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Home Intrusion Detection System Based on IoT Technique

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Abstract:

One of high technologies emerged in last decade is as called the Internet of Things (IoT). The IoT means the interconnection among devices to each other and to humans via the networks and internet. More that the communication science over this technique to the “ Thing-to-Thing”. The last provide many abilities in the surveillance and security, especially in the indoor systems as homes, and markets.

The intrusion detection system (IDS) is one of the challenges of IoT techniques. To achieve strong IDS inside the home, there are number of methods as an using the CCTV camera. The CCTV camera system has disadvantages as expensive and not efficiency.

This paper introduces a system for the Home Intrusion Detection System depending on the IoT techniques. The proposed method used PIR sensor and NodeMCU ESP8266 to detect the motion of intrusion, and link with the internet via IFTTT server. The system benefits and familiar for humans who like to secure life and accessibility. In addition, the system is very easily used for all peoples.

Keywords: IoT, Home Intrusion Detection System, Surveillance

1- AN INTRODUCTION:

The fast and huge development in the networks media and the internet communication led to produce as called the Internet-of-Thing (IoT). In this discipline, all devices and other objects regards as a “things” and can react with the environment. Also, these things link with each other and swap data via the internet [1, 2]. The scientists are expecting, at late of 2022, that more than trillion objects (devices or things) will connect to the networks as the IoT network [3].

The IoT can be defined as a collection of many devices, as computers, sensors and other network equipment. These things communicate and process data with each other. As a result those things can be stated as a new technology in the communication science hybrid among many technologies. The IoT joins number of devices to each other and to the network at same time.

To achieve the organization in the IoT technology (services and software) to process data, there is a controller system, work as brain, analyzes and uses the collecting data by the IoT network. This controller system does the decisions and initializes the jobs from same devices or others [4,5].

The main function of the IoT is to help us to access, control and identify thing from anywhere, at anytime via the internet. There are a large number of autonomous and intelligence services and application introduce

professional, economic, and personal benefits can link to each other by interconnected networks [6]. To make the life more easy and more productive develop many technologies to solve challenges in the energy, industrial, and environment [7]. One of the modern technologies is the IoT technology, which input different fields in the life across large networks.

One of the modern concepts in the new technologies is so-called Smart Home. This concept concentrates about how control in anything inside and outside the home as an energy saving, multimedia, temperature, doors/windows operations, and lighting. These services provide to the owner of home more abilities and more governing in the healthy and security home [6].

The security of home become more important in last years, and how to employ new IoT in this field. Many researches in IoT concern with the security in the indoor systems as the homes, markets, and classrooms. There is very interconnection between the smart home and the IoT technology especially the security of homes as an intruder detection and controlling from far places. Previously, the security of home methods meant having an buzzer alerts that would go off when a person attempt to break in, but the home security can be more than that [2]. In this proposed system, smart security system used to help the homeowner on-line of an intruder break-in by emailing his.

When the owners are out the home, they like to monitor their homes against the thieves and intruders. Then, the main purpose of this work is to build a smart security home system can notify the owner of an intruder break-in. This system will help the owner of homes to secure their homes by putting the system on the window or door and surveillance the motions via their tablets or phones.

2- RELATED WORKS:

Siwen *et al*, in [8], introduced system to monitor the home by using a LED is used, the system provides the owner of the home to re-change the pass code for the home. Khiyal *et al*, in [9], proposed a monitoring method depending on the SMS of mobile phone about the intruder. These SMSs sent automatically via the owner's phone number.

Vigneswari *et al*, in [10], proposed an algorithm to diagnosis an intruder by using the IR sensors, Raspberry Pi picture of intruder and a GSM technique for emailing that picture to the owner of home.

Priyanka *et al*, in [11], present a mechanism uses a robot to send a live video about the home. The owner will receive alerts from that robot about any anonymous movement. This mechanism used temperature sensor to help the robot, built-in with the robot.

Bangali *et al*, in [12], introduced a method using a GSM technique to notify the home's owner when an intruder is detected. Prasad *et al*, in [13], proposed a system used a camera and raspberry pi, then sending the location of the intruder to the owner of home via the smartphone.

3- PROPOSED SYSTEM:

The aim of this paper is to propose a system of the Home Intrusion Detection (HIDS). The proposed system goals to overcome the drawbacks of the past monitoring systems and to improve the security required. It does this by sending an email to the owner's smartphone when an intrusion is detected. The intrusion detection and its activate done by using PIR motion sensor. Firstly, it is activated, it will process as follow: it will trigger a web service on an account of an intrusion. After that, the neighbors or security guard is alerted by beeping in buzzer. Figure 1 introduce the conceptual illustration of the Home Intrusion Detection System (HIDS). The main blocks of the proposed system can be sketched in the Figure 2, as below.

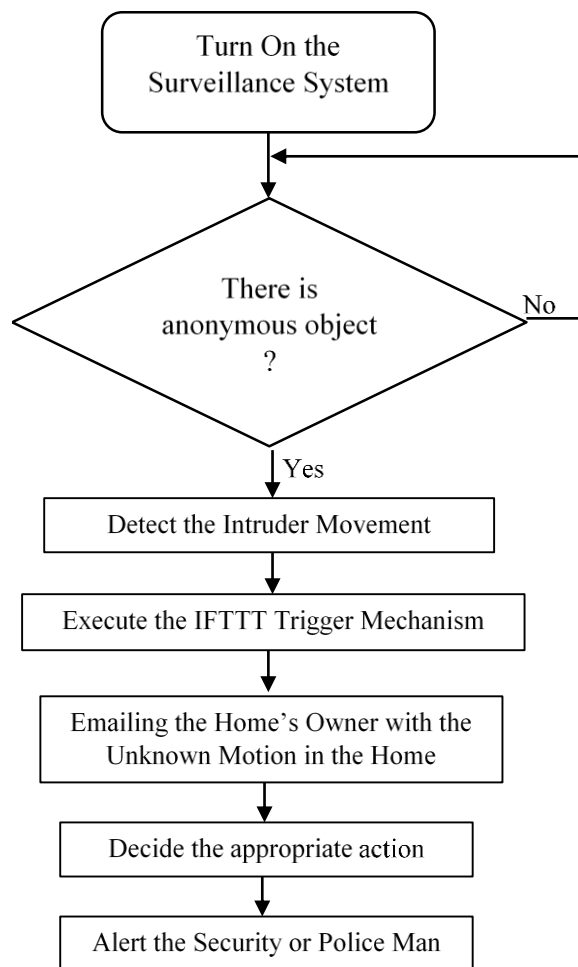
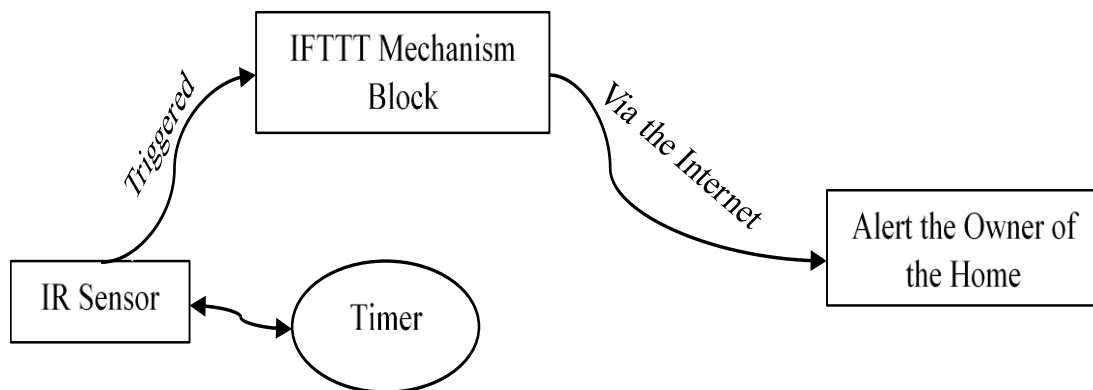


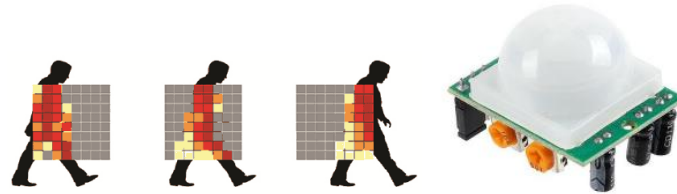
Figure 2: Flowchart of the Proposed System

3.1 Tools and Equipment

This work goals to build Home Intrusion Detection System (HIDS). There number of tools used in the proposed system are:

- **Passive Infrared (PIR) Senor.** This sensor is detecting the infrared radiation emitted or reflected from objects. When someone appear in the range of the PIR sensor, the temperature of the room rises

due to the human temperature of that person. This increase in temperature represent the movement of a



PIR Sensor

Person's Motion Detection

Figure (3): Infrared Sensor and Detect the motion of person

- person, Figure 3 illustrates this sensor and sketch the detection process.
- **Buzzer:** it is used to produce beeps when a power is supplied.
- **NodeMCU ESP8266** is a low-cost Wi-Fi chip and an open source IoT platform. The term "NodeMCU" by default refers to the firmware rather than the devkits. NodeMCU Development board is featured with Wi-Fi capability, analog pin, digital pins and serial communication protocols as shown in Figure 4.



Figure (4): NodeMCU ESP8266

- **Web-based Services IFTTT:** IFTTT means that "This" is a primary app and "That" is a secondary connected app. It is a free web-based service to create chains of simple conditional statements [9].
- **Sending and Receiving Data:** One of the IoT devices requirements is an availability to send or receive data. To achieve the strong connection, this depends on some factors, as: network size and scalability, data size, and device location. This work used the NodeMCU ESP8266 as a platform for IoT-based Home Intrusion Detection System.

3.2 Methodology

There are main three tasks of the proposed system can be summarized as follow:

- **Detection of Motion:** PIR sensors are placed in the rooms, when someone appear in the range of the PIR sensor, the temperature of the room rises due to the body temperature of that person. When the PIR

sensor detects an intruder, it sends a signal to the microcontroller (NodeMCU ESP8266) and the controller triggers the web services on an account of intrusion.

- **Notifying the Owner:** The primary app in this system is detects an intruder which represent “This” in ITFFF. Once NodeMCU ESP8266 receives a signal from PIR sensor, the controller triggers the web service (an applet of send notification) on an account of intrusion (IFTTT account).
- **Notifying the Neighbors or Security Guard:** Notifying the proprietor of the house, through internet and at same time generate beeps by the buzzer.

4-SYSTEM DESIGN:

To applying the proposed system as mentioned above, there are two sides: Hardware composite and Software design.

- **Hardware Design:** the proposed system composite from some tools and kits as NodeMCU ESP8266 module, PIR Sensor (HC-SR501), Buzzer, USB cable, Breadboard, and Jumper wires. These tools configured and built as in Figure 5.

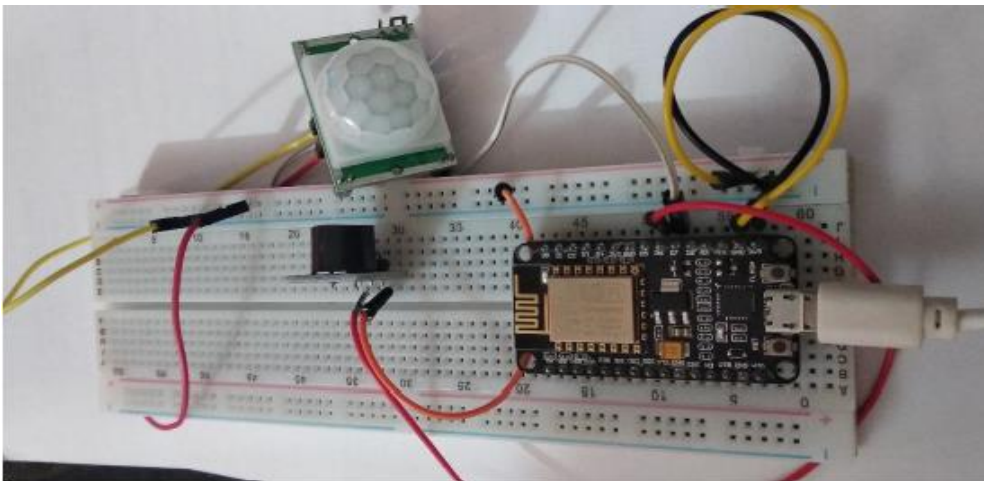


Figure 5: Hardware Connection of the Proposed System

Software Setting: in addition to the necessary hardware parts, there some important programs used to complete the proposed system are codes for the parts: connecting ESP8266 to the IFTTT, connecting ESP8266 to the Internet using Wi-Fi, reading motion sensor data, and publishing it to an account of intrusion using HTTP protocol. These parts will described as follows:

- Connecting ESP8266 to the IFTTT: registering in the IFTTT platform and using the maker webhooks channel which available in this platform by adding the email of the owner of home. In other words, create an account of the owner of home on the IFTTT platform. After that, put some information to the Arduino IDE as the host, event-name, and key.
- Connecting ESP8266 to the Internet: send the information of the network to the Arduino IDE to achieve the connection to the internet.
- Read PIR Motion Sensor Data: define the parameters of the PIR sensor to read the data coming from this sensor.
- Data Publish: declare some necessary factors to achieve the logging-in to the IFTTT platform.

5- IMPLEMENT AND RESULTS:

At this point, after building main structures of the proposed system, upload the code to the board and linked to the Internet and the server of intrusion detection account, as in the following steps:

- 1- Putting the sensor in particular locations.
- 2- Connecting the sensor node to the Internet through Wi-Fi mechanism and confirm that this connection successfully work.
- 3- The sensor will sends a signal to ESP8266 when it detects an intrusion in the home. After that, the buzzer will produce alerts to the gourds or neighbors.
- 4- To ensure that the events has been trigged, the board must be connected to the IFTTT platform server.
- 5- At the end, the owner email must be checked to notify the received messages from the ESP8266 server.

6- CONCLUSIONS:

One of the Internet of Things (IoT) applications is creating smart homes (e.g. smart surveillance system and security system), also the Intrusion Detection System (IDS). There are many methods and proposed strategies about the surveillance and security at indoor system, as in the homes, markets, and Olympic game halls, as the CCTV camera.

These traditional systems have some drawbacks as an expensive and require constant supervision. Therefore, to enhance this field, this paper presents proposed system of HIDS based on the IoT techniques, have some advantages as the low cost, the availability, the efficiency, and the scalability.

The proposed system work by inform the owner of home of an intruder through many ways: email, alerts the guards or neighbors via beeps of buzzer. The system characterizes with easy used and comfortable.

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