Volume 9, Issue 4, April – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1994

Optimizing Doctor Availability and Appointment Allocation in Hospitals through Digital Technology and AI Integration

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bstract:- Many patients miss their appointments all around the world and many of them don't even cancel at all or don't do so in time due to several reasons. In order to address the widespread issue of medical no-shows, this paper proposes a solution that involves building a machine learning model utilizing patient datasets that are already available. This model will identify patterns and links between various patient factors and the patients' propensity to miss appointments. As a result, based on their information, it is possible to anticipate the chance of a patient appearing. Based on the Support Vector Machines classification technique, the machine learning model created the solution predictive model. Effective healthcare services are vital in today's fast-paced environment. This strategy aims to reduce the distance between patients and medical professionals by offering a workable and friendly solution. For certain medical institutions, such as clinics and hospitals, this initiative makes it easier for patients and customers to schedule doctor appointments online. Using this technology, patients may easily browse a database of doctors' biographies, specializations, and availability. Even the day and time of their choosing can be chosen for appointments. Each patient's appointment request will be scheduled by this doctor's appointment system and forwarded to the physician. The system administrator will update the list of doctors, including their specialties, personal information, and system access credentials. Patients will look for a physician who specializes in their requirements by exploring the doctor's appointment system online. Before making their request, the patient can browse the doctor's weekly schedule to choose a day and time that works best for them. Following that, the physicians have access to all of their appointments as well as the patients' appointment requests, which are prioritized according to their availability. It gives medical professionals a strong tool for successfully managing the schedules, which reduces administrative strain and ensures a positive patient experience.

I. INTRODUCTION

The Appointment Scheduling system is presented in this paper. It allows people to plan appointments quickly and easily, and it gives medical professionals in a hospital or clinic accessible and useful schedule monitoring, reporting, and management.

Based on case-specific outcome projections, the suggested approach enables the automated handling of high-risk visits. The system was developed in conjunction with a classifier that uses machine learning to identify chronic no-shows. Thus, [1]this research employs a data set of 110,527 arrangement records to develop, test, and coordinate an effective classifier. The arrangement highlights documented in the logs include the [1]patient's ID, gender, lead time, age, clinic, area, health benefits, pre-existing medical problem, and a hail indicating the fact that the quiet was reminded. The framework's predictive modeling element learns sufficient from the information to provide precise expectations about non- attendance. This is frequently achieved by incorporating the technique's information into the preferred categorization strategy. As a consequence, the framework may use the classifier component's anticipated result to overbook vacancies that will not be filled. This investigation investigates and evaluates several commonly used machine learning procedures in order to bring together the classifier aspect that can create extremely precise and dependable forecasts so that the overall framework plan can appropriately manage no-shows.

The healthcare industry is always changing to meet the ever- increasing needs of patients and providers in our fast-paced, technologically-driven society. A key component of this development is the Doctor Appointment System, a cutting- edge and inventive solution made to make scheduling and managing doctor visits easier. With so many advantages for patients and healthcare providers, this system marks a major departure from traditional appointment scheduling techniques. The Physician Appointment System streamlines the process of scheduling visits with medical specialists by utilizing technology. It seeks to do rid of issues like lengthy wait times, overworked administrative staff, and misunderstandings that are frequently related to appointment scheduling. It gives patients a user-friendly platform to obtain information about doctors, their specializations, and the availability of appointments in real time, empowering them to take charge of their healthcare.

Current availability data Patients can minimize wait times and maximize the utilization of healthcare resources by choosing appointment times that work best for their schedules with the help of availability information. In addition to streamlining the scheduling process, the doctor appointment booking system also increases patient satisfaction and boosts the productivity of medical staff. It improves accessibility,

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1994

convenience, and efficacy of healthcare as a result.

II. LITERATURE REVIEW

We are currently introducing an interface that allows patients and physicians to communicate. Its exceptional multi-node administration improves communication between medical experts and patients. The hospital's server nodes are freely accessible to patients. [1]In this context, patients can discuss their symptoms with physicians. Physicians may keep track of and record persons who are scattered regionally, as well as provide appropriate diagnoses. Creating a new system that would allow doctors to monitor and manage patient visits while customers could schedule them effortlessly online. In this example, patients book their appointments online based on the doctor's availability and their time limits. In contrast, the physicians' working hours may vary depending on the number of patients arriving during the day.

- **Waiting period:** [2]Waiting time is simply the length of time that must pass after a request or mandate is made for a certain activity to occur. The term "patient waiting time" refers to the time between when a patient arrives at an outpatient clinic and when they take their medicine. [3] It refers to the total period between registration and a doctor's Consultation. There were two waiting periods: one for the doctor's appointment and another for the medicine to be delivered.
- **The Appointment System for Patients:** [4]We are currently introducing an interface that allows patients and physicians to communicate. Its exceptional multi-node administration improves communication between medical experts and patients. [5]Appointment system for patients The patient appointment system or timetable of a healthcare institution was developed long ago. In prior investigations, patient appointment management resulted in simplified queue models and largely unchanging scheduling situations.
- **Taking Care of the Patient Appointment System:** [6]According to Dexter, a computer software known as the managing patient appointment system is utilized to regulate and reduce the amount of time patients must wait in the medical institution. Some medical institutions do not have an appointment system. As a result, it has a longer average patient wait time than the medical institution that employs the patient appointment system.
- **Online Reservation Platform:** [7]An online system is often known as a web-based system. A website is a computer software that runs a webserver and provides access to a collection of connected web pages. A web is made up of web pages, also known as web sites. A system is made up of multiple interdependent components that work together to achieve a single aim.
- **Online Appointment Booking for Outpatient Care:** [8]One of the most pressing issues confronting the medical sector is the provision of high-quality and efficient medical services to patients with changing health needs.China's online medical services business is flourishing, growing in part to the country's rapid improvements in information and communication technology, as well as increased Internet and mobile device usage.
- **Current Hospital Scheduling Programs:** [9]Exponential entry arrival times were used in one application that handled patient appointment scheduling. Due to the nature of appointment scheduling, this model is limited and assumes that the exponential arrival times could not be explicitly validated by date. Because appointments are scheduled in the future, the accurate call arrival model will have a limited impact on metrics related to the duration between the call and the appointment time. As a result, developing an appointment system that functions well in the context of medical operations is tough. Consequently, the health centre's appointment provider can schedule a patient for a convenient time window on a certain day.
- **Appointment Postponement:** [10]Every day that a patient attempts to schedule an appointment, the likelihood of them cancelling or failing to show up increases. Out of 5901 samples, 31% cancelled or did not show up for their planned doctor's visit. Most of these appointments are scheduled within a few days of the request being received. The best course of action in this case would be to encourage them to come as soon as possible or to book an appointment at a time that is convenient for them...

III. RESEARCH GAPS

➢ *Integration with the Healthcare Ecosystem:*

- [8]The main barrier to e-healthcare systems attaining their full potential is the separation between them and the wider healthcare ecosystem. It is like attempting to put together a puzzle with missing pieces and failing to understand the larger picture or deliver the best treatment possible. Here is a deeper look at the problem:
- Isolated data silos provide incomplete patient records, hindering informed decision-making and leading to errors or missed diagnoses.
- Inefficiencies, such as repetitive testing, paperwork, and lack of collaboration, can result in costly and time-consuming activities.
- Difficult processes and lack of information can irritate patients and doctors.

➢ *Health Equity and Accessibility:*

- [12]The biggest impediment to achieving health equity and accessibility in e-healthcare systems is bridging the healthcare ecosystem gaps. The fragmented environment of this gap has significant impacts for vulnerable populations, including:
- The digital gap affects underprivileged populations, rural inhabitants, and those with disabilities by limiting access to technology, internet and digital literacy skills.
- Non-English speakers face language hurdles due to a lack of multilingual support.
- Design errors can further marginalize those with impairments.

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- Cost and affordability: Subscription fees and data costs pose financial challenges.
- Historical prejudice may lead to scepticism in data security policies.

➢ *New Data Entry and Extraction Procedures Must be Developed*

- Participants talked about the conflict between entering data in the EMR in a standardized manner and in free-text format.
- Participants indicated a strong opinion that include this data should not disrupt the duties of the PHC physicians and medical professionals.
- We are not yet in a position to leverage the entire interaction that free text permits for research and evaluation or developing EMR policy.
- By creating additional time demands that interfere with physicians' or healthcare practitioners' ability to provide patient care.

➢ *Determine the Worth of Electronic Medical Records(EMR):*

- [14]Considering the uncertainty surrounding EMRs' effects on patient care, evaluating the relevance of EMRs to PHC practice was crucial.
- how EMRs affect patient outcomes, safety, continuity of care, efficiency, patient and health system value against usefulness for professionals
- The effects of Find out the value of electronic medical records (EMRs), especially with regard to physician compensation, the requirement to use EMRs that impacts of various practice models, and the effect of generational differences.
- There is no evidence that they improve treatment in circumstances where persons recognize the absence of proof but still think the plan of treatment is acceptable.

➢ *Lack of Cooperation and Knowledge on Data Sharing:*

- In this broader environment, there is current lack of frameworks to guide data sharing.
- A lot of time is taking for ironing out of data sharing.
- Number of things might affect how valuable people believe an EMR to be, such as difficulties entering and extracting data, data sharing, and uncertainty about how Electronic Health Records (EMR) will affect patient care.

➢ *Existing Systems*

To organizing and monitoring patient visits, the current doctor appointment system depends on manual procedures and in- person contacts. Typically, patients schedule an appointment by calling the medical institution. Receptionists or administrative personnel then manually check for open slots and make the reservation. [16]Patients are regularly sent physical appointment cards as reminders, and appointment data are frequently entered into paper books or records. According to this approach, people must physically show up for their appointments, wait in waiting areas, and check in at the front desk. The typical appointment system may not scale well as medical facilities develop or as the number of patients increases. [17] Maintaining paper records might become unfeasible as the human processes get more onerous. When it comes to postponing or cancelling appointments, traditional methods sometimes provide little flexibility. Patients who wish to reschedule their appointments may need to contact more than once, and this depends on staff availability. Scheduling flexibility may be restricted, and access to patient information is frequently restricted during the procedure. Missed appointments, inefficient resource allocation, a hefty administrative burden for medical personnel, and scalability issues are some of the problems that this technique may cause. Although appointment management has always been done this way, the introduction of digital technology has brought forth more effective and patient-centred options that are becoming increasingly common in contemporary healthcare systems.

➢ *Disadvantages of Existing System:*

Medical practitioners and consumers may experience various drawbacks from the various doctor appointment systems now in use, regardless of whether they are digital or analog. Some typical drawbacks of these systems are as follows:

- **Restricted Accessibility**: [18]Patients who need to make appointments outside of regular business hours may find it difficult to use traditional systems as they only permit scheduling during these hours.
- **Rearranging**: [19] Patients may find it difficult to reschedule or cancel appointments using traditional methods without having to call them again or pay a fee.
- **Taking Up Time:** [20]Takes for time for administrative personnel to schedule appointments manually, which can result in mistakes and inefficiencies.
- **Resource Allocation**: Scheduling appointments might be difficult since facilities occasionally overbook personnel and supplies for appointments that do not happen.
- **Communication Breakdown**: The main means of communication in traditional systems are phone conversations and in-person meetings. This can lead to missed calls, longer waiting periods, and communication breakdowns.
- **Ineffective Record-Keeping**: Paper records, which are prone to mistakes, loss, or damage, are frequently used in traditional systems for appointment scheduling
- **Data privacy**: Whether using digital or traditional methods, there may be worries about patient data security and privacy, particularly if strong security measures are not in place.
- **Convenience**: Patients may find conventional methods less convenient since they need to schedule appointments in person or over the phone, which may be time-consuming and less patient friendly.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1994

IV. METHODOLOGY

The main components of the suggested system are a database, a machine learning component. The database, application logic, and user interface layers comprise the three-tier architecture used to build the system. The layered method facilitates decoupling, which has several advantages such as easier future implementation upgrades and changes, more understandable code, and enhanced flexibility.

A. User Interface Layer:

There are two client nodes—one for each kind of client—are present in the user interface (patient or hospital administrator). The online application component is housed in the owner status, whereas the smartphone app is located in the patient- owner. A component on every client node allows users to communicate with the system. To register, schedule appointments, and access other services, patients utilize the smartphone app.The application's mobile server provides web interfaces to give capabilities using the mobile app. The hospital administrator uses the web interface to input appointment hours, examine schedules, and information. To do these operations, the web application uses web interfaces given by the app server.

B. Classifier Implementation:

The ASIM system's prediction capability was created by pre- processing there is a availability of datasets of doctor appointments with patients which included group levelling and categorical info encoding. Then, for early testing, best show assessment, and model selection, this dataset was fed into a number of classification algorithms.

C. Dataset Used:

Medical Appointment No Shows. 110.527 medical visits have 14 related variables. The most crucial is whether the patient shows up or does not show up for the appointment.

➢ *The Dataset Contains:*

- *Available Data:*

The collection offers detailed information on medical appointments, including several attributes for each record. In addition to patient identity, appointment IDs, gender, scheduling and appointment dates, patient age, and neighborhood data, there are indications for medical diseases including diabetes, hypertension, alcoholism, and disability.

- *Dependent Variable Definition:*

The term "the patient canceled an appointment close to the scheduled time or did not show up according to a scheduled appointment" is used to describe no-show behavior in previous studies. In the event of an appointment-related cancellation (such as one made on or before the scheduled appointment day), outpatient appointments cannot be transferred to another patient.

- *Independent Variables:*

Apart from age and gender, Appointment Day, SMS received, and other predictive features are the main predictors in this study.

Modules are defined as follows; they are also referred to as predictor variables.

- ✓ Booked Day: The day and hour the appointment was booked.
- ✓ Date of Appointment
- ✓ SMS_received: indicates if the patient received an SMS reminder for the appointment (0 for No, 1 for Yes).
- ✓ Scholarship: Determines if the patient is eligible for a scholarship (0 for no, 1 for yes).

- *Requirement Analysis:*

We extensively investigated the existing appointment booking system to discover the essential required materials and features of doctor appointment system with the help of AI. Medical settings rely on systems and processes. We found the most popular demands such comfortable appointment scheduling, on time access to physician's conflict resolution, resource management, and personalized user experiences.

- *Data Preprocessing:*

- ✓ Missing Values: Check for null values in each feature and determine how to handle them (e.g., imputation, deletion).
- ✓ Encoding Categorical Variables: Using one-hot encoding, convert categorical information such as gender and neighbourhood characteristics into numerical representations.
- ✓ Scale's numerical features: Scale numerical features such as patient age to ensure that they have similar ranges, which can help some machine learning algorithms work more effectively.
- ✓ Feature engineering is Extract required features, such as calculating wait periods between scheduling and appointment dates.
- ✓ Develop additional features based on local characteristics such as population density or socioeconomic status.

- *Feature Selection:*

- ✓ Correlation Analysis: Determine the correlation between each feature and the target variable (no- show) to uncover potentially significant characteristics.
- ✓ Feature relevance Ranking: In this we need to use the tree type data structures or classification such as decision tree, random forest.
- ✓ Dimensionality Reduction: If the dataset has a high number of features, use techniques like PCA to decrease dimensionality while retaining the most relevant information.

- *Data Balancing:*

The distribution between 'No-show' and 'Show' records was done using percentages showed a significant imbalance, with 80% labeled as 'Show' and 20% as 'No-show'. A dataset logging patient attendance is predicted to show a significant class imbalance, given the majority of medical visits are attended while a minority are not. To address the class imbalance in the dataset, we tested several under-sampling and oversampling strategies.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1994

- *Model Selection:*

In this stage of developing and testing the model, the subpart of ml algorithms needed to solve patient attendance prediction is classification, which is a type of supervised learning. This is because the records that were extracted from the Brazilian dataset are labeled for the outcomes of show/no-show. In the context of this work, classification and prediction are identical because the model under development will be used to classify show/no-show cases. To create supervised learning models that carry out categorization.

➢ *The Algorithms Outlined Below were Tested using the SK-Learn API.*

- Decision Tree Classification
- Linear Support Vector Machines (SVM)
- Non-Linear Support Vector Machines (SVM)
- Logistic Regression
- KNN Classification

The dataset balanced by the IHT method was employed in this step of the model's development. In addition, every algorithm was subjected to a rigorous method of hyper-parameter tuning known as grid search, which is incorporated into the SKlearn library. This method determines the part of parameters given an algorithm, a parameter grid and a scoring performance function that serves as a criterion for choosing the best value for a parameter. To achieve comparable performance to that obtained with the entire, balanced dataset, the number of features in the dataset is also empirically decreased to the bare minimum. The two types of feature reduction that are examined are dimensionality reduction and feature selection, both of which have SK-learn library implementations. Feature selection, a feature reduction strategy, uses a parameter also designated "K" to truncate the columns inside a dataset, keeping the K most significant/informative features.

On the other side, dimensionality reduction which provide a limited representation and summary of the data found in the original features. SK-Learn's Principal Component Analysis (PCA) function is used in this research to do dimensionality reduction. The number of principal components that are desired after post dimensionality reduction is recorded in a parameter called n_components.

D. Application Layer:

- Admin Module
- Patient Module
- Doctor Module

- ADMIN MODULE: The login page allows the administrator to log in using their email address and password. The website's administrator can handle all aspects of the site.
- PATIENT MODULE: Patients may establish profiles, schedule appointments, view appointment history, and engage with healthcare professionals.
- DOCTOR MODULE: The doctor can log in using his or her email and password. This module enables doctors to manage profiles, appointments, patient information, and offer medical services.

➢ *Software Used:*

- **DJANGO:** Built by professional developers, it removes most of the difficulty of web development, allowing you to focus on building your app without having to waste a lot of time for no reason. It is completely free and open source.
- **MYSQL**: A database is an organized combination of data. MySQL is a popular open-source RDBMS for handling structured data. It plays a significant role in developing dynamic online applications, content management systems, e-commerce platforms, and other technologies. MySQL's relational database structure uses Structured Query Language (SQL) to efficiently store, retrieve, and manipulate data**.**
- **HTML:** HTML is the standard language for producing and organizing web content.HTML offers the fundamental structure and semantics of a web page.
- **CSS:** It is a style sheet language that specifies how a markup-generated page should appear and be styled. In compared to HTML, it provides one additional functionality. It is frequently used in combination with HTML to change the look of graphical user interfaces and internet pages. .
- **JAVA SCRIPT**: For web scripting, JavaScript is the most widely used language. Single-threaded, cross-platform, lightweight, interpreted, compiled language with ease of learning. On both the client and server sides, it is extensively utilized in web development. It is crucial to web browsers as a scripting language since it helps to improve user experience by enabling content alteration of web pages in real time.. JavaScript syntax is comparable to other programming languages like Java and C, making it quite simple to learn for people who are familiar with programming fundamentals. A program's logic is defined using variables, loops, conditional statements, functions, and objects.

V. RESULTS AND DISCUSSION

A histogram depicting the ages distribution for the subjects at the start of the research reveals the population's demographic mix.The incidence of the ailment in various age groups is then examined using gender-based analysis, which aids in treatment planning. Appointment day analysis identifies trends in attendance to help with schedule optimization. Attendance is compared to assess the effectiveness of SMS reminders. The effect of being awarded a scholarship on attendance is examined. Neighbourhood dispersion has an impact on resource distribution. Analysing appointment dates contributes to more effective scheduling. Finally, monthly data for programs that are particularly targeted demonstrates variations in seas

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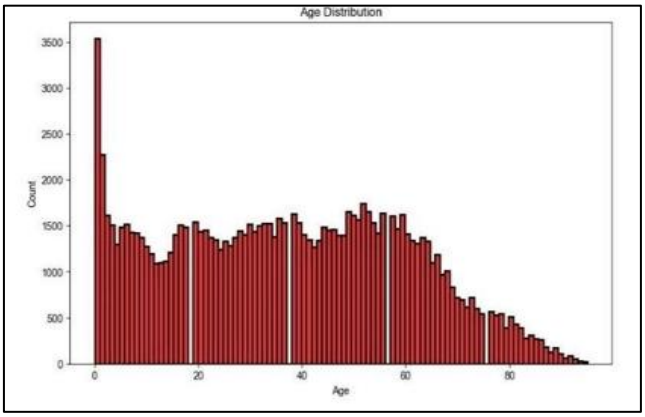

Fig 1: Graph between Age distribution and Count

Individuals between the ages of 20 and 60 are probably interested in making appointments, based on the above histogram.

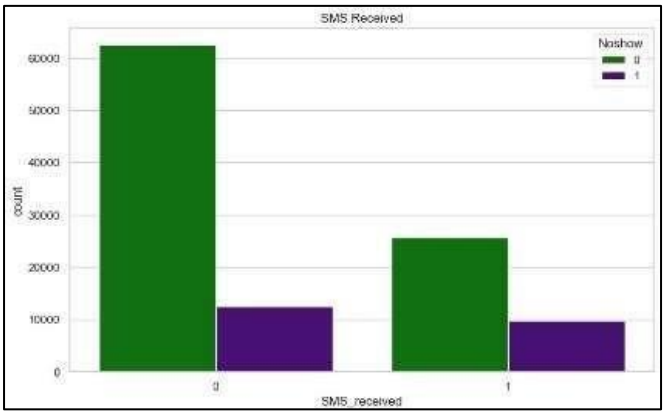

Fig 2: Graph between SMS Received and Count

Patients are more likely to attend their appointment if they get an SMS reminder, as seen by the bar graph above.

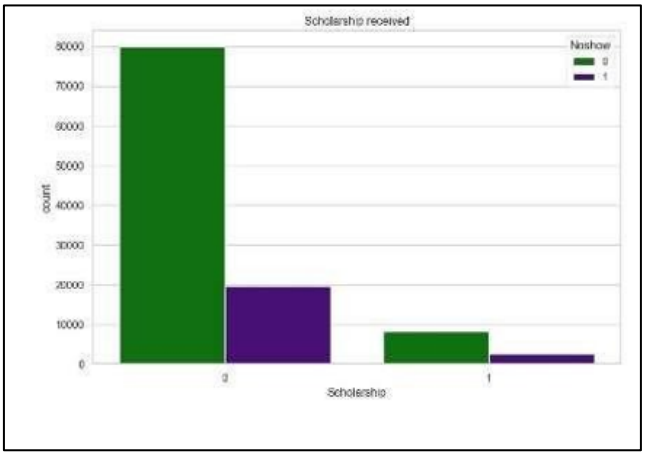

Fig 3: Graph between Scholarship Received and Count

(The bar graph above indicates that although fewer persons have gotten scholarships, it is clear that recipients of scholarships are more prone than non-recipients to miss appointments.)

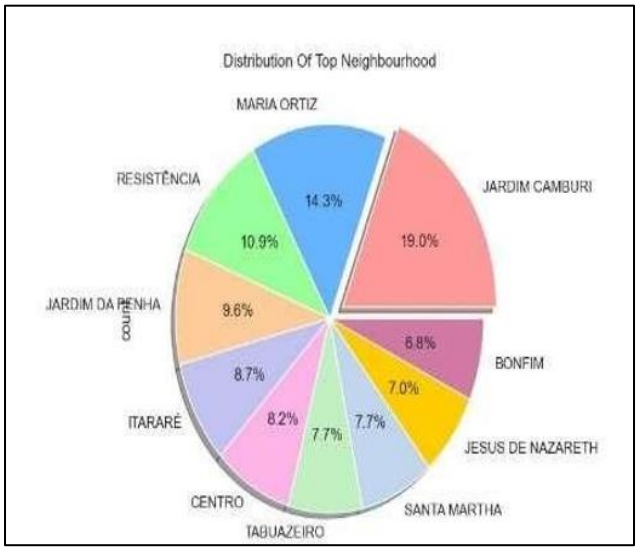

Fig 4: Piechart Representing the Distribution of Neighbourhood

(The piechart above indicates that the majority of the neighborhood has an 80% show rate. This suggests that this characteristic would not be very useful when developing a model to identify the patient segment that is most likely to attend a visit.Therefore, we are excluding this component from our study.)

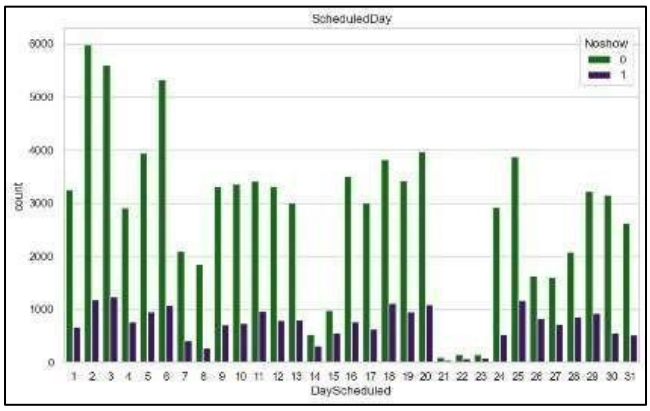

Fig 5: Graph between Schedule Day and Count

The majority of patients are turning up on the day that they are scheduled, according to the graph distribution.

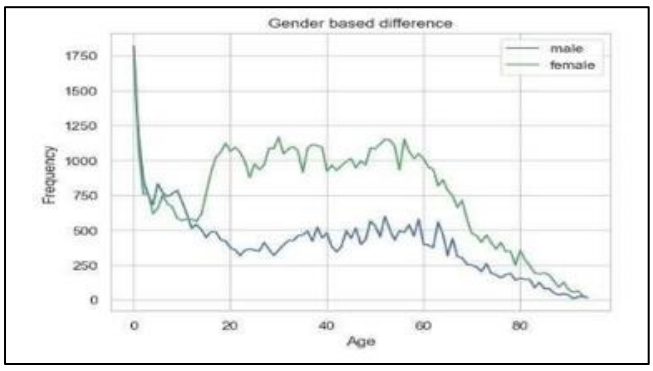

Fig 6: Graph between Gender Biased difference and Frequency

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1994

(Above graph indicates that women are more likely than males to see the doctor.) It is evident from the graph above that women are nearly twice as likely as males to see the doctor. However, it works well for a specific age range.)

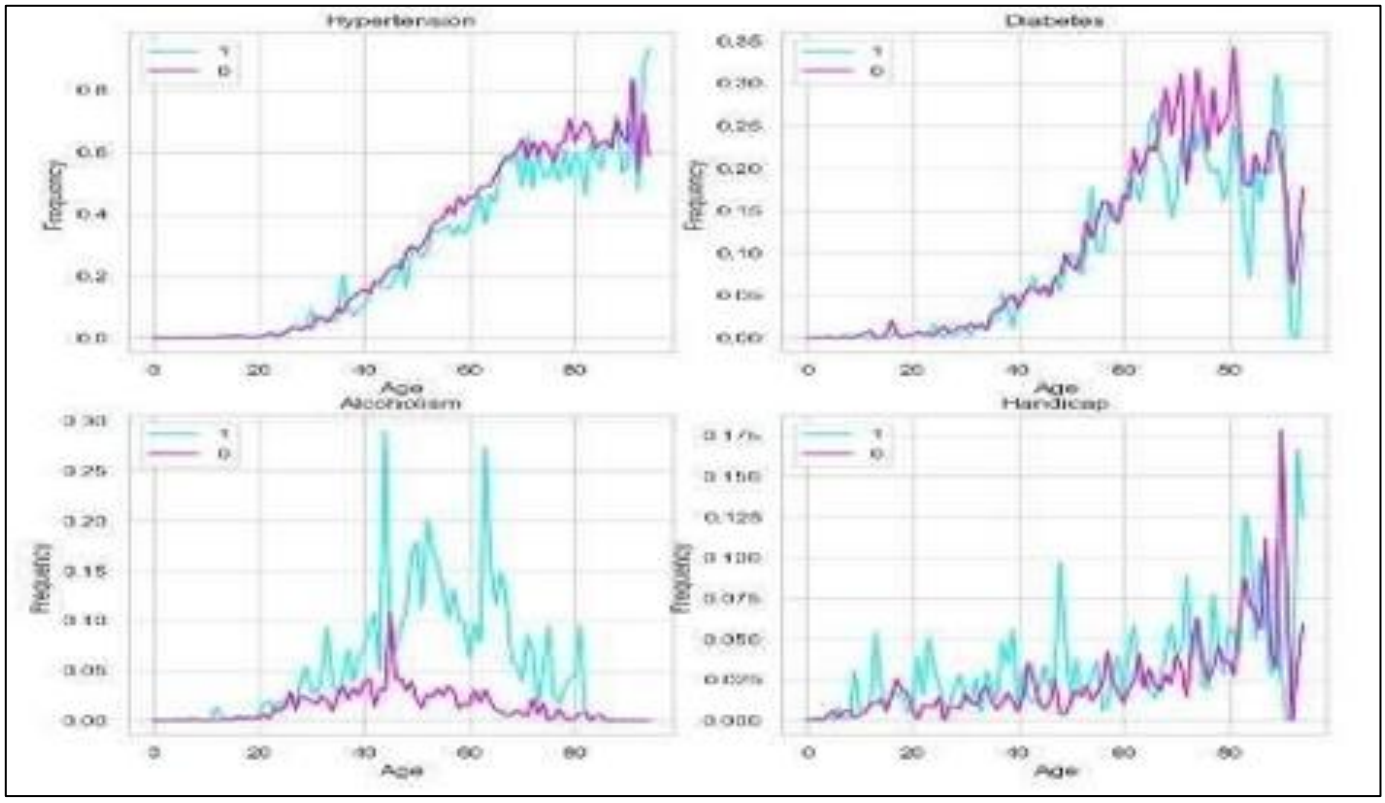

Fig 7: Graph between Age and Different Diseases
(above graphs give information about patients)

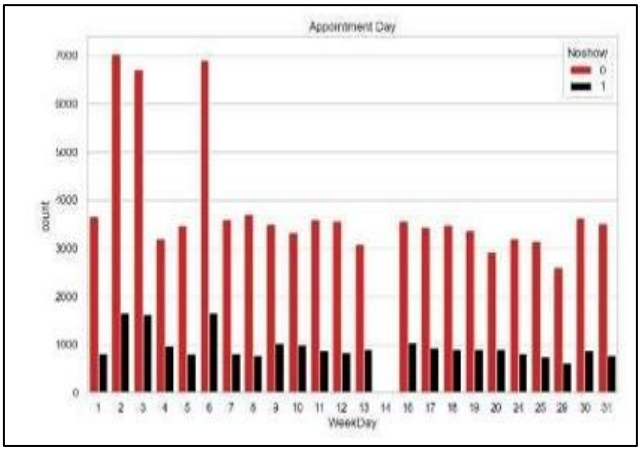

Fig 8: Graph between Appointment Day and Count

As can be seen from the graph distribution above, days in a week are when most appointments are made rather than weekends. Mondays and Fridays are the least common days for appointments, with Tuesdays, Wednesdays, and Thursdays being the most popular times of day.

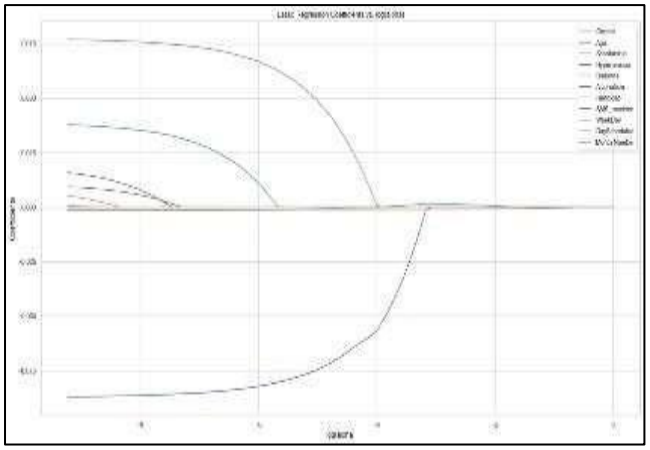

Fig 9: Feature Scaling using Lasso Regression
(Above graph displays lasso regression which determines feature scaling)

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Prediction model performance:

Algorithm Used	Accuracy(%)	Precision(%)	Recall(%)	f1-score
SVM Classification	80.00	64	80	0.71
Logistic Regression	79.54	71	79	0.71
KNN Classification	77.28	72	77	0.73
Decision Tree Classification	73.18	72	73	0.72

Fig 10: Table Represents Prediction Model Performance

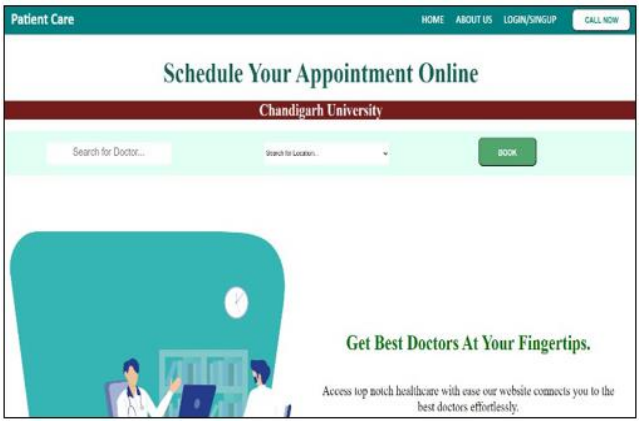

Fig 11: Displays Home Page of Patient Care Website

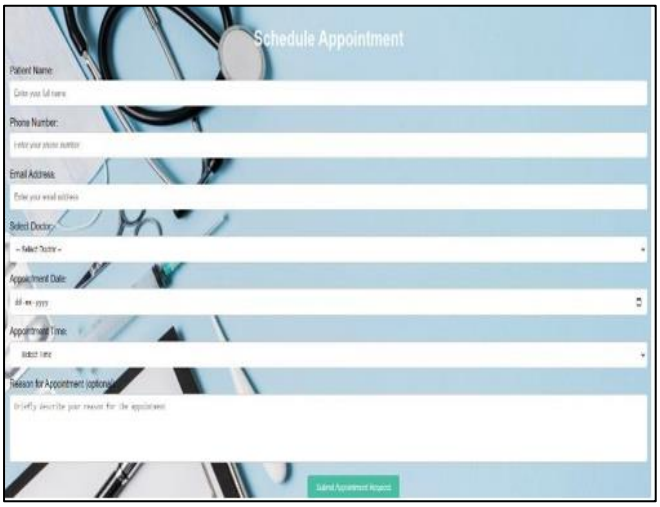

Fig 12: Displays Patient Module of Patient Care Website

VI. CONCLUSION

The System for Appointment Booking and Intuitive Management (ASIM) system utilized a classifier using machine learning to detect patient no-shows. This study achieved an accuracy and F1-score of 80%, indicating strong prediction ability. The study discusses how several techniques were used to create and evaluate the presented models. Models were evaluated on a dataset and compared using measures. To achieve the best outcomes from each method, several grid search runs were used to evaluate various settings. The presence of the lead time feature in the dataset is crucial for correct results. Without it, classifier performance reduces by up to 30 %. Current methods rely on telephone conversations and manual record-keeping, resulting in time-consuming and error- prone operations. Digital appointment systems provide patients online booking, real-time availability, and automatic reminders.

Real-time availability information enables patients to choose appointment times that best fit their schedules, reducing wait times and maximizing healthcare resources. It not only cuts administrative expenses, but also enhances the patient experience through user-friendly interfaces, self-service capabilities, and proactive care.

The Medical Appointment Booking System streamlines appointment scheduling, improves patient experience, increases healthcare professional efficiency, and optimizes services. As a result, it improves healthcare accessibility, convenience, and effectiveness.

FUTURE SCOPE

The integration in alerts via email capabilities will improve patient engagement and reduce missed appointments. AI will also play a crucial role in enhancing the system. AI-powered scheduling offers tailored reliable appointment recommendations based on patient preferences and prior appointment trends.

REFERENCES

[1]. F. A.-T. Louisa Aiyeyika, “Appoinment System using Artifical Intelligence Techniques,” *International Research Center for AI and IOT* .

[2]. Tsui, K. M., & Chan, S. C. (2012). Demand response optimization for smart home scheduling under real-time pricing. IEEE Transactions on Smart Grid, 3(4), 1812-1821.

[3]. Jin, Y., Wang, H., Chugh, T., Guo, D., & Miettinen, K. (2018). Data-driven evolutionary optimization: An overview and case studies. IEEE Transactions on Evolutionary Computation, 23(3), 442-458.

[4]. Humayun, M., Safdarian, A., Degefa, M. Z., & Lehtonen, M. (2014). Demand response for operational life extension and efficient capacity utilization of power transformers during contingencies. IEEE Transactions on Power Systems, 30(4), 2160-2169.

[5]. Symey, Y., Sankaranarayanan, S., & binti Sait, S. N. (2013). Application of smart technologies for mobile patient appointment system. International Journal of Advanced Trends in Computer Science and Engineering, 2(4).

[6]. Akinode, J. L., & Oloruntoba, S. A. (2017). Design and implementation of a patient appointment and scheduling system. Department of Computer Science, Federal Polytechnic Ilaro Nigeria.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1994

[7]. Song, J., Bai, Y., & Wen, J. (2018). Optimal appointment rule design in an outpatient department. IEEE Transactions on Automation Science and Engineering, 16(1), 100-114.
[8]. Edwards, T., & Sankaranarayanan, S. (2009, November). Intelligent agent based hospital search & appointment system. In Proceedings of the 2nd International Conference on Interaction Sciences: Information Technology, Culture and Human (pp. 561-567).
[9]. Usharani, S., Prithivi, S., Sharmila, S., Bala, P. M., Kumar, T. A., & Rajmohan, R. (2021, July). Mobile Application for Doctor Appointment Scheduling. In 2021 International Conference on System, Computation, Automation and Networking (ICSCAN) (pp. 1-6). IEEE.
[10]. Sankarananrayanan, S., & Wani, S. M. A. (2014, May). NFC enabled intelligent hospital appointment and medication scheduling. In 2014 2nd International Conference on Information and Communication Technology (ICoICT) (pp. 24- 29). IEEE.
[11]. Zhang, L., Xu, J., Vijayakumar, P., Sharma, P. K., & Ghosh, U. (2022). Homomorphic encryption- based privacy-preserving federated learning in iot- enabled healthcare system. IEEE Transactions on Network Science and Engineering.
[12]. Kaur, M., Singh, D., Kumar, V., Gupta, B. B., & Abd El-Latif, A. A. (2021). Secure and energy efficient-based E-health care framework for green internet of things. IEEE Transactions on Green Communications and Networking, 5(3), 1223-1231.
[13]. F. A.-T. Louisa Aiyeyika, "Appoinment System using Artifical Intelligence Techniques," *International Research Center for AI and IOT*.
[14]. Jin, Y., Wang, H., Chugh, T., Guo, D., & Miettinen, K. (2018). Data-driven evolutionary optimization: An overview and case studies. IEEE Transactions on Evolutionary Computation, 23(3), 442-458.
[15]. Humayun, M., Safdarian, A., Degefa, M. Z., & Lehtonen, M. (2014). Demand response for operational life extension and efficient capacity utilization of power transformers during contingencies. IEEE Transactions on Power Systems, 30(4), 2160-2169.
[16]. Akinode, J. L., & Oloruntoba, S. A. (2017). Design and implementation of a patient appointment and scheduling system. Department of Computer Science, Federal Polytechnic Ilaro Nigeria.
[17]. Edwards, T., & Sankaranarayanan, S. (2009, November). Intelligent agent based hospital search & appointment system. In Proceedings of the 2nd International Conference on Interaction Sciences: Information Technology, Culture and Human (pp. 561-567).
[18]. Usharani, S., Prithivi, S., Sharmila, S., Bala, P. M., Kumar, T. A., & Rajmohan, R. (2021, July). Mobile Application for Doctor Appointment Scheduling. In 2021 International Conference on System, Computation, Automation and Networking (ICSCAN) (pp. 1-6). IEEE.
[19]. D. Y.Huang, "Patient No-Show Predictive Model Development usinf Multiple Data Sources for an Effective Overbbooking Approach," *Applied Clinical Informatics*, vol. 5, no. 3, pp. 836-860, 2014.
[20]. Zhang, L., Xu, J., Vijayakumar, P., Sharma, P. K., & Ghosh, U. (2022). Homomorphic encryption- based privacy-preserving federated learning in iot- enabled healthcare system. IEEE Transactions on Network Science and Engineering.
[21]. N. G. X. Xingwei Pan, "Appoinment scheduling and real-time sequencing strategies for patient unpunctuality," *Operational Research*, vol. 295, no. 1, pp. 246-260, 2021.
[22]. Y. S. M. Suresh *Cloud & Ubiquitous*, pp. 98-103, 2013.
[23]. D. D., J. Ying Zhou, *Material Science and Engineering*, vol. 439, no. 3, 2018.