

Indian Institute
of Technology

e-Counselling Services

Medical
Colleges

National
Institutes
of Technology

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e-Counselling services offered by National Informatics Centre is a one-stop online solution for all examinations, results publication, counselling, and admission needs right from the application form, fee payment, e-Admit card, answer key display, e-Score card, selection of courses/ institutes, seat allocation, document verification, admission, seat withdrawal, and MIS & exception reports. The entire lifecycle for admissions has been captured on a single platform providing a streamlined stepwise process for application filing.

National Informatics Centre has been instrumental in partnering with 35+ examination and counselling bodies/ agencies like NTA, CBSE, AICTE, UGC, AKTU, OJEE, WBJEEB, etc. in facilitating central and state-level examinations such as JEE, UGC/ CSIR-NET, CTET, NEET, CMAT/ GPAT, IIFT, etc. Counselling services are provided to national/ state boards like JoSAA, CSAB, CCMT, BCECEB, MCC, UPSEE, WBJEE GGSIPU, etc. for admission to 3000+ academic institutions including IITs, NITs, MAMC, AFMC, and Central/ State-funded universities/ institutions in various domains like engineering, medical, architecture, pharmacy, agriculture, management, etc. catering to over 89 lakh candidates from 8th/ 10th pass to Post Graduates.

Counselling and admission services have transformed manifolds since their inception in the form of manual OCR forms. Services have brought significant changes to the counselling process which involved manual processing of forms along with the offline mode of payment. The entire process needed significant time efforts and manpower requirements for postal work, application scrutiny, and document submission. The candidate was also required to report to counselling centres for different stages.

Currently, the process has been digitized using emerging technologies providing the feasibility to apply from anywhere anytime. Academic parameters are evaluated for assessment of candidate application and custom business rules are developed to align the eligibility test with institutional goals. In order to conduct a holistic review of applications, stringent regulatory checks and exception handling algorithms have been introduced. The system has been designed to handle parallel execution of multiple counselling.

Objectives

- Standardize & streamline the admission process
- Provide Digital Infrastructure to educational institutions for smooth conduct of admission counselling.
- Build holistic capabilities across examination and counselling services leading to the transparent procedure for seat allocations in educational institutions.
- To allocate seats as per rank, merit, policies, and preferences exercised by the candidates
- Reduce physical, mental stresses & financial burden on candidates appearing for admissions at various institutions
- Reduces seat vacancy up to zero level.

Counselling and admission Services

The entire counselling process has been designed as a responsive web application made available to the user as a service suite. Automated and streamlined counselling process ensured 100% compliance with state/ centre policies. All the steps involved in the process are rolled out in the form of sub-modules. Personalized institute master as per eligibility for choice filling is provided to the candidate through a configurable and customizable solution. External payment gateway integration for leading banking services enables instant payment and confirmation for form submission. MIS reports empower daily monitoring of seat occupancy. The seat matrix for the current academic year and policy guidelines are updated by participating institutes.

The process starts with the candidate registration and online fee payment. Candidate has to select institute/ course from a master list created as per his/ her eligibility criteria. A mock counselling round is carried out to provide the probable institute and course to the candidate as per last year's opening and closing rank. Seat allotment is done in multiple rounds with provisions for seat up-gradation and seat locking. Introduction of Spot round ensured 100% seat occupancy. Documents are uploaded by the candidates for online verification by the officials and reporting.



“e-Counselling services developed by NIC are the result of a focused effort to put the best use of technology for bringing transparency in the admission process of the educational institutions in our country. This has also led to the implementation of a common selection process across universities. The stakeholders can now conveniently participate in the admission process for higher education.”

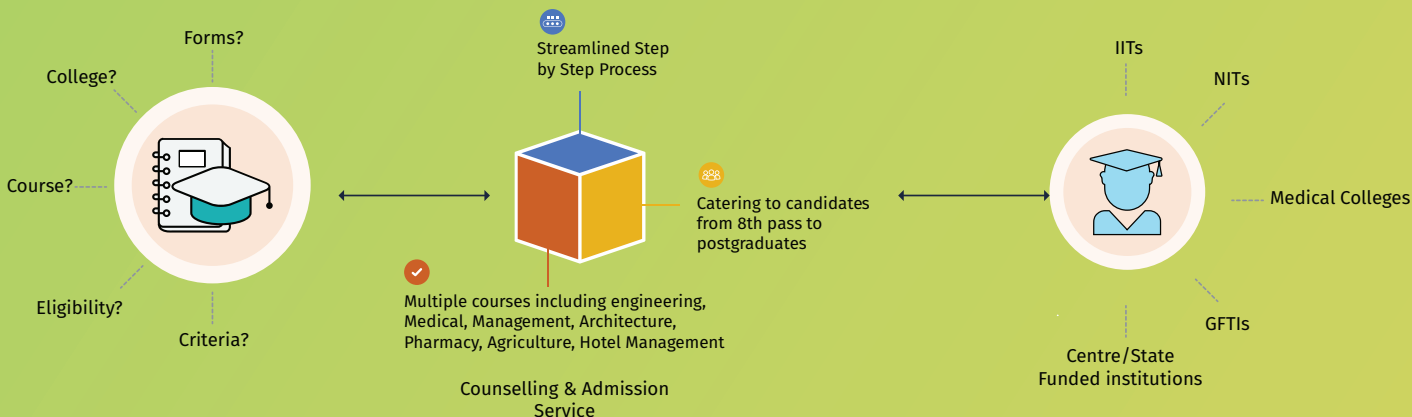
Dr. Neeta Verma
Director General, NIC

e-Counselling Process

Onboarding Process

• Rules Configuration

Business rules defined by the user are configured in the system to define the project lifecycle. At this stage, candidate parameters having direct implications on the counselling process and eligibility criteria are identified to fine-tune seat allotment algorithms.



Key implementation statistics (2019)

35+
Counselling
Boards

3000+
Institutions

7+ Lakh
Seats

37+
Examination

89 Lakh+
Applications
Processed

- **Seat matrix and institute profile**

Participating institutes need to update the seat matrix at the start of counselling process laying out details for the number of institutes, courses, and streams.

- **Customization**

Given process flow is a standard set of services designed for the admission process. Based on the user requirement, any level of complexity for regional variations in eligibility criteria and seat allotment algorithm can be integrated through configuration or development of new modules.

Registration

Simplicity is the key success factor as the web forms are used by candidates from 8th/ 10th standards students to postgraduates.

- **Form Filling**

Essential details for a candidate profile are captured having direct implication on the seat allotment process and required for necessary communications. Design thinking standpoints are followed to develop a simplified user experience with process committal in a three-step approach.

- **Fee payment**

Services are supported by external payment gateways of leading banks and Digi wallets in the country. Payment status is updated instantly upon getting a confirmation from the core banking system. Other means of payment that require physical visits to banks have also been retained including demand draft and bank challans. A wide array of payment options are available including bank challan, demand draft, internet banking, credit/ debit cards, digital wallets, etc.

- **Choice filling**

Custom institute master is created for every candidate as per their profile. Candidate has to Essential details for a candidate profile are captured having direct implication on the seat allotment process and required for necessary communications. Design thinking principles are followed to develop a simplified user experience.

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- **Choice filling**

Custom institute master is created for every candidate as per their profile. The candidate has to lock choice of preference for institute and courses. The choice selection at this stage is used for seat allotment while conducting one-to-one mapping between candidate roll and seat matrix as per merit.

Seat Allocation

- **Mock seat allocation**

A mock seat allocation round is conducted to provide a tentative idea about a probable seat allotment. A single flat listing previous year's opening/ closing rank is made available to assist students in choice filling as part of e-Counselling.

▼ Stakeholders



Technical consultancy provided by NIC from conceptualization to final admissions proved essential in the implementation of critical Business Rules. The solution provides ease of use to aspirants and participating institutions including reporting centers for seamless admission process covering registration, digital fee payment, choice filling, seat allocation, etc. Continuous process improvement techniques used by NIC scientists for the JoSAA-2020 counselling helped in improving execution time and system reliability. This was very important in the current year when candidates could not travel physically due to COVID-19.



Prof. Parag Singla

Organizing Vice-chairman
JEE(Advanced) 2020
JoSAA-2020 Co-Coordinator



Dr. APJ Abdul Kalam Technical University Lucknow was the organizing University for the Conduct of Uttar Pradesh State Entrance Examination 2019 for Admissions to various Institutions and Universities in Uttar Pradesh for the Academic Session 2019-20. Being Chairman CAB, I am pleased to let you know that the Entire UPSEE 2019 Counseling & Seat Allotment has been an enormous success especially due to NIC's Experience and dedication in conducting e-counseling, The Solution provided by NIC including Registration, Verification Process & Seat Allotment was error-free and as per our requirements.



Dr. Vinay Kumar Pathak

Vice Chancellor
Dr. APJ Abdul Kalam Technical University Lucknow

Multiple round seat allotment

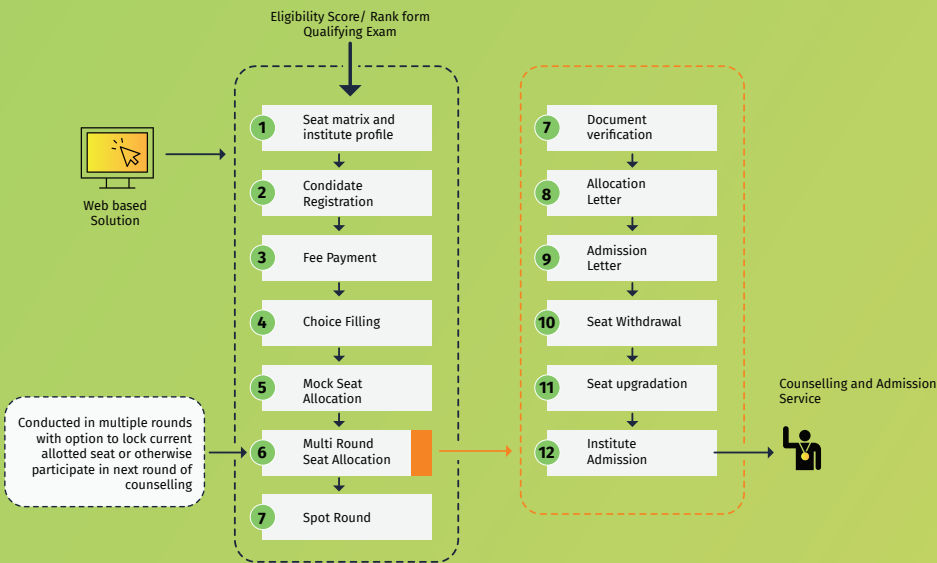
Seat allotment is done using the Deferred Acceptance (DA) algorithm in multiple rounds to ensure the optimal and truthful allocation of the best possible seat as per candidate preference. It ensures maximum occupancy of available seats by covering cancelled/ vacant seats in subsequent rounds of allotment.

Admissions

The number of rounds and the process varies for each counselling. Necessary configurations/ customizations can be done to provide custom build solutions tailor-made to cover user needs.

Document verification & Online reporting

Academic, domicile, and special category



▲ e-Counseling Process Flow Diagram

records are uploaded by the candidate for document verification and online reporting.

Allotment letter

An allotment letter is generated for each candidate at the end of the seat allotment round. This letter is used for acting reporting at reporting cum document verification centres.

Admission letter

An admission letter is generated upon payment of fees. This acts as the final confirmation of the allotted seat and can be used to join classes at the start of the session in respective institutes.

Seat withdrawal

Candidates can cancel the allotted seat in subsequent rounds of counselling, this seat is considered for re-allotment for other eligible candidates in the next round.

Seat upgradation

Any confirmed seat allotment is automatically considered for up-gradation as per the preferences

set by the candidate. However, the candidate can also freeze the current seat and opt out of the up-gradation process.

Institute admission

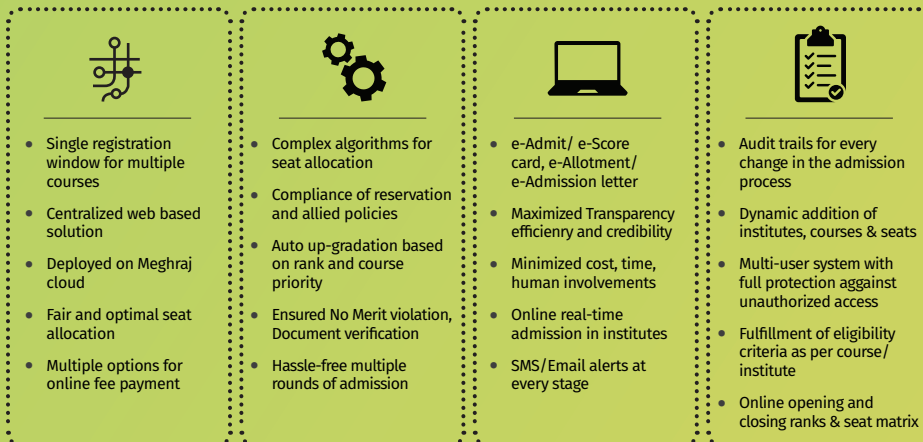
The process ends with a confirmed seat for each candidate. There are provisions for an optional spot round wherein all the remaining seats are allotted to candidates on a first come first serve basis.

Business Rule Configuration

The solution has been designed as a generic platform deployable for admission processes in institutions across the country. Counselling and admission services are administrated by complex business rules that vary from board to board, institute to institute, and course to course. Services integrate wide variations in business rules.

Rank Generation Rules

Rank is either determined by examination body such as JEE(Main)



▲ Figure 4 : Key Features

■ Examination ■ Eligibility Test ■ Counselling ■ Results

JEE Main/Advanced				JOSAA	JAC Delhi	ACPCD			
NEET UG	IGNOU			CSAB NIT, IIIT	DELHI IIT	OJEE	WBEEB		
CMAT GPAT	IIFT	CET DELHI		CCMT	IOT Delhi	IKGPTU	UPSEE		
NCHM JEE	ICAR	IPU DELHI	UGCNET	NCHM CT	JEE Chandigarh	DTU	UKTU	NTA Results	
ARPIT	UPSEE	PSBTE	CSIRNET	Assam ITI	GGSIU	IGDTUW	PSBTE	results.gov.in	
JNUEE	WBEEB	OJEE	CTET	BCECEB	SCERT	ACPC Gujrat	MCC Tripura	CBSE Results	

▲ Major Counselling Projects

- Rank is also generated for registered candidates as per rules defined by the board taking the weighted contribution of the qualifying score, board exams, achievements in predefined activities such as sports, cultural achievements, etc.

Candidate Registration Rules

- Only the eligible candidates are permitted to register. Eligible candidate data is provided by the counselling board in the form of rank or qualifying score. In few cases, eligibility is generated online as per the candidate claim
- In single round registration, registration is only permitted only in the beginning of counselling
- Some of the boards allow registration in every round of counselling for filling vacant seats

Restriction on Institute-Course Rules

Restrictions are implemented for institute and course selection based on percentage in qualifying exam, subjects, age, gender, etc.

Choice Filling Rules

- Custom Institute and Course Master:** The registration process takes critical inputs from the candidate regarding their eligibility for courses. The eligibility of courses depends on many of these inputs such as subjects & percentage of marks in the qualifying examination, age, gender, single girl child, type of entrance examination, rank, board of qualifying examination, the income of the parent, reservation categories, State of domicile or State of eligibility, nationality, etc. Only valid choices from the seat matrix are shown to the candidate at any point in time.
- One Time Choice Filling:** Candidates are given the chance to provide the willingness to participate in the subsequent round for upgrading to a better seat.
 - Float: All better choices than the one allotted are considered
 - Slide: All better choices within the already

allotted institute are considered

- Freeze:** The candidate does not want further allotment and happy with the current allotment. In such a case, the candidate is considered to have frozen the seat and goes out of the counselling
- Multiple Choice Filling**
 - Float/ Upgrade:** In the case of Float candidate can participate in the next round and resubmit choices all over again.
 - Freeze:** The candidate does not want further allotment and happy with the current allotment. In such a case, the candidate is considered to have frozen the seat and goes out of the counselling

Profile Update Rules

- Rank Revision:** Rank is revised when a candidate reports revision in marks due to re-verification. There is the possibility of the creation of supernumerary seats due to upward revision of rank
- Birth Category:** In case Candidate Profile data is obtained from the entrance examination candidate's category can be changed only from a beneficial category to a non-beneficial category. This change is permissible while the candidate is doing the registration, or a document verification officer correcting the error as per the candidate claim.

Reservation Criteria Rules

- Reservation category:** The candidate can claim single or multiple reservation categories as per rules defined by the counselling board. Some of them are SC, ST, PH, FF, Defence, Sports, Cancer Patient, and Border Areas, etc. Reservation of seats is mainly done based on various reservation categories which vary from State to State.
- Various categories include birth category, economic status, defense, a special category such as single girl child and board topper, geographical location such as border areas, medical ailments,



As the system administrator from the client's end, I would like to specifically mention the excellent points e.g. 24x7 response and service, continuous improvement, 100% correctness, and 100% adherence to schedule. It's due to the flawless service provided by NIC during the last so many years with their huge experience and knowledge in conceptualization to seat allocation that WBEEB has earned a place honour and reputation.



Prof. D K Mitra

Vice Chairman
West Bengal Joint Entrance Examinations Board

minority, Kashmiri migrants, North-East states, etc.

- Seat Type:** Different seat types are defined including home state, Home State Quota Shared Among States, the Other States, All India, Tuition Fee Waiver (TFW), Language-Based, Entrance Examination, etc.

Seat Allotment

- Seat Conversion:** It applies to the conversion of seats from one category to other and vice-versa as per rules defined by the board and regulatory body. Conversion of seats takes place during the various iteration of the allotment program in every round of counselling
- Sequence of Allotment:** Sequence of Allotment changes from State to State and Board to Board. The sequence of allotment also deals with the logical sequence to be followed for the allocation of seats under various categories and seat types. Different seat types are defined including home state, Home State Quota Shared Among States,



Admission processes are becoming increasingly complex due to the greater number of candidates and complex business rules to incorporate eligibility criteria and government regulation. NIC e-counselling and admission services provide end-to-end technology consultancy including software setup, capacity building, infrastructure readiness, and traffic monitoring for successful completion of mission-critical admission processes for the institute as well as candidates.

Rajender Sethi
Dy. Director General & HoG
National Informatics Centre

Other States, All India, Tuition Fee Waiver (TFW), Language-Based, Entrance Examination, etc.

- **Seat Allotment:** The withdrawal request is made online through the OTP authentication process or at Reporting Centre. Candidates who withdraw once are not eligible to take part in a subsequent round of counselling except SPOT ROUND.

Admission Rules

- **Physical Reporting:** At the end of counselling rounds candidates need to join by reporting physically at the institute in which their final admission (latest confirmation letter) is granted and start attending the classes
- **Document Verification:** Document verification is carried out before or after the seat allotment. Candidate need to appear in person at the Reporting Centre and produce all required documents in original to the official(s)
- **Fee Payment:** Payment of Admission Fee as defined by Counselling Board needs to be paid after allotment of seat. This is to be paid only

Impact

01	ICT enabled solution with streamlined workflows have resulted in smooth and robust counselling and admission processes
02	Every user activity is compiled in a log for all the roles to maintain an audit trail
03	Number of instances of physical reporting have been reduced significantly resulting in saving in time and money
04	Customized institute master is only made available to each candidate as per his/her eligibility criteria
05	MIS reporting and daily monitoring of counselling process has resulted in 100% occupancy of seats.
06	Full automated process ensures transparent seat allotment as per merit

once during the counselling

- **Seat Cancellation:** During the Document Verification if any of the documents found to be incorrect the seat allotted to the candidate gets cancelled as per business rules. The relaxation on the list can be given by the counselling board in advance and should be dynamically configured in the software

Administrative

Centralized Admission System

Unified admission platform helps counselling boards to monitor admissions across all participating institutes while delivering a simplified candidate experience. The entire admission process is streamlined with provisions of software extensibility for integrating use-specific requirements and workflows.

Content Management System

The content management system has been designed to manage web content allowing contributors to create, edit and publish content as per templates approved by the user department. Approved users can easily publish web pages with minimal software programming. Any update of the data element in the database is reflected throughout the website.

Automated system

Various processes like form assessment, discrepancy check, and mail to functionalities have been automated to promote cost optimization and higher efficiency.

Verifiable

Validation criteria are implemented at the source code level to ensure that it meets the specifications defined by counselling boards and achieves the intended purpose

Scalable

- **Application Scalability:** Process flow for the admission process has been designed based on decade-long expertise acquired by

delivering successful counselling projects. Custom requirements can be accommodated as additional services of the e-Counselling suite working in tandem with existing algorithms.

- **Resource Scalability:** e-counselling services are hosted at the NIC Meghraj Cloud environment. The Meghraj cloud environment provides scaling out or horizontal expansion of resources i.e. adding more nodes (VMs) at the time when a high volume of traffic to the system and also enable scaling up or vertical expansion of resources for a single node (VM).

Secured

Services run on HTTPS encryption. Sequential hierarchy is maintained for a list of services in the application and role-based access is provided to all users. Network Firewalls are installed to examine incoming traffic for potential security threats.

Auditable

Activity log is recorded and stored for all user actions

Customizable Real Time Reports

Institutes can monitor the ongoing process with a detailed summary of daily progress. Custom KPI reports can be generated by applying pivots on the existing data set.

End User

Dynamic and User Friendly

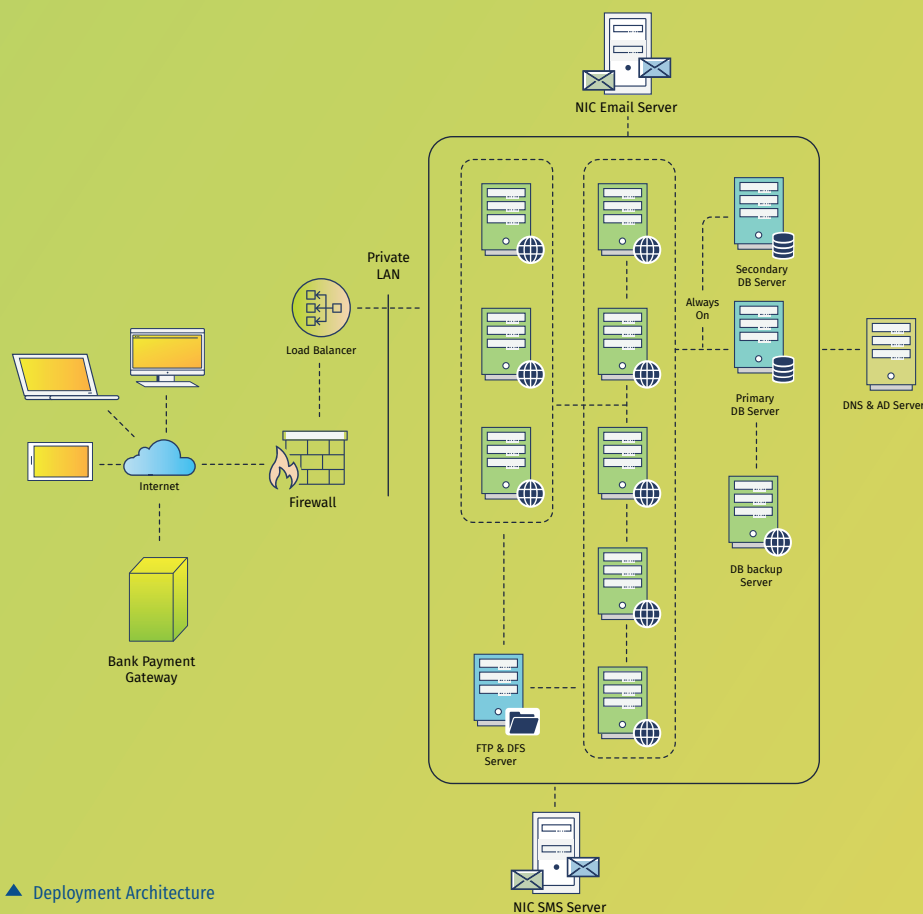
Any change in counselling process is reflected in real-time and is communicated instantly to all the candidates. Lean UI interface has been developed for easy adoption and easy navigation.

Communication and dissemination strategy and approach

All relevant information related to the admission process is made available online for public view. Automated notifications are sent to all registered candidates through SMS and emails.

24 x 7 Availability

Application is hosted on NIC cloud Meghraj



▲ Deployment Architecture

delivering the speed and scalability required for admissions software. It ensures business process continuity with reduced downtime and low operational risk.

Entry level eligibility test

Preliminary eligibility criteria are tested by implementing front-end input field validations. The candidate can proceed to complete the application form only after filling in all mandatory details in the expected format.

Advantages

No Geographical Boundary

A great advantage of the online Examination and e-counselling service is that it makes it possible for candidates from across the country and even abroad to apply to Indian institutes without any hassles. It eliminates the inconveniences caused by ailments and exigencies, providing deserving candidates a convenience that has never before been available.

Paperless Transactions

Digital exchange of information is supported in all instances. The requirement for institutes to print and store forms has been removed due to the introduction of online web forms.

Applicants Convenience

One of the greatest advantages of this system is that applicants can choose to submit their applications at their convenience. All that is required is access to a computer and internet connectivity.

Logistics

No more running out of paper application forms, picking the right colour ink pens, illegible prints, and wondering if the application has been received at all. The system offers applicants a uniform platform for filling in their applications. The acknowledgment is immediate and the system is user-friendly.

Advantage to Examination board/ Universities

Examination Boards/ Universities are also at a major advantage when it comes to an online admission process. Quick access to student records and databases, efficient systems for filtering out candidates and processing of applications is possible through the online application process. The costs of processing applications and employing additional manpower during admissions are slashed with the implementation of this system.

Increases Accuracy and Efficiency

Board/ university officials accepting thousands of paper applications each day at office counters understand that high fatigue and monotony

involved in the paperwork is a catalyst for errors. Each error could cost students their academic career and educational prospects. The online admission system is highly reliable and efficient and eliminates chances of such errors.

New initiatives

Multi-tenant cloud-based solution

Counselling and admission services are being extended to be rolled out to users in the form of services. The process of consolidation has been initiated to run multiple counselling projects as independent tenants from a unified source code with provisions of configurability and extensibility rendered to the user itself for building custom solutions as per business rules.

Institute directory as a service

Institute master directory is being created as a single source of truth for all education sector projects facilitating API-based data exchange and uniformity in unique identifiers associated with each institute in isolated IT systems.

Adopting digital technologies & measures for enhanced services during pandemic

- **Online Reporting & Online Document Verification:** In response to the pandemic, counselling & admission services have been equipped with technological advancements like online reporting & document verification modules to replace the physical reporting needs for seat confirmation and maintain social distancing norms for the students.
- **Online Admission:** Complete admission process has been offered in online mode covering various activities including institutional fee, document discrepancy removal, submission of willingness for seat cancellation/ up-gradation, query redressal, etc.
- **e-Counselling division** has been using online video conferencing platforms for the training of user department officials

Impact Delivered

One integrated configurable solution has been developed for Countrywide adoption to achieve 100 percent compliance with state/ centre guidelines. The cost and time involved in manual paperwork and the conventional postal system have been significantly reduced. Seats are allocated as per merit and preferences of institutions and branches exercised by the candidates.

Dashboard

KPI dashboard was created for the division to capture essential parameters for counselling projects providing a visual display of key insights for decision-makers. Role-based login has been provided to counselling board officials to identify

performance indicators for every sub-activity associated with the process flow.

Effective usage of technology

The introduction of digital solutions by e-Counselling division for admissions in institutes has brought a significant impact on counselling and admission processes for all stakeholders. Examination and counselling services are empowered with various technical perspectives like multi-tenant cloud-based configurable solutions, Auditable and data traceability, payment gateway integration, etc. Seat allotment algorithms have been successful in garnering trust amongst counselling bodies for merit-based admission confirmation to candidates. Services have revamped the traditional admission systems that were marred with long queues, higher time and manpower requirements, and manual processes and brought the entire admission process to the behest of a candidate's desktop.

Deployment architecture has been designed to facilitate easy and swift communication between the middleware systems and the database while handling service requests from multiple applications. Network traffic is routed through a firewall, load balancer on a common public IP for multiple e-Counselling projects. The relative arrangement of FTP and DFS serves is done to service enhanced reliability requirements. Application is integrated with external systems through National Informatics Centre SMS and e-mail servers.

Functional Architecture

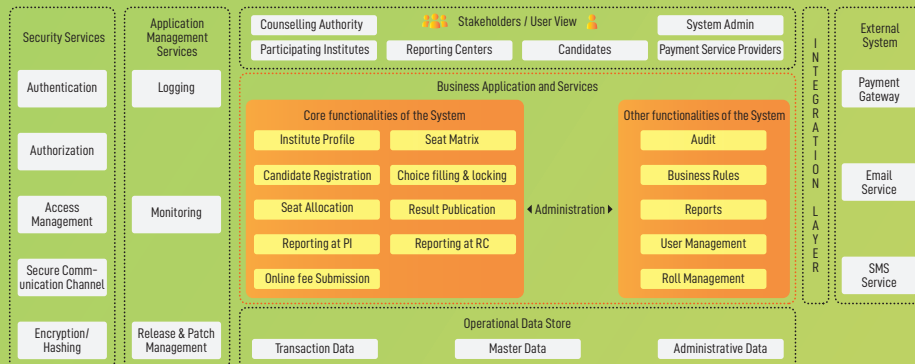
Application enterprise structure has been structured in different layers including the data access layer, business logic layer, and presentation layer. The system has been decomposed into various logical components like external systems, security services, and application management services that interact with different layers to satisfy the system requirements.

Integration with other system

Counselling and admission services are integrated with various external systems like SMS, Email, and payment gateway to implement the digital communication and information broadcasting strategy and improving the ease of application filing index for the candidates. Every student is kept informed about various milestones and processes involved in participating in counselling process to bring all of them to an equal foothold irrespective of prior knowledge about available choices and counselling process.

Awards

- SSKOCH award for technology in education 2012
- Gems of Digital India award (Jury Choice), 2019
- Excellence Award (Enterprise Applications), Digital



▲ Figure 9 : Functional Architecture

technology Sabha, 2020

Way forward/ conclusion

e-Counselling division is progressing towards consolidation of various Digital services in the education sector into a single "Platform for Education". Counselling and admission services are being remodeled into a generic solution for a nationwide implementation under the one nation one system approach. The introduction of the institute directory as a service is a marquee attempt for standardization of education sector IT systems. Centrally managed directories can act as a single source of truth for authentic and reliable data leading to the integration of multiple standards with multilingual support. Unique identifiers for institutes and other master data entities can usher in the creation of monetized digital ecosystem on the lines of Aadhaar. Effective disaster recovery strategy needs to be drafted for counselling and admission services which are extremely data-sensitive, time bounds, and user-centric. Principles of network monitoring data backup and cyber resilience can be incorporated to design a robust DR/ DC strategy. For simplification of the technology environment, IT Consolidation can help organize the delivery of IT services – taking existing organizations, services, or applications and combining them into a single operation.

A simplified onboarding process needs to be developed through a multi-tenant cloud-based application with capabilities to incorporate any combination of business rules and eligibility criteria for user departments across the country. The registration process can be strengthened by the implementation of facial recognition technology for the unique identification of candidates. A single sign-on feature can be provided to candidates based on department ownership for reusability of essential details across all forms and single window progress tracking for all filled forms.

In order to provide effective guidance during counselling phase, a digital counsellor can be

developed and rolled out to users in form of a mobile application. It would take relevant inputs from the user, couple them with essential details mapped to student profile, and assimilate a probable seat matrix providing a list of institutes/ courses befitting the profile as per performance in qualifying examination and previous year opening and closing rank. The digital counsellor would run on learning algorithms executing test runs on our existing database and identifying patterns between test data and target attributes. Upon achieving formidable accuracy levels, It would be able to predict target attributes for an unknown data set. Data analytics on the information obtained over the years can be used to identify the trends in preference choices of candidates and provide a recommendation to various concerned organizations like UGC, AICTE, NMC/ MCC, etc. upon introduction of courses/ seats. Key insights derived using predictive analytics can be used to match the demand for courses in the higher education sector and work on the employability of students.

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