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IOT BASED SMART SECURITY AND HOME AUTOMATION

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Abstract - *Internet of Things is a system where appliances are embedded with software, sensors and actuators. Wi-Fi is one of the main wireless communication protocols for connecting different devices for exchange of data over Internet. IoT is implemented in smart home security to device embedded module for standalone operation of collecting and monitoring different sensor data for home security. This project focuses on building a home security system which will be wireless. Security over a network is achieved using arduniouno. This system was used for monitoring the status of home by using different sensors. The sensor data is processed by Node MCU and if any abnormality found then it will automatically send service request to the concerned person regarding the abnormality.*

***Key Words*: Internet of Things, Home Automation, Smart Security, Camera, Arduino uno**

1. INTRODUCTION

Homes of the modern world will become smarter and more automated due to the advantages of automation. Automation system in smart home allows users to control different electric and electronic appliances. Safety and security of the home is one of the most primary concerns. The advancement of technology now provides the option of the safety and security of people along with their belongings. This paper focuses on a system that provides features of Home Automation relying on Internet of Things to operate easily, in addition to that it includes a camera module and provides home security.

Security is achieved with motion sensors if movement is sensed at the entrance of the house; a notification is sent that contains a photo of house entrance in real time. This notification will be received by the owner of the house via internet such that app can trigger a notification. So owner can raise an alarm in case of any intrusion or he/she can toggle the appliances like opening the door if the person is a guest. The user can make use of this system to control switching on of lights, fan, AC, etc. automatically. [2]. We have also incorporated a smoke sensor which, on detection of smoke will ring an alarm and alert the user on their phone by SMS alert.

The project mainly aims to overcome the shortcomings of home security systems by providing information of current situation when the owner is away from the house. It will also enhance the IoTs' network security using encryption and decryption of the user's data.

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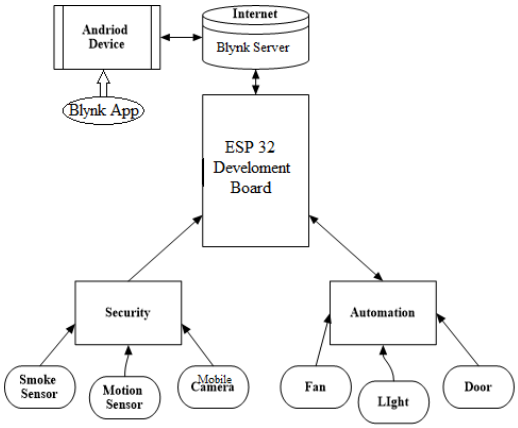


Fig. 1: Block Diagram security system

Main responsibilities of Node MCU in this project is collect the external data through input ports, process the data and transmit data to the network module. The network module responsibilities are collecting the data from the node mcu and transmit the data to external cloud or IoT platform. Internet of things (IoT) is considered as the next revolution in monitoring the data and analysis for control.

1.1 IMPLEMENTATION

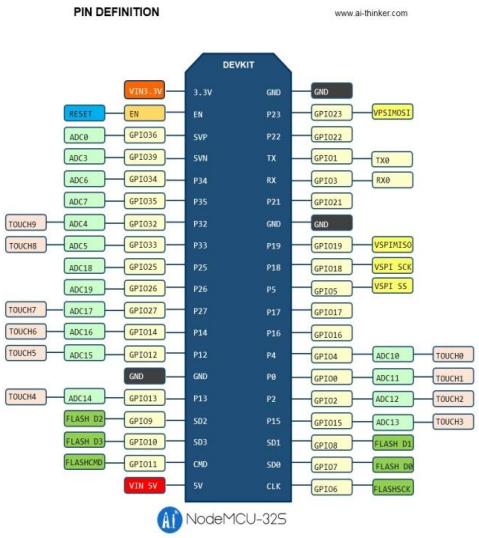
A. Hardware Components

We can differentiate the components used for implementing system into two. They are hardware components and software components. Hardware components mainly consist the following

- nodemcu 32
- Pi Camera
- door sensor
- MQ2 gas Sensor
- flame Sensor
- ultrasonic Sensor

1) Node mcu

The core of this module is the ESP32 chip, which is scalable and adaptive. Two CPU cores can be individually controlled. The clock frequency is adjustable from 80 MHz to 240 MHz and supports RTOS. It is a general-purpose Wi-Fi+BT+BLE MCU module.ESP-WROOM-32s. The module integrates traditional Bluetooth, Bluetooth low energy and Wi-Fi. Wide range of uses: Wi-Fi supports a wide range of communication connections, as well as direct connection to the Internet via a router; Bluetooth allows users to connect to a mobile phone or broadcast a BLE Beacon for signal detection. The module supports data rates up to 150 Mbps and antenna output power of 20 dBm for maximum wireless communication. As a result, this module has industry-leading specifications and performs well in terms of high integration, wireless transmission distance, power consumption, and network connectivity.

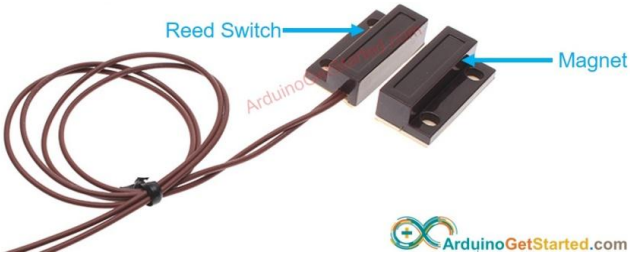


2) Camera

Camera is an imaging device. It is an optical instrument which is used to capture the image or video. It has electronic image sensor, usually a CCD (charge coupled device) or a CMOS sensor to capture images according to light fallen on It. It uses decoder for the capture the image according to the light sensed by the CCD, and then it transfers it to the storage location for example memory card or internal flash storage of the camera for later playback or processing. Pi camera is a camera module specially designed for Raspberry Pi. It is an 8MP, 1080p resolution camera. it is mainly used for HD video recording and to capture still photographs. It is connected to the Raspberry Pi via a 15cm ribbon cable to the CSI port. While programming Pi camera, python libraries are added to access the camera. The following figure shows the Pi camera.

3) Door sensor includes two components

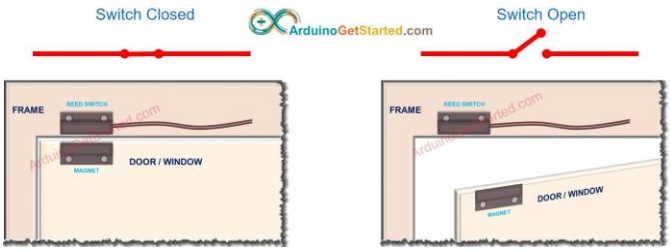
- One reed switch with two pins
- One magnet



Just like a normal switch/button, we do NOT need to distinguish the two pins of the reed switch.

The magnet is attached to the door/window (moving part), and the reed switch is attached to the door frame (fixed part). The two components are in contact when the door is closed.

- When the magnet is close to the reed switch, the reed switch circuit is closed
- When the magnet is far from the reed switch, the reed switch circuit is open.



If we connect a pin of the reed switch to **GND**, the other pin of the reed switch to Arduino's input pin with a pull-up resistor (internal or external):

- When the magnet is closed to the reed switch, the value in Arduino's input pin is **LOW**
- When the magnet is far from the reed switch, the value in Arduino's input pin is **HIGH**

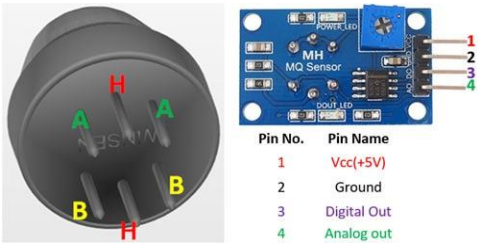
So:

- To check the state of the door, we just check the state of Arduino's input pin:
  - If the state is **LOW**, the door is closed
  - If the state is **HIGH**, the door is open
- To detect the door-opening/door-closing events, we can detect the state change on the Arduino input pin:
  - If the state changes from **LOW** to **HIGH**, the door-opening event is detected
  - If the state changes from **HIGH** to **LOW**, the door-closing event is detected.

4) MQ-2 gas sensor

The **MQ-2 Gas sensor** can detect or measure gasses like LPG, Alcohol, Propane, Hydrogen, CO and even methane. The module version of this sensor comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used with most common microcontrollers.

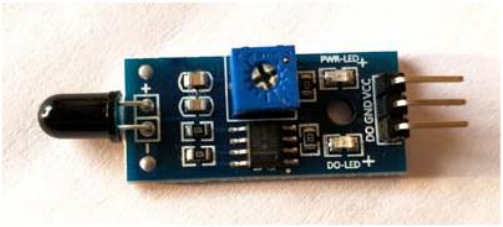
So, if you are looking for a sensor to detect or measure gasses like LPG, Alcohol, Propane, Hydrogen, CO and even methane with or without a microcontroller then this sensor might be the right choice for you.



5) Flame sensor

Flame sensor module has photodiode to detect the light and op-amp to control the sensitivity. It is used to detect fire and provide HIGH signal upon the detection. Arduino reads the signal and provides alert by turning on buzzer and LED. Flame sensor used here is an IR based flame sensor.

A **flame detector** is a sensor designed to detect and respond to the presence of a flame or fire. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system.

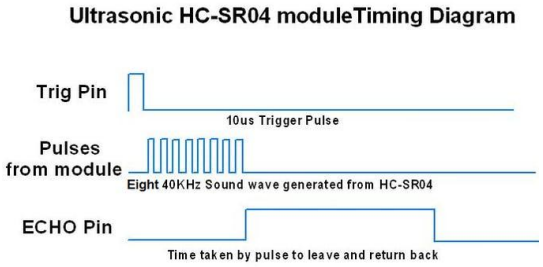


In this project we are using an **IR based flame sensor**. It is based on the YG1006 sensor which is a high speed and high sensitive NPN silicon phototransistor. It can detect infrared light with a wavelength ranging from 700nm to 1000nm and its detection angle is about 60°. Flame sensor module consists of a photodiode (IR receiver), resistor, capacitor, potentiometer, and LM393 comparator in an integrated circuit. The sensitivity can be adjusted by varying the on board potentiometer. Working voltage is between 3.3v and 5v DC, with a digital output. Logic high on the output indicates presence of flame or fire. Logic low on output indicates absence of flame or fire.

Ultrasonic Sensor HC-SR04 is a sensor that can measure **distance up to 14 feet's (or 4 meters)** . It emits an **ultrasound** at **40 000 Hz (40kHz)** which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.

The configuration pin of HC-SR04 is VCC (1), TRIG (2), ECHO (3), and GND (4). The **supply voltage** of VCC is **+5V** and you can attach TRIG and ECHO pin to any Digital I/O in your Arduino Board.

In order to generate the ultrasound, we need to set the **Trigger Pin** on a **High** State for **10 µs**. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo Pin. The Echo Pin will **output** the **time** in microseconds the sound wave travelled.



B. Software Components

1. SMTP

Simple Mail Transfer Protocol (SMPT) is a protocol for sending e-mail messages between servers. Most e-mail systems that send mail over the internet use SMTP to send messages from one server to another. We will be using s**mtp2go SMS or way2sms server** to send notification to user about the abnormality at home.

2. Smart home automation system

Under the Home Automation we can control all electrical appliances from long distance through an mobile phone. In this project we are controlling Lights and Fans through an Internet .Even though if Wi-Fi is not available we can go to 3G or 4G services to operate the system. This will helps us to operate our home appliances through a long distance. This will helps the handicapped and aged people to control their home appliances easily.

1. BlynkIoT Platform

Blynk is an Internet-of-Things platform designed to make development and implementation of smart IoT devices quick and easy. It can be used to read, store, and visualize sensor data and control hardware remotely.

3. Blynk App for Android Device

The mobile app developed by Blynk works as a control panel for visualizing and controlling your hardware. It is available for both Android and iOS. The app offers a very productive interface and various different widgets for different purposes. Blynk works on a currency of its own called energy. New users get 2000 amount of Blynk energy with a free Blynk account and this energy is used to buy and deploy widgets in the projects.

4. Blynk Server

The most amazing component of the Blynk Platform which makes it all possible is the Blynk Server. Blynk offers a secure, responsive and centralized cloud service through its server which allows all of this communication between the devices. The Blynk server is also available as open source so you can literally make your own server and make it even more secure with a little tinkering.

2. WORKING

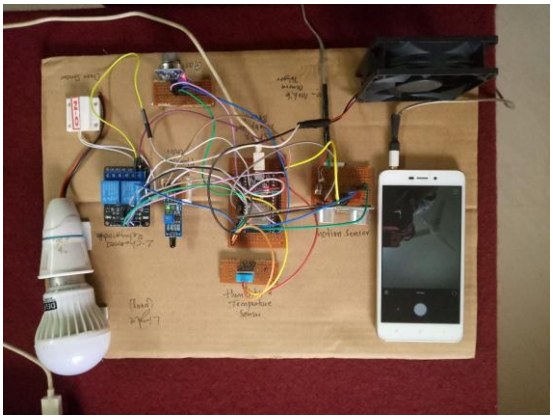


Fig.2.Embedded system

When the system is initialized, Node MCU will connect to the already existing Wi-Fi network. All the sensors are interfaced to the Node MCU, so the data coming from the system is processed by it and sent to Blynk server. Blynk server will receive the data and visualize the data in the form of graph. When the output of PIR sensor is high, system will capture the image with camera with is interfaced to raspberry pi. And then notification is sent to the user and the concerned person like security person. In the same way, when Smoke sensor detects smoke or gas it sends notification to the fire department and to the user. Vibration sensor is placed near door and windows so it will detect when someone tries to open it forcefully and the system will send the notification to the concern person. Temperature sensor is used to monitor temperature and report any abnormal temperatures recorded. Captured images are stored in Node MCU microcontroller for finding intruder. The data logged by the sensors are always updated to the Blynk server for continuous monitoring of the present status

of home. The following figure shows the Block diagram of data flow in working model.

3. CONCLUSION

The proposed system sends the service request to concern person when sensor detects abnormality. In this project, we collect data from different sensors for monitoring the present status through IoT. This can be useful for intruder detection; fire accidents and any other abnormalities occur From the proposed system the authorized persons get the images captured by the camera via sms and email and the user will also get the count of people who visited the house.

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