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Iot-based Classroom Attendance and Performance Management System

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Abstract--
The traditional way of keeping attendance record cards is not only a tedious task but also a cumbersome one, involving several chances of human errors. To tackle the problem mentioned above, this research project proposes to implement an "IoT-Based Classroom Attendance and Performance Management System". It is an online system that simulates some basic features of the Internet of Things, including real-time data updating, data centralisation, and digital monitoring in the context of academics. This IoT-based attendance system provides different login credentials to faculty and students separately for a smooth and safe access to academic records. Using the system, professors can perform activities like adding student profiles, marking attendance records each day, and using a digital dashboard. Not only this, but they can also access attendance records from any specified date and find out which students attended classes on that day or remained absent from the class. Besides, a timetable viewing facility is available for both faculty members and students. From the student's side, the attendance system provides them with a digital dashboard where they can view their attendance percentage, attendance records for the whole semester, and the timetable. The incorporation of IoT-based digital aspects in classroom management through this study makes classroom management more transparent, efficient, accessible, and accurate when it comes to maintaining records of education. The research contributes towards attaining quality education (SDG 4) because it eliminates paperwork and minimises human error.

Keywords: Internet of Things (IoT), Smart Classroom, Attendance Management, Academic Performance, Real-Time Monitoring, Quality Education

1.Introduction

1. Maintaining attendance data using the conventional method of manually recording attendance data via manual record cards is an exercise that not only involves much effort but is highly susceptible to mistakes by the users. For instance, in many instances, mistakes in marking attendance data, duplication or even loss of the data can easily be made by professors and other lecturers who manually manage large amounts of data. Moreover, accessing attendance data manually becomes difficult as one would have to make numerous efforts to search for such information.

Moreover, apart from being ineffective in handling the huge amount of data, it is also inefficient and lacks transparency and accessibility. As a matter of fact, the data is usually inaccessible to the students themselves, while the instructors would require more time than necessary in managing and updating their database regularly. As a result, it might be difficult to make decisions when the attendance of a student is at risk**.**

Due to the fast growth of digital technology, and especially the concept of Internet of Things (IoT), the trend of automation and creation of smart systems has emerged in many different fields, including education. IoT offers the ability to gather information on time, manage it using centralised databases and monitor all the data in real time, which makes this concept ideal for implementation in the educational field. Implementing IoT characteristics in classroom management software will allow universities to increase their efficiency, improve information management and become less dependent on manual work.

2. Proposed System

The new system will propose a more efficient and technology-oriented system of managing student attendance that will do away with the manual system. The old system is characterized by repetitive processes such as attendance recording, maintenance of physical registers and report compiling that are likely to be erroneous and inaccurate by humans.

The given solution is founded on the principles of the IoT to develop a smarter and responsive attendance system. It is made available as a web-based platform and two different log-in portal; one portal is faculty portal and the other is student portal. This role based access control will enable each user to only access those information and features that is relevant to his or her responsibilities.

The significant system capability is the mechanism of real-time updating of data. When the attendance is recorded, all the entries are automatically entered in a central database and can be readily accessed. Faculty members will be able to request a query of attendance based on a specific date and get a transparent report of students present and absent. This real-time access to data does not presuppose any manual validation and saves a lot of time.

The system also has a built in timetable management system which will be accessible to students and faculty members alike and allow them to check and manage their schedules and plan their academic activities with a sense of ease. The system will remove the use of several tools since attendance tracking and timetable management are incorporated in a single system. Individualised dashboards can be particularly useful to students, as they can easily find all the essential information: their attendance rates, a history of attendance throughout the semester, and the weekly lesson plan. The system calculates the percentage of attendance automatically, which eliminates the need to do it manually and enhances uniformity in the accuracy.

In conclusion, the proposed system facilitates the attendance process, minimizes the presence of inaccuracies in the recording process and enables the management of academic data in a more efficient way. These characteristics help to make wise decisions as well as contribute to the existence of a well-structured and well-organised learning environment**.**

2.1 The proposed system will have the following flow as shown below:

The system proposed is organized, and chronological. The system works in the following step-by-step way as depicted in the flowchart below:

Login by User: Students and faculty are allowed to log-in with their respective accounts into their respective dashboards. The system enforces confidentiality of data and ensures that information of every user is secure.

Student Profile Management: Faculty members are allowed to create and manage student profiles in the system. All the information of the students is stored in the electronic database in a organised and structured manner.

Mark Attendance: Attendance is computerized and has a user friendly interface that enables the faculty to mark students present or absent with just a few clicks and chances of error are minimal when inputting the data.

Data Storage: Once a submission is done, all the records of attendance are automatically stored in the central database of the system without necessarily making any other manual action.

Data Processing: The system has now been automated to make calculations on the stored data as it calculates the attendance ratio of each student such that no manual calculation has to be performed.

Report Viewing - Attendance reports can be viewed by the instructors and students. The faculty members will be able to observe students who have alarming attendance rates, and students will be able to observe their individual attendance rates

Output Display: Data and reports are presented to users in an interactive dashboard format, which allows them to have all the information easily and transparently.

Flow Chart:

Login → Student Profile Management (attendance monitoring, data storage, data processing, report viewing) → Output Display.

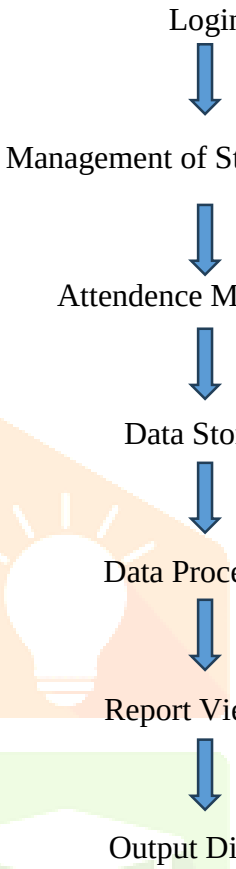

Fig.1 Flowchart of the proposed system

2.2 System Architecture

The proposed IoT-based classroom attendance management system architecture aims to ensure the efficient data management and easy interaction between the users. Fig. 2 gives a general picture of the system architecture in which the data flows between the user side interface to the ultimate display layer.

Each of these stages, starting with user authentication and the data entry as well as its storage and reporting are addressed within the system architecture and it is now easier to manage the data and enhance the overall performance. This architecture is also modular and hence it is simple to scale and extend when the requirements vary. Each of the modules in the architecture is outlined in the following sections.

2.2.1 User Access Layer

The User Access Layer is the entrance to the system and the layer that authenticates the identity of users prior to getting into the system. It also ensures that no one can access the platform other than the authorised ones and hence it is secure and reliable.

The system has two different log-in routes faculty and students, and access rights are based on the role of the user. Administrative features such as handling student records and attendance records are given to faculty members, but students can only see their attendance information and schedules.

This role based authorization system maintains privacy and security of the data in the system.

2.2.2 Student Management Layer

Student Management Layer is the layer that communicates with any student related activities, including the creation, updating and retrieving of student records. The information in the database is organized in a way that can make it accurate and readily available.

This layer will allow faculty members to manage student information better as they will not have to use physical documentation to do this. The students receive a unique identification number with which the records of the students can be located and updated.

This unique ID enables proper and effective management of individual student profiles in the system.

The proposed IoT-based classroom attendance management system architecture aims to ensure the efficient data management and easy interaction between the users. Fig. 2 gives a general picture of the system architecture in which the data flows between the user side interface to the ultimate display layer.

2.2.3 Layer for Capturing Attendance

The Attendance Capture Layer is one of the fundamental units of the system, which is in charge of capturing the student attendance in a daily manner using the digital means. The interface of the system allows instructors to enter the attendance records of each session of the classes.

This layer assists in capturing real-time data and it is important to note that the attendance records are updated in the database in real-time. It also includes validation mechanisms which minimize the possibility of common errors like duplicate entries.

Also, the layer enables faculty members to access any related attendance records on any particular date at their convenience, enabling on-demand and flexible data access.

2.2.4 Data Processing Module

The Data Processing Module is at the center of its role in converting raw attendance data into valuable insights. This module automatically calculates the attendance percentage of each student after the submission of attendance records without the need to use manual calculation.

The module performs various functions such as data validation, aggregation and percentage calculation, where all the outputs are accurate and consistent. After processing, the information will be formatted and prepared to be reported and analyzed.

The patterns that can be identified in the data through the module include frequent absenteeism, which is a pattern that the faculty members can act on to track and react upon the behaviour of the students.

2.2.5 Report and Analysis Module

Report and Analysis Module will produce detailed attendance reports and analytical summaries. It allows the members of the faculty to query the attendance records with regard to particular dates and evaluate the attendance of individual students.

In addition to retrieving data, this module assists in identifying students whose attendance is below the acceptable levels and this allows them to take academic action. The presentation of all the outputs is in an understandable format to facilitate efficient use by the faculty and administration.

The presence of proper and comprehensive attendance records facilitates transparency throughout the institution and the analytical knowledge acquired in this module makes the decision making process simple and robust.

2.2.6 Data Storage Module

Data storage module deals with the safe storage of all data in the system in a central database. This consists of student profile information, attendance records, and system generated reports, which are all stored in one, organised repository.

Having all the data stored in a single point enhances retrieval efficiency greatly since all data can always be accessed at a single point. The system keeps historical records that can be used in future as a reference or during auditing or trend analysis.

The storage architecture is specific to be scalable and adaptable with the possibility of adding new records without interrupting or overwriting the existing ones.

2.2.7 Timetable Management Module

The Timetable Management Module gives the faculty and students a systematic and organized manner of looking and controlling their academic schedule. Users are able to get the latest news on timetable information via the platform.

This module can help manage time better by giving all users clear and detailed information regarding the class timings, thereby eliminating confusion in scheduling. The system is an all-inclusive classroom administration system due to its integration into the larger platform.

2.2.8 User Interface Layer

The User Interface Layer is the last layer of the system as all processed data are displayed to the users in an understandable and accessible format. It is the interface between the end users and the system back-end operations, and facilitates simplified and user-friendly interaction.

The system will have individual dashboards that suit the requirements of individual user groups. Tools to manage attendance, generate reports, review analytical data can be found in the faculty dashboard, and attendance percentages, attendance history, and the class timetable can be found in the student dashboard.

The interface will be user friendly and easy to use so that non technical users can easily navigate through the system. Charts, graphs and summary panels are also included as visual elements to improve the understanding of data.

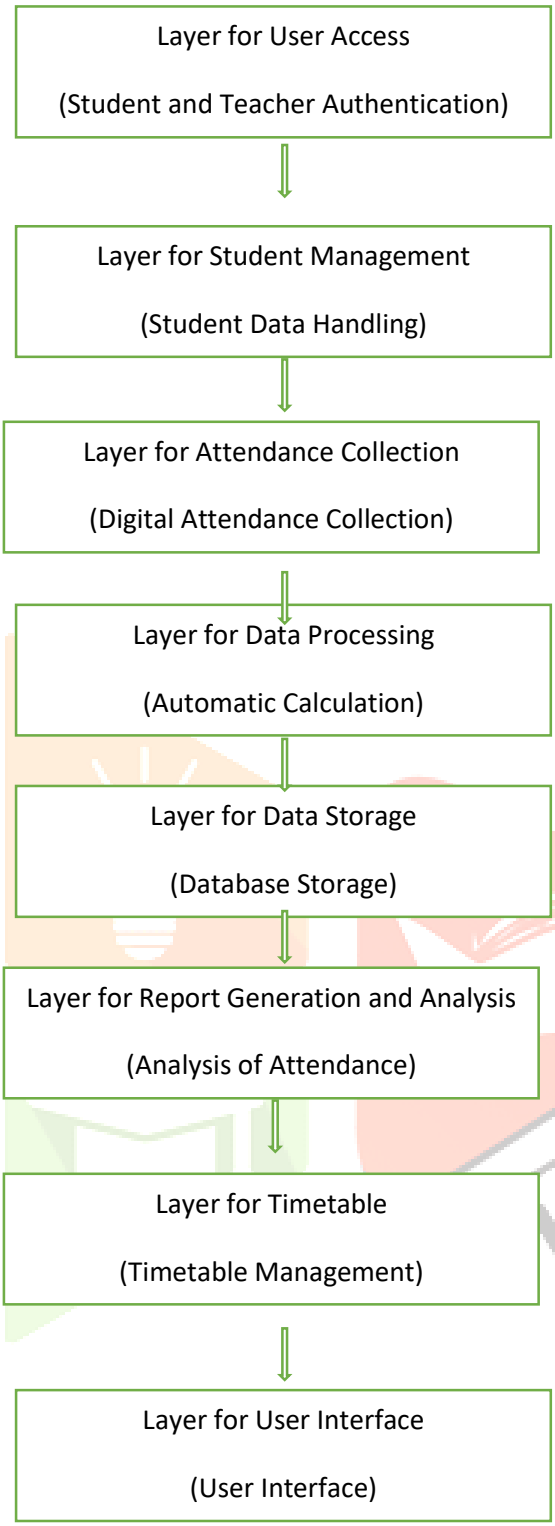

Fig. 2 System Architecture

The system, as shown in Fig. 2, starts with user authentication then student data management and attendance recording. This data is then processed and analysed and is stored in the database and is presented to the users via the interface.

2.3Proposed System: Major contributions.

The proposed system is a big improvement on the traditional methods since it implements the concept of IoT in a web-based attendance tracking system. This solution will digitalise the whole attendance workflow,

unlike traditional systems that rely on paper registers and manual entry causing a faster, more reliable, and efficient process.

One of the most useful features of the system is the automated data processing option, which will transform the attendance data into organized digital files and allow real-time monitoring to be conducted. This feature gives both students and faculty the power to get the latest attendance data when they need it.

2.4 The Proposed System has the following Advantages

- The system is economical, and paper work is not needed.
- It minimizes mistakes made when recording attendance and calculations.
- The system is time saving to teachers and staff.
- Real-time attendance information can be accessed by both teachers and students.
- Easy to use due to a user-friendly interface.
- The system can be used to mark attendance automatically.
- The system makes it easy and centralised to store data.
- Scalable system..

3.Experimental Setup

The experimental setup was designed to be straightforward and practically oriented, aligned with the realistic operational needs of academic institutions without requiring complex infrastructure. The primary objective was to develop and validate a system capable of accurate attendance management, reliable data handling, and appropriate information access for relevant stakeholders. The system was built as a web-based application and evaluated using a simulated student dataset.

For the purpose of testing, a representative set of student records was generated and loaded into the system's database. Both the faculty and student login modules were tested according to their respective role-based access rights. Attendance was recorded through the faculty dashboard over a defined period, with all data entry and update tasks carried out in a controlled and structured manner to minimise errors.

Once attendance data was entered, all processing operations — including percentage computation, date-based sorting, and data aggregation — were executed automatically by the system. This ensured that all users consistently had access to current and accurate information.

The application was developed using widely adopted web technologies, including HTML, CSS, JavaScript, Python, and PHP. The system was designed to operate on standard hardware configurations, requiring as little as 4 GB of RAM, making it accessible and cost-effective for institutions with limited resources.

System outputs were delivered through role-specific dashboards that presented key information including attendance records, computed percentages, and class schedules in an accessible format. Experimental results confirmed that the system is efficient, practical, and readily deployable within real classroom settings

4. Results

The results of using an IoT-Based Classroom Attendance and Performance Management System prove that implementing the principles of IoT to an online educational system provides an efficient and viable solution to the problem of attendance and record keeping in students. Unlike the previous traditional method which

required the use of physical registers, paper timetables and hand written reports, the proposed system is entirely digital in terms of the attendance tracking and monitoring of academic performance.

The following section gives a detailed discussion of the findings of each system element including the performance of modules, the results of attendance tracking, the results of the dashboard, the ability to access the timetable, the process of logging in and the analysis of graphical reports.

4.1 Input Data Description and Preparation

The input data of the system is academic and attendance data of students which is gathered via the faculty dashboard and is stored in the database of the system to be processed and reported.

Based on the records of a simulated classroom setup, the system was created and tested. The data used as an input consisted of the following categories:

- Student records
- Faculty records
- Attendance records
- Timetable records
- Record of attendance in classes daily.
- Attendance rate calculations

Table 1: Input Data Distribution Table

Type of Data	Number of records	Percentage
Student Records	120	40%
Attendance Records	96	32%
Faculty	24	8%
Timetable Entries	30	10%
Daily Reports	30	10%
Total	300	100%

Table 1 shows the input data that was distributed in the development of the proposed system. There were 300 records used that included: 120 records of students, 96 attendance records, 24 faculty records, 30 timetable entries, 30 daily attendance reports.

4.2 User Interface and Dashboard Outputs

This system has been launched successfully as an online digital dashboard with different interfaces to faculty and students. The design places emphasis on the usability and accessibility, which means that both categories of users would be able to go around the site with ease to administer classroom academics.

The digital dashboard has major interface modules that include the following:

- Faculty login
- Student login
- Timetable access
- Attendance marking
- Display percentage of attendance.
- Daily attendance (present/absent)
- Attendance submission
- Student portal

The dashboard outputs indicate how the system has been successful in assisting with the running of the attendance and academic activities. The interface allows users to easily deal with attendance information and timetable. The products and services produced confirm that the modules have been properly integrated and the transition between portal access, submission of attendance, viewing of the timetable and the student portal is smooth.

4.3 Performance in Attendance Recording

One of the basic functions of the proposed system is attendance management. Upon logging in, faculty members will be able to access the attendance portal, input the details about attendance every day, and submit the records. This data is captured by the system and it is stored in the database and the new values are immediately reflected on the dashboard.

Table 2: Performance in Attendance Recording

Constraints	Traditional Method	Suggested
Attendance Entry Time	**12-15 min**	**2-4 min**
Error Probability	**High**	**Low**
Record Accessibility	**Limited**	**Instant**
Attendance Update	**Delayed**	**Real-Time**
Daily Monitoring	**Difficult**	**Easy**

The information provided in the table clearly shows that the offered system is more efficient than the traditional manual one in all the parameters measured. It also saves a lot of time taken in recording and updating attendance and the digital recording is always reliable and effective compared to the traditional manual means.

4.4 Results of the Calculations of Attendance Percentage

The system automatically determines the percentage of attendance of each student according to the percentage of classes attended to total number of classes that are being conducted. This automation removes the possibility of manual calculation and the possibility of error in calculations is greatly minimized.

Table 3: Attendance Percentage Calculation Examples

Student ID	Total Classes	Attended Classes	Attendance Percentage
S101	30	28	93.33%
S102	30	25	83.33%
S103	30	21	70.00%
S104	30	18	60.00%
S105	30	29	96.67%

Table 3 shows that the system will automatically calculate the percentages of attendance of individual students. The feature ensures that it is easy to locate students with low attendance without necessarily going through them manually. The computations are done in real time and accurately and this is beneficial to both students and faculty members to keep track of academic involvement.

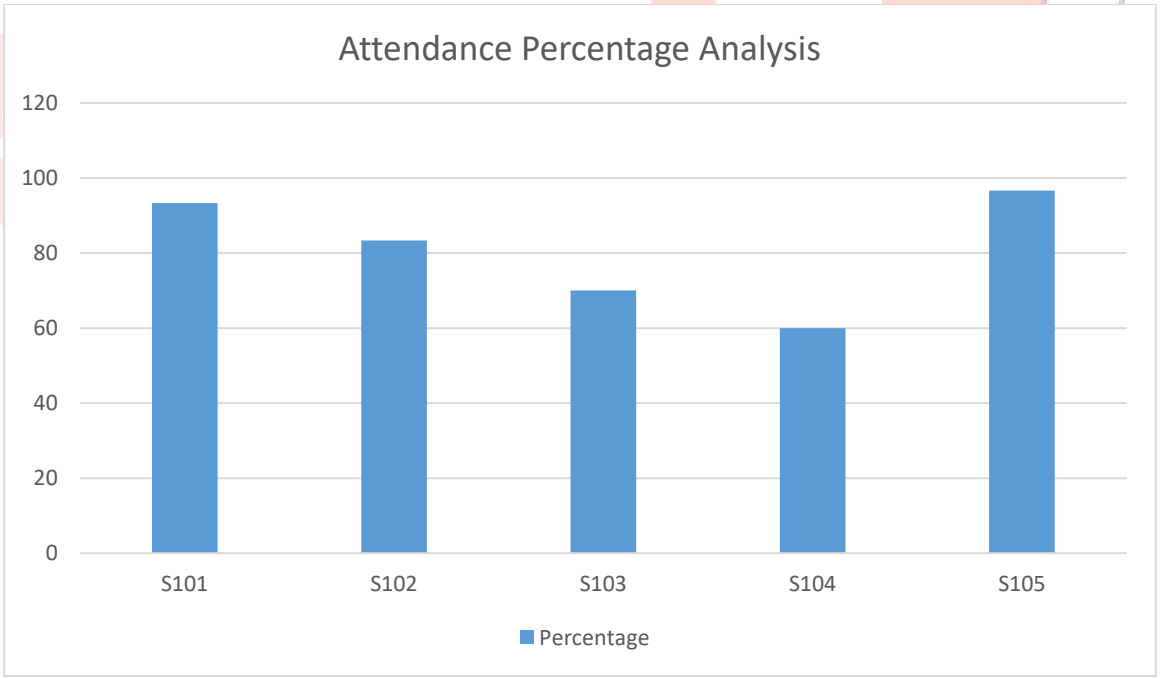

Fig. 3: Attendance Percentage Analysis

4.5 Low Results of attendance detection

Among the remarkable results of the offered system is that it would automatically identify students who have inadequate attendance. Students who will not reach the required level are marked by the system and the faculty is able to start timely and adequate academic intervention.

Table 4: Low Attendance Detection

Student ID	Attendance Percentage	Status
S101	93.33%	Safe
S102	83.33%	Safe
S103	70.00%	Warning
S104	60.00%	Critical
S105	96.67%	Safe

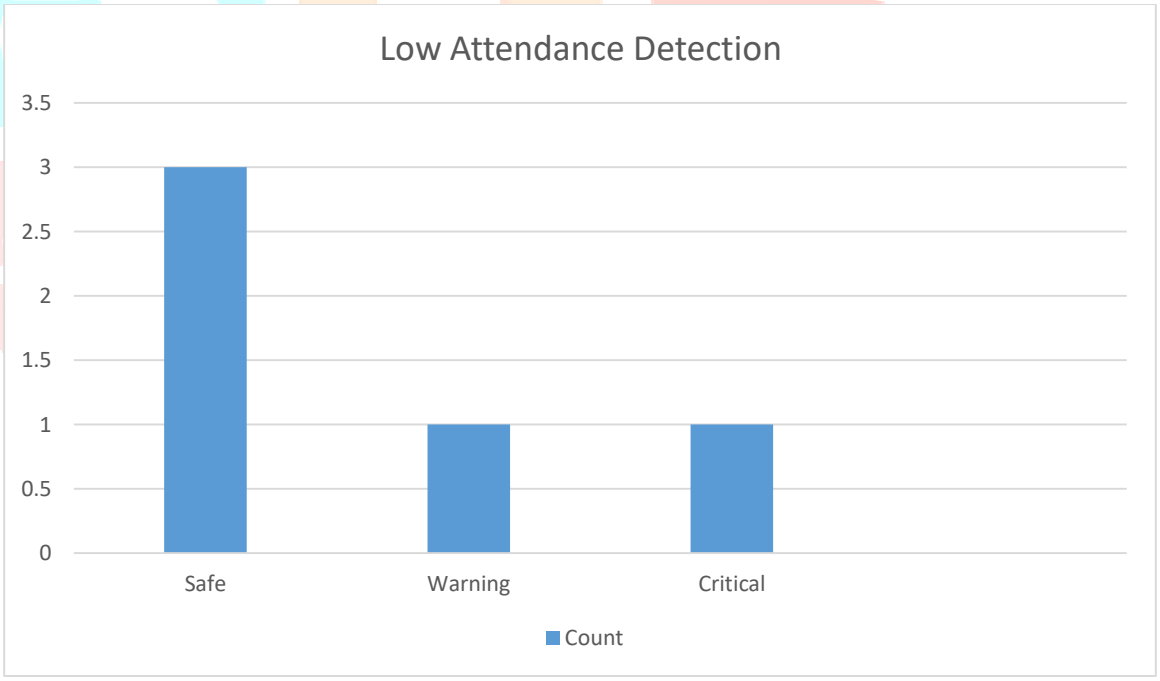

Fig.4 Low Attendance detection

4.6 Tracking of Students' Attendance per Day

The system assists faculty members to be aware of the number of students that attended on any given day and the number of students that did not attend on any given day. The day-by-day-tracking will simplify the overall attendance-tracking process, and provide an informative outlook on how students attend over time.

Table 5: Observation of Classroom Attendance Per Day

Day	Total No of Students	Present	Absent
Day 1	30	28	2
Day 2	30	27	3
Day 3	30	26	4
Day 4	30	29	1
Day 5	30	25	5
Day 6	30	27	3
Day 7	30	28	2

Table 5 presents day-by-day analysis of student attendance over a sample week, and one can observe that there are some natural variations in day-to-day attendance. This tracking option in granular form comes in handy in the identification of the attendance patterns and in identifying the patterns of student engagement.

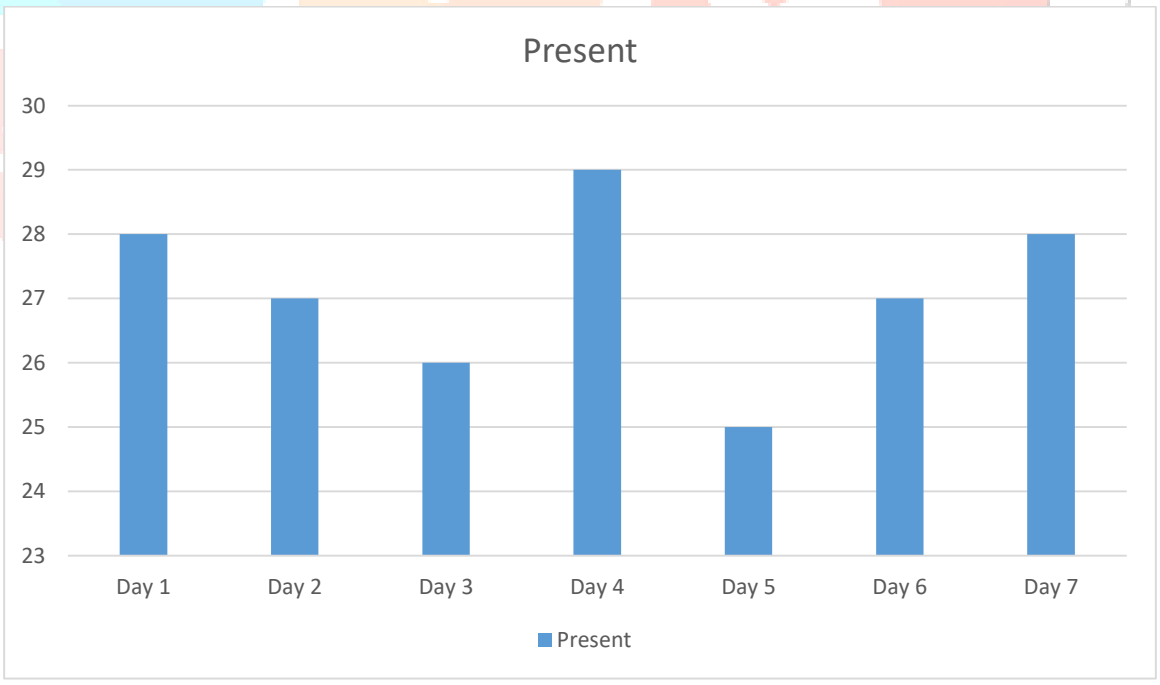

Fig. 5: Daily Attendance Trend

4.7 Outcomes of Timetable Module

The timetable module is incorporated into the dashboard of the faculty and students and avails online access to lecture times, subject schedules, and schooling periods. It will help eliminate the need to have printed schedules and ensure that the data concerning schedules is always updated and current.

Table 6: Analysis of Timetable Module

Feature	Availability
Faculty Timetable	Yes
Student Timetable	Yes
Subject-wise Schedule	Yes
Day-wise Schedule	Yes
Online Access	Yes

Table 6 affirms that the timetable module works well in the system. The web interface will enable the faculty and students to access well structured and up-to-date schedules without the need to use hardcopy schedule documents and improve the overall convenience of scheduling.

4.8 Graphical Report Results

System generates graphical reports that allow the faculty members to enjoy a visualised intuitive view of the attendance pattern. The visual representations help to interpret the data easier and make informed and evidence-based decisions.

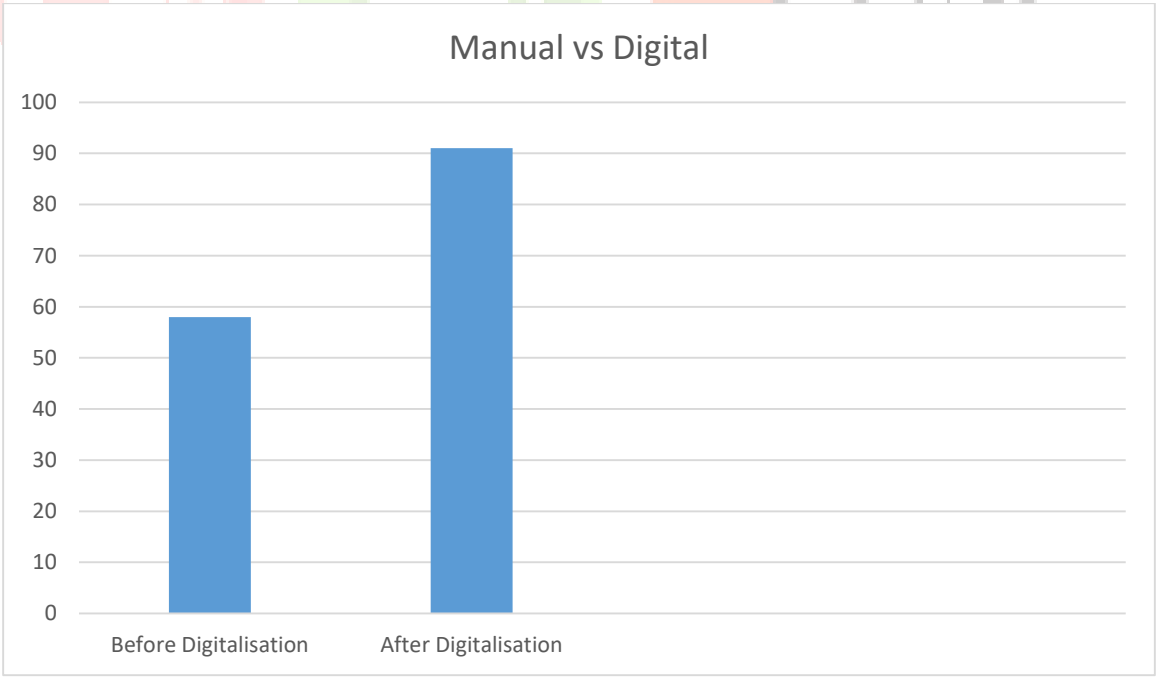

Fig. 6: Comparison of Efficiency in the Manual System to That of the Digital System

Pre-Digitalisation = 58 After Digitalisation = 91

As the figure shows, the transition towards the digital attendance management causes a major improvement in the efficiency of the operations. The statistics corroborate the fact that the digital system is considerably quicker, more precise, and more effective in general than the manual processes.

4.9 Faculty and Student Portal Access Results

Role based access control will be utilized in the system whereby faculty and students will be allowed to access the platform depending on their allocated permissions. The administrative and management service is found in the faculty portal, and the student portal is devoted to the personal academic monitoring and viewing of records.

Table 7: Portal Access Functions Module

Module	Faculty Access	Student Acess
Mark Attendance	Yes	No
View Attendance %	Yes	Yes
Check Daily Status	Yes	Yes
Timetable	Yes	Yes
Add Student Data	Yes	No
View Student Records	Yes	Yes

4.10 Comparison with Existing System

Table 8: System Comparison

Parameter	Existing Manual Method	Proposed
Attendance	Register based	Digital
Time Required	High	Low
Error Rate	High	Low
Timetable Access	Offline	Online
Attendance Percentage	Manual	Automatic
Daily Present/Absent check	Difficult	Easy
Report Generation	Manual	Automated
Accessibility	Limited	Real Time

The comparison between the manual system of the traditional approach and the proposed smart classroom is made in Table 8. The results are obvious, with the proposed system signaling improved performance across all of the measured parameters with automation and digitisation being the catalysts of quantifiably elevated efficiency.

4.11 Ablation Experiment

A series of ablation experiments were done to establish the contribution of each individual module to the system as a whole. The concept of every experiment was to selectively disable some of the components and measure the next impact on the performance and efficiency of the system.

Table 9: Ablation Study Results

Condition	System Efficiency
With all modules	94.20
Without a real-time update	86.45
Without the attendance percentage calculation	84.10
Without login modules	80.72
Without timetable modules	88.31
Without report Visualisation	85.66

Table 9 confirms that the system can only work best when all the modules are turned on. The omission of certain aspects such as real-time updates or the log-in module or the percentage calculation option adds to the radical decrease in the system efficiency. These results confirm that all the offered modules are crucial to the effectiveness and thoroughness of the system.

4.12 Overall Result of the Research Project

Based on the analysis above we can say the following:

- Good attendance of students and grades data.
- Student and professor log in the application.
- Automatic computation of the rate of attendance per student.
- Students who have poor attendance can be identified with the help of the application.
- Professors are able to access daily attendance data.
- Information on timetable is available to students and professors.

These results indicate that digital automation is an important factor in enhancing classroom management and academic administration. Activities like keeping attendance records, schedules and assessment of performance are basic in educational organization but are often done inefficiently using manual tools. Digital automation assists in addressing these inefficiencies and consequently enables such routine tasks to be executed at a quicker and more accurate manner. Markedly, the results also suggest that an effective educational management system does not necessarily rely on any sophisticated and expensive technologies.

4.13 Screenshots

Faculty Dashboard: It is the Smart Classroom Monitoring Dashboard of the proposed system as shown in Fig. 7 below. The dashboard illustrates the key functional features Portal Access, Faculty login, Timetable, Mark attendance and Student Portal in a well-organized interface. A message of welcome is sent to confirm that the faculty user has logged in well and interacts with the system.

Faculty Dashboard:

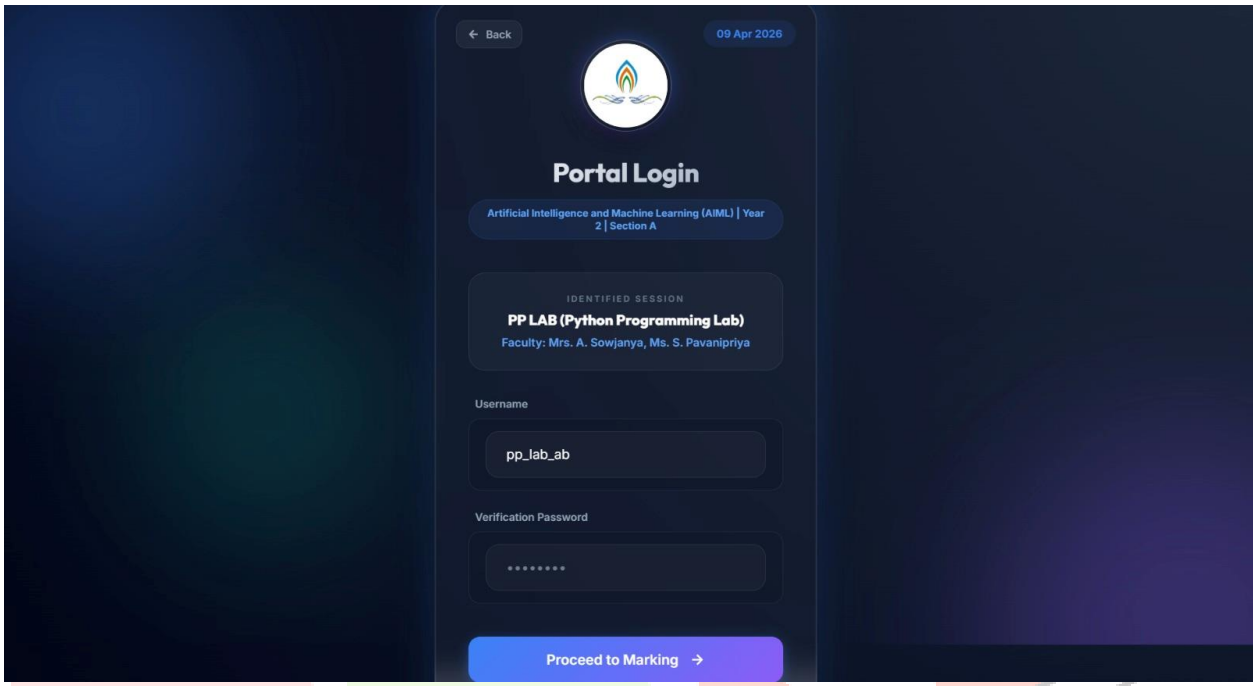

Fig. 7: Smart Classroom Monitoring Dashboard

Submittance of Attendance Results of Submittance:

Attendance Submission Results: Fig. 8 shows the confirmation screen which will appear after a successful submission of an attendance. The output will confirm that the data that the faculty member has typed in the system is saved in the right place by the system and therefore the attendance management module can be trusted in regard to its acceptance of submission and real time up-to-date software..

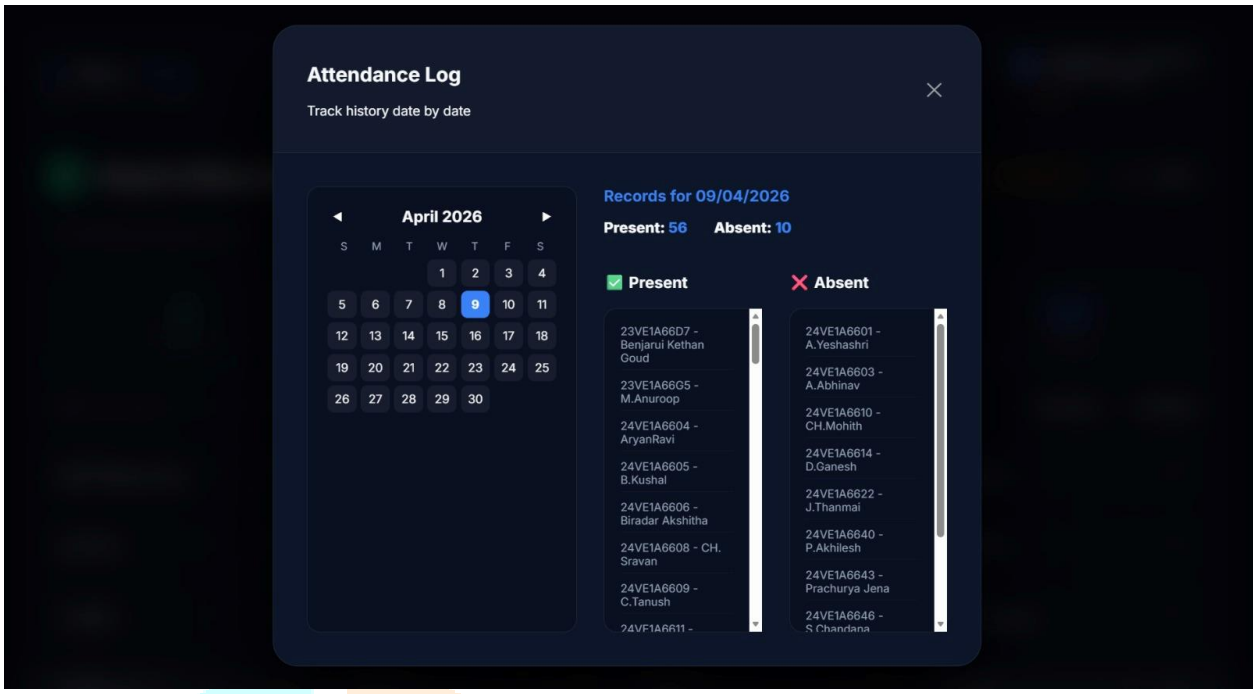

Figure 8: Output for Attendance Submittance

Access to Faculty Timetables:

Facility Timetable access: Fig. 9 will indicate the faculty timetable access module in the system. This interface enables faculty members to have a convenient access to their teaching schedules and time of the academic sessions and this will assist them in planning and managing their time.

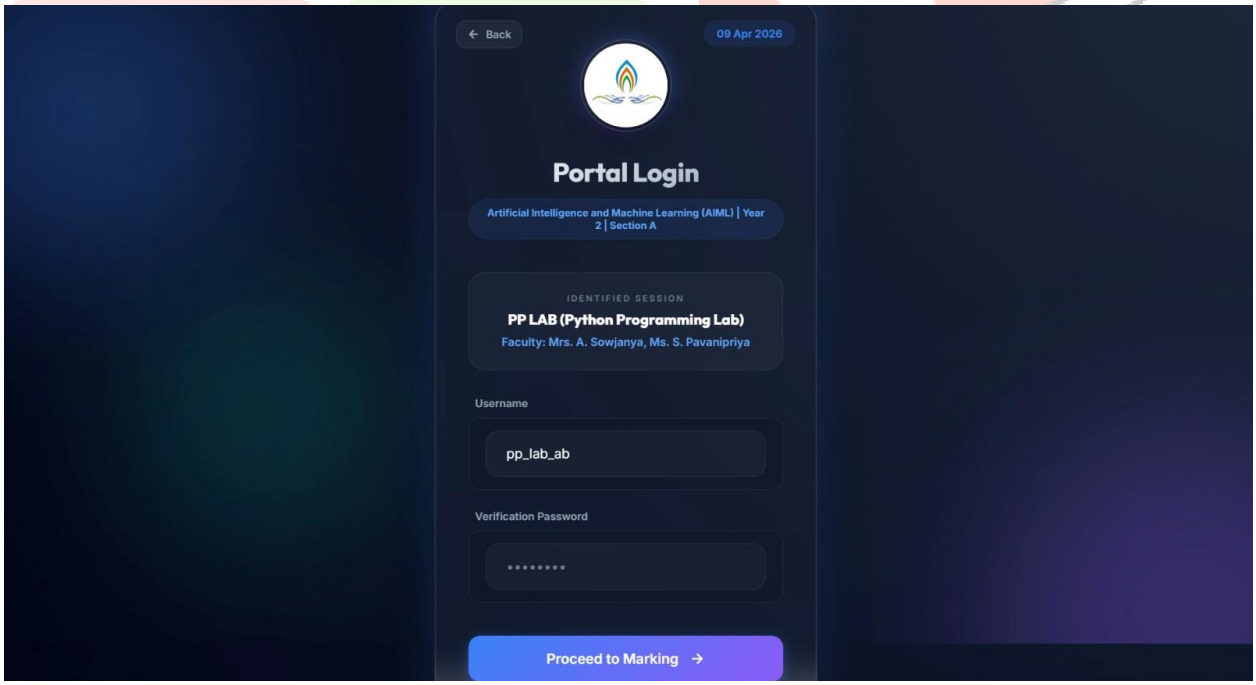

Fig. 9: Faculty Timetable Interface

Output of the Student Portal:

Student Portal output: Fig. 10 depicts the interface of the student portal, which allows a student to log in and view his/her academic data. The portal will provide an access to the attendance percentages, class schedule and semester by semester attendance records with just a single click.

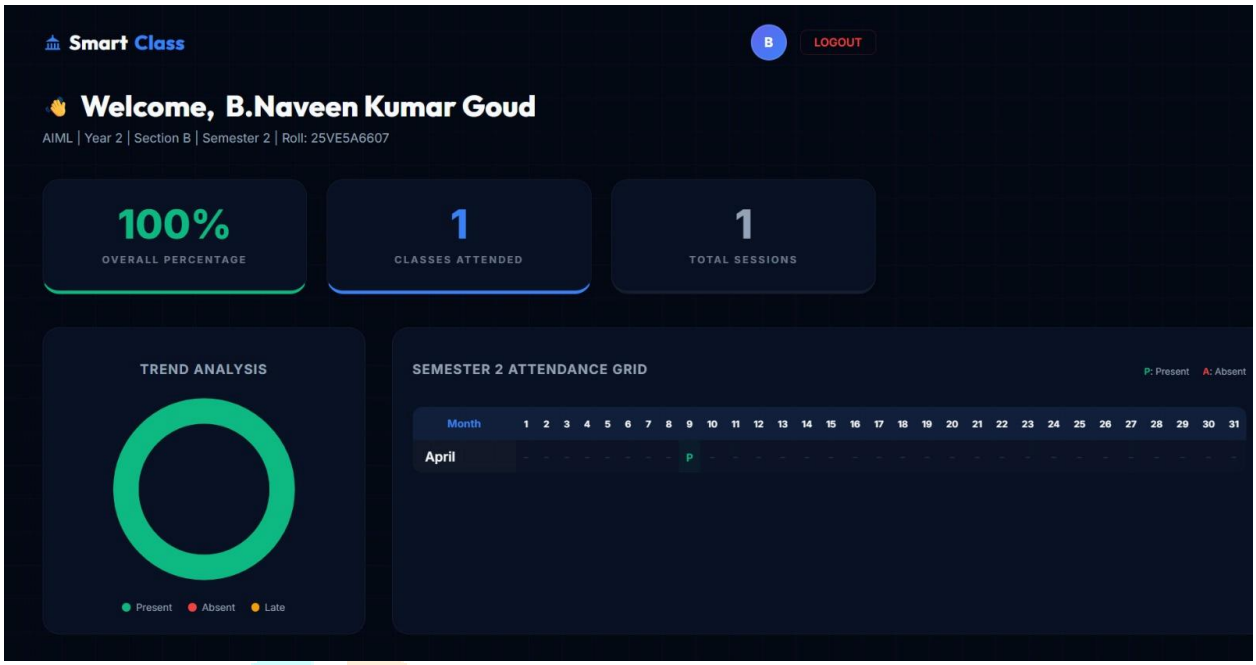

Fig. 10: Screen of Student Portal

Results of Attendance Monitoring:

Output of Attendance Monitoring: The figure below illustrates the output of the process of attendance monitoring where the attendance data is processed and presented in the system. It is also an indicator of the attendance trends which are observed during the monitored period..

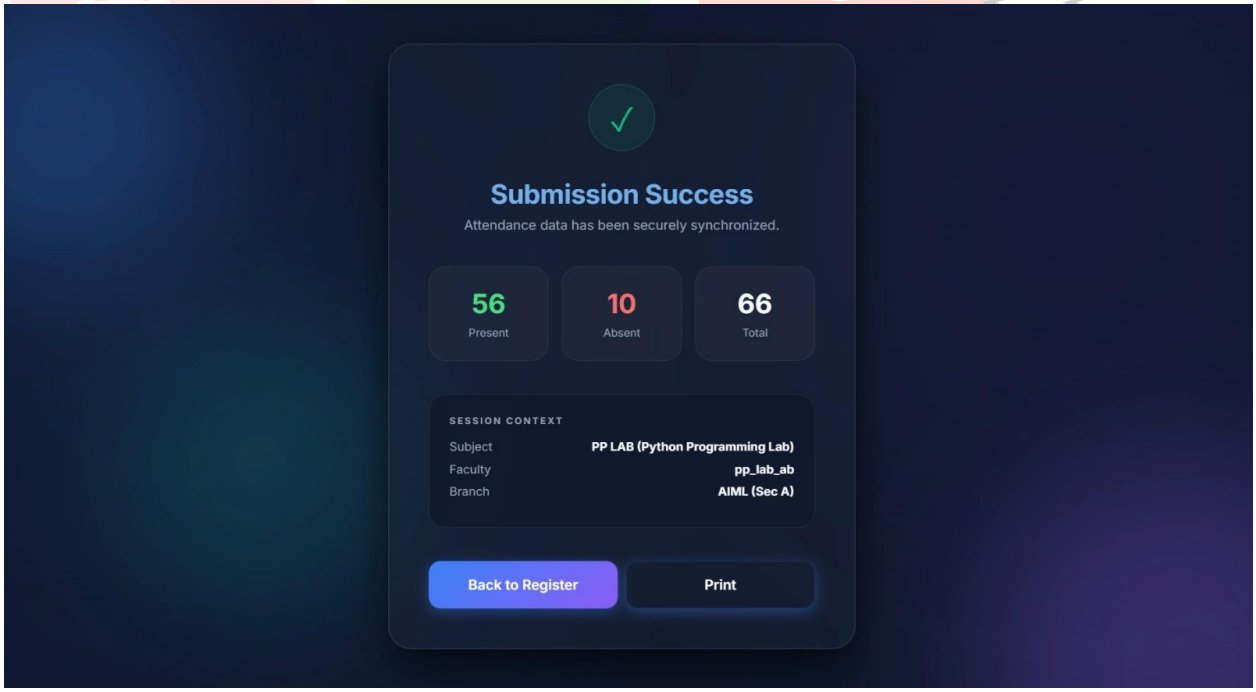

Fig. 11: Results of Attendance Monitoring

5. Applications/Discussion/Abolition Study

5.1 Applications

The suggested IoT-Based Classroom Attendance Management System has vast application in any learning institution where the previous system of tracking attendance is not feasible, efficient, or prone to errors.

The system can be deployed in schools, colleges and universities as cost effective in the management of attendance records. Digitally recorded information on attendance improves access and eliminates the use of hardcopy registers, which results in improved and more reliable management of educational records.

In addition, the system can add significant value to the learning process because it will provide more communication and openness between the learners and the lecturers. The students are able to keep track of their attendance status on their own and stay conscious of their attendance responsibilities, which helps them be more accountable.

Moreover, the efficient character of the system in managing large volumes of information involving students is another solution to one of the biggest problems of manual data management that require a considerable amount of time to process large records and that is also likely to create errors.

5.2 Discussion

The results of this study clearly show that the Classroom Attendance Management System, an IoT-based system, is quite successful in managing the attendance of students in the classroom. The system not only registers attendance but also computes the percentages of attendance and the bad attendants are automatically determined by the system. The fact that it has real-time data collection capability will minimize human error that is involved in the manual process.

The best advantage of the IoT-based system is that it will aid in automating the process of managing the attendance process fully. In contrast to the manual way of recording data, the system handles and archives data in real time and helps in saving precious time that could be used by faculty and decreases the administrative pressure involved in the process of tracking attendance.

5.3 Ablation Study

A series of experiments was done to evaluate the contribution level of each component of the system to the overall performance. The experiment was conducted through the systematic alteration or removal of some parts and observing the alterations in system behaviour and efficiency.

Missing Data Preprocessing When data preprocessing steps, such as data cleaning, data normalisation and percentages, are removed in the pipeline:

Lower accuracy rate

Incorrectly created attendance reports

The reports do not go together.

Lack of Internet of Things and Automated Logging (Manual Entry Only) Incident In case the automated logging has been replaced by the manual data entry in its entirety:

Poor system performance

Increased chances of error

The tracking cannot be done in real-time.

The ablation experiment attests to the fact that the accuracy of the system is reliant on the interdependence of all the main components. Specifically, the system must incorporate data preprocessing, recordings that are performed with the help of the IoT, data collection during several days, and feature-based pattern recognition, among others, to be most effective.

6. Conclusion

The IoT-Based Classroom Attendance and Performance Management System is effective in addressing the basic disadvantages of the manual attendance management system, namely, that it is susceptible to human error, is not cost-effective, and does not offer much data access. These difficulties are overcome by changing to an electronic approach. The centralised information storage, real-time data updating, and wide system accessibility are the key IoT principles that enable the platform to suit the needs of the contemporary educational setting.

It is created practically and the faculty and students are presented with different interfaces to the system to access it in a role appropriate way. The faculty members are provided with the tools to handle the information about students, mark their attendance on a daily basis, their academic achievements and view schedules. Students, in turn, will be able to look at their attendance percentage and attendance history, performance statistics, and schedules in the student portal.

The automated features of the system such as percentage of attendance calculation, low attendance identification and generation of reports provide users with the required data-driven insights to take the right and timely decisions. The system assists in streamlining the running of institutions of learning since there is no need to have to go through the tedious paper work and manual record keeping.

In conclusion, the proposed system demonstrates the potential of the IoT-based technology to be used in the management of a classroom in the way that can be practical, efficient, and effective. It promotes the objective of digitalisation of education and helps to attain Quality Education (SDG 4). To continue to the

future, the system might be extended with biometric attendance-detection, facial-recognition, and mobile application support, as well as predictive analytics, to offer an even more efficient and intelligent system.

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