

# IOT BASED SMART CLASSROOM AUTOMATION

Chanchal dokras<sup>1</sup>, Swejal Bhojar<sup>2</sup>, payal wanjari<sup>3</sup>, Saurav jambhulkar<sup>4</sup>, Prof.M.N.Thakare<sup>5</sup>

<sup>1,2,3,4</sup>B.Tech Student, Dept. of Electronics & Telecommunication Engineering, Bapurao Deshmukh college of Engineering Sewagram, Wardha, Maharashtra, India

<sup>5</sup>Professor (Internal Guide), Dept. of Electronics & Telecommunication Engineering, Bapurao Deshmukh college of Engineering Sewagram, Wardha, Maharashtra, India

\*\*\*

**Abstract** - A classroom is a place where there is always room for development; therefore just as the development for a student results in the ease of living, similarly a smart classroom focuses on the structural development leading to effective time and energy utilization. The project titled "IoT-Based Smart Classroom" aims to revolutionize traditional classroom settings by integrating cutting-edge technology to enhance both student development and operational efficiency.

Central to this initiative is the incorporation of an Arduino UNO Microcontroller, serving as the brain of the system. The utilization of a fingerprint sensor facilitates seamless attendance tracking, automatically updating an Excel sheet.

Additionally, a PIR sensor detects motion within the classroom, optimizing energy usage by intelligently controlling the activation and deactivation of appliances through relay mechanisms. By focusing on structural development and leveraging these innovative features, the smart classroom ensures effective time management, energy conservation, and an overall enriched learning environment.

**Key Words :** Arduino Uno, Relay, PIR Sensor, Fingerprint Sensor

## 1.INTRODUCTION

Innovating the educational landscape, our IoT-based smart classroom system represents a pinnacle in merging technology and pedagogy.

With a foundation built upon Arduino microcontrollers, PIR motion sensors, fingerprint recognition, and relay modules, this pioneering initiative transforms traditional classrooms into intelligent, responsive environments.

Revolutionizing traditional classrooms, our IoT-based smart classroom system amalgamates cutting-edge technology to enhance efficiency and security within educational spaces.

Seamlessly integrating Arduino microcontrollers, PIR motion sensors, and fingerprint recognition technology, this innovative setup redefines conventional attendance tracking and resource management.

By leveraging the PIR sensor's ability to detect motion, coupled with fingerprint sensors for precise identification,

the system automates attendance recording, capturing timestamps and logging attendance data directly into an Excel sheet.

Furthermore, its capability to control classroom appliances through relay modules ensures energy optimization by activating devices only in the presence of individuals, fostering a technologically advanced and sustainable learning environment

## 2.METHODOLOGY

The proposed system integrates a suite of components to orchestrate a streamlined and intelligent classroom environment. Leveraging Arduino microcontrollers as the system's core, the PIR motion sensors actively detect any movement within the classroom, triggering subsequent actions. Upon motion detection, the fingerprint sensor initiates authentication, enabling precise identification and attendance tracking. Timestamped attendance records are then seamlessly logged into an Excel sheet, facilitated by the Furthermore, the relay modules facilitate the system's ability to control appliances, activating them upon validated entry and deactivating in the absence of motion, optimizing energy usage. This interconnected network of components operates in tandem, providing a sophisticated yet user-friendly system that automates attendance, enhances security.

## 3.SYSTEM REQUIREMENT

### Arduino Uno

Arduino Uno is a popular microcontroller development board based on 8-bit ATmega328P microcontroller. Along with ATmega328P MCU IC, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller



Figure 1 Arduino Uno

**Relay**

Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or no.

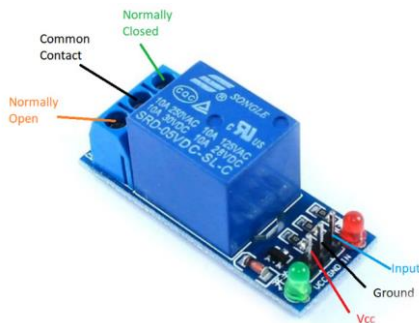


Figure 2 Relay

**PIR Sensor**

The PIR sensor stands for Passive Infrared sensor. It is a low cost sensor which can detect the presence of Human beings or animals. This **HC-SR501 PIR sensor module** has three output pins Vcc, Output and Ground as shown in the pin diagram above. Since the output pin is 3.3V TTL logic it can be used with any platforms like Arduino, Raspberry, PIC, ARM, 8051 etc..

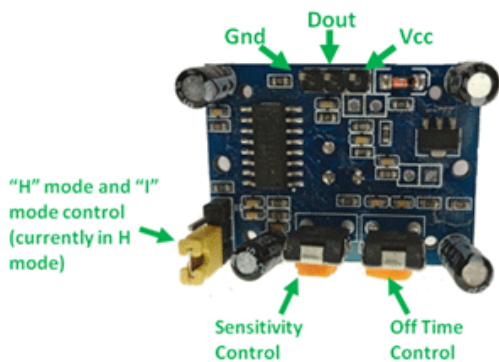


Figure 3 PIR Sensor

**Fingerprint Sensors**

Fingerprint sensors are sophisticated biometric devices that capture and analyse unique patterns on a person's fingertip to authenticate their identity.

These sensors utilise advanced technology to map the intricate details of ridges and valleys on a fingerprint, creating a digital representation stored for comparison.

Widely integrated into security systems, smartphones, and access control devices,

Fingerprint sensors offer a highly secure and convenient method for user authentication, replacing traditional passwords or PINs.



Figure 4 Fingerprint Sensor

**CIRCUIT DIAGRAM**

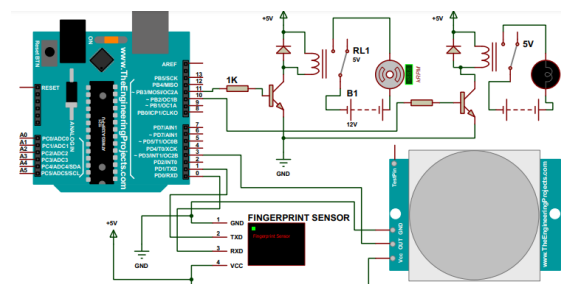


Figure 5 Circuit Diagram

**4.WORKING**

The IoT-based smart classroom system operates by utilizing Arduino microcontrollers, PIR motion sensors, fingerprint authentication technology, and relay modules. Upon detecting motion within the classroom, the PIR sensors trigger the activation of the fingerprint sensor for authentication. Once authenticated, attendance records are automatically logged into an Excel sheet. Additionally, the system controls appliances via relay modules, activating them upon validated entry and deactivating in the absence of motion to optimize energy consumption. This integrated

network of components works harmoniously to automate attendance tracking, enhance security, and efficiently manage classroom resources, thereby modernizing conventional classroom management practices

**BLOCK DIAGRAM**

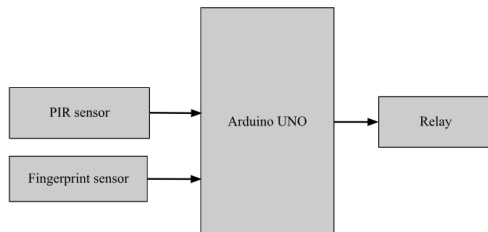


Figure 6 Block Diagram

**5.SOFTWARE USE**

**Arduino IDE Software**

The Arduino IDE software is instrumental in developing the firmware for our fruit spoilage detection system. It offers a user-friendly interface for coding the ESP8266 module and interfacing with sensors. Developers utilize its extensive library of functions for efficient sensor data management. The IDE's debugging capabilities aid in identifying and resolving issues during firmware development. Real-time monitoring through the integrated serial monitor facilitates rapid iteration and refinement of code. Compatibility with the ESP8266 platform ensures smooth execution of firmware tasks. The IDE enables sensor calibration, error handling, and data processing. Its streamlined workflow streamlines firmware development, optimizing system performance. Overall, the Arduino IDE serves as a vital tool for creating reliable and efficient firmware solutions for our project.

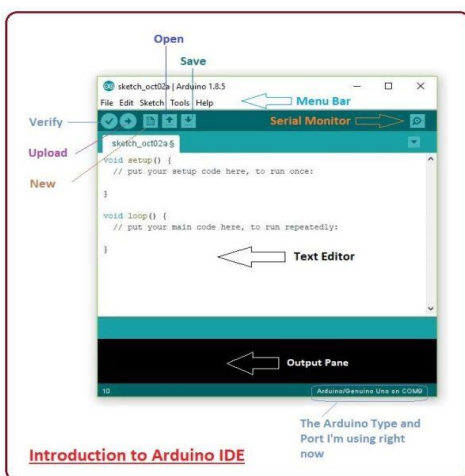


Figure 7 Arduino IDE

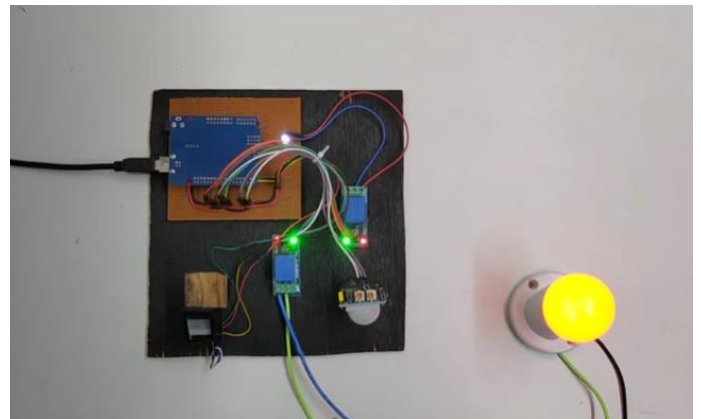


Figure 8 Experimental Setup of the system

**6.ADVANTAGES & DISADVANTAGES**

**ADVANTAGES**

1. Increased efficiency through automated attendance management.
2. Enhanced security with precise fingerprint-based identification.
3. Improved resource allocation and energy efficiency.
4. Seamless integration for a user-friendly classroom experience.
5. Real-time monitoring and control for enhanced supervision.

**DISADVANTAGES**

1. The technology used in the smart classrooms is very expensive.
2. All teachers cannot use smart technology for teaching.
3. Like all electronic gadgets, the gadgets used in smart classrooms require proper maintenance.
4. All the electronic devices are prone to faults.

**APPLICATIONS**

1. Educational institutions
2. Corporate environments
3. Healthcare facilities
4. Government buildings
5. Retail stores

## 7.CONCLUSION

The IoT-based smart classroom system represents a transformative leap in educational technology. Offering a comprehensive solution to the persistent challenges of manual attendance tracking, resource management inefficiencies, and energy wastage in traditional classrooms. By seamlessly integrating Arduino microcontrollers, motion and fingerprint sensors, and relay modules, this system introduces an innovative approach to attendance recording, authentication, and appliance control. It not only streamlines the attendance process through automated, accurate logging but also ensures heightened security with precise fingerprint identification. The system's intelligent energy optimization by activating appliances only in the presence of individuals exemplifies its commitment to sustainability and operational efficiency. This pioneering system not only revolutionizes classroom management but also heralds a new era of responsive, eco-conscious educational environments,

## REFERENCES

1. Prajas Kadepurkar, Prim Dsouza, Nivya Jomichan, "IoT Based Smart Classroom", International Journal of Applied Sciences and Smart Technologies Volume 3, Issue 1, pages 35–54. 2020.
2. Dr.C K Gomathy, Ms.R.Ruchitha, Ms.S.Haritha, Sri Chandra sekharendra, Saraswathi Viswa Mahavidyalaya, "SMART CLASSROOM WITH THE HELP OF IoT", International Journal of Scientific Research in Engineering and Management (IJSREM) Volume: 05 Issue: 10 , Oct - 2021.
3. Connor Harmer, Boroka Szeles, "IoT: A study into the effectiveness of smart classrooms", International Journal of Applied Sciences and Smart Technologies, 2022.
4. Revathi, R., M. Suganya, and Gladiss Merlin NR. "IoT based Cloud Integrated Smart Classroom for smart and a sustainable Campus." *Procedia Computer Science* 172 (2020): 77-81.
5. Kaur, Avneet, Munish Bhatia, and Giovanni Stea. "A survey of smart classroom literature." *Education Sciences* 12, no. 2 (2022): 86.
6. Chan, E. K. F., M. A. Othman, and MA Abdul Razak. "IoT based smart classroom system." *Journal of Telecommunication, Electronic and Computer Engineering (JTEC)* 9, no. 3-9 (2019): 95-101.
7. Ani, R., S. Krishna, H. Akhil, and U. Arun. "An approach towards building an IoT based smart classroom." In 2018 International Conference on Advances in Computing, Communications and Informatics (ICACCI), pp. 2098-2102. IEEE, 2021.
8. Burunkaya, Mustafa, and Kazım Duraklar. "Design and Implementation of an IoT-Based Smart Classroom Incubator." *Applied Sciences* 12, no. 4 (2022): 2233.
9. Atabekov, Amir. "Internet of things-based smart classroom environment: Student research abstract." In *Proceedings of the 31st annual ACM symposium on applied computing*, pp. 746-747. 2020.
10. Yağanoğlu, Mete, Ferhat Bozkurt, F. Baturalp Günay, Sinan Kul, Emrah Şimşek, Gökhan Öztürk, and Selçuk Karaman. "Design and validation of IoT based smart classroom." *Multimedia Tools and Applications* (2023).