

Home Security System using IoT

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Abstract—In day-to-day life, security is the most important issue. In our busy schedule, many times we forget to lock the door. Physical doors lock keys are time-consuming so we decided to make an IoT based digital doors lock and security system using RFID, Arduino, ESP8266, ultrasonic sensor, etc. The system will inform the owner whenever someone stands in front of a door or when unauthorized entry a buzzer sounds the alarm. The main advantages of the system are low-cost, less power consumption, and low maintenance.

Keywords— IOT, Security system, Home security, Notification system(Telegram).

I. INTRODUCTION

Home security is a growing concern for homeowners, as the number of burglary cases and home invasions continues to rise. In recent years, the emergence of IoT technology has revolutionized the way we interact with our homes and the devices within them. With the increasing number of IoT devices being introduced into homes, there is an opportunity to integrate these devices with home security systems to improve their functionality and effectiveness. This paper provides a comprehensive review of the current state-of-the-art home security systems and the potential of IoT integration to enhance home security. We identify the challenges and opportunities associated with IoT integration and discuss the various IoT technologies that can be used to enhance home security.[1]

IoT-based home security systems using the internet of things could be used to protect homes from intruders.[2] Systems use Arduino Uno, module ESP wifi, ultrasonic sensor, and a smartphone app to send alerts when there is any motion in front of the door.. It will use an Arduino UNO board, ESP8266 Wifi-module, RFID reader, RFID card, Solenoid

lock, Lcd Display, Ultrasonic sensor and Smartphone. This system will message to the owner person through an telegram application that ALERT MOTION DETECTED.

II. Literature Review.

Ni Ni San Hlaing and San San Lwin had attempted to make user-friendly Electronic Door Lock [1] for the security of homes, schools, offices and industries. This Electronic Door Lock is made using Arduino UNO, RFID technology and keypad. From this proposed system we learnt about the RFID technology, its internal construction and how it works. We also came to know how to interface RFID and keypad with Arduino UNO. However, this system can't detect whether someone is trying to enter inside.

Taryudi , Davin Bagas Adriano and Wahyu Apsari Ciptoning Budi had built the home security and monitoring system [2] for the people who spend many activities out of home. This IoT based system is made by using RFID technology, Arduino-nano and NodeMCU ESP8266 as a microcontroller, DHT-11 sensor, rain sensor, fire sensor and LDR sensor for detecting temperature, rain , fire and light conditions respectively. What we learnt from this system is how to interface all sensors with Arduino-nano and NodeMCU ESP8266. We also came to know about the connecting Wi-Fi module which is NodeMCU ESP8266 with Blynk application. However, this system also can't detect the movement around the door.

Khaing Myat Nwe , Kaythi Wut Mhone Khin , Zin May Win and Zarni Sann had focused on making a home security and home automation project which sends alert to the user and blows an alarm when any movement is detected inside the home. In this IOT based Smart Home Security System using RFID and Bluetooth [3] motion sensor HC-SR is used

which communicates with the GSM module by sending SMS after detecting the motion. We came to know about the interfacing of the motion sensor with the GSM module and we learnt the process of sending messages on Android applications.

Htay Myint and May Zaw Tun had made a Secure Door Control System using RFID Card [4] using RFID technology to give access only to those who have correct tags or RFID cards. An automatic identification and authentication system that might be put at building entrances to confirm the identity of authorized people is the recommended solution. Anyone attempting to obtain admission must enter the right code number on the keypad. Card readers are replaced by access control keypads, and entry is only allowed with the right code. The barcode system is another name for this method. An RFID card can operate a door lock in this setup.

Anitha A had made the project Home security system using internet of things [5]. This proposed system is built by using Arduino Uno and NodeMCU ESP8266 (Wi-Fi module) as a microcontroller and it uses a reed sensor module which is used to open and close the automatic doors. We learnt about reed sensors from this proposed system.

III. Objectives

- Access Control: One of the main objectives of using RFID in home security systems is to control access to the property. RFID tags can be attached to keys, access cards, or even embedded in smartphones to grant authorized individuals access to specific areas of the home.
- Intruder Detection: RFID sensors can detect when someone enters a restricted area of the home, triggering an alarm or notification to alert the homeowner or security personnel. This can help deter burglars and provide an early warning system for potential intruders.
- Asset Tracking: RFID technology can be used to track valuable assets within the home, such as expensive electronics or artwork. This can help homeowners keep tabs on their belongings and ensure that they are not stolen or misplaced.
- Smart Home Integration: RFID technology can be integrated with smart home systems, allowing homeowners to control various aspects of their home security using voice commands or mobile devices. This can include locking doors, turning on alarms, and monitoring surveillance cameras.

IV. METHODOLOGY

Components:

1. Arduino UNO



Fig. no. 1 Arduino UNO

The ATmega328 is the foundation of the Arduino Uno microcontroller board (datasheet). It has a 16 MHz crystal oscillator, 6 analogue inputs, 14 digital input/output pins (of which 6 may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It includes everything required to support the microcontroller; to use it, just plug in a USB cable, an AC-to-DC converter, or a battery to power it. It features a 5v working voltage, a DC current of 40mA per I/O pin, a DC current of 50mA for a 3.3v pin, 2kb of SRAM, 1kb of EEPROM, and a clock speed of 16MHz[4, 7].

2. RFID (Radio Frequency Identification)



Fig. no. 2 RFID

RFID (radio frequency identification) employs electromagnetic or electrostatic coupling in the radio frequency area of the electromagnetic spectrum to uniquely identify a thing, an animal, or a person.

3. NodeMCU ESP8266



Fig. no. 3 NodeMCU ESP8266

The ESP8266 Wi-Fi chip's LUA firmware serves as the foundation for NodeMCU. Its price is affordable. It is simple to connect to the IoT. NodeMCU includes the Wi-Fi module. There is a 30 pin connector available. Numerous pins, including the Power, GND, and GPIO pins, are used to interact with external circuitry. There are 17 GPIO pins in all. The operational voltage range is 2.5V to 3.3V. It has a micro-B USB port built right into it that powers the board. Due to its incredibly low energy usage and small design, it is frequently used.

4. Solenoid Lock



Fig. no. 4 Solenoid Lock

A latch for electrical locking and unlocking is referred to as a solenoid lock. It is offered in locking and keeping and unlocking in the power-on mode types, both of which can be employed in different circumstances. Only when the solenoid is turned on is unlocking possible with the power-on kind.

5. Relay module



Fig. no. 5 Relay Module

NodeMCU can only operate at 5V, therefore it cannot regulate voltages over that. The 230V AC is controlled by the relay module. A relay is a switch that is used to change circuits or turn a circuit on or off. It is able to control high-power circuits by employing low-power impulses. It has a low voltage signal (S) and pins that are positive (+) and negative (-). It has three terminals: one that is generally closed, one that is normally open, and one that is linked to an external circuit. When the relay is deactivated and when it is engaged, normally closed (NC) and normally open (NO) are controlled by the same terminal.

Flowchart:

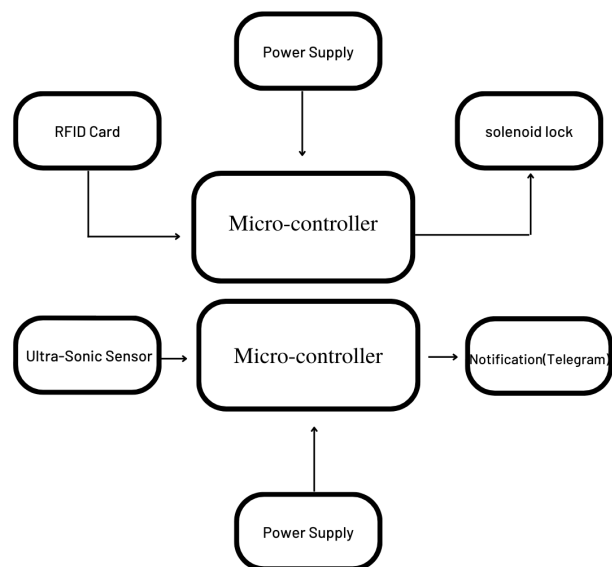


Fig. no.6 Flowchart of the System

Theory

The system consists of two main Parts, examining the RFID card and based on that showing the output on an solenoid lock and on Lcd Display, and another part is detection of movement in front of the door and based on that sending the notification to the owner of the House.[3]

The ESP8266 is used for sending notifications to the telegram application. The ultrasonic sensor is placed at the top of the door, so the transmitter part of the ultrasonic sensor is continuously emitting ultrasonic sound waves with the help of piezoelectric crystals, and the receiver receives the sound after it has traveled to and from the target[5]. So, wherever there is any motion detected in front of the door within the range of 11 meters[4], the echo pin receives the ultrasonic waves and the ESP starts working, and we receive the notification from the telegram that ALERT MOTION DETECTED!!. For this purpose we have to create a bot in the telegram application this bot are: 1)BotFather 2)IDbot

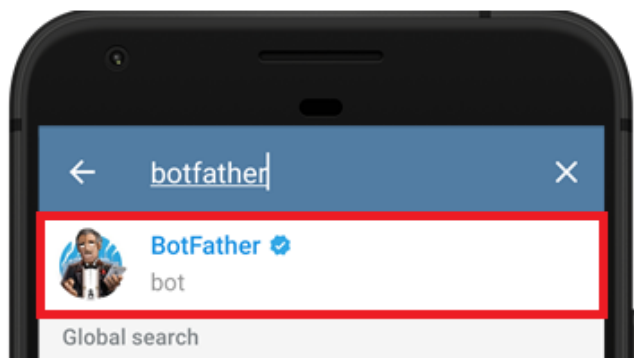


Fig.no.7 Showing the BotFather bot of Telegram application[6]

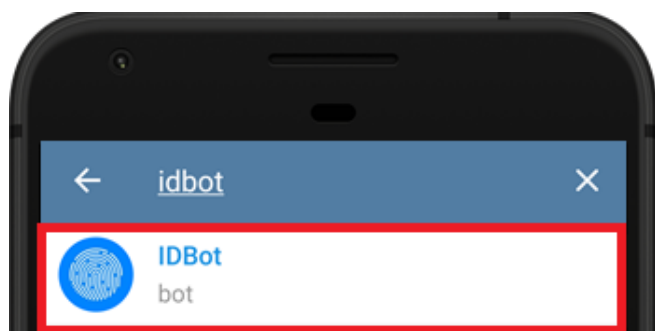


Fig.no.8 Showing the IDBot bot of Telegram application[6]

The BotFather bot will generate a link to access the bot and the bot token. This Bot token will be interacting with the ESP8266. But, random person who knows our username of our bot can interact with it so, we make sure make sure that we ignore messages that are not from our Telegram account (or any authorized users), you can get your Telegram User ID. Then, when your telegram bot receives a message, the ESP can check whether the sender ID corresponds to your User ID and handle the message or ignore it. and this will be possible with the help of IDBot[6].

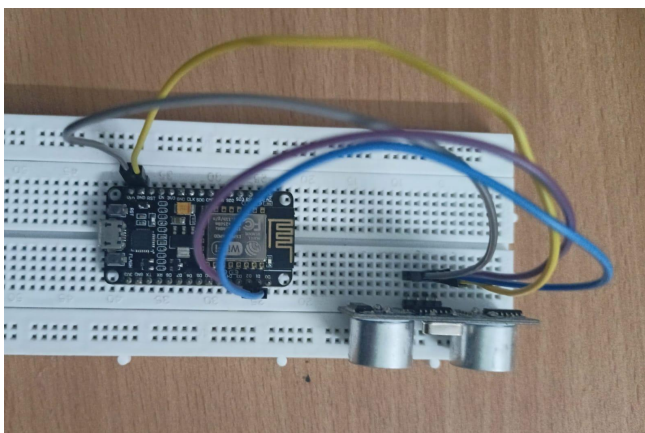


Fig. no.9 Interfacing of Ultrasonic sensor with ESP8266 Wifi Module

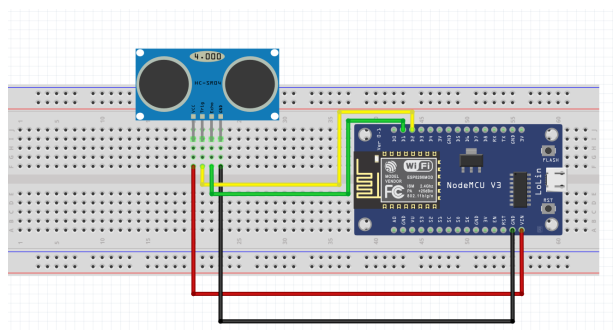


Fig.no.10 Circuit Diagram of Interfacing ESP8266 with Ultrasonic sensor

Now, Interfacing of RFID with Arduino Uno. When power supply is given to Arduino this door lock system is activated, the solenoid lock activates. On the LCD Display it displayed "Welcome, put your card". Whenever we bring the RFID tag closer to the RFID reader, it is scanned. For that particular case, it is displayed as "scanning" on the LCD display. Then, if the RFID tag is correct, the solenoid lock is activated and the door lock is pulled back. The LCD shows "Door is Open". If a wrong RFID tag is used according to the program, it will be displayed as "Wrong card" on the LCD Display.[7]

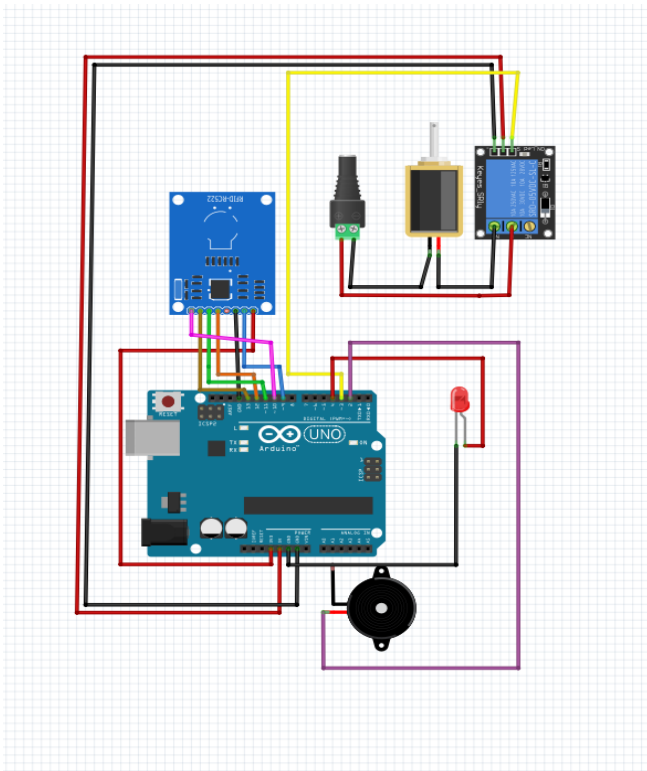


Fig.no.11 Circuit Diagram of Interfacing RFID with Arduino-Uno

The software platforms used for this project are Arduino IDE for programming the Arduino Uno and ESP8266. Telegram Application. The following are the library module files are imported on Arduino IDE:

```
1 #include <ESP8266WiFi.h>
2 #include <WiFiClientSecure.h>
3 #include <UniversalTelegramBot.h>

3 #include <LiquidCrystal_I2C.h>
4 #include <SPI.h>
5 #include <MFRC522.h>
```

Fig.no.12 Showing the Library used

After importing required Library modules, we need to define ssid, Password, BoTtoken and ChatID for receiving Notification.:

```
6 const char* ssid = "POCO X3"; // Enter your WIFI SSID
7 const char* password = "password4"; // Enter your WIFI Password
8
9
10 #define BOTtoken " " // Enter the bottoken you got from botfather
11 #define CHAT_ID " " // Enter your chatID you got from chatid bot
```

Fig.no.13 Showing the changes

RESULTS AND DISCUSSIONS

The IoT-based home security system we have designed is not only capable of detecting an unusual activity but also it can alert the victim about a threat in its surroundings.

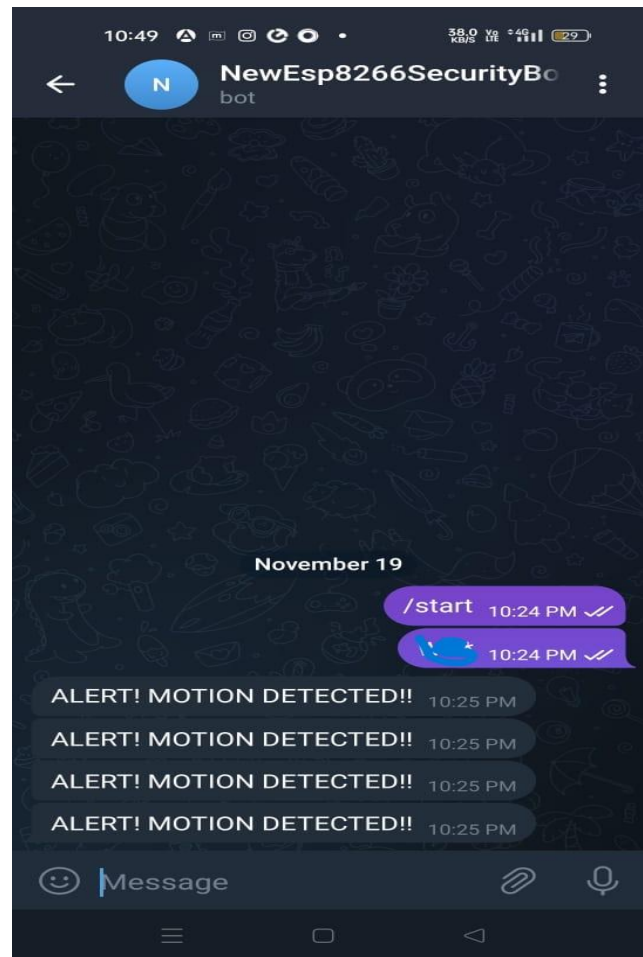


Fig.no.14 Showing the Created bot and Received Notification

CONCLUSION

Based on the implementation and validation process of the designed system, all subsystems can successfully work. In the home security part, the system can detect an RFID card that is integrated with the notification system by sending an ALERT MOTION DETECTED and using a RFID card to open the door.

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