Cloud Based Smart Virtual Interactive Environment for Work in Universities Using IOT

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Abstract*: *In this digital era education sector is accomplishing IOT based technologies. This paper represents the study of various methods of smart learning and better understanding of students in smart classrooms and their implications. In this paper the initial development of the SVIEW is to be introduced and discussed. Our focus is towards providing a solution which could help in enhancing learning process and reducing overhead of students and faculties in a smarter way. This paper also presents the certain systems that may be integrated in an university field

Index Terms*: *IOT; smart classroom; smart campus; e-learning; education; smart device; smart phones; pedagogy; Information Technology;

I. INTRODUCTION

With the various inventions using technologies like IOT, cloud and other buzz ones, classrooms and learning environments are changing in the 21st century. Physical and virtual classrooms-learning environment plays very important role in Faculty-Student life and in turn society as smart student will lead to smart citizens and which in turn will be the pillars for building strong nation.

Various technological developments are aiming at overcoming certain limitations in classroom and to develop good interface for main agents of physical as well as virtual learning world namely as student and faculty. These technologies aims at improving learning experience in classroom for school life as well as higher studies in universities [24][25][26][23][20]. Various developments have been studied for controlling hardware devices in classrooms for students increased participation and enhanced learning [11][29][30][31][32][16].

IOT creates a world where all objects, are called smart objects, and these smart objects are connected to the internet and then communicated [12]. Smart technology for connecting things [2][8][3] will be used for health monitoring of students and faculties in class as they are surrounded in radiations emitted by various smart devices. Although these radiations are not harmful up to much extent but our aim is to provide better learning, increased understanding, increased participation but keeping health in consideration. Initially IOT was used for smart city development [5][6][7] but now the raised need of connecting various computing devices in classrooms specially at university level , smart classrooms have adopted this technology.

Some named smart classrooms [18], some as intelligent classrooms [28] but we can say it as smart learning environment. [28] Focussed on how to benefit students in school life while focussed mainly on data sharing between students, teachers and authorities responsible for learning process.[13] discussed how to teach one particular topic in class but it is not feasible for all topics of all subjects.

In [27] hover et al. Discussed measures for student's attentiveness in class and gave solution architecture which supported lectures to recognize a decline of student's attentiveness.

Our work aimed at proving following features in classroom:

1. Simple interface
2. Better understanding of student
3. Increased learning of student and faculties.
4. Increased student participation
5. Increased student motivation
6. Improved attention in class
7. Improved concentration in class
8. Immediate assessment
9. Data sharing
10. Controlling electronic devices
11. Monitoring faculties

This paper is organized like follow: the next section present the survey, the next section i.e. section 3 presents the future work. Section four presents mathematical model and section five presents algorithm analysis. Finally, we present some conclusions.

II. SURVEY

Conducting surveys is an unbiased approach to decision –making. We can collect unbiased survey data and develop sensible decision based on analyzed results. Next we decided to conduct both offline and online surveys. First we completed offline survey for field research and for face to face consumer interaction in various educational institutes in India in various cities like Hyderabad, Pune, Faridabad, Delhi. Then we started online survey or web-based as we were unable to intercept and connect with consumers in IT Industry.

Survey contained general questions like Name, age, DOB, address, contact number, mail id, gender, highest qualification, disciplines majoring in etc. There were other related questions such as:

1. Educational Goals
2. Class Learning

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3. Problems affecting educational system and changes needed
4. Technologies experienced in classified
5. Class experience using any class management tools
6. Benefits of using information technology in class

Then we started online survey or web-based as we were unable to intercept and connect with consumers in IT Industry. In total we got 119 responses of online survey. With the help of this survey we got to know that in India still more than 70% educational institutes are not using course management system [fig 1] and even if the online features are used in class, a large number of students and faculties do not use them for syllabus, learning, discussion, access to quizzes and other related activities [fig 2].

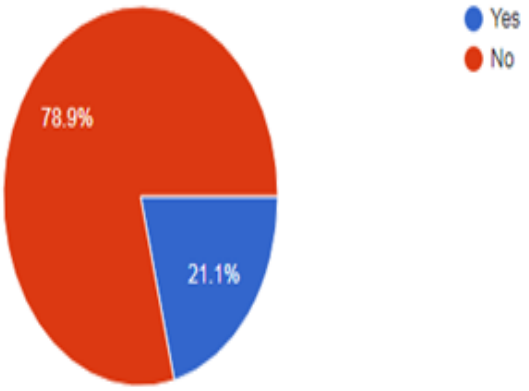

Fig. 1 Course management Report

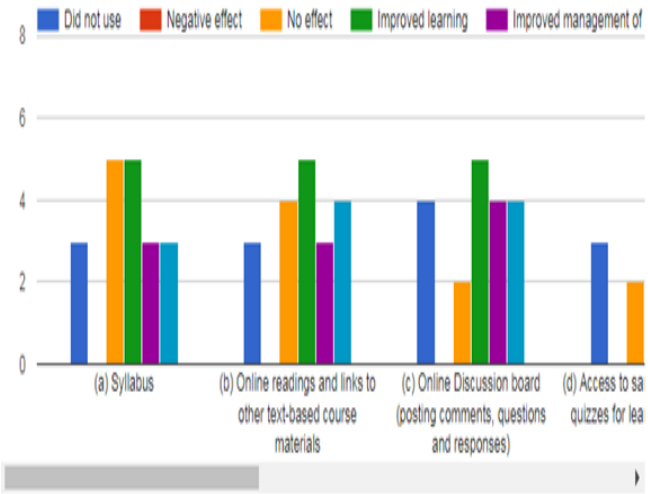

Fig. 2 Online Features usage experience in class

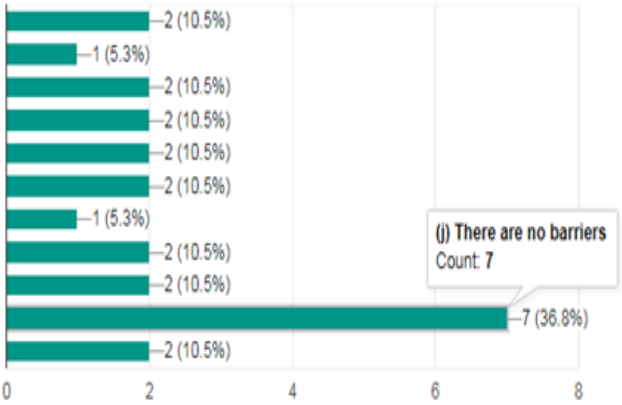

Fig. 3 Barriers using IT in class

Fig 3 shows that more than 60% consumers faced problems using IT in their daily classwork. The problems they faced were not limited to trouble connecting to internet, feels extra work, don't have sufficient skill to use computer or IT, expensive.

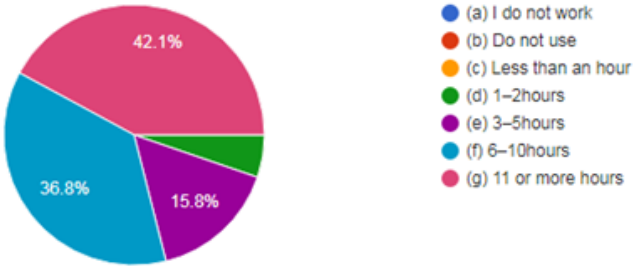

Fig. 4 Number of Hours each week spend on working electronic devices

Although maximum consumers as per the chart ratio in fig 4 are using electronic devices more than 11 hours, they face problem in using IT in classes. This can be result of either poor interfaces of the devices being used for smart classroom, the lack of training or they don't know much about the technologies being developed. If consumers see latest innovations around them in their working environment they would get motivated to use them and which in turn will increase their learning.

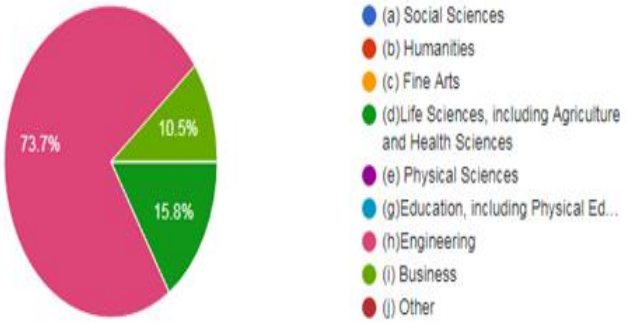

Fig. 5 Discipline of majoring

Authors were literally shocked to know that even though more than 73% consumers are from Engineering discipline still they are not comfortable in using information technology or computers in their working environment. This was the main reason behind our proposed model named as SVIEW which not only provided very simple and efficient interface to use the IT and related technologies but mainly focussed on improving learning of consumers.

III. PROPOSED WORK

We are developing SVIEW (Smart Virtual Interactive Environment for Work)

Smart: Having quick-witted intelligence

Virtual: not physically existing as such but made by software to appear to do so

Interactive: allowing a two-way flow of information between a computer and a computer-user; responding to a user's input

Environment: combination of hardware and software in a computer

Internet of things can be seen as the building blocks for the SVIEW. In this section, we will view some of the utilities that can be implemented in a SVIEW. These services aim at increasing productivity in a working environment of SRM University, better learning of students, saving electricity, saving a lot of time and make life easy for all those people(students/staff/management) present at the University. These services are:

1. Smart-class room approach: When faculty finish the lecture they will upload some question about the topic covered in the lecture and students have to answer them .This will help the faculty to view the no of students understand the topic covered in the lecture. Faculty will also upload lecture data which can be accessed by students using this application. This makes the education system smart.

2. Smart Biometric for Classrooms: Electrical appliances in a classroom/laboratory are being left on and there are many classrooms in a campus. Generally maximum consumption of electricity in a campus is in classrooms and laboratories. So, we will build smart biometric systems that will work on sensors and will not only reduce electricity wastage but will also be used as an Faculty monitoring in classroom and laboratories , Class monitoring . When teacher enter classroom thy will scan the fingerprint in the biometric system and once the fingerprint is validated the electrical appliances will get turned on .We will also give an limited authority to a student (class representative) per class just in case faculty come late in class due to some unavoidable reason, that particular student can turn on lights and fans . With this message will also go to class teacher regarding classroom without any faculty.

3. Smart Garbage Management System: A campus generates a lot of waste that should be handled properly at regular intervals so that a campus can be clean and hygienic. For waste management system the person who is a part of university will capture the photo and upload to a system. The authority person who has a login from web application will solve the issue.

4. Parking Management: This work is also providing service of parking system .The pre booking system is being used for this utility. The students or faculty can check and book the parking slot for their vehicle parking. Various existing system were studied [1] [9] [10]. In future we will implement this module.

5. General complaints: To maintain an environment in the University the user can raise a complaint to authority about any issues regarding canteen, or other management imbalance.

Fig. 6 shows the system architecture of SVIEW where we present the system. Our system uses two technologies one is Android Application for general user of University and web application for authority. The system will maintain the data base. When faculty or any person as a part of university raise any complaint or have any issue they will register the complaint in the system the system will forward the issue to authority person who is log in at our web application. For Parking Management the system maintains the vehicle pool where user can book the parking slot in the system and check the available space for parking. When teacher scans the fingerprint on bio metric machine the all-electric appliances gets turned on. This helps to save electricity and makes University smarter. As we are also implementing the smart learning for better understanding of student concept where after completing the lecture the teacher will upload the question paper and students have to solve it.

This helps the teacher to get to know that how much the students understand the topic being covered in that particular lecture.

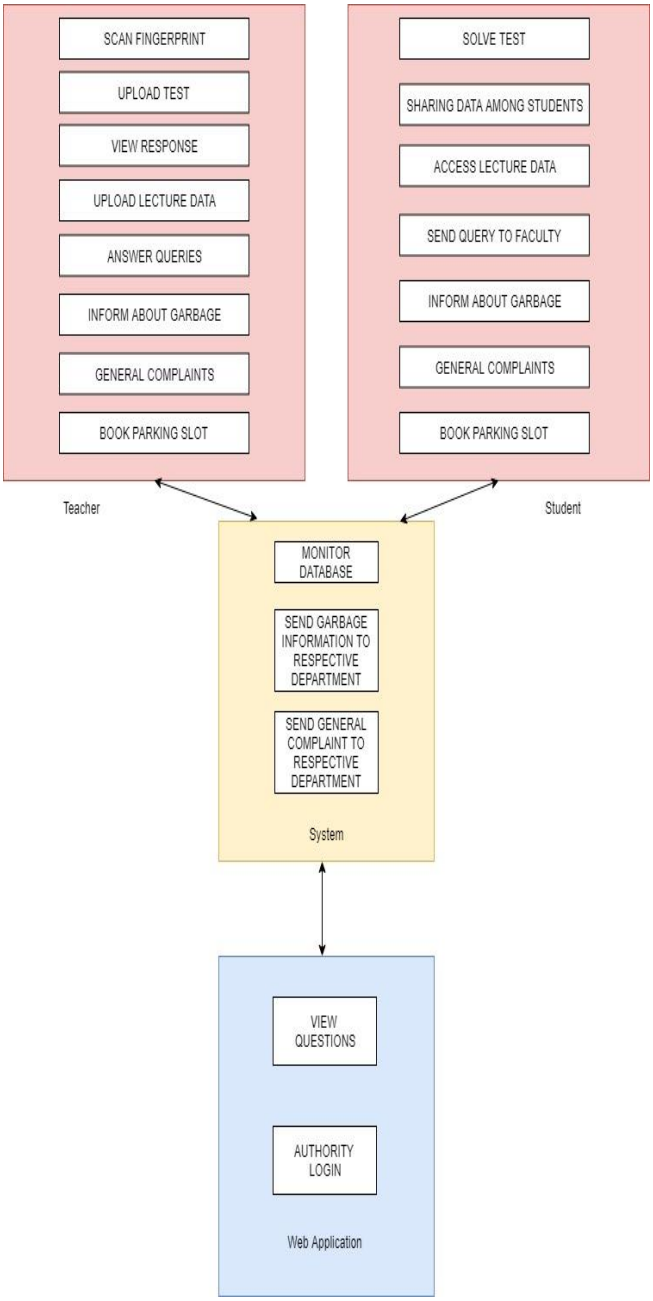

Fig. 6 System Architecture

System Overview: Proposed system architecture as of now consists of four agents: Teacher (Faculty), Student, System, Web application. Teacher's fingerprint is used to control electrical appliances of classroom. Limited access of fans and lights is given to class student coordinator so that in case if any faculty comes late in class, class student coordinator can turn on these appliances.

Initially we have developed two main modules on which we are focusing in this paper and which cover functions of our proposed system architecture i.e.

A. Biometric Module

This module covers –Access Control: Faculty Identification and access to TURN ON/OFF electrical appliances.

Comfort: Management can monitor faculty on system as the entire report will get saved in database.

Resource Usage: it defines how device is used by a task for a every task possibility that contains the resource (using DTMF we control lights and fans of classroom)

Smart Environment: Electricity is being saved

(i) Data flow

Data flow is shown below in Fig 7 and Fig 8.

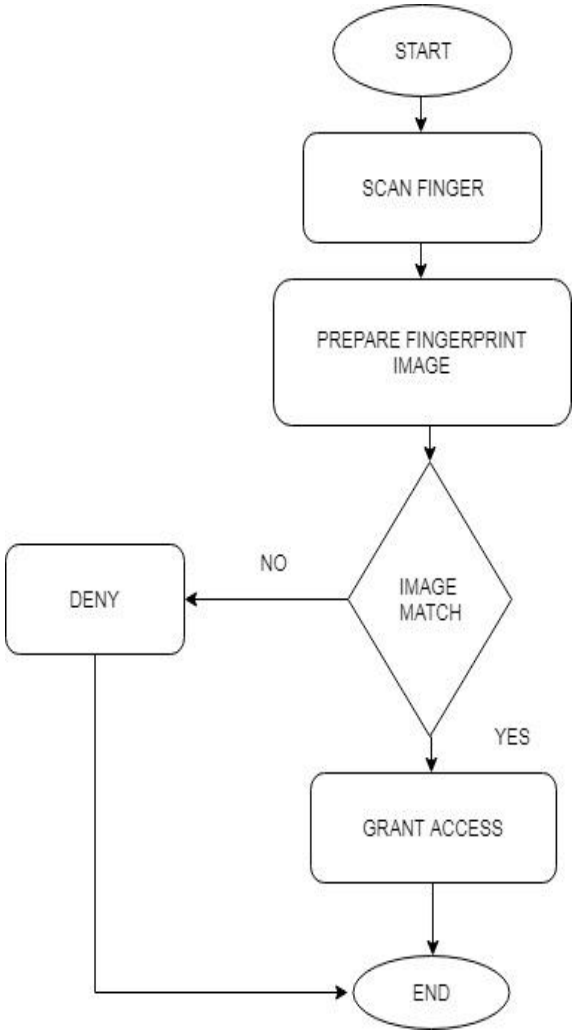

Fig. 7 DFD Level 1

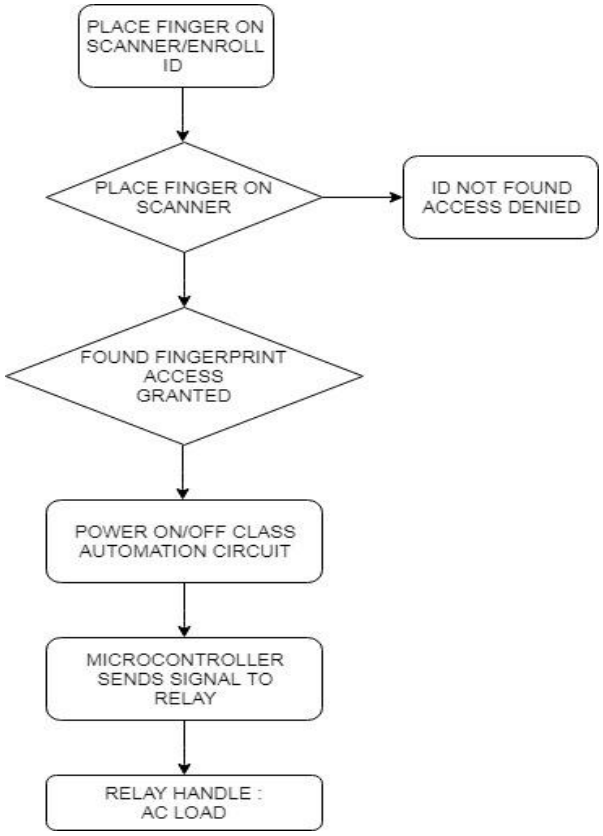

Fig. 8 Level 2 DFD

(ii) Advantages

- Class Management : Engagement of class, controlling appliances
- Faculty Monitoring: Identifies which faculty is coming late for lectures and if one leave then whether proper adjustments are being done or not.
- Efficient use of energy : save wastage of electricity resource
- Save Time

(iii) Algorithm

In Our model algorithm is designed for biometric and contains following functions

1. Authentication
2. Access to electronic devices

We are using fingerprint authentication based system as fingerprint recognition enables an easy to use, reliable and cost efficient way to authenticate an individual.

Our goals for using biometric device in our sample smart classroom are:

- Authentication : for faculty
- Track: We will be able to check which faculty goes late in lecture and also if any faculty is absent then, whether class was engaged or not? This will solve problem for monitoring faculties entering late in class and while taking unplanned/planned leaves they don't arrange their lectures.
- Alert message : If any faculty gets late more than 5 minutes ,alert message will go to management or assigned In-charged

- Save Electricity: In spite of asking students to turn off all electronic devices while leaving classroom they intentionally or unintentionally leave device ON sometimes. But with our proposed system we can manage to save electricity

Explanation: When faculty will enter class he/she will punch on biometric device. With the access all electronic devices in classroom will get TURN ON. While leaving again faculty will punch device and with this action all electronic devices in classroom will get TURN OFF. With this we are able to track and identify punctual faculties, Faculties who go late for their lectures, faculties who do not engage students for the required duration of a lecture, faculties who do not arrange their lectures while on leave. And the main advantage is that everything can be done just sitting at system. Entire data will be saved in document form using NOSQL database (Mongo dB).

Firstly using fingerprint scanner main questions raised in our mind were:

1 What is a fingerprint scanner ?
2 How does it work?
3 What is a live scan?
4 Which sensor to use?
5 What it is used for?
6 How long does it take to scan a finger?
7 How fingerprint data is stored?
8 How much is the cost?

Once we got answers for the above mentioned questions we started working on designing architecture. The automated authentication system typically performs the following operations:

• Scanning of fingerprint image – A sensor of some kind captures data from the biometric identifier used. (We are using optical sensors)

• Enrollment – The captured data is analyzed and its unique features are stored as a digital template [Fig 9]. Image quality improvement and image processing is being done at this step.

• Authentication – When the enrolled faculty wants to authenticate himself/herself, his/her biometric data is captured once again and compared against the template generated by the enrollment [Fig 10].

• Matching – (Algorithm to recognize fingerprints) an algorithm is used to compare if there is a match between the stored template or not. If there is a match the user has been authenticated, otherwise access is denied. (Minutiae based algorithms is being used for our device)[Fig11].

H/w Architecture includes optical fingerprint sensors along with network equipment like switches & adapters, pc devices etc. S/w architecture includes c and mongo dB (as of now).

Process:

1 LED's scans light onto the surface on which fingerprint is processing.
2 Image quality will vary in accordance of processing way, how clean fingers are? , cleanliness of surface, light level in the room where bio-metric device is kept.
3 Light bounces back through glass on image sensor.
4 If this process of image capturing takes time, it means bright image is formed on the sensor.
5 In too bright captured image areas of fingerprints might get washed out completely or if image is too dark, details will become invisible.
6 This algorithm tests whether an image is dark or bright. If it is so, a beep will alert the operator to go back to step 1.
7 If image is accepted temporarily another algorithm will test details and if image fails again, will go back to step 1 again and try..
8 Once image passes both the tests, image will be sent to the operator and scanner gets the signals
9 The stored image will be transmitted for further processing.
10 Normally image captured are:
- 512*512 pixels
- 2.5cm square
- 500 dots per inch
- 256 shades of gray

11 The host computer compares it against saved fingerprints to find a match.

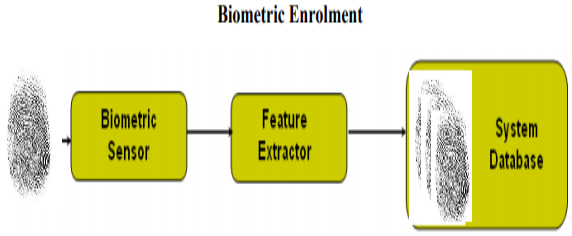

Fig. 9 Biometric Enrollment Process

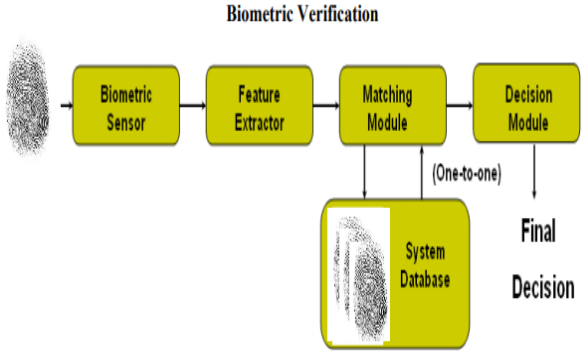

Fig. 10 Biometric Verification Process

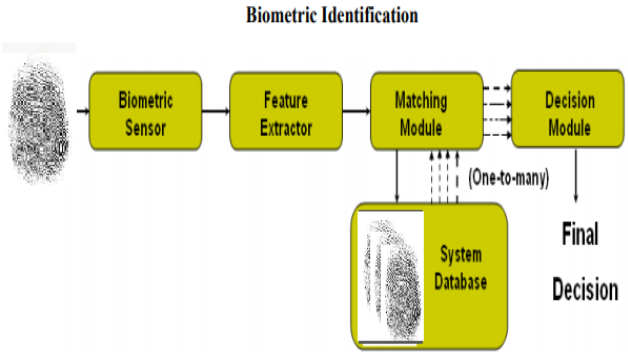

Fig. 11 Biometric Identification Process

B. IEP Module

This module covers –

Smart Learning: Students will use smart technology around themselves which will encourage them to learn more

Better Understanding: As faculty will focus on each and every student with the help of throwing questions after every lecture
Smart Environment: paper use is reduced
Surveillance: Faculty will be able to have close observation of every student

This module basically refers to Individual Education Program. Its basic architecture includes
1. Faculty
2. Student
3. Tablets
4. Cloud

Faculty will throw questions on cloud after completion of lecture to student and students will answer questions using their tablets. Once they finish, immediately result will be computed and displayed. Faculty will take required action on the basis of students result in that particular lecture only.

Concept is

"I hear and I forget.
I see and I believe.
I do and I understand. - Confucius"
Traditional teaching method was one way flow i.e.

Fig. 12 Traditional Teaching Method

An Interactive Learning Process

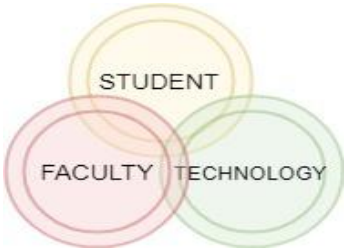

Fig. 13 Interactive Learning Process

(i) Advantages

- Focus on individual student for improvement in academic performance
- Better learning
- Better understanding
- Experiencing Technology: By using things we get to know more about them so the same concept is used here. When students see and use various technologies like cloud, smart android application, biometric systems etc. they visualize, perceive and interpret things and moreover it become enjoyable class experience.
- Instant evaluation than distant evaluation

(ii) Discussion

In this section we will describe how our IEP application facilitates learning process. The general functionalities of IEP module are listed below:
(i) Student (will be able to)
- Give Test
- Check grades
- Check attendance
- Access lecture data
- Send message regarding garbage in campus
- Complain
- Give feedback

(ii) Faculty
- Upload Test
- Check Result
- Upload attendance
- Send message regarding garbage in campus
- Complain
- Upload Lecture data

(iii) Student-to-student interface
- Enable to share their documents

(iv) Faculty-to-Student
- Creates exams, send exam, can collect result and can send grades back to students.

(v) Student-to-Faculty interface
- Help students to submit progress report
- Write exam and Submit
- Student can project their homework

We have so many online exam tools available in the market but our proposed work is different in a way that it is not only used for evaluation of understanding of student lecture wise but also enhancing learning of both the consumers. Students can correct their errors and can get to know in which topic they are facing problems. Faculty will be able to identify the needs of student and will be able to learn fact about extent of students learning.

(iii) Design and Method of the study

After doing survey (online and offline) and literature review, we focused on experimental development. For this we considered two broad categories of students i.e. Low achievers and High achievers. Pretest and posttest were conducted to determine the effect of SVIEW on learning of low and high achievers in particular to respective subjects. . Sampling Process is shown in fig 13.
Faculty has selected 60 students as sample and classified as

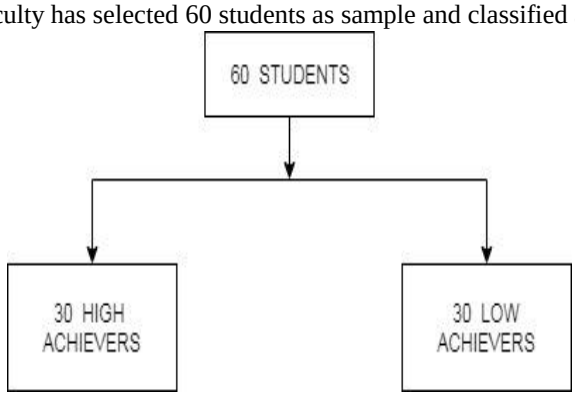

Fig. 13 Sampling Process

Steps for construction of test to achieve enhanced learning are:
(a)Plan Test: This step includes planning construction of test like considering limitations, taking expert advice for framing questions.

Both the tests data will then be saved in database and will cover the topic like "ACID Properties of database" of Database Management System. In total 10 questions are planned for conducting test. Students will then be asked to complete test in 10 minutes.

(b)Test Validation: Expert opinion will be considered for validating the test.

Result will be analyzed by statistical techniques.

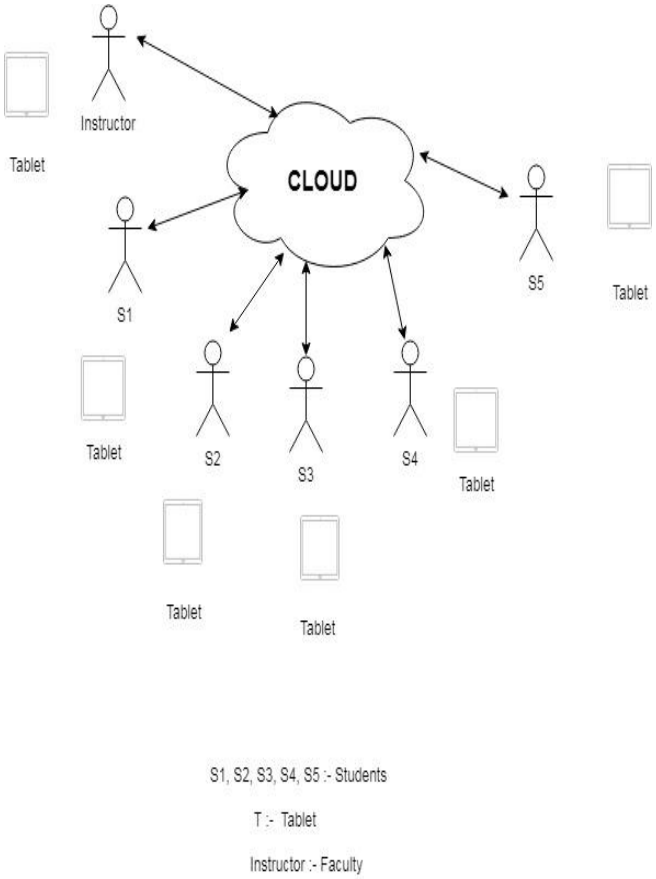

Fig. 14 Agents in IEP

IV. MATHEMATICAL MODEL

Let S be the Whole system S= {I,P,O}

1. ***I-input***
2. ***P-procedure***
3. ***O-output***
4. ***Input I={ Q,P,F,PR }***
5. ***Where,***
6. ***Q- Question Set***
7. ***P = {Q1, Q2… Qn}***
8. ***P- photo***
9. ***P= {P1,P2…Pn}***
10. ***F- Finger Print***
11. ***F= {F1, F2…Fn}***
12. ***PR= Parking Request***
13. ***F= {PR1, PR2…PRn}***
14. ***Procedure (P),***

The teacher will scan the finger print on bio metric machine. And using this system the Lights, fans and other equipment gets turned on.

After the lecture the teacher can upload the Question set about topic discussed on that day and lecture data as well, and Students have to solve the questions as this will help the teacher to understand how much students have understood that particular topic and up to what extent they have learned. Also students can download and share data using this application.

The student can upload the image of garbage or any issue in the university and system will send it to web application where respective authority person will get notice and solve the issue.

The faculty or student of university can book the parking slot through the application.

Output: {View available parking space, register complaints, on/off electronic appliances as per finger print, give exam, upload lecture data, data sharing among students}

V. ALGORITHM ANALYSIS

Among the many existing cryptographic algorithms [4], DES, BLOWFISH and AES are selected and compared on the basis of Speed, security, flexibility to expand in future and limitations. Table 1 illustrates the comparative study on selected algorithms on the basis of time required for execution of algorithm for the following sample data.

Table. 1 Algorithm Analysis

Data	Blowfish	AES	DES
Tejas	748	651	769
Ganesh	760	705	767
Chaitali	757	713	765
Pooja	781	697	786
Diksha	778	687	781
Rupali	746	702	756
Ankita	728	669	732

The Fig 15 shows graph of Different encryption algorithm analysis where, graph shows the time require to encrypt the encrypt the same data with different algorithm and as a result we get AES Algorithm which require the minimum amount of time

Apart of encryption in this research, a SVM (support vector machine),) based report generation is discussed for Authority (User at web application site) that contain a web based assessment system using review mining. Expected outcome of this project is that a system will be available that will help the authority person to analyze the maximum number of complaints reasons in the University. Scope of the project is that to make University Smart and help the faculty to solve the issues arised in University.

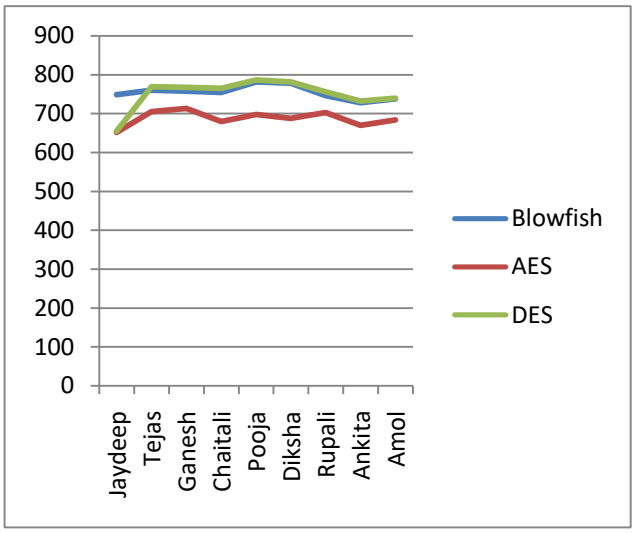

Fig. 15 Algorithm analysis graph

VI. CONCLUSION

SVIEW project is a scalable project which can be extended to other university campuses. In this paper, we analyzed technologies that can be implemented to develop a smart environment for physical learning world. Previous research [17] gave solution to problems of decreased concentration, inefficient interaction. [15] Gave solution using feedback systems. [14] Discussed digital classrooms but none of them discussed about improvement in teachers learning. Our system proposed method for improving teachers learning which will not only help teachers to improve grades of student but will also focus on each and every student of class .There are many standard technologies that can be used, we have smart parking system, garbage management system, smart classroom and Smart lighting system that we are going to implement in a SRM University, Section 3 covered a general architecture of a SVIEW. In future additions to our SVIEW will include integration of electric vehicle charging stations, smart laboratories, smart structural health systems and data-analysis of the data generated from the sensor nodes. Future work will also focus on developing algorithm for more interesting interface for improving learning.

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