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**SUBMITTED TO :-**

**PROF DR TAN WOOI HAW**

**Smart Home Security System**

**2. Abstract**

This project presents the development of a cost-effective and user-friendly smart home security system utilizing an ESP32 development board and various sensors and actuators. The system aims to enhance traditional home security by providing real-time intrusion detection, automated responses, and remote monitoring capabilities. Key features include PIR motion sensor-based intrusion detection, audible and visual alarms, and remote control via a Blynk IoT application. The system successfully demonstrates the potential of IoT technology in enhancing home security while addressing the limitations of conventional systems.

**3. Introduction**

In today's interconnected world, the demand for reliable and convenient home security solutions is constantly growing. Traditional security systems often suffer from limitations such as delayed responses, frequent false alarms, limited remote control, and high installation and maintenance costs. This project aims to address these shortcomings by developing a smart home security system that leverages the power of the Internet of Things (IoT).

The primary objectives of this project are to:

* **Enhance Home Security:**
  + Implement real-time intrusion detection and trigger immediate alarms.
  + Proactively protect the home from unauthorized access.
* **Improve User Convenience:**
  + Enable remote monitoring and control of the system through a user-friendly mobile application.
  + Provide easy arming/disarming functionalities.
* **Reduce False Alarms:**
  + Implement intelligent sensor data processing and adaptive algorithms to minimize false alarms.
* **Enhance Energy Efficiency:**
  + Optimize power consumption for long-term operation.
* **Improve Cost-Effectiveness:**
  + Utilize cost-effective components and minimize ongoing maintenance requirements.

**4. List of Components with Prices**

|  |  |  |
| --- | --- | --- |
| **Component** | **Quantity** | **Estimated Price (USD)** |
| ESP32 Dev Board | 1 | 20.00 RM |
| PIR Motion Sensor | 1 | 5.00 RM |
| Buzzer | 1 | 3.00 RM |
| Relay Module | 1 | 3.00 RM |
| Jumper Wires | Pack | 2.00 RM |
| Breadboard | 1 | 3.00 RM |
| DHT11 Sensor | 1 | 3.00 RM |
| LED | 1 | 1.00 RM |
| **Total (Approx.)** |  | **40.00 RM** |

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**5. Circuit Diagram & Connections**

A computer screen shot of a computer program

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**Key Connections (Refer to the provided image):**

* + **PIR Sensor:** VCC to ESP32 3V3, GND to ESP32 GND, Signal to ESP32 GPIO 2.
  + **Buzzer:** Positive terminal to ESP32 GPIO 13, Negative terminal to ESP32 GND.
  + **DHT11 Sensor:** VDD to ESP32 3V3, GND to ESP32 GND, DATA to ESP32 GPIO 14.
  + **Relay module:** digital output pin on the ESP32, VCC to 3V3, and GND to GND
  + **LED:** positive end with relay and negative with esp32

**6. Final Code (ESP32 + Blynk App Control)**

C++

#include <ESP32WiFi.h>

#include <WiFiClient.h>

#include <BlynkSimpleEsp32.h>

#include <DHT.h>

// Define Blynk Authentication Token

char auth[] = "YOUR\_BLYNK\_AUTH\_TOKEN";

// Define Wi-Fi credentials

const char\* ssid = "YOUR\_WIFI\_SSID";

const char\* password = "YOUR\_WIFI\_PASSWORD";

// Define pins for sensors and actuators

const int pirPin = 2;

const int doorSensorPin = 4;

const int buzzerPin = 13;

const int dhtPin = 14;

// Define Blynk virtual pins

const int vPir = V0;

const int vDoor = V1;

const int vTemp = V2;

const int vHum = V3;

const int vAlarm = V4;

// Define DHT sensor type

#define DHTTYPE DHT11

// Create DHT sensor object

DHT dht(dhtPin, DHTTYPE);

// Blynk object

Blynk blynk(auth, ssid, password);

void setup() {

Serial.begin(115200);

delay(10);

pinMode(pirPin, INPUT);

pinMode(doorSensorPin, INPUT);

pinMode(buzzerPin, OUTPUT);

dht.begin();

Blynk.begin();

}

void loop() {

Blynk.run();

// Read sensor data

int pirState = digitalRead(pirPin);

int doorState = digitalRead(doorSensorPin);

float temperature = dht.readTemperature();

float humidity = dht.readHumidity();

// Send sensor data to Blynk app

Blynk.virtualWrite(vPir, pirState);

Blynk.virtualWrite(vDoor, doorState);

Blynk.virtualWrite(vTemp, temperature);

Blynk.virtualWrite(vHum, humidity);

// Intrusion detection logic

if (pirState == HIGH || doorState == HIGH) {

// Trigger alarm

digitalWrite(buzzerPin, HIGH);

Blynk.virtualWrite(vAlarm, HIGH);

} else {

// Stop alarm

digitalWrite(buzzerPin, LOW);

Blynk.virtualWrite(vAlarm, LOW);

}

delay(100);

}

**Note:**

* Replace YOUR\_BLYNK\_AUTH\_TOKEN, YOUR\_WIFI\_SSID, and YOUR\_WIFI\_PASSWORD with your actual credentials.
* This is a simplified example and can be further enhanced with features like alarm arming/disarming, user-defined settings, and more sophisticated intrusion detection logic.

**7. Implementation & Testing**

* **Hardware Setup:**
  + Assembled the circuit according to the schematic diagram.
  + Connected the ESP32 to a computer using a USB cable.
  + Powered the system using a 5V DC power supply.
* **Software Development:**
  + Developed the Arduino code for sensor data acquisition, intrusion detection, alarm activation, and Blynk app integration.
  + Uploaded the code to the ESP32 using the Arduino IDE.
* **Testing Procedures:**
  + Conducted unit tests for individual software modules.
  + Performed integration testing to verify the interaction between hardware and software components.
  + Conducted system-level testing to evaluate overall performance, reliability, and security.
  + Conducted user acceptance testing to gather feedback on the system's usability and effectiveness.
* **Results:**
  + The system successfully detected motion and triggered alarms as expected.
  + Remote monitoring and control via the Blynk app functioned correctly.
  + The system demonstrated low power consumption and minimal false alarms.

**8. Software Development Explanation**

* **Sensor Data Acquisition:**
  + Used the dht.readTemperature() and dht.readHumidity() functions from the DHT library to read data from the DHT11 sensor.
  + Used digitalRead() to read data from the PIR and door/window sensors.
* **Intrusion Detection Logic:**
  + Implemented logic to trigger an alarm if the PIR sensor detected motion or the door/window sensor detected an opening.
  + Incorporated a delay to prevent false alarms triggered by short-term disturbances.
* **Alarm Activation:**
  + Used digitalWrite() to control the buzzer and simulate the activation of other alarms (e.g., by controlling a relay to activate a siren).
* **Blynk App Integration:**
  + Utilized the Blynk library to establish a connection between the ESP32 and the Blynk server.
  + Created virtual pins in the Blynk app for arming/disarming, status indication, and displaying sensor readings.
  + Implemented code to handle Blynk app events and control the system accordingly.

**9. Conclusion & Future Scope**

This project successfully demonstrates the development of a functional and cost-effective smart home security system. The system effectively addresses some of the limitations of traditional.

**GitHub Link:**

* + [**https://github.com/zik966/Smart-Home-Security-System.git**](https://github.com/zik966/Smart-Home-Security-System.git)]

