WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Smart Door Lock with Intrusion Detection

Nitin Narula, Ritesh Kumar Singh, Dushyant Pratap Singh

Assistance Professor, EEE Department, Raj Kumar Goel Institute of Technology, Ghaziabad, Uttar Pradesh, INDIA
Student, Raj Kumar Goel Institute of Technology, Ghaziabad, Uttar Pradesh, INDIA

ABSTRACT:

IoT-based solutions are now widely used in society due to the digital age. IoT technology is currently present in the majority of modern gadgets in one way or another. Utilizing the numerous wireless technologies offered by IoT can help create machines that are effective and efficient. With the aid of a remote, one of the sensors—an IR receiver diode—can assist in the development of numerous wireless electrical smart gadgets. One can connect to the internet using Wi-Fi using ESP8266, the Wi-Fi module offered by IoT as well. With the help of these two sensors, we can build a safe Internet of Things-based Smart Door Locking system that also has a PIR sensor for intrusion detection. By addressing the various drawbacks of conventional door locking systems, this module adds an additional layer of security.

Keywords: **IoT, embedded, wireless, sensor, diode, ESP8266, PIR sensor,**

1. Introduction:

1.1 Background:

In recent years, the idea of "smart homes" and the Internet of Things (IoT) has become increasingly popular. Through the integration of numerous networked devices and systems, smart home technologies seek to improve the comfort, convenience, and security of residential settings. Smart door lock systems, which offer better access control, automation, and monitoring capabilities, are a crucial component of smart homes. Traditional door locks have drawbacks in terms of convenience and security. It might be inconvenient to carry around many keys for various doors, and keys can be easily misplaced or stolen. Traditional locks are also unable to remotely regulate and monitor entry, which makes it challenging to efficiently manage and safeguard a property.

Smart door lock systems have become a practical remedy to these drawbacks. These systems use IoT technology to support real-time monitoring, better security features, and remote access. They combine several elements to build a smart, connected locking mechanism, including microcontrollers, sensors, actuators, and communication modules. A common option for creating IoT projects is the Nodemcu, an open-source Wi-Fi development board based on the ESP8266 microprocessor. It is perfect for smart home applications because it has built-in Wi-Fi, GPIO ports for connecting to sensors and actuators, and compatibility with Arduino development environments.

The Blynk IoT platform offers a user-friendly interface for managing and keeping track of IoT devices in collaboration with the Nodemcu. Blynk gives consumers the ability to create unique mobile applications that communicate with their linked devices, providing a simple and convenient way to manage smart door lock systems.

Smart door lock systems must have intrusion detection in order to identify unauthorised access attempts and respond appropriately. In smart houses, PIR (Passive Infrared) sensors are frequently utilised for intrusion detection. These sensors have the ability to recognise variations in infrared radiation, such as the presence of body heat, and can then send a warning or engage the door lock system.

A fingerprint reader's integration with smart door lock systems gives an additional layer of security. Only anyone with the right authorization can enter the property thanks to the practical and safe authentication provided by fingerprint recognition technology.

Overall, a smart door lock system with intrusion detection that combines Nodemcu, Blynk IoT software, solenoid lock, servo motor, PIR sensor, and fingerprint reader offers improved security, convenience, and control for residential settings. These solutions offer consumers greater access management, real-time monitoring, and reassurance about the security of their properties by utilising IoT technologies and intelligent automation.

1.2 Objective:

The following goals are intended to be attained by the Smart Door Lock System with Intrusion Detection project:

Create a system for smart door locks: Create and implement a solenoid lock controlled by a microcontroller (Nodemcu) to lock doors securely and effectively. Access control provided by the system should be dependable and practical.

Establish seamless interaction between the Blynk IoT app and the Nodemcu microcontroller to integrate IoT. Allow users to lock and unlock doors from anywhere using their cellphones by enabling remote control and monitoring of the door lock system using the Blynk app.

Integrate a PIR sensor to detect potential breaches or unauthorised access attempts while implementing intrusion detection. When the PIR sensor picks up movement close to the door, the system should send out an alert or sound the alarm.

Use a servo motor to replicate the opening and closing of the door to demonstrate door opening/closing. Through the Blynk app, the servo motor should respond to user orders and display the status of the door visually.

Integrate a fingerprint reader to further strengthen the system's security by adding fingerprint authentication. Utilise fingerprint recognition technology to verify authorised users' identities and enable them entry to the space.

Ensure User-Friendly Interface: Create a user-friendly interface for the Blynk app so that users can manage the door lock system, keep track of sensor readings, and receive notifications in real-time. The user interface must be simple to use, responsive, and intuitive for users of all technical levels.

Conduct Evaluation and testing: To verify the Smart Door Lock System's usability, dependability, and performance, thoroughly test and evaluate it. Test each piece of hardware, ensure its integration, and confirm the intrusion detection system's precision and responsiveness.

Performance and Usability Evaluation: Evaluate the accuracy, promptness, and capacity to reduce false alerts of the intrusion detection system's performance. Gather user feedback to assess the system's usability, pinpoint areas for development, and improve the overall user experience.

Examine Potential Improvements: Determine potential areas for improvement in the future, such as adding more security features, increasing compatibility with other platforms and smart home devices, and improving energy efficiency. To inform upcoming adjustments and enhancements, take into account customer feedback and recommendations.

The Smart Door Lock System with Intrusion Detection project intends to achieve these goals in order to develop a dependable, safe, and user-friendly solution that improves home security and access management while utilising IoT technologies for better functionality and convenience.

Methodology:

Hardware Components:

1. Nodemcu:

Nodemcu is a well-liked ESP8266-based open-source development board that has built-in Wi-Fi capabilities, making it appropriate for Internet of Things (IoT) projects.Nodemcu serves as the system's primary controller, interacting with other parts and connecting to the Blynk IoT app.

Fig 1. ESP8266 (NodeMCU)

2. Blynk IoT App:

Blynk is an intuitive IoT platform that permits remote management and observation of linked devices.

The user interface for controlling the smart door lock system from a smartphone or tablet is the Blynk app.

It facilitates user verification, allowing interaction with system features, and offers a visual depiction of the lock state.

Fig 2. Blynk app logo

3. Solenoid Lock:

A solenoid lock is an electromechanical device used to secure doors or access points.

Solenoid locks are frequently utilised in electronic door locking systems due to their dependable and durable performance.

They are composed of a solenoid coil that, when energised, operates a locking mechanism to engage or disengage the door.

Fig 3. Solenoid Lock

4. Relay:

A relay is a switch that is electrically activated and enables low-power control signals to regulate higher-power circuits.

Relays are utilised in the smart door lock system to connect Nodemcu and the solenoid lock.

To deliver the required voltage and current levels to activate or deactivate the solenoid lock, Nodemcu controls the relay.

Fig 4. Relay

5. Servo Motor:

In the smart door lock system, a servo motor is used to simulate the opening and closing of the door. The servo motor's shaft is connected to the door mechanism, enabling controlled movement within a specific range of angles.

Fig 5. Servo Motor

6. PIR Sensor:

The smart door lock system uses the PIR (Passive Infrared) sensor to detect intrusions.

It can identify variations in infrared radiation brought on by moving objects, such as people.

The PIR sensor is often installed close to the entry or in a key place to watch for movements near the door.

Fig 6. PIR Sensor

7. Fingerprint reader:

A secure user authentication method is to utilise a fingerprint reader. In order to give access to authorised people, it records and validates the distinctive fingerprint patterns.

Fig 7. Fingerprint reader

8. Power supply:

The smart door lock system needs a steady power source in order to function properly.

The power source should be able to supply all components, including the Nodemcu, relay, servo motor, and PIR sensor, with the voltage and current they need.

Depending on the exact components used, the required power may be supplied by batteries or a DC power supply.

9. Wiring and Connectors:

Wiring and connectors of different types are needed to create the electrical connections between the parts.

• The design of the project and the exact components used will determine the wiring arrangement.

• To maintain electrical integrity and minimise risks, it's crucial to make sure there is adequate insulation, secure connections, and the right wire gauge.

It's vital to remember that the models and specifications of the individual components may change depending on your project's needs and availability. Make sure the components you select are appropriate for your application and compatible with the Nodemcu board.

10. Circuit diagram :

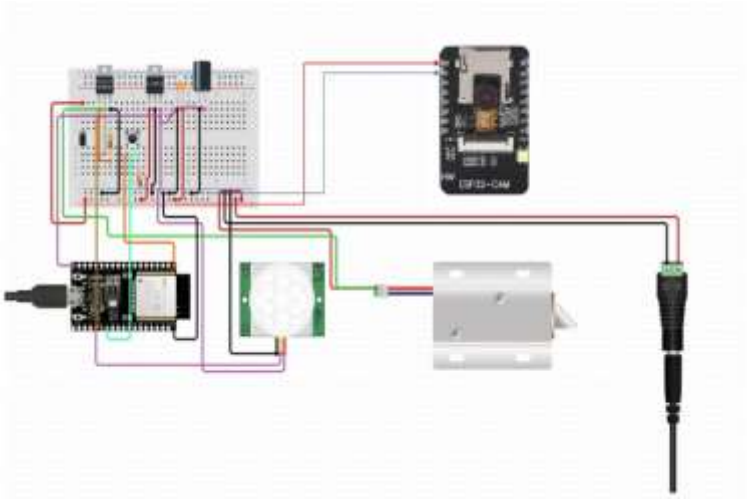

Fig 8. Circuit Diagram

Conclusion :

In conclusion, the project's goal of developing a strong, secure door locking mechanism with cutting-edge features was accomplished with the help of the Smart Door Lock System with Intrusion Detection. The Nodemcu, Blynk IoT app, solenoid lock, servo motor, PIR sensor, and fingerprint reader are just a few of the hardware elements that have been integrated to create a comprehensive solution to improve home security and access control.

The project has shown the system's usability, dependability, and efficacy through thorough testing and review. During the unit testing stage, it was made sure that every piece of hardware worked properly and delivered the desired results. Integration testing verified the coordinated and flawless connection between the sensors, the Blynk app, and the Nodemcu, ensuring a solid system. The Nodemcu board was programmed, the Blynk app's user interface was created, and the sensors and control systems were integrated as part of the software implementation. The user interface gave users a simple way to operate the door lock, keep track of sensor data, and get instant alerts. A further degree of protection was added with the inclusion of the fingerprint reader, allowing for safe and practical user authentication. The accuracy in detecting intrusions, prompt reaction, and robustness under various conditions of the intrusion detection system were highlighted by the performance study. False alarm mitigation strategies were put in place to reduce false positives and make sure the system runs consistently and doesn't create unneeded hiccups. In order to improve the user experience and guarantee the effectiveness of the system, the usability of the system was also evaluated.

Overall, the effort to develop a smart door lock system with intrusion detection has been a success in showcasing IoT technologies' potential in the field of home security. A dependable and user-friendly system has been created by combining hardware elements, software implementation, and thorough testing. The project improves the overall security of the premises by enabling straightforward control over door locking systems as well as the detection of unauthorised entrance attempts.

Future developments can include increasing the system's robustness, extending its compatibility with other platforms and smart home gadgets, and adding more sophisticated security features. The Smart Door Lock System has the potential to advance home security systems by making them smarter, more effective, and more secure with continuing development and improvement.

References:

1. **Books:**
   - Tero Karvinen, Kimmo Karvinen, and Ville Valtokari. "Make: IoT: Building Arduino-Based Projects." Maker Media, Inc., 2016.
   - Charalampos Doukas and Spiros Louvros. "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications." Morgan Kaufmann, 2013.
2. **Research Papers:**
   - Chen, X., Lin, Y., Qiao, X., Lin, L., & Ma, M. (2017). Design and implementation of a smart home control system based on IoT. IEEE Access, 5, 1517-1525.
   - Das, S., Nayak, B., Behera, H. S., & Panda, G. (2018). Smart home automation using IoT and Blynk app. In 2018 International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering (ICRIEECE) (pp. 1-6). IEEE.
   - Mohsen, R. K., Samy, M. E., & Emira, A. E. (2019). Home automation and security system using IoT. In 2019 IEEE 9th Annual Computing and Communication Workshop and Conference (CCWC) (pp. 800-804). IEEE.
3. **Online Resources:**
   - Blynk Official Website: https://blynk.io/
   - NodeMCU Documentation: https://nodemcu.readthedocs.io/
   - Adafruit Learning System: https://learn.adafruit.com/
   - Arduino Official Website: https://www.arduino.cc/