FPT UNIVERSITY

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PROJECT TITLE:

IoT-Based Intrusion Detection System Using NodeMCU and Arduino

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Abstract

This paper presents an IoT-based intrusion detection system utilizing NodeMCU and Arduino. The system employs PIR to detect motion or intrusions and IR sensors to receive signals from the remote. Upon detection, the system activates an LED light and a buzzer. This project aims to provide a cost-effective and reliable security solution.

1 Introduction

Intrusion detection systems are critical for ensuring security in residential and commercial spaces. Traditional systems can be expensive and complex. This paper introduces an IoT-based solution using NodeMCU and Arduino to create a simple, affordable, and effective intrusion detection system.

2 Main Proposal

This section describes the necessity, significance, and implementation of the proposed intrusion detection system.

2.1 System Models and Block Diagram

The system consists of a PIR sensor for motion detection, an IR sensor receive signals from the remote, NodeMCU for wireless communication, Arduino for sensor interfacing, an LED light, and a buzzer for alerts. Figure 1 shows the block diagram of the system.

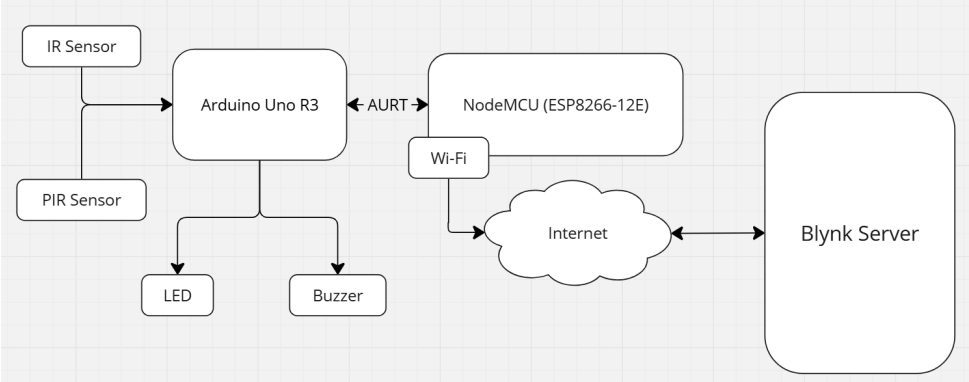
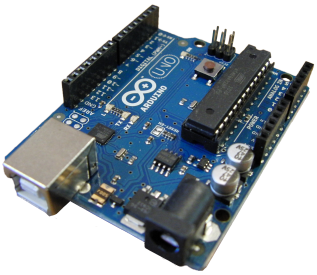


Figure 1: Block diagram of the developed system.

2.2 Components and Peripheral Devices

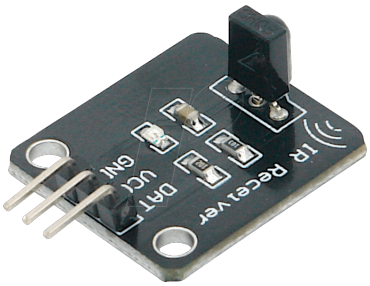
List all main components used in the developed system. Explain the functions and how to use the components in the developed system.

NodeMCU: A low-cost open-source IoT platform that is based on the ESP8266 Wi-Fi module. The NodeMCU connects to the internet via Wi-Fi. This allows data from the Arduino to be sent to the Blynk server.



Arduino: Acts as the central processing unit, receiving inputs from the IR and PIR sensors. Based on sensor inputs, it controls the LED and Buzzer.

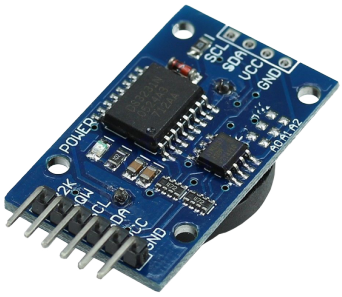
PIR Sensor: A Passive Infrared sensor used for detecting motion. It measures infrared light radiating from objects in its field of view.



IR Sensor: Infrared receiver for remote

LED Light: A light-emitting diode used as an indicator. It is activated when motion or intrusion is detected.

Buzzer: An audio signaling device used to produce sound alerts. It is activated alongside the LED light to signal an intrusion.



RTC: A real-time clock module used for keeping track of time. It helps in time-stamping the events

Table 1: Interfacing between Arduino and Its Components

Arduino	**ESP8266**	**PIR Sensor**	**IR Sensor**	**LED (Nha)**	**LED (Bao Dong)**	**Buzzer**	**RTC**
GND	GND	GND	GND	GND	GND	GND	GND
5V	-	VCC	VCC	-	-	-	VCC
D2	TX	-	-	-	-	-	-
D3	RX	-	-	-	-	-	-
D4	-	OUT	-	-	-	-	-
D7	-	-	OUT	-	-	-	-
D9	-	-	-	-	-	+	-
D12	-	-	-	+	-	-	-
D13	-	-	-	-	+	-	-
A4	-	-	-	-	-	-	SDA
A5	-	-	-	-	-	-	SCL

2.3 Circuit Diagram

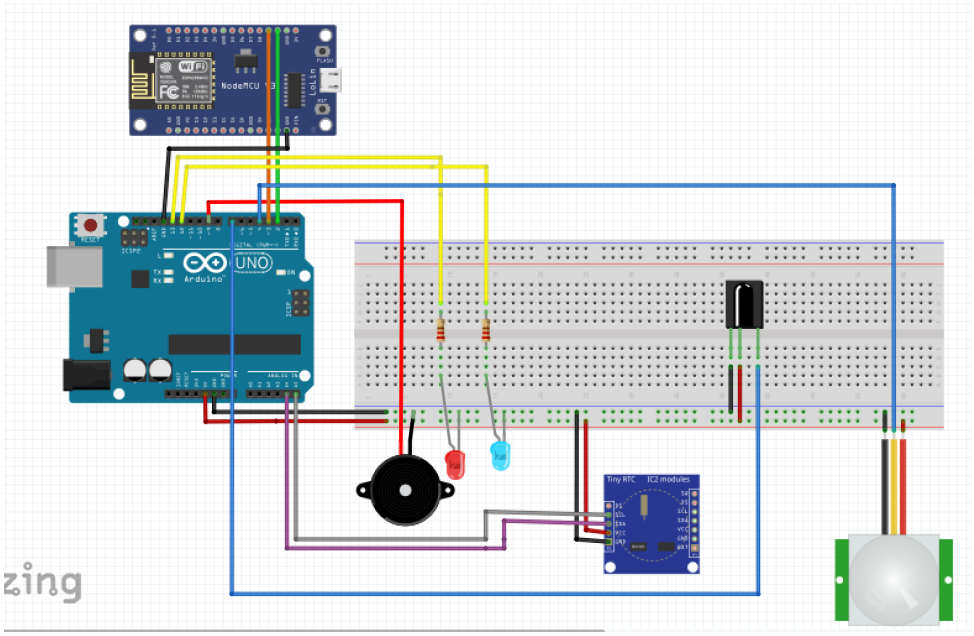


Figure 2: Circuit diagram of the developed system.

2.4 Software Programming

The NodeMCU and Arduino Uno R3 are programmed using the Arduino IDE. The software handles sensor data processing and triggers the LED and buzzer upon detecting an intrusion.

```
Initialize system components
While (True):
    If PIR sensor detects motion:
        Turn on LED
        Activate buzzer
        Send alert via Wi-Fi
```

2.5 Programming Flowchart

The programming flowchart involves initializing the sensors, continuously monitoring their outputs, and activating the LED and buzzer when the sensors detect motion or intrusion.

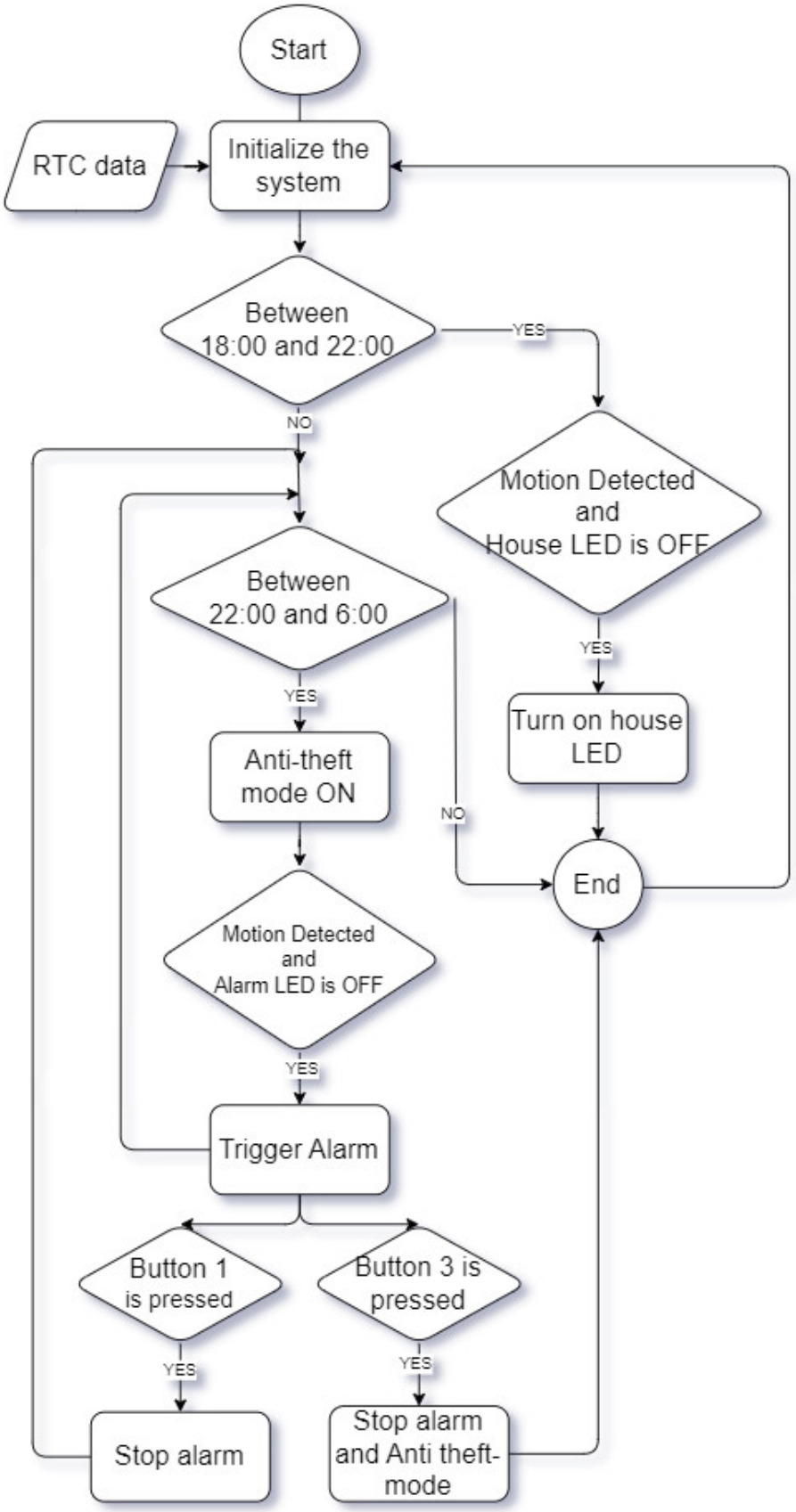


Figure 3: Programming flowchart.

2.6 Product Image

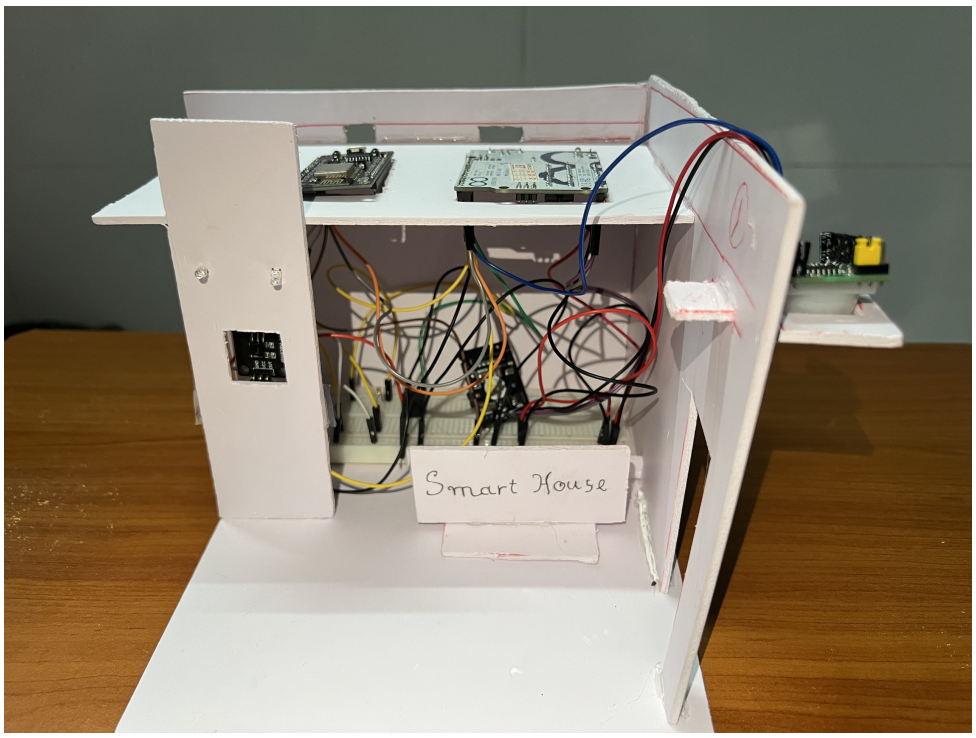


Figure 4: Product.

3 Results and Discussion

This section describes the research methods, prototype implementation, experimental results, and discussion.

3.1 Prototype Implementation

The prototype involves assembling the components on a breadboard, connecting the sensors to the Arduino, and interfacing the Arduino with NodeMCU for wireless alerts.

3.2 Experimental Results

The system was tested in various scenarios. The PIR sensor successfully detected motion. Upon detection, the LED light was turned on, and the buzzer sounded an alert.

3.3 Discussion

The system demonstrated reliability in detecting intrusions and activating alerts. Using NodeMCU allowed for future enhancements like remote monitoring and integration with other smart home devices.

Table 2: Research Plan

No	Task	Result Form	Time Schedule
1	Writing proposal	Proposal	May 11-May 18, 2024
2	Designing circuit	Circuit Design	May 25-Jun 1, 2024
3	Programming	Code	Jun 8-Jun 22, 2024
4	Testing	Test Report	Jun 22-Jun 28, 2024
5	Writing final paper	Paper	Jun 26-28, 2024

4 Conclusion

The project successfully developed an IoT-based intrusion detection system using NodeMCU and Arduino. The system effectively detected motion and intrusions, activating alerts accordingly. Future work includes integrating remote monitoring capabilities, integrating with cloud services, enhance sensor network,.... [1–3]

References

[1] D. N. M. Dang *et al.*, "Her: Hybrid approach to enhance reliability in iot networks," in *Proceedings of the International Conference on IoT*, 2014, pp. 123–130.

[2] N. T. Anh and D. N. Minh Dang, "Waste management system using iot," *Journal of Environmental Science*, vol. 8, no. 3, pp. 45–52, 2020.

[3] W. Li and X. Zhang, "Iot security: A survey," *IEEE Internet of Things Journal*, vol. 5, no. 6, pp. 4535–4552, 2018.