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Smart Class Room Monitoring System

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Abstract: ***Now-a-days the class rooms are equipped with modern technologies like smart board, LCD projectors, flexible displays etc. These classrooms are called as smart classrooms. Due to diverse demands on student time, attendance is falling down even though the enrollment is rising. Our proposed system provides the solution to address this issue. The proposed system can be implemented in an economical and precision manner. It consists of students density monitoring system and digital notice board presentation. If the classroom has sufficient student strength, then the controller enables the smart display and plays a lecture corresponding to the scheduled subject. This ensures the student strength in the class and avoids the idle classroom scenario in the absence of teaching faculty.***

Keywords: Attendance monitoring system, Cloud Computing, Context Modeling, Internet of things (IoT), Smart classroom.

I. INTRODUCTION

Classroom teaching increases the learning by passive and interactive sharing of technical knowledge. As teaching is a noble profession, it needs changes on regular basis to inculcate better performance in the dynamic education process. Chalk and talk with black board is the old and traditional method that provides face-to-face contact, but increase in number of learners, abolished the old method in many institutes [1]. In this technology - emergent world the erudition styles of students are continuously varying and hence it requires the review of customary lecturing style in order to find their appropriateness with student knowledge levels. Due to the change in surrounding world, it is necessary for the teachers to assess their education methods and guarantee that there is suitable match to students learning styles [2]. Thus to ensure better teaching-learning new and smart methodologies are required.

Hence, now-a-days many classrooms are equipped with variety of smart devices and are called as smart classroom system [3]. It enables the student learning in a better manner. The proposed system addresses this smart learning environment problem. If the class strength is sufficient then the lecture is delivered in the smart display through Wi-Fi modules.

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II. RELATED WORK

In [1], teacher instructs the students in isolated location and classroom students simultaneously. This method selects the students in remote manner using a projected display and a computer-vision-based module through pen – based interface. A speech-capable visualized system allows the educator to manage the lecture and updates all classroom activities. To telecast the video for remote students, technically rich camera module switches between several cameras without human intervention. This enables the student to listen the class without any problems.

RFID technology used in [2], facilitates automatic wireless identification of students through electronic tags. It addresses the recurrent lecture attendance-monitoring problem. This study reduces the delay incurred by physical collection of student's attendance and provides the opening to monitor the classroom activities in an efficient manner.

In [3], ARM processor LPC2148 is interfaced with graphical display for classroom monitoring. The decoder used in this system selects a display and information to concern person is done using GSM technology. The work in [4] discusses about the growth and confirmation of the smart classroom scale (SCS). The SCS is developed from the existing technologies like TROFLEI, TICI and CCEI. Result of this study shows ten scales of the SCS like Spatial design, Flexibility use of smart classroom, Technology usage and Learning data etc. The SCS instrument's Cronbachs alpha reliability is calculated and is 0.902. This proves that SCS is an economical instrument for assessing the technology affluent smart classroom.

The system described in [5], elaborates the Classroom 2000 project and discussed the effect of an automated capture in teaching and learning. The system is continuously evaluated for effectiveness and the environment should address the issue of scale and extensibility.

Single local class proposed in [6] solves the challenges involved in the multipoint-multiple classroom architecture and it provides a service to multiple remote classrooms in an efficient manner. Web browser used in smart phones provides access to the World Wide Web (WWW) [7]. Smart objects are created using the two dimensional barcode labels. The mobile computing capabilities create a good impact on society about education. The system used in [8], proposes a classroom model with smart devices like laptops, tablets and projectors connected with internet. This system enhances the communication of learners with smart environment. The gateway used in this system controls the smart devices of classroom using usual recognition and connectivity. It provides an application execution platform to manage the classroom from remote centre. The system of [9] focused to construct elegant university nomenclature.

It discover the main features, components and technologies used in smart universities compared to traditional university that involves face to face learning environment.

III. PROPOSED SYSTEM

A. Smart classroom environment

A smart classroom is a technology-rich environment in which, an instructor handles lecture using audio-visual equipment and internet. Audio-visual equipment includes DVD player, power point presentation, demonstrations and animated videos etc. The contents of lecture are shown to students using LCD projector. Some of the smart classrooms have a partially- enduring unit called Smart Consoles.

B. Activity recognition

Proposed smart classroom system consists of an automatic student's density monitoring unit and the digital notice board for presentation. The IR sensors used in student density monitoring unit counts the number of students entered and left the classroom. The minimum density value of the class is fixed. When the students count matches the threshold density, then the Micro-controller unit ensures the presence of students. After this matching process, the controller displays the student count value in the LCD display. If the Student density is more than the threshold value, the lecture corresponding to the particular classes either power point presentation or video will be played automatically in the screen. If the student density is lesser than the threshold value then the lecture will not played and it gives the message that the classroom has insufficient strength.

C. Student monitoring

In the absence of instructor, the students will not listen to the lecture displayed in the screen. Thus to ensure the effectiveness of smart classroom, the student activity is to be monitored. For doing this, sound sensors are connected to the microcontroller unit, which monitors the noise intensity inside the classroom. If this noise value is high, (i.e.) the noise level exceeds the threshold noise level then the microcontroller unit displays "high noise" in the screen. This can also be intimated to higher authority for further action using cloud.

D. Internet of things

The Internet of things (IoT) is a network of digital identities and physical objects that are recognized using standardized electronic discovery systems and wireless devices (WSN, NFC, Zigbee) [13]. This will retrieve, store, transfer data and process discontinuity between physical and virtual devices. It has authority to modify our living environment. It is an exemplar transfer in technology that occupies numerous domains. Figure 1 shows the simple architecture of IoT. There are many useful areas for IoT. Some prospect consumer application envisioned the IoT is a major field in science fiction, however some sensible and practical sounding possibilities for the technology include:

- If IoT network detect any hazardous change in the nearby environment then it will send warning message to our phone or wearable smart device.
- Automatic parking facility for automobiles.
- Automation in groceries ordering and other home supplies.
- Habitat monitoring of animals and day-to-day personal activity of human including goal tracking and regular growth information.

Fig. 1. Internet of Things

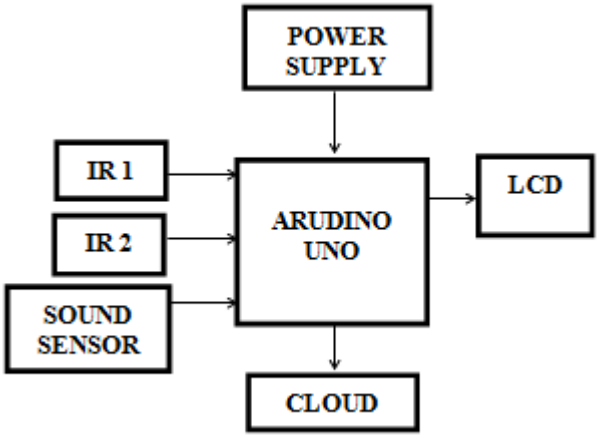

Fig. 2. Block Diagram

E. Functional diagram of Proposed Smart Classroom

Functional diagram of proposed smart classroom system in figure 2. Arduino microcontroller [14] is connected to IR sensor, sound sensor, LCD and cloud. Maintenance of student's attendance record is mandatory for every educational institute. This enables the successful functioning of the institute. This facilitates the maintenance of attendance record easy and accuracy is retained. The proposed system is used to save the precious time of the students and teachers of educational institutions. The proposed smart classroom comprises automatic students density monitoring system using IR sensors along with digital panel for presentation. The IR sensors used in the proposed system counts the entry and leaving of students.

Threshold value is set for minimum student density value of class. When the students count matches the threshold value, the lecture will be played automatically in the screen. The lecture video is played based on the time scheduling process (i.e.) time table of that class which is stored in the cloud. During the progression of lecture,

If the student density becomes less than the threshold value, then the video lecture stops playing the content and displays that the "**Class strength is less**" in the screen. The sound sensors connected to Arduino Micro-Controller is used to sense the noise level of the students inside the class. If the noise level of students is more than threshold value then the screen displays the message "**high noise**". This information will be intimated to higher authority via cloud for further action. For improved performance, the LCD screen displays the student count and the current subject, which is in progress.

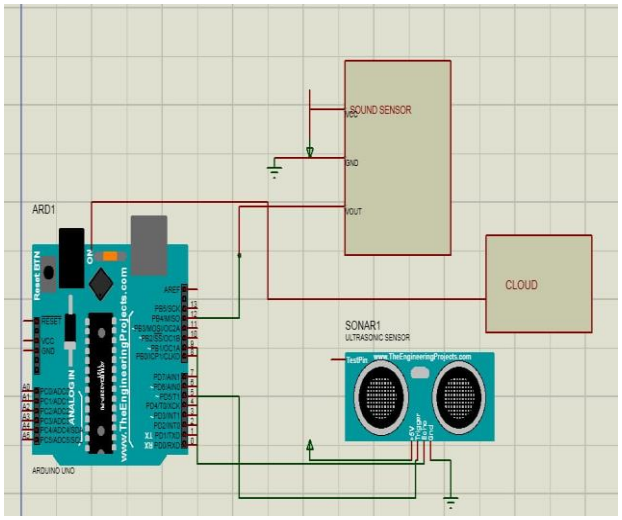

Fig. 3. Layout of proposed Smart Class Room Module

F. Working Principle –Student Density Monitoring

Simulation layout of proposed smart classroom is given in figure 3. Student density is monitored by using IR (Infra Red) sensor. In general, the radiations falls on the white surface reflects whereas the radiations are absorbed by black color surface. LED of IR sensor emits the light signal if the supply is given to IR sensor. This emitted light signal will reaches the photo diode that is in reverse bias. If the light intensity is more then, the temperature of the diode junction increases and hence voltage increases. If the light intensity falling on the photodiode junction is less then, the temperature is less and it will not allow the diode to conduct. From this, it is clear that the output voltage of photodiode is directly proportional to the light intensity falling on the junction. The output of photodiode is connected to microcontroller pin number 3. The comparator available in the processor compares the voltage at pin number3 and voltage at pin number 2. If the pin 3 voltage exceeds pin 2 voltage then the comparator output is high. This shows that if the comparator output is high then more light felt on the photodiode. By using this concept, the student density is measured. The students are allowed to enter the classroom in between IR sensor and photodiode. While student entry, the light from LED is blocked. This enables the comparator output low and the student count is increased.

IV. RESULTS

Now traditional black board education is changed to modern smart classroom technology. This allows the teacher to teach the subject using power point presentations, audio clips, video lectures and images. A picture is worth a thousand words! In line with this famous quote, smart class students will be able to absorb all the information presented during lecture compared to traditional classroom students. Because, in smart classroom instead of writing in the board, the teacher projects the lecture in audio-visual (AV) form using digital tools like CDs, pen drives and documents. This enables the students to concentrate more compared to traditional class students. Thus, this method of teaching - learning in the modern technology world reduced the issue of taking notes during the lecture progress and they can concentrate more on concepts. Constructed hardware module of the proposed system is given in figure 4. The threshold student count maintained in the proposed system and the details of action taken by proposed system is shown in Table 1.

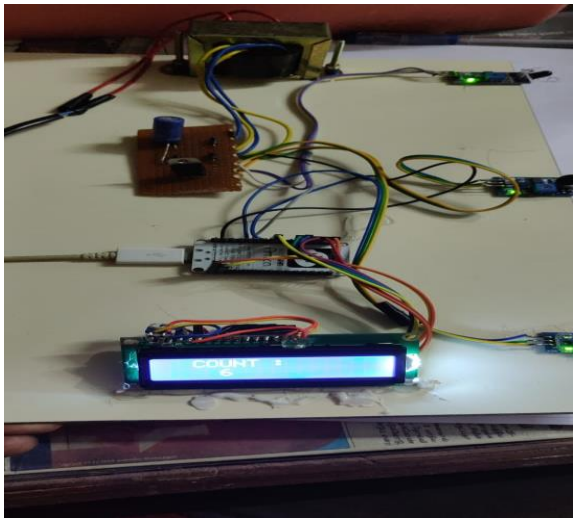

Fig. 4. Hardware module of proposed system

Table- I: Action taken by proposed system

Actual Student count	Action
< 4	Lecture will not open
> 4	Lecture will open

Fig.5. Output of proposed system

V. CONCLUSION

Fixed and pre-planned timetable are the problems of traditional classroom. This environment is not comfortable for students and faculties of institute. The duration of single period is rigid and cannot extend. Hence, to give explanation on same topics, extra classes are scheduled. This leads to additional burden for students and hence attendance is low in special classes. In traditional classroom, the module is naturally instructor–driven and instructor -centric. Lecture notes, charts, blackboard, physical models and laboratory experiments etc, are the teaching tools used in the traditional classroom. This makes the dull learning environment and fun less. Evaluation of student involves tests, and assignments. But, it is time-consuming and the processing of result takes more time. In traditional classes, if a student forgets to take notes then it is difficult to understand that topic. Our proposed system addresses all these issues. The student can repeat the lecture videos for better understanding. It does not require any extra classes. This improves the performance of the students. Accuracy of work is increased in smart classroom and manual work is reduced. The main advantage of proposed system is its low cost and thus it can be incorporated in all educational institute. With digital system, the infrastructure of institute can be improved and possibilities of mistakes can be reduced. Thus, the smart classroom provides a convenient learning environment by improving the comfortability inside classrooms and automating services intelligently and unobtrusively with minimum human intervention. The proposed system uses an automatic context-aware adaptation of classroom equipment, which consumes precious class time if done manually, and improves the performance of instructors by focusing more on their main tasks. The adaptation was done using a rule-based system and implemented with classroom equipment. In future, this work can be implemented using advanced high-end processor for improved performance and lab classes can be included for better understanding.

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