Smart Classroom Automation

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***Abstract*— It often happens that we forget to switch off the electric equipment in our classrooms and later remember that. But, that time we don't have chance to come to our classrooms, and these incidents cause great waste of energy and sometimes great danger like fire due to short circuit can be occurred. Our system will reduce the risk of these dangers, provide the facility to ensure a centralized control on the classrooms, labs, office-rooms electricity system and bring the whole institute under an automation service. Any authorized person can view and access the classrooms situation from any place and any time he/she wishes.**

***Index Terms*—Automation, authorization, equipment, control, electricity**

I. Introduction

Automation of devices is the core of today's modern world. A automation system for controlling the equipments in a classroom is just one more step towards modernization in out day-to-day life. Smart Classroom Automation system uses a Bluetooth Model as a controller and connects it to the App, which can be then controlled by authorised users. There are couple of existing systems to access and monitor the electrical status from remote place. Most of them are embedded system. Hence, the system is not accessible for multiple user and the feature of user authentication is not performed. In our system, different users can perform different tasks, all the tasks are integrated and the authentication barrier is strictly maintained.

This project aims to develop an automation service that will allow stakeholders to control electrical devices in easy way, even not being present there and it also aims to reduce unnecessary power consumption.

II. Literature Review

Classroom Automation is a now a rather common study for research and development to engage more in this world of technology. More technologies are now being used to step-up the game.

The system in [1] uses a camera to recognize the presence of people in the classroom and analyze their seating positions. Based on that, the light/fan is switched ON. The input data from camera goes through image processing to detect human presence and an Arduino board is used to determine whether the light/fan should be switched on or not. This method is rather less costly as compared to sensors

[2] is a system that uses a counter system by using an IR sensor to detect when a person enters a room and increments the counter thus, a light turns ON. Similarly, when a person leaves the room the counter decrements and when it reaches, the lights turn OFF.

[3] is a proposed prototype for smart classroom controlled by using Raspberry Pi. An android application is used to command the Raspberry Pi with the help of which different equipment in a classroom is controlled.

The framwork in [4] controls programmed ON/OFF of fan and light depending on the nearness and nonappearance of the human inside the room through IR Sensor and on the temperatures of the room. It is created with the assistance of Arduino Nano board which is utilized to control the electric fan dependent on the adjustments in temperature of its encompassing utilizing DHT11 Sensor.

Moeiz Miraoui[5] proposes a context-aware automation of classrooms which contributes to improving the quality of the educational process by automating various tasks. This system provides a comfortable learning environment. A part of it is Light System Automation. It is triggered when a course time starts, and the classroom system perceives the presence of at least one of the course attendees. When triggered, the light system starts to adjust the luminosity level inside the classroom according to the current context composed basically of the outside light. Other modules of the system proposed by [5] also includes both temperature and learning system automation.

The working of [6] is such that the fan gets turned on as per the room temperature. If it is hot, the sensor will detect and give signals to PLC. And the fans will get turned ON as per saved program in PLC. Thus it is saving valuable time and is economical by saving the bill of electricity.

A part of [7] is to automatically control the fan and lights. Sensors are placed all over the classroom and give a planned feedback to the response these sensors receive. An example would be having temperature sensors during the class room that would examine the temperature and carry out to any change by altering the fan speed. For light control, there are proximity sensors that would detect student's presence and allows the lights to run on if students are nearby. Fan and Bulb are connected with temperature sensors controlled by micro-controller.

III. Design And Development

The features of this system are:

1 Monitoring: There are two types are users in our system. Low level users are students. They can only view the

classroom whenever they wish. For that they must have an account/ID.

2 Accessing: Authorized users are instructors,head of department. They can control various electrical equipments. They can switch off equipments from various distance whenever they find it on after working hour. For that they also must have an account/ID.

3 Authentication: Central authority will provide authentication service so that only students/instructors/lab assistants of the institution can get account to view or control

The system architecture of this project is shown below:

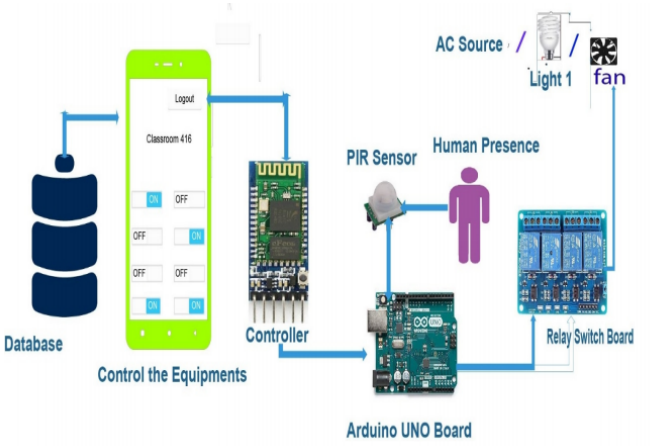

Fig. 1: System Architecture

The workflow diagram of this project is shown below:

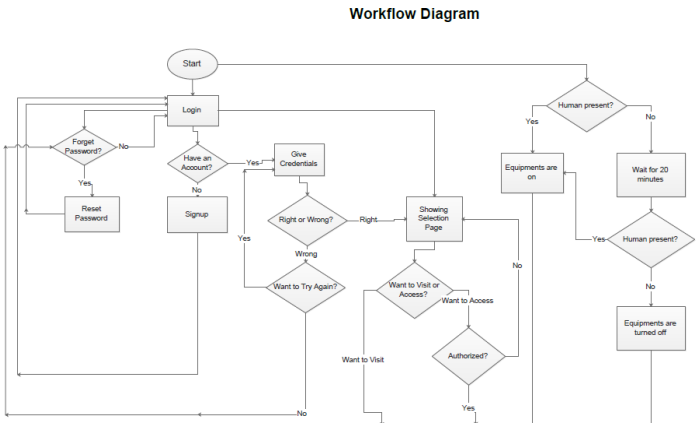

Fig. 2: Workflow diagram (part 1)

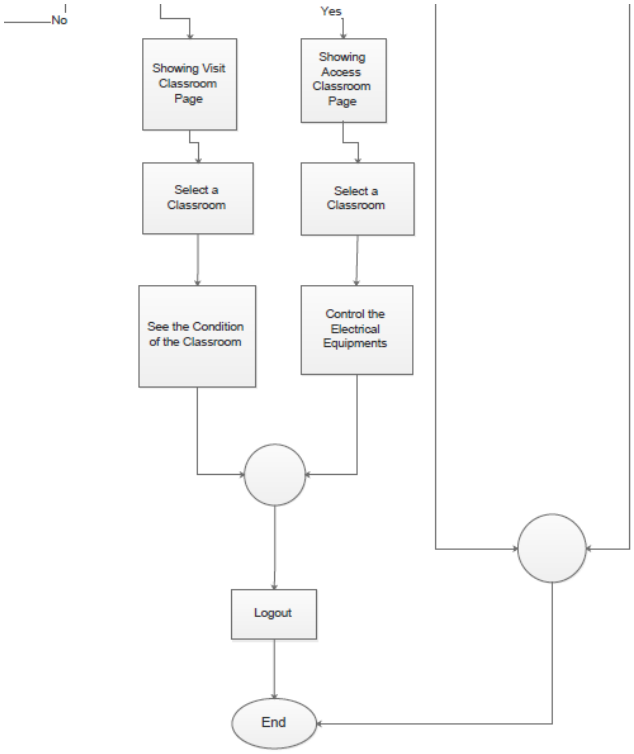

Fig. 3: Workflow diagram (part 2)

IV. Experimental Study

There is a database where all the information about the user and equipment status will be saved. A connector (controller - here Arduino) is connected with both the database, user interface and hardware. All the interaction performed here will be controlled by this. When user sends a request to access an equipment, it will go to the connector. The connector checks the status of that user, whether he is authorized or not. If authorized, then the database is accessed by this user and necessary response is performed.

The participants in our system are instructors, lab assistants and students. Since the instructors are our highest level of stakeholders, they can control any classroom from any place. Lab assistants can each control specified floors. And the students can only view the state of the rooms.

The system has been setup using a relay board connected to a few switches for fan/light and later controlled through an Arduino board. The Arduino is also connected to a PIR sensor that can detect motion of human presence. This redeems the problem of switching off the electrical equipments when a class is ongoing.

After the setup of hardware materials, it was integrated with the mobile application. Which consists a sign up page to create account, verification page, login page, page showing state of classroom.

1 At first, user needs to create an account to access this system. Here's the interface to create a new account.

A verification code/link will be sent to confirm user's primary information.

2 When user has an account, he can monitor and access the equipment through logging in. For this, a login page has been designed where using email and password, login can be performed.

3 There is a feature, if the user forgets his passwords. A verification code will be sent to user's email. Using that, password can be reset.

Lastly, it was tested by a few participants to check the validity of the system.

V. Results

The results for our software application are shown below:

Account Creation: The screenshot of the Sign Up page from our mobile application is shown in Fig: 4

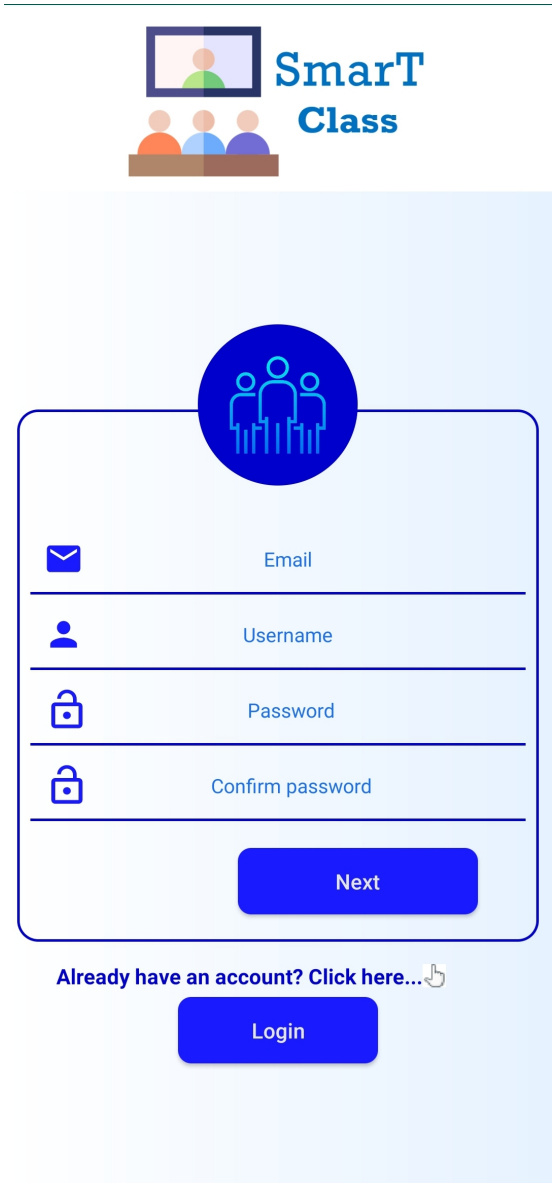

Fig. 4: Sign up page

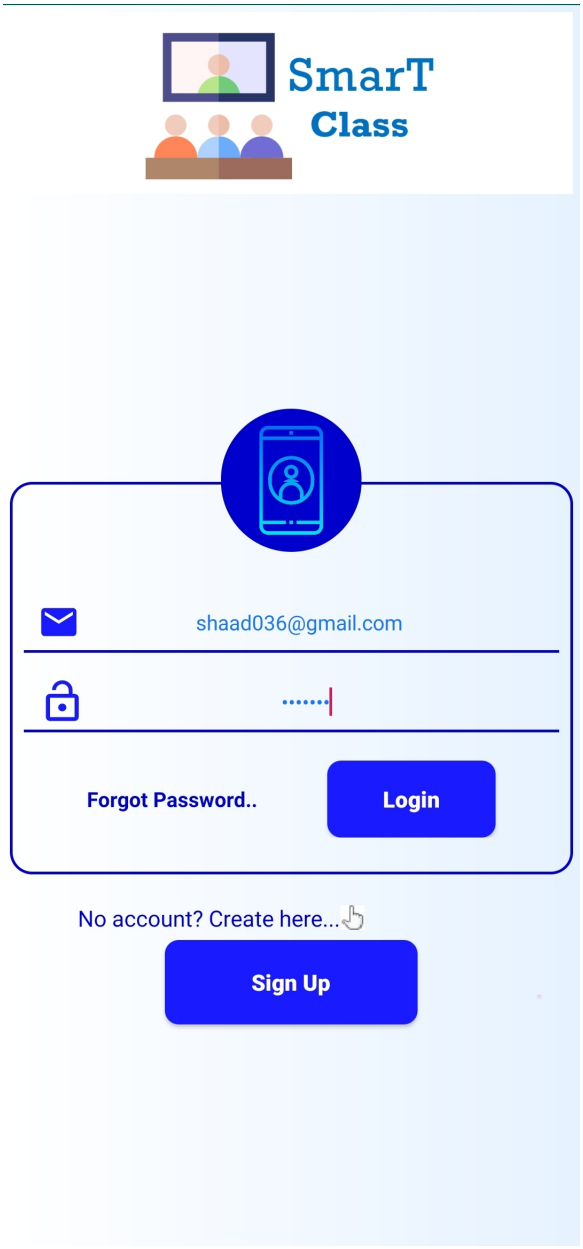

Fig. 5: Log in page

Login Homepage: The screenshots of the login page (Fig: 5) and homepage (Fig: 6) from our mobile application is shown below

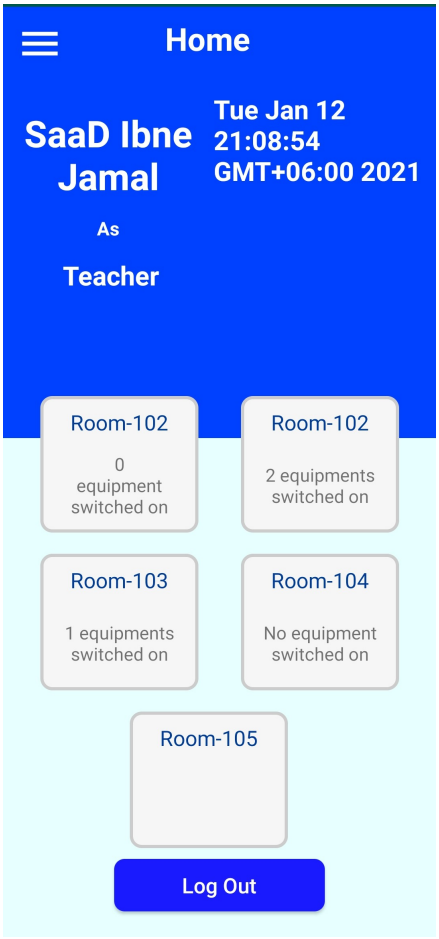

Fig. 6: Home page

A few pictures of our project prototype is shown in Fig: 7 and Fig: 8. Fig: 9 shows the hardware integration.

Fig. 7: Prototype (part 1)

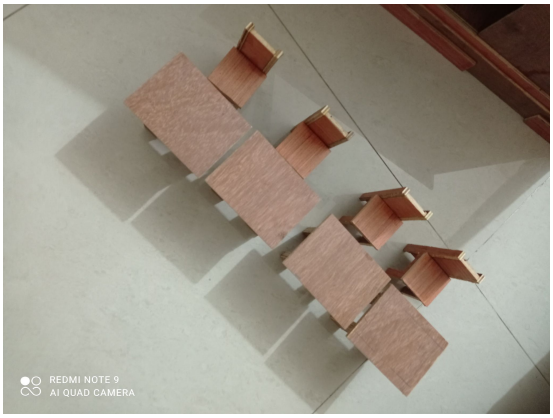

Fig. 8: Prototype (part 2)

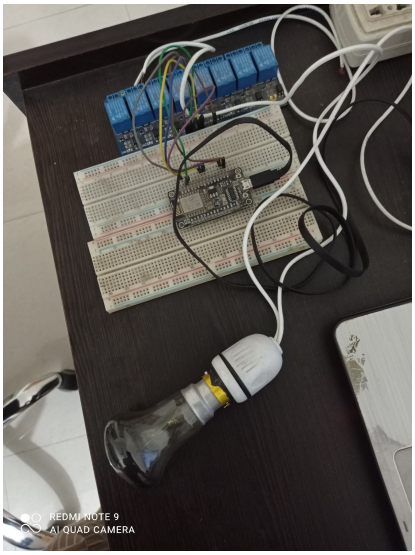

Fig. 9: Hardware components integration

VI. Limitations and Future Work

As the sector of smart classroom is very outstretched, we haven't developed our system including all the features of a smart classroom. Currently we are experimenting on less number of devices.In future we are planning to add large number of devices.Currently we are using mobile/web app to turn on/turn of switches.In future we are planning to use sensor to do it automatically and mobile app for verification.

VII. Conclusion

We are developing an autonomous system for a better quality of teaching and establishing control on classroom.Our system will allow the entire classroom to be automated.We are using networking,database etc to build up our system. This system will strengthen centralized control over every classroom.

[1] [2] [3] [4] [5] [6] [7]

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