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Automated Attendance System

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Abstract
Nowadays, in educational institutes, the academic administration becomes an important component to manage daily procedures and successful course completion. Example of such system includes maintaining academic records, preparation of lesson plan, tracking beyond syllabus activities, generation of meeting alerts, defaulter's students list generation, etc. Thus, the progress in the level of education should be equally matched by the progress in administration. In this paper, an automated model for the attendance record is proposed which is implemented as a live application in Ramrao Adik Institute of Technology, Nerul, Mumbai. An integrated automated web and mobile based paperless system is described by the proposed work that converts the process of manual filling of attendance into online system. This is obtained by controlling access to the online resources by identifying and understanding the users, their roles and present hierarchy in the organization. By classifying the hierarchy of administrative users depending on their roles, tasks and positions our system segregates the administrative actions. By utilizing the automated system, accessing the online resources has been ameliorated by taking required administrative decisions and actions at a faster pace that improves the overall efficiency and performance of the organization's workflow.

Keywords: Automation; ICT; RBAC; Notification

1. Introduction
Multiple pathways are provided by internet. Trading of statistical data, audio, video and fact files can be performed by utilizing these pathways. Accessing these pathways is possible only when the users are connected to internet. Internet is composed of millions of smaller domestic, academic, business, and government networks and websites, which work together and hold different types of information. In other words, multiple networks and sub networks are woven together forms the Internet. All the technologies used to handle telecommunications, transmission medium, communication systems and network-based control and supervising functions is called an Information Communication Technology (ICT). Information Communication Technology can be availed in all educational institutes to computerize various everyday conducts. Looking at the current practice, many educational institutes use paper based system to manage their academic details which involve iterative manual work, making the process longer and error-prone. In order to raise efficiency and simplify workflow, education administration management system begins to shift the workflow from paper document workflow to an electronic document form. A paper based system requires larger storage space to store data, limits the mobility and causes loss of documents and editing problems. A collaboration of work with such system becomes difficult which mainly slows down processes and delays entire decision making in an administrative system. By understanding importance and scope of requirement, our aim is to develop an 'Automated Attendance System for Educational Institutes', which is web-based and android based Central Data Repository System to maintain student attendance records in an electronic form and to automate academic processes in an Education Institutes using Information Communication Technology (ICT). A fundamental goal of the system is used as a podium to enter student attendance details online and computerized student attendance processes which lessens the monotony of manual paper based work and aids upper user hierarchy to supervise processes and assess performance to generate decisions for enhancement. It also delivers central data archive to store attendance details together which allows College Administration System to generate quick and appropriate decisions without

any need of monitoring distributed data at distinct locations.
In this paper, we have proposed an automated attendance system with Role-based hierarchy model to manage attendance in educational institutes with services like notification and backup. This model is implemented as a live application in Ramrao Adik Institute of Technology, Nerul, Navi Mumbai. The concept of proposed system is explained in section II. Section III highlights existing automated systems and their analysis. Section IV presents proposed system and section V its implementation. Section VI presents the results and findings of the paper and at last, section VII comments on conclusion and the future scope of proposed system.

2. Concept

In today's world, administration and management of organizations, particularly in education institutions become a tedious and complex task. To engage best students, yield best results and launch best images, there is a need of systematic approach, proper planning and appropriate control of different administrative processes. These institutions are increasingly seeking the help of information technology to improve their facilities and maintain a competitive edge to their educational business. Therefore, there is a need of extremely efficient, secured, systematic and sophisticated, user friendly automated system in Education Institutes An integrated automated web and mobile based paperless system is described by the proposed work that converts the process of manual filling of attendance into online system. This is obtained by controlling access to the online resources by identifying and understanding the users, their roles and present hierarchy in the organization. By classifying the hierarchy of administrative users depending on their roles, tasks and positions our system segregates the administrative actions. By utilizing the automated system, accessing the online resources has been ameliorated by taking required administrative decisions and actions at a faster pace that improves the overall efficiency and performance of the organization's workflow. It uses Role Based Access Control Model to form user level hierarchy. It provides additional services like notification through emails, SMS, backup and generation of various reports.

3. Literature Survey

An automation or automatic control is the process of utilizing computer procedures and other machinery to supersede manual operations. Objective of implementing Automation is to enhance efficiency, reduce delays, increase manufacturing flexibility, reduce prizes, eliminate human error, mitigate labour shortage, high degree of precision. It is also implemented for carrying out tasks that are beyond human potential in terms of magnitude, mass, pace, endurance, etc. University of Toronto Library Automation System (UTLAS) in 1963-1972 [1] was one of the first attempt of achieving automation by developing a system for efficiently managing library records and data. Automated System for Educational Assessment developed in Nigeria elaborates how adoption of an e-Learning based examination System obviates challenges like unfair administration practises, biased grading systems, etc. al. encountered with conventional paper based examinations[2], bolstering another example for adopting automation techniques. Automated Project Grading & Instant Feedback System [4] also demonstrates a success story by increasing overall efficiency and performance over manual methods. However, Gerald Weber, suggests that people might still be a bit skeptic about paperless system, mostly because they are unable to find a direct and reliable mapping between paper-based and paperless contexts [5].

A. Access Control Methods

Access control methods allow us to enforce authorized restrictive policies over different segment of users. This provides an effective security policy mechanism which can be used to defend data privacy and confidentiality against 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)

Role Based Access Control Model (RBAC) fits in perfectly for our use case in the proposed system.
From above analysis we come to know that we need a system to understand the number of users, their functions and hierarchy present and the access control rights associated with each user. It needs to focus on roles performed by users in the organization which makes the system faster. Thus by understanding the need, we proposed a new model which is termed as "Automated Attendance System".

4. Proposed system

It has been observed that the process of manual attendance has been carried out across almost all educational institutions. The process is not only time consuming but also sometimes inefficient resulting in the false marking of attendance. Manual entering of attendance in log books, generating defaulters and further processing of such information consumes more time. The existing system is actually paper based and it has several downsides like misplacement of attendance sheet, time consumption etc. The current system does not have any online facility hence administrative authority have to personally meet department or physically have to see records, need to do further analysis. Similarly, students cannot get any statistical information about their attendance.
In order to overcome limitations of existing system, we have proposed a web based and mobile based attendance monitoring system. This system is an automated system developed for daily student attendance in schools, colleges and institutes. It facilitates to access the attendance information of a particular student in a particular class. This system helps in evaluating attendance eligibility criteria of a student. By just a click, the system will be able to produce the student's attendance report, thus reducing the need for iterative manual work which is prone to human errors and time consuming. It is built for automating the processing of attendance. It also enhances the speed of performing attendance analysis easily. It helps higher authority to monitor whether class has been engaged by faculty or not, if yes then what was strength of a class, also it provides list of students who were present in previous lecture but not present in next and vice versa. By using notification system it generates email and SMS alerts also it provides additional service of generating backup of records and generation of various reports.

The automated system expands the attitude of RBAC, Classification in RBAC, Management Model and Task Engineering approach without defying the role hierarchy and their access right policies in an organization [6]. The proposed system uses Form Oriented Model for implementation of paperless system.

The proposed model follows the steps below for implementation of RBAC model:

i) Registering users and allocating tasks based on their role type
ii) Defining user role hierarchy
iii) Defining Administrative Role based Access Control

i) Formation of users and tasks assignments according to 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 an organization and by understanding the functionality of each role our proposed system provides access to the functionality. The type of user roles in our system are Administrator, Principal, Head of the Department (HOD), Student.

ii) Formation of type role user hierarchy

The facility of accessing the resources is highly dependent on the hierarchy of the organization. The system model adheres to standard mechanisms like principle of strict least privilege, supports the delegation of authority, reflects the reporting structure, enforces separation of duty control principles etc. User Role hierarchy consists of different types of roles that are associated with each other. A distinction is made between organizational roles, task roles. Position in the User Role Hierarchy can be formed as:

$U_{RH} => UR_{org} \cup UR_{task}$

where,

UR_{org} represents user roles that relate to the hierarchy in an organization,

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 partitioning (Defining various hierarchical roles)
ii) Horizontal partitioning (Across various departments)
iii) Define organization positions (In our case, Principal, HOD, Faculty, Student)
iv) Define task based roles (Who can take attendance, who can update attendance, who can create defaulters etc.)
v) Assign Users (Map users to their corresponding roles)
vi) Assign Permissions (Assign permissions and privileges to user groups or assign special privileges to some users)

i) Vertical organization partitioning

In this step, we have done vertical partitioning by considering division of an organization into number of departments that are grouped together using higher level unit.

ii) Horizontal partitioning (UR_{job})

Each vertical partition is partitioned horizontally, spanning across the same privileges to a specific role through various departments.

iii) Define organization positions (UR_{org})

Defining which segments of users can be mapped to which access level of RBAC. In our case, for instance, principal was mapped to access-level 0, which denoted highest accessibility, followed by HOD- level 1, faculty- level 2, student- level 3 and so on.

iv) Define task based roles (UR_{task})

Here we define which roles has access to what types of tasks. For example, in our system, the authorization to update/modify/alter attendance is only given to Principal and HOD whereas access to generate defaulters list is given to Principal, HOD and faculty members.

v) Assign User

Users are assigned to the highest possible role UR_i where,

$UR_i = UR_{org} \cup UR_{job} \cup UR_{pri} \cup UR_{task}$

Accordingly, Administrator, Director, Principal users belongs to topmost hierarchy whereas Head of Department occupies middle position, faculty at next level and Student occupies bottommost position in the hierarchy.

vi) Assign Permissions

Finally, we assign access privileges to various user groups of the system and accommodate requests for special privileges to specific users beyond their access level as well. Hence formation of 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.

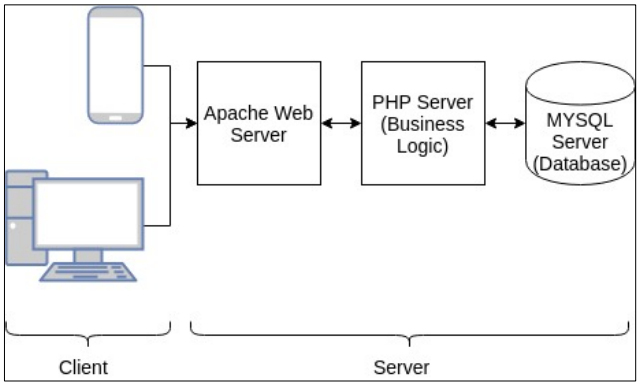
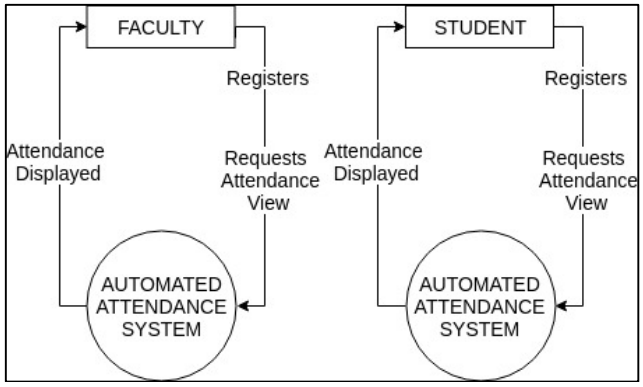


Fig 1: General Architecture of Automated Attendance System



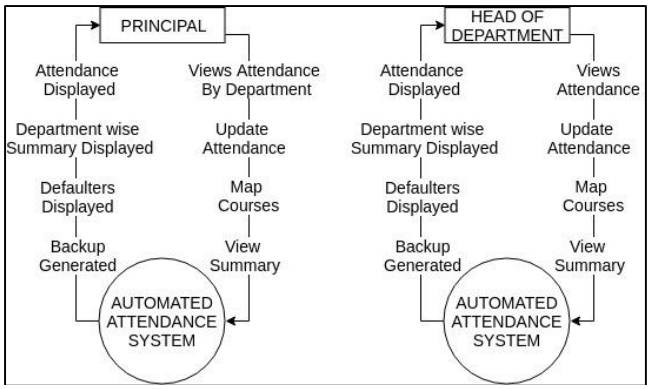


Fig 2: Data Flow Diagram of Proposed System

5. Implementation

The proposed system is implemented on three tier architecture in which the client interface is simply a web browser, XAMPP is configured as a web server, PHP is used as scripting language, MySQL Database connectivity. In order to provide mobile compatible view used HTML5 for designing. This paper outlines the characteristics and features of proposed system.

A. Features of Proposed System

- This system takes department wise students data as input roll no, serial no, last name, first name, middle name, year, division and batch
- Faculty registration in department
- Course addition for each department
- Subject allocation for a faculty
- Lecture wise attendance for students
- Defaulter's list for a division according to mentioned criteria for a given period
- Special attendance to students involved in extracurricular activities
- Display attendance for mentioned period and add-on feature for printing same and can send on faculty's registered mail id.
- Print defaulters list
- Department head can view lecture wise status of a class for a specified date
- Principal of an institute can view lecture wise status of entire institute.

B. Notification

It creates separate notification program in our proposed system. Using GUI user can either send SMS or Email or both as per the requirement to the targeted user or group of people or entire department or entire college (specifically by Principal or Director users).

C. Access Control

In a system, a Role-based Access Control Model (RBAC) is implemented where each user has access rights to access features of a system as per their level.

In current system, users are categorized at three levels-

1) Principal User (Level 1)
2) Head of Department (Level 2)
3) Faculty (Level 3)
4) Student (Level 4)

1) User Level 1 – Principal

Level 1 user is the Principal of an institute. Different access rights given to level 1 user are:

- View department wise attendance status for entered date
- View attendance of a student
- Generate status summary report
- Generate defaulters list

2) Level 2 user – Head of Department

Level 2 user is head of Department. Different access rights given to level 2 user are:

- Upload student roll list in CSV format
- Add/ delete student
- Add/ remove different courses
- Course allocation to faculty for a division
- View attendance status of a student
- View class wise attendance status
- View attendance status for all divisions and print summary report for same
- Generate defaulter's list for a class and print same
- Display attendance
- Backup database
- Truncate existing student and faculty records

3) Level 3 user- Faculty

Level 3 user is faculty. Different access rights given to level 3 user are:

- Register into respective department
- Take batch wise attendance
- Display attendance
- Print attendance
- Send attendance sheet on email ID
- Generate defaulters list

4) Level 4 user – Student

Level 4 user is student. Different access rights given to level 4 user are:

- Student can view his/ her attendance
- Student can request for leave

6. Application

An e-attendance system is accessible on personal computer, laptop and cell phone.

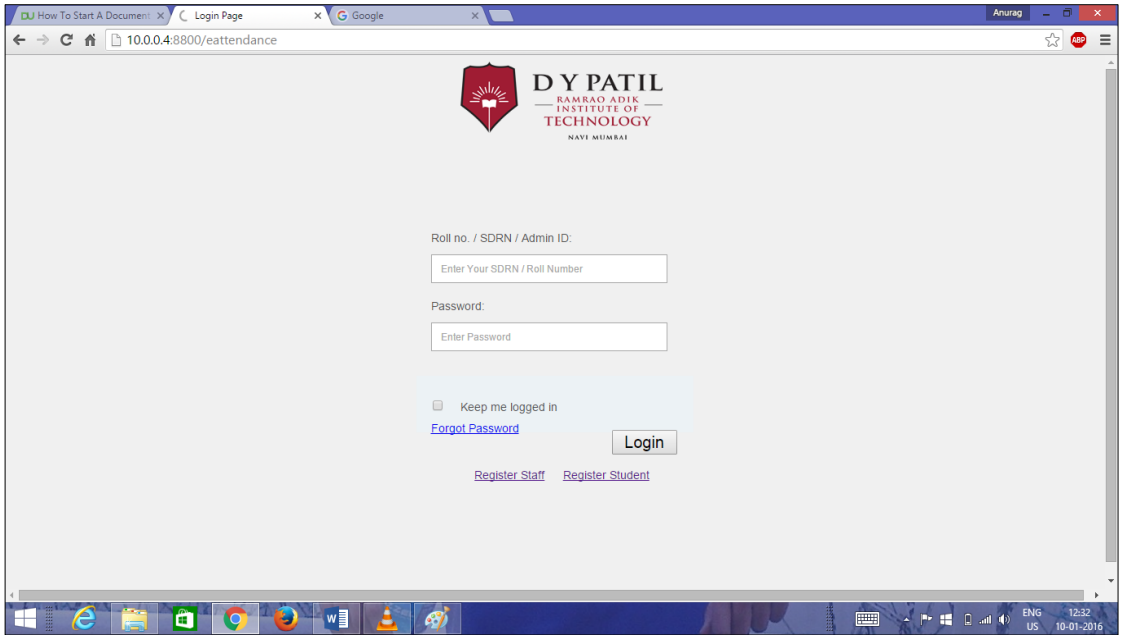


Fig 3: Home page of Automated Attendance System

Figure 3 represents home page of system through which administrator/faculty and user can login.

Following Figure 4 represents vertical partitioning of role based hierarchy where user has to select department to continue his/her activity.

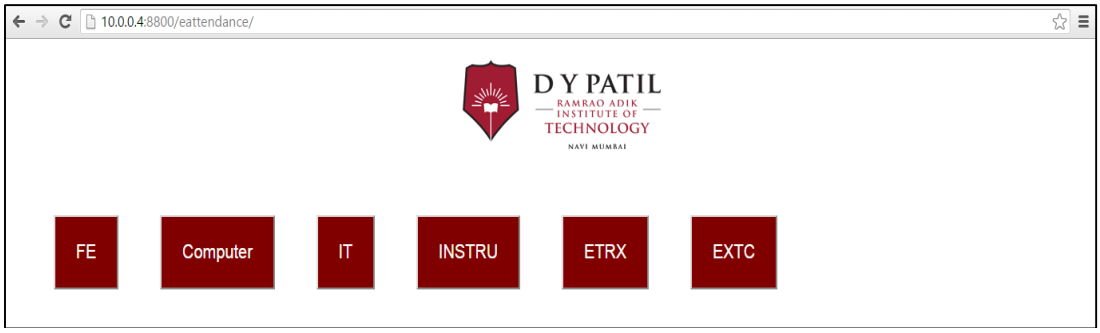


Fig 4: Selection of Department

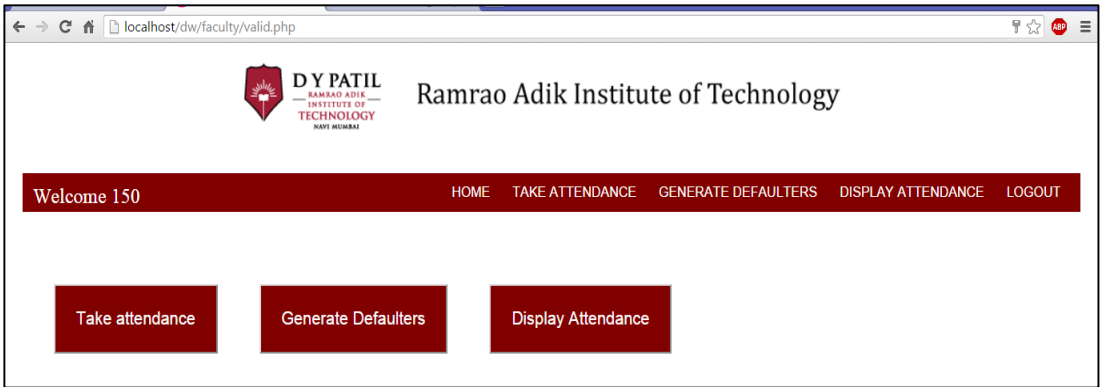


Fig 5: Faculty Login View

Fig 6: Take Attendance

In figure 6, for green selected part indicates present student for lecture time and date selected by faculty. It also take care of duplication of lecture timings.

Following Figure 7 displays attendance view batchwise from start date to end date for which we want to display attendance.

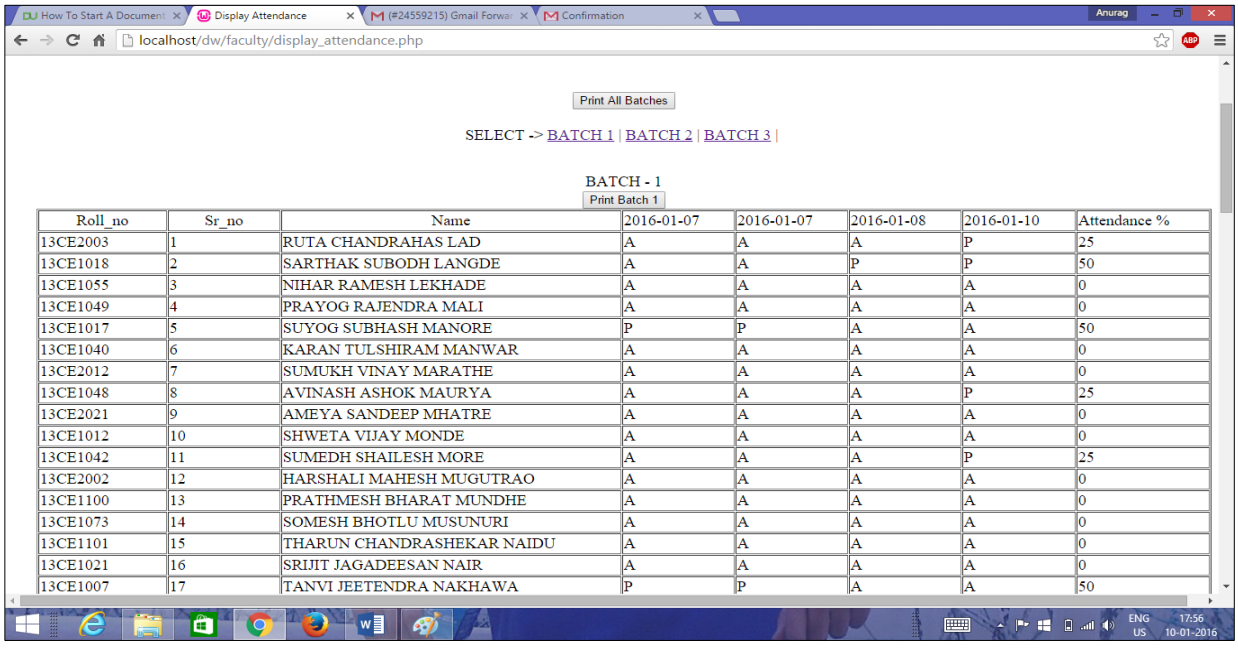


Fig 7: Display Attendance

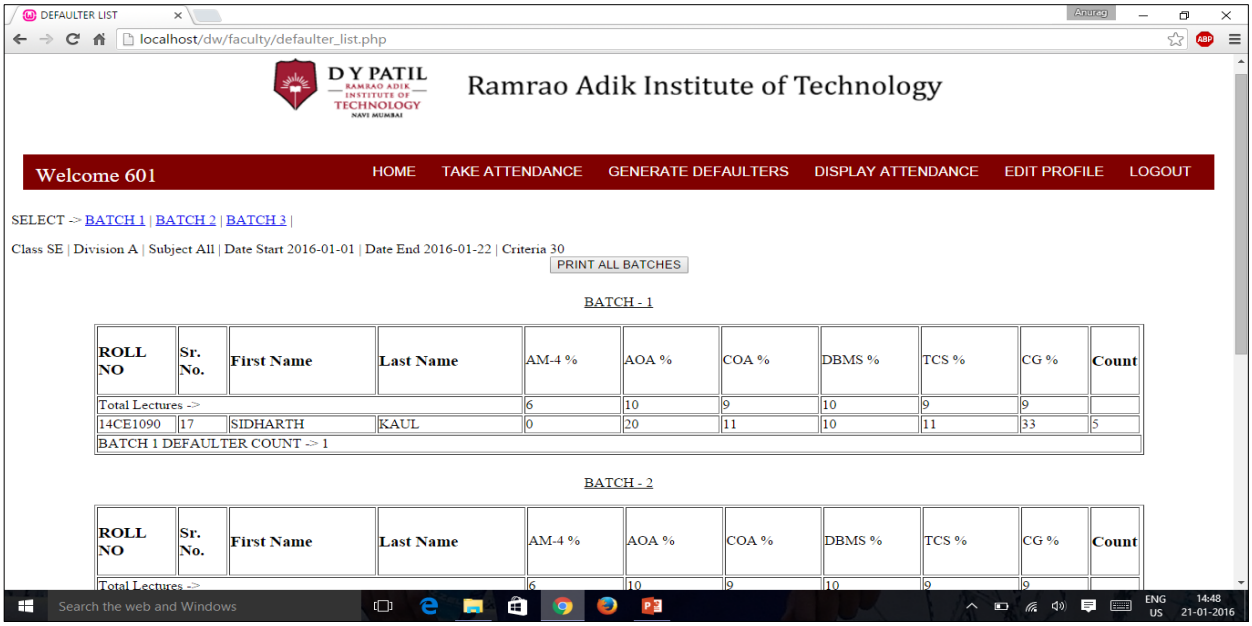


Fig 8: Generate Defaulters

A defaulters list can be generated as per mentioned period. This system facilitates printing of document such as attendance list, defaulter's list shown in Figure 9. It can also be saved as pdf and same document can be sent on registered email ID.

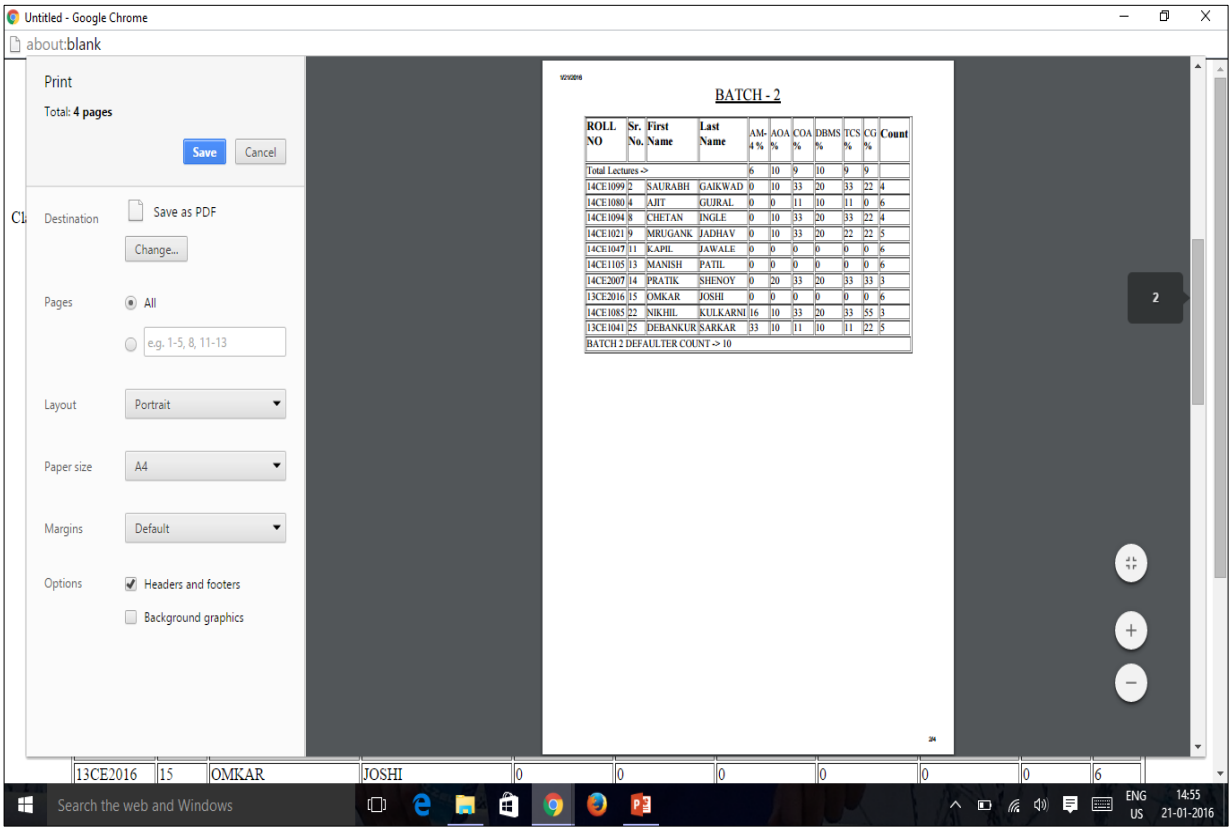
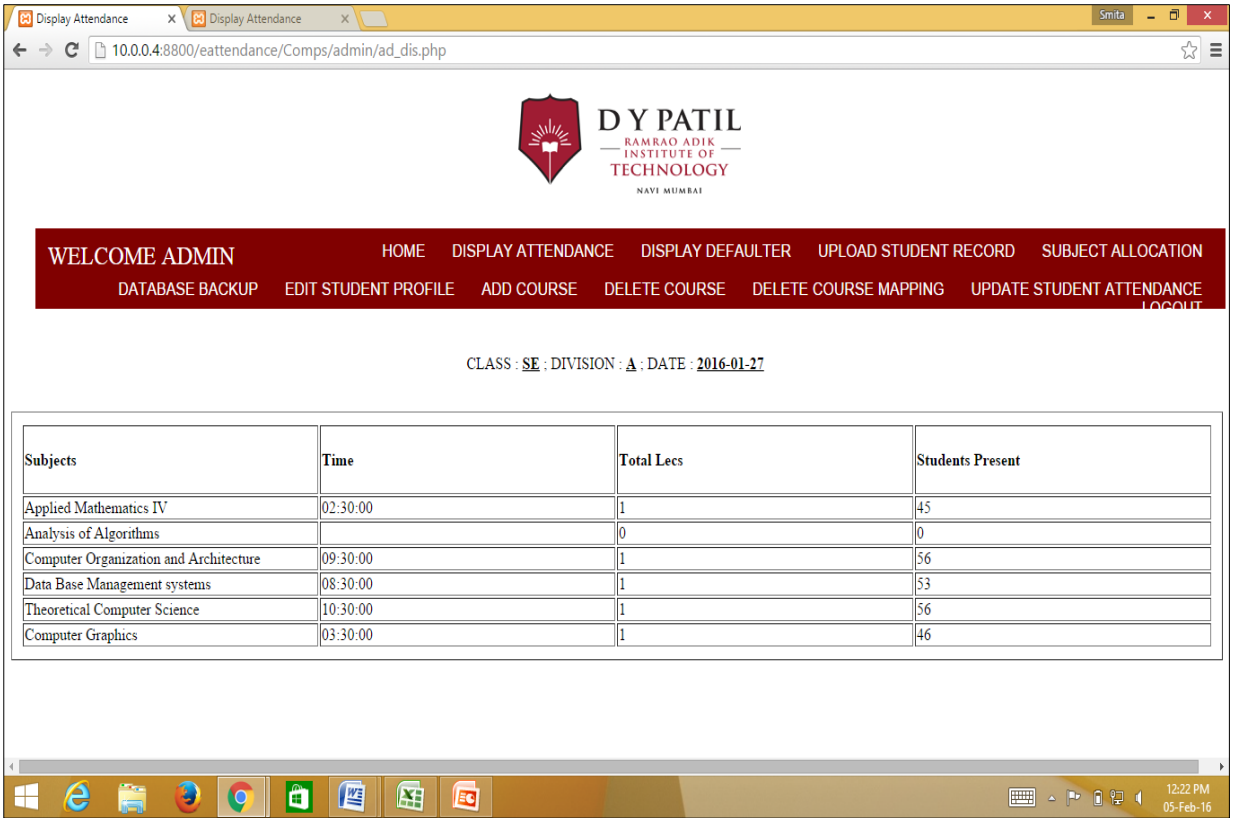


Fig 9: Print Defaulters List



Subjects	Time	Total Lecs	Students Present
Applied Mathematics IV	02:30:00	1	45
Analysis of Algorithms		0	0
Computer Organization and Architecture	09:30:00	1	56
Data Base Management systems	08:30:00	1	53
Theoretical Computer Science	10:30:00	1	56
Computer Graphics	03:30:00	1	46

Fig 10: Administrator Class View

TIME START ->	08:30:00	09:30:00	10:30:00	11:30:00	12:30:00	01:30:00	02:30:00	03:30:00	04:30:00	05:30:00
Lecture / Faculty Name :	DBMS Sumithra T.V	COA Savita Sawant	TCS Smita Patil	NA	NA	NA	AM-4 vishvas patil	CG Kriti Karnam	NA	NA
Students Present	53	56	56	NA	NA	NA	45	46	NA	NA

CLASS : SE , DIVISION : B , DATE : 2016-01-27

TIME START ->	08:30:00	09:30:00	10:30:00	11:30:00	12:30:00	01:30:00	02:30:00	03:30:00	04:30:00	05:30:00

Fig 11: Administrator View for Entire Department

Fig 12: Student Attendance

Figure 12 shows attendance for a student which is available for student as well administrator.

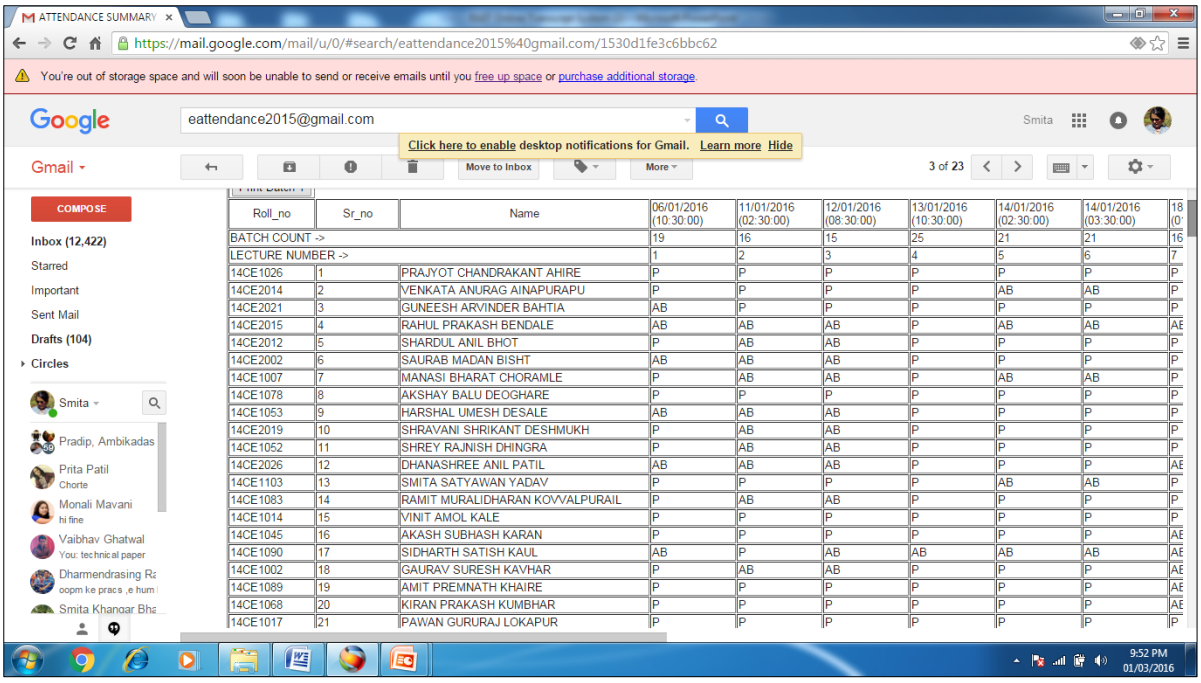


Fig 13: Notification and File sent on Email

7. Conclusion & future scope

This paper describes the working of an automated model for attendance recording, which is implemented as live application in Ramrao Adik Institute of Technology, Nerul, Mumbai. We have also considered the importance of administrative actions performed in the organization. By

classifying the hierarchy of administrative users depending on their roles, tasks and positions our system segregates the administrative actions. Therefore the resultant automated system improvises the controlled access on the online resources by making administrative decisions and taking respective administrative actions in a beneficial way that enhances the overall performance and efficiency in the workflow of the organization.

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