthcaresystem.

HealthcareProviders:

Medical practitioners stand to gain significantly from the implementation of this intelligentscheduler. The system's AI-powered appointment allocation and real-time doctor presencemonitoring will optimize the utilization of their time, allowing for a more efficient andorganized schedule. This, in turn, enhances overall productivity, reduces schedulingconflicts, and enables healthcare professionals to focus more on patient care and less onadministrativetasks.

Patients:

Patientsarepoisedtobenefitimmenselyfromtheimprovedappointmentschedulingsystem. The dynamic allocation of appointments based on real-time data and prioritizationalgorithms will lead to reduced waiting times. This not only enhances the patient experiencebut also ensures timely access to medical care,particularly forurgent cases.

In summary, the Intelligent Appointment Scheduler serves as a catalyst for positive change,streamlining operations for healthcare providers, enhancing the patient experience, andcontributing to theoverall efficiency and effectiveness ofthehealthcaresystem.

### LITERATURESTUDY

**Depthofresearchconducted:**

In embarking upon the development of an Intelligent Appointment Scheduler for HospitalOptimization, a comprehensive and in-depth research initiative was undertaken to explorethe intricacies of current hospital appointment scheduling systems, identify pain points indoctor availability and patient waitlist management, and delve into the integrationpossibilities of Digital Technology and Artificial Intelligence (AI). The researchencompassed a thorough examination of existing healthcare management systems, data onpatient waiting times, and the utilization of AI in healthcare settings. Academic literature,case studies, and technological advancements in related fields were scrutinized to extractvaluable insights that would inform the design and functionality of the proposed system. Byundertaking this rigorous exploration, we aimed to establish a profound understanding ofthe challenges inherent in hospital appointment scheduling and lay the groundwork for aninnovative solution that not only addresses existing issues but also sets a new standard forefficiency andpatient-centric careinthe healthcarelandscape.

**RelevanceofLiteraturereviewed:**

**PAPER1.**

Onlineappointmentbookingsysteminonelargetertiarypublichospitaloutpatientservicecenter

AUTHOR:**MinMinZhang,CongXinZhang**

The proposed project is smart appointment booking system that provides patients oranyuserandeasywayofbookingadoctor’sappointmentonline.Thisisawebbased

application that overcomes the issue of managing and booking appointments accordingto user’s choice or demands. The task sometime become very tedious for thecompounder or doctor himself in manually allotting appointments for the users as pertheir availability. Hence this project offers an effective solution where user can viewvarious booking slots available select the preferred date and time. The already bookedspace will be marked yellow and will not be available for anyone else for the specifiedtime. This system also allows users to cancel their booking anytime. The systemprovides an additional feature of calculating monthly earnings of doctor. Doctor has tojust feed the system regularly with daily earnings and the system automaticallygenerates a report of total amount earned at the end of the month. The application usesAsp.net asafrontendand sqldatabase astheback-end

### PAPER2.:

DoctorFinderandAppointmentBookingWebsiteusingDJANGO

**AUTHOR:**Dr.Usha

### YEAR:2022

- Life has become too hard in order to get appointment in case of any medical issue ornormal routine checkup .the main aim of this site is to make easy and comfortable for thepatient who are taking appointment of a doctor in nearby location and to resolve variousproblem that a patient had to face while taking an appointment .The website act as adatabase containing doctor details, patients detail, and appointment details are maintainedby server and this website also has future of finding doctor near you using GPS andlocationsensing.

### PAPER3:

MEDICALAPPOINTMENTAPPLICATION

**AUTHOR:**NoorsyahiraIsmail

### YEAR:2017

The current standard operating procedure in healthcare environment for patient registrationandappointmentschedulingaretimeconsumingandsomehowtroublesome.MedicalAppointmentApplicationisaweb-basedmobileapplicationdevelopformanagingappointment-booking process for a few medical organizations, regardless of the type ofservicetheyscheduleinParitRajaandBatuPahatarea.Thepracticeswillhavetosignuponthe online appointments portal themselves and can view the appointment made by user, thepatients.Itwillhelpuser,thepatientstobooktheirappointmentusingtheMedicalAppointment application. Furthermore, Prototype Model is used to develop this system. AsforthehardwareandsoftwareusedtodevelopthissystemisMySQLDatabaseandprogramming language use is PHP and JavaScript. By developing this system, it will reducethenumberofcallsforanappointmentandavoidthemorningrushforanurgentappointment.Also, it will potentially reduce the need for extra reception staff, a significant reduction inlabor. Furthermore, it helps user in time saving and avoiding the need to negotiate with thereceptionist for a convenient appointment time. This technology can transform the currentdaunting appointment process and enable them to run more efficiently, effectively andprofitably.

### PAPER4:

E-HealthAppointmentSolution,AWebbasedapproach

**AUTHOR:**CristianCola,HonoriuValean

**YEAR**:2015

—In this paper we will discuss a video appointment solution using web technologies. Thesolution proposed is taking advantage of the web technologies to handle the doctorappointment. If the doctor and patient decides, they can have a video consult instead of anormal visit at the physician office. The appointments are made based on on time slotsinterval available in a day. These time slots are defined by the physician or by a delegatedperson. Video appointments are made inside a web browser; no additional software isrequired.

**IdentificationofKeyOpportunities:**

The identification of key opportunities in the Intelligent Appointment Scheduler forHospital Optimization project lies in its ability to overcome existing limitations andsignificantly elevate the standards of healthcare appointment scheduling. Unlikeconventional systems, our project harnesses the power of Artificial Intelligence (AI) todynamically allocate appointments based on real-time data. This not only optimizes doctoravailability but also prioritizes appointments, addressing urgent cases promptly. Theintegration of a user-friendly digital platform ensures accessibility for both healthcareprovidersandpatients,fostering atransparentand efficientschedulingexperience.

Furthermore, the incorporation of AI-driven analytics and continuous improvementmechanisms distinguishes this project by its commitment to adaptability and refinementover time. By bridging the gaps in current systems and introducing innovative features, thisproject opens avenues for enhanced efficiency, reduced waiting times, and an overalltransformative impact on healthcare scheduling, setting it apart as a pioneering solution incomparison topre-existingprojects.

### SYSTEMANALYSIS

### EXISTINGSYSTEM

The current appointment scheduling system in hospitals resembles a well-worn map,meticulously crafted but outdated. It relies heavily on static calendars, manual updates,and human intuition, often failing to adapt to the dynamic rhythm of patient flow anddoctor availability. This static approach results in frustrating bottlenecks, with patientslanguishing in waiting rooms long after their scheduled appointments, while doctorsfaceuneven workloads andwastedidletime.Ourproposed AI-poweredsystem,in

contrast, is like a GPS for navigating the hospital’s scheduling landscape. By utilizingreal-time data, predictive algorithms, and dynamic allocation, it continuously updatesitself, weaving a fluid path through the maze of appointments, optimizing utilizationand minimizingthoseagonizing detoursknown as“wait times.”

This paragraph highlights the limitations of the existing system by comparing it to astatic map, emphasizing its lack of adaptation and real-time updates. It then contraststhis with your proposed AI-powered system, using the metaphor of a GPS to showcaseits dynamic, data-driven approach and ability to optimize scheduling. By focusing onpatient wait times and doctor utilization, it addresses two key pain points within theexistingsystemandshowcases thepotential benefitsofyourAI-basedsolution.

### DRAWBACKSOFEXISTINGSYSTEM1.ManualandRule-BasedProcesses:

Therelianceonmanualorrule-basedschedulingmethodsinexistingsystemsoften leadsto inefficiencies and errors. Manual scheduling is time-consuming and prone to humanerror,resulting in challenges suchasscheduling conflicts and inaccuracies.

### LimitedAdaptability:

Many current systems lack adaptability to dynamic conditions. They often struggle torespond to real-time changes in doctor availability or unexpected variations in patientdemand,leading tosuboptimal allocationofappointments.

### LackofPrioritizationMechanism:

Existing systems often lack sophisticated prioritization mechanisms. Urgent medicalcases may not receive the attention they require, as these systems do not have thecapabilitytoprioritizeappointmentsbasedonthecriticalnatureofpatients'conditions.

### PROPOSEDSYSTEM:

Implement a sophisticated AI algorithm to analyze the doctor's real-time availability andthenumber of patientsonthewaitlist.

Utilize machine learning models to predict appointment durations, optimizing schedulingforvariousmedicalscenarios.

### Real-TimeDoctorPresenceMonitoring:

Integrate sensors or a digital check-in system to monitor and update the doctor's currentpresenceinthehospital.

Ensurereal-timesynchronizationwiththeschedulingsystemtoreflectaccurateavailability.

### User-FriendlyDigitalPlatform:

Develop an intuitive and user-friendly digital interface accessible to both healthcareproviders andpatients.

Implement a secure login system for doctors and patients, ensuring data confidentiality andaccesscontrol.

### DynamicAppointmentOptimizationEngine:

Constraint Engine: Defines rules and policies for appointment scheduling (e.g., doctorschedules,appointmentdurations,patienturgencylevels).

### PrioritizationAlgorithm:

Implement an algorithm to prioritize appointments based on the urgency of the medicalcondition,ensuringtimely accessfor critical cases.

### IntegrationwithElectronicHealthRecords(EHR):

Seamlessly integrate the system with existing EHR systems to access patient records andensurecontinuityof care.

Enableautomatedupdatingofpatientrecordsaftereachappointment.

### DataAnalyticsforContinuousImprovement:

Incorporate data analytics tools to monitor system performance, gather feedback, andidentify areasforimprovement.

Use collected data to refine the AI algorithm for better prediction accuracy andappointment optimization.

### DataAcquisitionModule:

Sensor network or employee check-in system to track doctor presence in real-time(location,availabilitystatus).

Hospital information system (HIS) integration for patient data access (demographics,medical history,appointmentrequests).

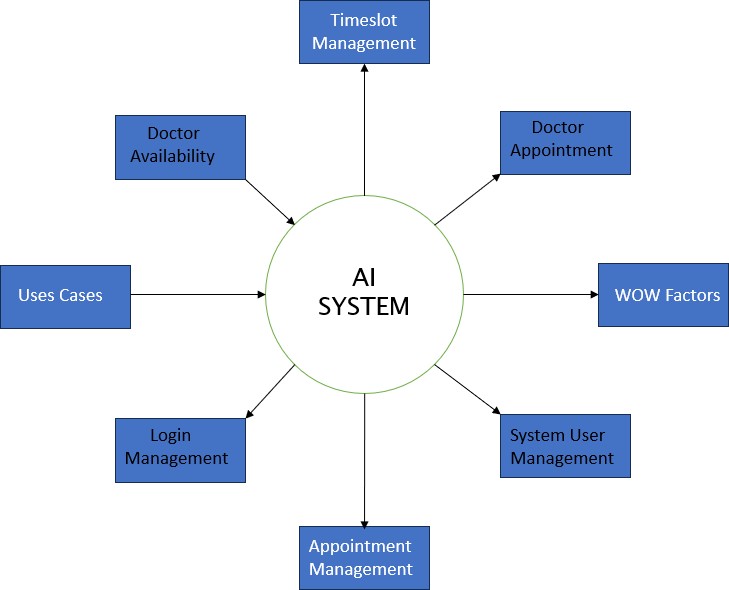
### PredictiveDemandForecastingModule:

Machine learning models trained on historical appointment data and live patient flowpatternsto predict futuredemand forspecificspecialties and timeslots.

### ADVANTAGESOFPROPOSEDSYSTEM

* + - Thereareawiderangeofbenefitsforbothhealthcareprovidersandpatients:
    - TheywillperformforGeneralAppointmentSchedulingandUrgentCareTriageandSpecialist Referrals.
    - Improved Doctor Utilization: Optimized schedules maximize doctor availability forpatient care,increasingefficiency.
    - EnhancedOperationalEfficiency:Streamlinedprocessesandreducedadministrativeburden improve resource allocation.
    - Data-DrivenDecisionMaking:Historicalandreal-timedataprovideinsightsforoptimizingstaffing,scheduling,and resourceallocationstrategies.
    - ImprovedPatient-DoctorCommunication:Real-timeupdatesandcommunicationfeaturescontributeto amoreinformedandcollaborativepatientexperience.
    - SystemprovideChronicDiseaseManagementand Long-termCareCoordination.
    - TheyprovideDoctorWorkloadBalancing(60minutesbreakwillbeprovided)andWaitlist Managementandonlinepayment.
    - ProvidesReverseSlotforpreviousdayunattendedappointment.
    - Multi-locationScheduling(F)andPharmacyrecommendation.
  1. **BlockdiagramorArchitectureDiagram**

**Comprehensivearchitecturedesign:**



ALLOCATIONPROCESS



### GeneralAppointmentScheduling:

General appointment scheduling is the process of booking routine, non-emergencyappointments with healthcare providers for primary care, check-ups, or follow-upconsultations.

Patient flow in general appointments is relatively routine, with patients scheduled inadvance,reducingwaittimes.

### UrgentcasesTriage:

Urgent care triage involves prioritizing and assessing patients with acute or urgentmedical conditions. It helps determine the severity of a patient's condition andwhethertheyneedimmediate attention.

Urgent care is immediate and focuses on patients with sudden, serious, or potentiallylife-threatening conditions.Itoperates outsideregularofficehours.

Noappointmentrequired.

### SpecialistReferral:

Specialist referrals are the process of directing a patient to a specialized healthcareprovider (e.g., a cardiologist, neurologist) for in-depth evaluation or treatment of aspecificmedical condition thatrequires expertisebeyond generalcare.

Specialist referrals are based on the primary care physician's recommendation or thepatient'sspecificneeds,withwaittimesdependingonthespecialist'savailability.

### REQUIREMENTSPECIFICATION:

Technological Stack : The technological stack for Optimizing Doctor Availability andAppointment Allocation in Hospitals through Digital Technology and Al Integrationtypically includesthefollowingcomponents:

1. Programming Languages : Python: Core language for machine learning and backenddevelopment.
2. DeepLearningFramework:TensorFlow:ForbuildingandtrainingtheCNNmodel.
3. Machine Learning Libraries :Keras (integrated with TensorFlow): For building andtraining machine learningmodels.
4. Web Development Framework : Flask: Lightweight web framework for building the webapplication.
5. Front-End Technologies : HTML, CSS, JavaScript: For creating an intuitive andinteractiveuserinterface.
6. ImageProcessingLibrary:OpenCV:Forpreprocessingtasks,suchasresizingandaugmentation.
7. GPU/TPU Resources : NVIDIA GPUs or Google TPUs: To accelerate the training ofdeep neuralnetworks.
8. Web Server :Gunicorn (for production deployment with Flask): To serve the webapplication.
9. REST API : Flask-RESTful: To implement a RESTful API for communication betweenthefrontendandbackend.
10. Containerization:Docker:Forpackagingtheapplicationanditsdependenciesintocontainers.
11. Database (Optional) : SQLite or PostgreSQL: For storing additional information ifneeded.
12. WebApplicationDeployment:Heroku,AWS,orGoogleCloud:Forhostinganddeployingthe webapplication

### CONCLUSION:

CrossingtheThreshold:FromInefficiencytoIntelligentHealthcare

This project stands as a beacon of hope, illuminating a path towards a healthcare futurewhere technology serves not as a barrier, but as a bridge to efficient, accessible, and patient-centered care. We have meticulously woven a tapestry of AI-powered solutions, not merelyto mend the tattered fabric of appointment scheduling, but to fundamentally transform theexperienceofseekingcare.

This journey transcends the reduction of wait times; it embodies an unwaveringcommitment to human dignity. We envision hospitals brimming not with frustration andwasted time, but with the quiet hum of efficiency, where patients encounter not onlyattentivemedicalexpertise,butalsotheempoweringcertaintyofreceivingtimelycare.Our journey, however, does not end with the completion of this project. It marks theopening salvo in a continual march towards a healthcare ecosystem governed by data-driven insights and intelligent algorithms. As we refine our system, gather data, and learnfromtheconstantheartbeatofhospitallife,weaimtopushtheboundariesfurther,weaving

even deeper threads of optimization and human-centered design into the fabric of healthcareexperience.

This project is not merely a culmination of research and development; it is a promise, awhispered pledge to every weary patient waiting in a sterile hallway, to every doctorjuggling an overbooked schedule, and to every healthcare professional striving for a better,more efficient tomorrow. We stand on the precipice of change, ready to cross the thresholdfrom inefficiency to intelligent healthcare, hand in hand with the transformative power oftechnology.

This conclusion strikes a balance between celebrating the project's achievements andemphasizing its future potential. It uses powerful imagery and metaphors to connect withthe reader on an emotional level and convey the project's transformative impact on thehealthcare experience. By highlighting the commitment to ongoing improvement and thepromise of a better future, it leaves a lasting impression and paves the way for furtherexploration andimplementation.

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