International Journal of Engineering Science Invention Research & Development; Vol. I Issue IX March 2015
www.ijesird.com e-ISSN: 2349-6185

An Integrated Automated Paperless Academic Module for Education Institutes

Prita Patil , Kavita Shirsat
Computer Engineering Department, Mumbai University, Vidyalankar Institute of Technology, Mumbai
[1]prita.patil@gmail.com, [2]kavita.shirsat@vit.edu.in

***Abstract*— A design of suitable automated system for filling and managing the academic details plays vital role in an Educational Institute. In this paper, we proposed an integrated automated web based paperless system that converts physical form of manual filling of academic records into online web based paperless system, providing controlled access to the online resources by understanding the users, their job responsibilities (role) and present hierarchy in an organization. It also focuses on the implementation of Task Engineering without disturbing the Role hierarchy and their access rights policy. Our system also taken care of administrative actions required during management of academic details in an organization. It has divided the Administrative actions by forming the hierarchy of Administrative Users based on their role, tasks, position. This enables improvement in automated system by providing online data management, reduction of overall paper work, provision of ccontrolled access on the online resources, making administrative decisions and performing actions in fastest way, achievement of Task Engineering that speeds up the process and data storage at central location enables to automate various procedures involved in an acaemic administration. It also provides additional services like notification, performance evaluation and knowledge forum that raises the overall performance of the automated system and gives satisfaction to the users.**

***Keywords*— automation, access control, ICT, user hierarchy, TEATRHBAC**

I. INTRODUCTION

An internet gives various pathways that allows exchange of information, data files, audio, video files etc. Being connected to the Internet is a mean of getting access to these pathways. It has millions of smaller domestic, academic, business, government networks and websites, which together carry many different kinds of information (facts, details) and services. Thus in other words, an internet is a network of networks. Information Communication Technology (ICT) refers to technologies that provide access to information through telecommunications which focuses primarily on communication technologies that includes an internet, wireless networks, cell phones, and other communication media. It can be utilized to automate various daily procedures in an Educational institutes. Administering a college is one of the biggest challenges that the educationists face now-a-days. Planning and implementation of academic processes is a crucial part of any Educational Institute. It requires careful planning, systematic approach and accurate control of administrative processes to produce best results and project the best image. In some colleges, management of an organization is done manually and to connect various departments and interaction between them was felt as a difficult task. By understanding the importance and scope of requirement, we have proposed efficient, systematic, secured access and sophisticated user friendly automated System in Educational Institutes to manage their academic details and automate the daily procedures.

In order to understand the effectiveness of the proposed system, we have implemented our proposed work as Live application in Vidyalankar Institute Of Technology (VIT), Wadala, Mumbai that will be named as 'Aacademic Module for Educational Institutes'. The principle idea of the System can be used as platform in Educational Institutes to fill and manage academic details online, automate most of the academic processes that reduces iterative manual and paper based work. It also helps upper user hierarchy to monitor administrative processes and evaluate the performance to take decision for improvement. A proposed system provides a central data repository for maintaining institute's academic details together so no need of searching for segregated data at different places and enabling College Administrative System to make fast and informed decisions. A provision of services (notification, performance evaluation and knowledge forum improves overall efficiency of System and provides user satisfaction.

In this paper, we proposed online web based efficient, systematic, secured access and sophisticated user friendly automated system in Educational Institutes to manage their academic details and their administrative actions. In section II we have given importance of automation and access control models, ICT in automation. A proposed system is discussed in section III. A section IV gives implementation and analysis. A section V gives simulation results and finally section VI gives conclusion of a proposed work.

II. LITERATURE REVIEW

A. Automation

An automation [1] is a replacement of manual operations with computer procedures and other machinery. An automation is required to increase productivity, reduce production time, increase manufacturing flexibility, reduce costs, eliminate human error, reduce labor shortage, high degree of accuracy, performing tasks that are beyond human capabilities of size, weight, speed, endurance, etc.

A Library Automation System implemented in University of Toronto Library in 1963-1972[1] and University of Illinois at Urbana-Chamnpaign1965-2000[2], Automated System for Educational Assessment [3] developed in Nigeria,e-Learning System [3],Automated Project Grading and Instant Feedback System [4]are well-known examples of Automated Systems those have achieved automation in their manual processes and enhance their overall performance. An automation is achieved by converting paper based system into paperless system [5]. The popular models used in paperless systems are Single Copy model, Form oriented Model.

B. Access Control Methods

As automation provides various advantageous features we need to take care of data privacy and confidentiality. An Access Control mechanism is an effective security policy that provides verifiable system to guarantee the protection of information from unauthorized access. Usually Access Control Models are categorized into four types [6] as- i) Mandatory Access Control (MAC), ii) Discretionary Access Control (DAC), iii) Role-Based Access Control (RBAC), iv) Domain Type Enforcement (DTE). After comparing various access control models, we found that Role Based Access Control Model (RBAC) is suitable for proposed system.

Different implementations of RBAC are BASE Model for RBAC [7] focuses on role of a user and assigning the access controls to users. A Role Hierarchies in RBAC [7] on the implementation of user hierarchy and assigning the access control based on senior and junior roles. Management Model in RBAC [7] helps in managing and assigning the access rights by the administrative person of the organization.The proposed work on Workflow Access Control from Role Engineering to Task Engineering focuses on Constraint Satisfaction Problem (CSP) based approach to achieve task engineering in Workflow access of a system [8]. Also elaborated the importance of Task Engineering with Role Engineering

C. Information and Communication Technology (ICT)

ICT refers to technologies that provide access to information through telecommunications. It is similar to Information Technology (IT), but focuses primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication media. In the past few decades, information and communication technologies have provided society with a vast array of new communication capabilities. For example, people can communicate in real-time with others in different countries using technologies such as instant messaging, voice over IP (VoIP), and video-conferencing. A social networking websites like Facebook allow users from all over the world to remain in contact and communicate on a regular basis.

D. Impact of ICTs in Automation :

ICT is a potentially powerful tool in achieving automation in daily procedures by providing effective IT infrastructure. ICT plays important role in automation because of following reasons -:

- Anytime, anywhere -: ICT allows user to access resources from any location at any time that speed up the entire process and improves the System Performance.
- Access to remote resources -: ICTs facilitate access to remote resources that reduces overall component cost and allows effective utilization of the resources.
- Greater efficiency throughout -: Communication channels are increased through email, discussion groups, chat rooms and notification
- Improves the quality of education -: ICTs can enhance the quality of education in several ways: by increasing learner motivation and engagement by facilitating the acquisition of basic skills, and by enhancing teacher training

An Automated Stationary Request Procedure System[9], Heath Care System [10] highlights the successful implementation of use of ICT to achieve automation in their daily procedures.

From above analysis we come to know that we need an integrated web based system with the improvement in terms of controlled access on the online resources, making administrative decisions and performing administrative actions in fastest way, achievement of Task Engineering without violating the Role hierarchy and their access rights policy, provides central repository for data storage, ensures data security and data privacy of each user and utilizing the additional services offered that enhance the overall performance of the System and provides user Satisfaction.

III. PROPOSED WORK

A design of a proposed automated system involves integration of various phases that mainly focuses on :

- Conversion of paper based work to paerless work using Form Oriented Model
- Managing access control and task completion using Type Role Hierarchy based Access Control (TEATRHBAC) model to ensure the confidentiality and privacy of data
- Implementation of Services like notification, performance evaluation and knowledge sharing point
- Providing Central Repository for data storage
- Ensuring data security by using SH1 algorithm, data privacy mention
- To acheive automation in manual processes

Phase -1 : Conversion of Paper based documents into Online documents :

In this phase, we have converted physical documents of academic details into online web based system using Form Oriented Model which is simple and gives exact natural appreance as same as that of existing paper based documents of academic details, So users will feel easy while interacting with the paperless system.

Table 1: Conversion of physical academic details into Online E-Diary System

Diary Name	Academic Details
Staff E-Diary	This online Diary contains all the information about faculties admitted in to the department like staff's personal details, journal or/and paper publications done, mentoring progress, guest lecture invitee etc.
Course Theory E-Diary	It keeps all the records about conduction of Theory Subjects like lesson plan, teaching resources, beyond syllabus activities details, course details, defaulter student report, term work submission etc.
Course Practical E-Diary	It keeps all the records about Practical Subject like practical plan, teaching resources, beyond syllabus activities details, defaulter student report, term work submission etc.
Lab E-Diary	It keeps all the laboratory details present in the organization like equipment details, lab readiness details, lab time table etc. which will help in maintaining laboratories in the college
Student E-Diary	This online Diary contains all the information about students admitted in to the department like student personal data, academic achievements, mentoring details etc
Project E-Diary	It will keep track of final year B.E. and M.E. project progress

Therefore, implementation of 'E-Diary' concept in our System gives easiness in maintaining academic details and allows efficient data management.

Phase – 2 : Designing User roles, userHierarchy, access right provision and task division using Task Engineering with Administrative Type Role

Hierarchy based Access Control(TEATRHBAC) model

The proposed model extends approach of RBAC, Hierarchies in RBAC, Management Model and Task Engineering approach without violating the role hierarchy and their access rights policy together.

Our proposed model (TEATRHBAC) follows the following steps :

i) User creation and functionality assignments as per their user role type
ii) Formation of user role hierarchy
iii) Formation of Administrative Role based Access Control
iv) Division of work task using task engineering approach

i) *User creation and functionality assignments as per their user role type:*

In this step, proposed model focuses on Users (U)and their roles(R) and association of User Creation(UC) follows the rule UC => U X R. Each user role type plays specific functions in the organization.The type of user roles that our system is going to focus are Admin, Director, Principal, Head Of the Department(HOD) , Head Clerk , Staff, Student .

ii) Formation of type role user hierarchy:

Permission for accessing the resources is highly depends on the hierarchy present in an organization. While providing access control services to the users using type role hierarchy we have satisfied following requirements like : It supports the principal of strict least previliage, supports the delegation of authority, reflects the reporting structure, allows for slight differences between positions, enforces separation of duty control principles etc.[11].

User Role hierarchy consists of different types of roles that are associated with each other. A distinction is made between organizational roles, task roles ,private roles and job roles. User Role Hierarchy UH can be defined as

$UR \Rightarrow UR_{org} \cup UR_{job} \cup UR_{pri} \cup UR_{task}$

Where

UR_{org} => represents roles that relate to the hierarchy in the organization ,

UR_{job} => represent roles that broadly define a persons job. Examples can be found in general terminology, such as HOD, Principal, Directore, Clerk etc.

UR_{pri} => represents private roles, i.e. roles where the permissions are not inherited upwards.

UR_{task} => represents the roles that relate to specific tasks, it the building block of organizational workflows.

Creation of User Role Hierarchy involves following steps :

i) Vertical organization partitioning
ii) Horizontal partitioning
iii) Define organization positions
iv) Define private roles
v) Define task based roles
vi) Assign Users
vii) Assign Permissions

i) Vertical organization partitioning **:** In this step, we have done vertical partitioning by partitioning the organization according to number of departments present in the organization that can be grouped together using higher level unit.

ii) Horizontal partitioning: Each vertical partition, is partitioned horizontally according to type of a role performed by each user. These roles may be related to each other through a generalization relationship.

iii) Define organization positions: Many times for each role in the organization, there exists many different people that fulfill single role. For example, many users having same post HOD, staff, clerk for different department. During this step the different users are created for same roles in the different departments.

iv) Define private roles: Each user may require a private role. For example, in a proposed system each user from senior to junior having rights of

uploading their research work documents in common knowledge sharing point. Every user can share that documents but the updation or deletion permission is only given to user that uploads the documents even he is the junior no such permissions are inherited to senior authority provision of such facility gives appearance of assigning private role to the user.

v) Define task based roles: After analyzing the existing system we have build task based roles in the hierarchy to complete the task and accomplish the workflow of the system. If the permission assigned to the task role should be inherited upward ,the task role should be linked to a job role. Finally, if the task should only be done by a specific role, it should be linked to a private role of the job.

vi) Assign Users: Users are assigned to the highest possible role $ur_{i\ in}$ where $ur_i \in UR_{org} \cup UR_{job} \cup UR_{pri} \cup UR_{task}$ if he satisfies this equation in the organization. Accordingly Admin, Director, Principal users belonging from topmost hierarchy whereas Staff, Student and Clerk occupies bottommost post in the hierarchy and HOD users occupies middle position in the hierarchy.

vii) Assign Permissions: In this step, permission is assigned to each user in order to access the appropriate resources. In our proposed, we have created separate platforms for each user by understanding their UR_{org} , $UR_{job,}$ UR_{pri} and UR_{task}.

3) Formation of Administrative Role based Access Control Hierarchy: This step focuses on Administration in an organization. It forms a hierarchy of all users that plays important role in Administration. Managing the security policies and access control becomes difficult as the number of users associated with the users get increase. To overcome this situation, our proposed system forms an Access Control Hierarchy of Administrative users that performs the administrative actions in effective and efficient manner. The benefits offered by this proposed technique are:

- Formation of user hierarchy in an organization using task division approach that reduces overall user creation time
- Provides authorized user permissions to access appropriate resources
- Manages change in role of user in the Role Based Hierarchy
- Manage and verify completion of task from a user to whom they are controlling
- Removal of central administrative action by single person.

Hence formation of Administrative Role based Access Control Hierarchy is essential for the division of administration activity and enhance the overall workflow of the system to complete the task in fastest way under secured access control.

iii) Division of work set using Task Engineering approach :

In our proposed system we have achieved combined effect of Task engineering along with Role Engineering without conflicting their role access controls in three different ways :

i) Using 'Duplicate User Role Creation by Administrative User Hierarchy' technique to achieve Task Engineering
ii) Completion of multiple task by the Single User with Multiple Role Types using Task Engineering(creating separate platform of resources associated with the user role type)
iii) Division of work set into multiple task set to achieve parallelism.

i)Using 'Duplicate User Role Creation by Administrative User Hierarchy' technique to achieve Task Engineering :

Task Engineering Approach is achieved by proposing a new technique known as 'Duplicate User Role Creation by Administrative User Hierarchy'. By understanding the importance of work completion in short time span or to handle complex situation like managing the department or

organization in the absence of senior user e.g. HOD for department and Principal or Director for college 'Duplicate User Role Creation by Administrative User Hierarchy ' technique is introduced. With the proposed technique, users can create similar duplicate users in the organization with proper user authentication and will provide access control permission by assigning appropriate user role. Creation of duplicate user and assigning the appropriate role is under the control of Administrative user Hierarchy. Again creation of duplicate user is bounded to Administrative User Role Hierarchy. The steps involved in our proposed technique are :

Step 1 -: Create Duplicate user by Administrative User as per the real time demand.

Step 2 -: Assign Role to Duplicate user by Administrative User as per the real time demand.

Step 3 -: Acquire all the access control permissions same as that of Actual User.(as per the role)

Step 4 -: Complete the task associated with the user role type

Step 5 -: Delete the duplicate user after completing the task

The major goals of proposed technique are Removal of person dependency in the work, completion of task within a shorter duration of time, mitigate the urgent task completion situation, division of similar task among multiple users to complete the task in fastest way.

The major challenge with this implementation is keeping track of Actual User and Duplicate User , which is overcome in our proposed system by assigning separate user id to each user in the system even their role is same. So in the case of misuse, we can easily track the responsible user for given task. In this way our proposed system takes care about security violation.

ii) Completion of multiple tasks by the Single User with Multiple Role Types using Task Engineering: Single user can perform multiple roles in an organization so work responsibility associated with each role type is different. For example HOD user can be a 'Lab In charge' and 'Teaching Staff' too. So he need to get access and activate multiple roles simultaneously to complete the task associated with individual role. In addition to complete the individual task, he would like to have independence in the working platform to feel the privacy. To complete multiple tasks simultaneously, we have created separate resource platform associated with each user role type, which he can easily activate simultaneously by providing appropriate authentication in terms of user id and password associated with the role.

iii) Division of work set into multiple task set to achieve parallelism: In order to achieve parallelism in the work flow of the system, we have divided each resource platform into multiple resource units and each resource unit is further divided into smaller sub units. Here each unit and sub unit can be completed in parallel. So that entire work can be done in fastest way.

Phase 3: Implementation of Services like notification, performance evaluation and knowledge sharing point

- Notification :

A Notification Program is an additional service offered in our proposed Automated System to notify the targeted user (any user of an organization) for conveying some important messages like meeting alerts, exam supervision alerts etc. Here sender can notify targeted users by using ICT techniques like SMS and Email. The permission to access this service is only offered to the Administrative users like Principal, Director, HOD and Head Clerk users. So by using our interface they can send either SMS or Email or both SMS and Email too. With this we can notify the target user either single name person or few persons in the department or college by sending either SMS or Email or both (SMS and Email) together. The advantage of implementing our proposed service is to enhance the overall performance of the system and provides user satisfaction.

- Performance Evaluation

A Performance Evaluation implemented in our system increases the overall efficiency of the

Proposed System. This service helps upper user hierarchy importantly administrative users to make administrative decisions in fastest way. We have presented performance of each staff, student and academics in graphical form so to visualizing the performance of each user by graphical form is much easier compare to including theoretical concepts which allows to make decision faster and perform administrative actions quickly.

The features offered by this service are -:

- Evaluation of student performance
- Evaluation of staff performance
- Due to graphical representation, analysis can be made easily and decision making becomes faster
- Speed up the administrative actions and controlling power
- Each user is able to see his/her performance graph so that they can perform the actions for self-improvement
- Self-improvement of each user will enhance the overall efficiency of the organization.

  Therefore implementation of Performance Evaluation Service plays important role in the proposed automated system to enhance the performance and efficiency of the system.

- Knowledge Sharing Point :

It is a special service provided in our proposed system. Here each user either student or staff can share their research work and knowledge gain from outside resources. During implementation we have used the concept of private user role. Each user can share their research work and knowledge gain and its visible to all the other users present in an institution but Delete and Edit permission access control is only assigned to that individual users and not getting inherited to upper user hierarchy.

Phase 4: Providing Central Repository for data storage

The present system involves scattered data across all the departments so integration and sharing for different purpose become difficult and time consuming. To overcome this difficulty we have proposed Central Repository for database system. with three-tier client server architecture.

Phase 5: Ensuring data security and data privacy

In this phase, we have considered security aspect of our proposed system. We are going to secure our System by implementing IP based Security and Password security. In IP based security, we have assigned separate IP to our Proposed System and Data Repository which can be accessed only after proper authentication. Due to secured access the code future system modification is secured.

Password based security plays vital role for accessing any data, permission policies, role based access to each users in our proposed system. For System, data or resource access, each user must have proper username and password and a password is protected by using Encryption technique.

Phase 6: To acheive automation in manual processes

Last phase of this system is to automate various manual procedures of an organization. Automation in various academic processes is achieved after Online Data fill by each user. Our System utilizes online academic detailed filled by each user in their respective E- dairy and will generate meaningful outputs to achieve automation in academic processes.

Automation of processes involves :

- Generation of Student Defaulter list
- Generation of student performance graph
- Generation of staff performance graph
- Generation of subject performance graph
- Sending notification messages to the targeted user by utilizing the online data filled about student or staff data

IV. IMPLEMENTATION AND ANALYSIS

The proposed system is implemented on three tier architecture in which the client interface is simply a web browser, XAMP 1.7.1 is configured

as a web server, PHP is used as scripting language,MySQL Database connectivity.

After successful completiontion of all the mentioned in proposed technique, we are able to achieve the following aspects related to access control in any organization:

- *Online Filling of Data :* After User Creation each user will have their own authenticated login and can fill their academic details at central location and further can be utilized for automating the daily procedures.
- *Secured Access Control:* By creating different resource platform for each user type our system is preventing the resource access from unauthorized users.

- *Strict least privilege in the system: U*ser belongs to a superior role is a necessary condition to assign the task to the user. For example, unless HOD user will not assign blank format of academic details to 'Staff' user. He/she is not able to view the academic details associated with him/her.

- *Delegation of authority :* In our proposed system, we have achieved delegation of authority by creating private task based role so that even the user is performing lower role in an hierarchy, the permission rights will not be inherited upwards.
- *Reflection of the reporting structure :*The association of position of the roles with one another allows for defining a "supervision" relation.
- *Enforces separation of duty control principles :* We have achieved the separation of duty by providing the permissions as per the task role approach. By providing different resource interface as per the user's role and completion of task. Therefore, even HOD user is performing three roles- HOD, Staff and Lab In Charge in the organization he has feel of performing separate independent duties associated with the task assigned to the respective roles.
- *Task Engineering approach speed up the process:* Implementation of task engineering approach removes the single person dependency. Task engineering approach in Administration reduces the overall burden in managing the organization and its various departments, helps in completing various tasks simultaneously. Each step while performing task engineering takes care of not violating the permissions and access control associated with the Role Engineering.
- *Services offered enhances overall performance :* Notification service, Performance Evaluation GUI, and Knowledge Sharing Point enhance the overall performance of the system and provides satisfaction to the users.

V. EXPERIMENTAL RESULTS AND DISCUSSION

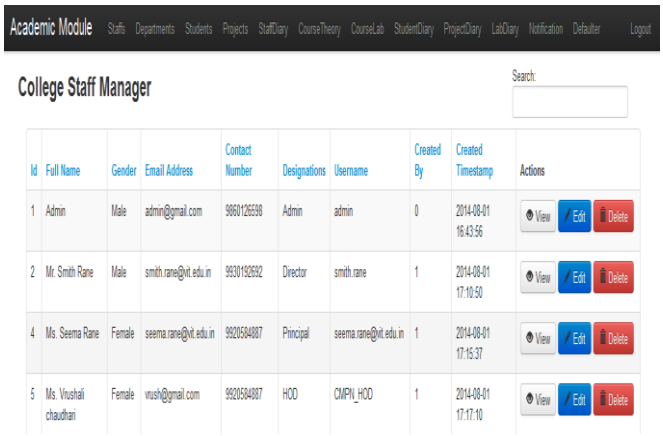

Fig. 1 Administrative Role User Hierarchy

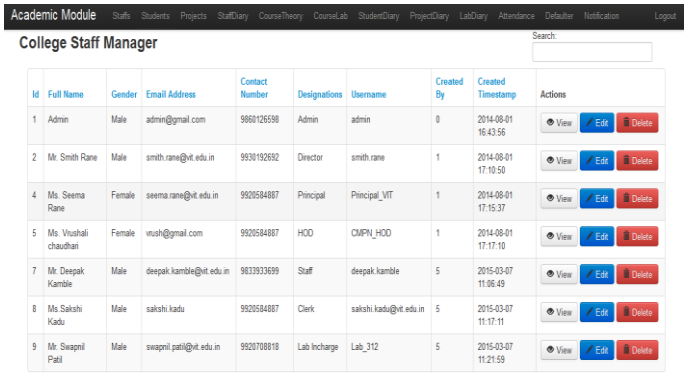

Fig. 2: User Role Hierarchy

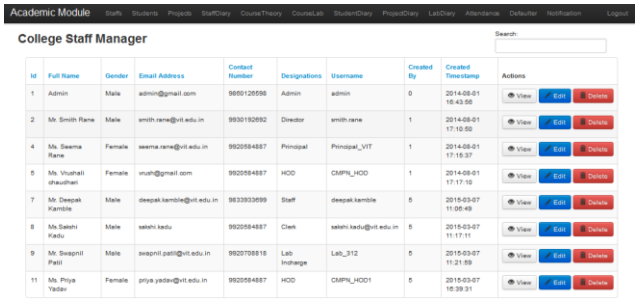

Fig. 3: Duplicate User Role

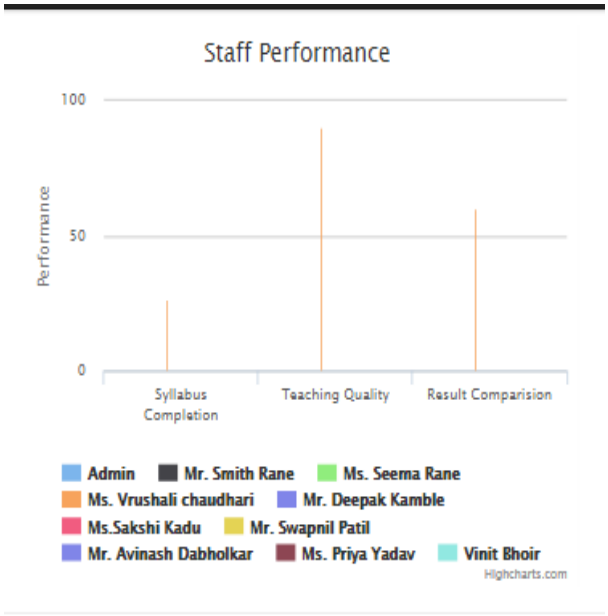

Fig. 4: Staff Performance Graph

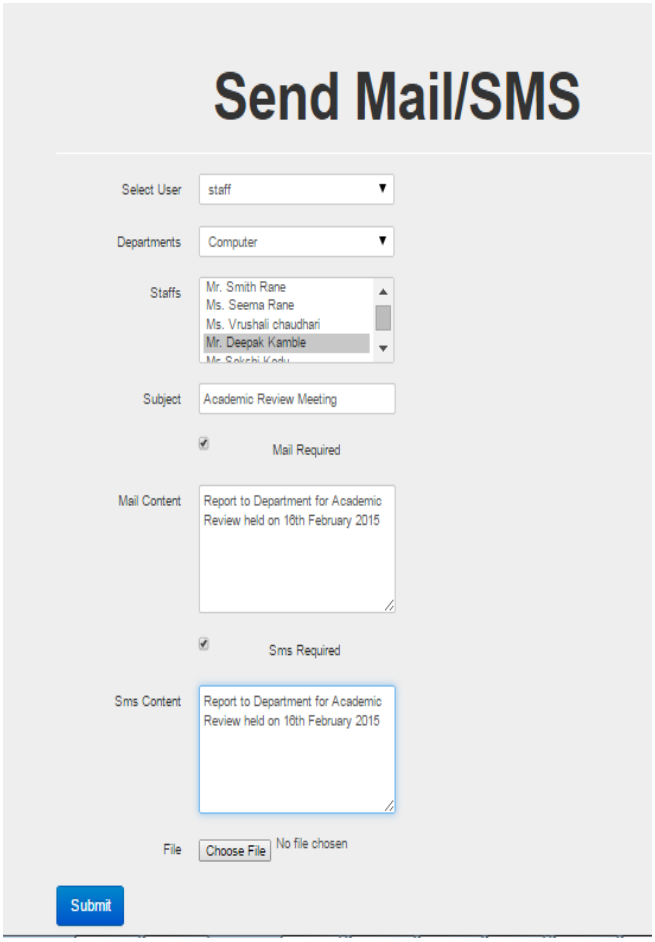

Fig. 5: User Notification System

Table 2: Comparison between an Existing system and a Proposed system

Parameter	**Existing System**	**Proposed System**
Basic method	Paper based System	Papaerless web based System
Record maintainance	Academic details are maintained in the form of Physical Diaries	Academic details are maintained in the form of E-Diaries
User Hierarchy maintainance	Manual	Automated
Division administrative actions among administrative user roles	Absent	Present

Task Engineering approach	Absent	Present
Duplicate User Role	Absent	Present
Parallelism in task while perfomring multiple roles by single user acheived?	Yes	No
Central Repository of Data	Manual	Automated Secured
Notification	Using email	Using email as well as SMS
Performance Evaluation	Manual	Automated
Speed of performance evaluation	Slower	Faster
Knowledge Sharing Point	Absent	Present
Speed of Administrative Actions	Slower	Fatser
Data Access	Slower	Faster

VI. CONCLUSION

In this paper, a suitable automated web based paperless system is designed. The principle idea of the System is used as platform in Educational Institutes to fill and manage academic details online, automate major academic processes that reduce iterative manual and paper based work and helps upper user hierarchy to monitor administrative processes and evaluate the performance to take decision for improvement. System provides Central Data Repository for maintaining Institute's academic details together so no need of searching for segregated data at different places and enabling College Administrative System to make fast and informed decisions. Utilization of services (notification, performance evaluation and knowledge forum) improves overall efficiency of System and provides user satisfaction.

REFERENCES

[1] Ritvars Bregzis,Calvin Gotlieb,Carole Moore , *"The Beginning of Automation in the University of Toronto Library,1963–1972",* in IEEE Annals of the History of Computing, April–June 2002..

[2] Prof. Godswill Obioma , Prof. Ismail Junaidu , Dr. Grace Ajagun , "The Automation of Educational Assessment in Nigeria: Challenged and Implications for Pre-Service Teacher Educaion",Annual Conference of the International Association for Educational Assessment (IAEA) held at the Dan Panorama Hotel, Tel-Aviv, Isreal October 20th – 25th, 2013

[3] M. Jou,J.K. Shiau and H.W. Zhang,"Application of Web Technologies in Automationon Technology Education", International Journal of Computers and Applications, Vol. 31, No. 4, 2009

[4] Xiang Fu, Boris Peltsverger, Kai Qian, Lixin Tao, Jigang Liu," *APOGEE – Automated Project Grading and Instant Feedback System for Web Based Computing*", Computer Science and Information Technology, 2nd IEEE International Conference 2009.

[5] Gerald Weber," *Defining the Paperless Workplace with the Paper Metaphor -Not a Contradiction in Terms*", Conference: Proceedings of the Fourth Australasian Workshop on Health Informatics and Knowledge Management - Volume 120

[6] Ryan AusankaCrues," *Methods for Access Control:Advances and Limitations",* Ryan Ausanka-Crues Harvey Mudd College 301 Platt Blvd Claremont, California ,2001

[7] Ravi S. Sandhu{, Edward J. Coynek, Hal L. Feinsteink and Charles E. Youman*," Role-Based Access Control Models",* IEEE Computer, Volume 29, Number 2, February 1996, pages 38-47.

[8] Hamid Hatim, Hanan El Bakkali, Ilham Berrada," *Workflow Access Control: From Role Engineering to Task Engineering*" Internation Journal Internet Technology and Secured Transactions Vol 4, no.1, 2012

[9] Noorr Azah Samsudin,Shamsul Kamal Ahmad Khalid et.al. *,"Procedure Automation with Immediate User Notification : A Case Study"*, IEEE Symposium on Buisness, Engineering and Industrial Applicatins, Malaysia, 2011.

[10] Andrew Rebeiro-Hargrave1, Hiroshi Nakajima, "*Investigation into Blood Pressure Variability in Japan and Bangladesh by ICT based Healthcare Systems",* 2014 IEEE International Conference on Systems, Man, and Cybernetics October 5-8, 2014.

[11] Reinhardt A. Botha, Jan H.P. Eloff," *Designing Role Hierarchies for Access Control in Workflow Systems*", 0-7695-1372-7101 $10.00 *0* 2001