**Noida Institute of Engineering & Technology**

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**­­­Smart Classroom Automation**

**A Research Paper based on the Energy Efficient Smart Classroom Automation**

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­­**[1] Abstract**

With the new technologies being introduced in the market, automation is the need of the hour. Due to the discovery of Internet of Things (IoT), there has been a vast increase in applications which do not require human to human or human to computer interactions. This paper demonstrates the use of Internet of Things to automate the working of lights and fans of the classroom for energy efficient usage of resources. We have used Node MCU and Arduino, popular open source IoT platforms for the system to be self-operating. The main control system implements wireless technology to provide remote access from smart phone. We have used sensors like PIR and ultrasonic sensor to detect human presence in classroom and accordingly adjust the lights and fans of the class. The system is user friendly, flexible and can be advanced with new features in future. In this paper, efforts are being made to minimize human effort, conserve electrical energy, and enable remote access.

**[2] Keywords**

**IoT, Automation, Arduino, Smart controls, Lights, Optimum energy conservation, Transceiver, Appliances, Embedded, Prototype, Server**

**[3] Introduction**

In today’s era, energy efficient devices are the need of the time. We humans are wasting too much electricity by not turning of the lights and fans in our class. The people don’t even pay attention to unnecessary usage of electrical energy. So, we need a smart system to control the functioning of the lights and fans according to the requirement in the room. The system is based upon IoT.

Internet of Things (IoT) has made the technology development evolve swiftly. IoT is used to control devices and systems from anywhere using Internet. It acts as a platform to transfer data between computing devices. IoT can also make use of artificial intelligence and machine learning [2] to make data collecting processes easier and more dynamic. Using new wireless technologies like Bluetooth and Wi-Fi, different devices have capability to connect with each other.[3]

This project can solve various problems that usually happen in college, for instance, electricity wastage amongst students, electricity-related accidents, electrical short circuit situation and many more. For this project, the design [2] and development of the smart college room is constructed based on NODE MCU board. The board has ESP8266 Wi-Fi serial transceiver module. This will help the communication [1] between the board and the mobile phones provided that internet connection is good throughout the process. The interaction occurs for the user to monitor the electrical appliances in the room [3].

**[4] Literature Survey**

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| --- | --- | --- | --- | --- |
| SNO. | AUTHOR | TITLE | SOURCE | FINDINGS |
| 1 | Nazwa Nasuha | A Design of Smart IoT-Based College Room Using Arduino | Journal of Physics, Conference series | Project’s design and development is based on IoT by  implementation of Arduino. The project applies Arduino MEGA 2560 board in conjunction with  ATmega2560 chip.[1] |
| 2 | Soumyajit Mitra | Smart Light for Home with Automatic Direction and Intensity Adjustment using Arduino | International Journal of Recent Technology and Engineering (IJRTE) | The system uses a series of sensors to track human movement in a confined space and focus more light in that direction. Also the system has the ability to adapt the intensity and number of lights based on number of people in the room***.***[2] |
| 3 | Shivani Jadon | Comfy Smart Home using IoT | International Conference on Innovative Computing and Communication (**ICICC**-**2020**) | IoT is used to connect various devices and describes the working of face recognition systems using machine learning and it can be embedded in security locks.[3] |
| 4 | Deny Nusyirwan, Arnav Choudhary,Himanshu Saini, Utkarsh Dua, Nikhil Sharma | Engineering Design Process of Arduino Uno based Smart Classroom Technology | Journal of Innovation and Technology | This research is a form of higher education contribution in improving student learning outcomes in elementary schools, through the provision of facilities in classrooms. Technology in schools is one of the driving forces for advancing education in schools and is expected to be able to change the mindset of students.[4]   |  | | --- | |  | |
| 5 | Ravi Wankhade, Shashank Karhade, Pratik Mohite, Kanchan Dhole, Akash Ganvir, Bharti Khedkar | Home Automation System based on IoT using cellular devices | IJSRST 2019 | Designed an  easy and a secure system to regulate home appliances  particularly aimed to help elders and disabled.[5] |

**[5] Methodology**

Automation is the need of the hour in today’s times. We have designed a prototype of a smart classroom depicting usage of smart automated appliances [4] in the class.

Our prototype provides the following features:

* It establishes a wireless remote switching technique for the appliances.
* It basically uses Wi-Fi for the wireless control, which gives an indoor range of about 150 feet.
* Any appliance can be switched on and off by just clicking on the radio buttons of the application.
* It also provides the option to just give the voice command to remotely control appliances.
* It is energy effective.
* Simple design and easy to integrate into a variety of appliances.
* A socket is made available for user to connect other appliances.
* Any device capable of Wi-Fi connectivity can be used to control the prototype.
* It is cost effective.

**[5.1] Hardware Requirements**

* **NODE MCU**: It is the microcontroller unit in the prototype. It has an in-built Wi-Fi module (ESP8266) that establishes wireless remote switching of appliances.
* **LEDs:** They are used to depict the working of lights in a classroom.
* **Ultrasonic Sensor:** It is an instrument that measures the distance to an object using ultrasonic sound waves. It uses a transducer to send and receive ultrasonic pulses that relay back information about an object’s proximity.
* **PIR Sensor:** It measures the infrared light emitted by the objects in its observable area. It is Passive Infrared sensor.
* **Arduino:** It is an open-source electronic platform based on easy-to-use hardware and software. These boards can read inputs and turn it into an output.
* **Relay:** It is an electrically operated switch. It basically works on the principle of electromagnetic induction.
* **Servo Motor:** It is a small device that has an output shaft, which can be positioned to specific angular positions by sending servo a coded signal.
* **DHT Sensor:** It is used to display humidity and temperature of the classroom.
* **LCD Screen:** It is placed in the classroom to show the readings of humidity and temperature of room depicted by DHT sensor.

**[5.2] Software Requirements**

* Blynk Application: It was designed for the Internet of Things. It can control hardware remotely, display sensor data, store data and visualize it.
* Google Assistant: It is a system software present on the android phone. It interprets the voice commands by the users to turn on or off the appliances.
* IFTTT Application: It is an intermediate application that interprets commands from Google assistant and sends on and off signals to Blynk application via Blynk server.[6]

**[6] Block Diagram:**

Initializing Wi-Fi

Connecting Wi-Fi

Initializing Blynk Server

Mobile Application Interface

Connected to Blynk

Check I/O pins

Display

**[7] Conclusion and Future Scopes**

From our prototype we can infer that it is possible to make a smart automation system for our classrooms using IoT and Artificial Intelligence embedded with a mobile application acting as a central control.

The user was able to remotely access all the appliances of the room[5] and control it. The knowledge derived from our estimation can enable many variable applications for social good such as effective utilization of the available power and we consider our project as a contribution for developing smart city. The electrical energy was saved through this model and class was automated.

This model can be applied in real time environment in schools and colleges to make the students integrate with technology. Nowadays, latest technologies and gadgets have conquered the whole market. This model can be embedded with more services in the future[6].

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