IOT fire detection system using sensor with Arduino

Système de détection d'incendie IOT utilisant un capteur avec Arduino

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ABSTRACT/ In the past few decades many studies and researches have taken place in order to improve security systems and to increase their level of protection in different fields. One of the major problems that security must deal with is the fire outbreak that can happen in everywhere including houses , schools , factories and many other places, and to avoid that or to minimize the damage caused by fire outbreak an IOT technology is used to control such a kind of risk. IoT is a modern system that consist of sensors and switches connected to a central hub which called (gate way. In this project we will use temperature sensor known as (Flame sensor) with Arduino device to detect fire outbreak and to measure the amount of heat intensity generated by a fire outbreak or in a specific location in our house, offices and other places. It sometimes take to much time for the fire station to reach to the fire outbreak location and works on extinguish the fire and so these sensors will work as an early alarm system which will send an email notification to our mobile phones, fire stations and hospitals if any fire outbreak occurred to let us know the situation clearly and before its too late, we act to avoid significant damage in case the fire outbreak was observed after a long time from its outbreak.

RESUMEN/ En las últimas décadas se han realizado muchos estudios e investigaciones para mejorar los sistemas de seguridad y aumentar su nivel de protección en diferentes campos. Uno de los principales problemas que debe enfrentar la seguridad es el estallido de incendios que puede ocurrir en todas partes, incluidas las casas, las escuelas, las fábricas y muchos otros lugares, y para evitar eso o minimizar el daño causado por el estallido de incendios, se utiliza una tecnología IOT para controlar Qué tipo de riesgo. IoT es un sistema moderno que consta de sensores e interruptores conectados a un concentrador central que se llama (puerta de entrada. En este proyecto usaremos un sensor de temperatura conocido como (sensor de llama) con un dispositivo Arduino para detectar brotes de fuego y medir la cantidad de calor. intensidad generada por un brote de incendio o en un lugar específico en nuestra casa, oficinas y otros lugares.A veces la estación de bomberos tarda mucho tiempo en llegar al lugar del brote de incendio y trabaja para extinguir el fuego, por lo que estos sensores funcionarán como un sistema de alarma temprana que enviará una notificación por correo electrónico a nuestros teléfonos móviles, estaciones de bomberos y hospitales si ocurriera un brote de incendio para informarnos claramente la situación y antes de que sea demasiado tarde, actuamos para evitar daños significativos en caso de que se observe el brote de incendio después de mucho tiempo desde su brote.

Introduction

In the addition to the numerous, advantages of   wireless sensor, network over the traditional, security systems, against fire outbreak its considered a as a cheap product in the terms of equipments and installation . Since IOT technology is becoming more and more popular in the commercial market , its related systems and components is becoming more desirable and that include the (wireless sensor network) which is used in security and in our case security against fire outbreak. Wireless sensor network is considered as a practical method for security systems against fire outbreak which have drawn a substantial amount of attention recently and it has been

well established. Fire outbreak is likely to happen in anytime and everywhere , its considered as a (sudden event) which requires a predictable security system to counter this kind of risk. Fire sensors which are considered as a part of (wireless sensor network) plays an important role in monitoring and detecting any abnormal increasing in the temperature and humidity rate . A (DHT 11) sensor is used in this project to monitor the temperature and humidity rates in a specific location , this sensor is conected to a (arduino node mcu) chip , this chip is conneted to a wifi network , the (node mcu) will continously sends data from the sensor to a (data base) which is connected to it by internet. In case of fire outbreak the temperature will increase and the humidity will decrease , these abnormal changes in the rates will be detected by the (DHT 11) sensor , the (node mcu) then will receive these changes as a (Data) from the sensor and send it through the internet to a (data base) which will be stored there as a (values) , then the data base will sends these values as an (SMS Message) to a our mobile phones to inform us about the situation , it can be used also to send a notification to the fire stations and hospitals in case of fire outbreak in forests, factories, houses....etc.

Aim of paper
The main aim is to design a low cost and simple wireless protection system against fire outbreak and provide an early alarm system to avoid serious damaged due to this type of hazards.

Related work
In 2013, Houache Nourekddine, Kechar Bouabdjellah and Larbi Sekfhri made a profound investigation of utilizing remote sensor system to distinguish fire flare-up in woodlands . The system embraced incorporates three noteworthy stages: information collection,communications through the system and investigation of gathered information, likewise catching different climate conditions essential for the figuring of list (or recipes), this runs occasionally until an occasion of location of flame happens.

In 2016 , Kargwan Jabbeary, Ebubeckir Erdem, Sercan Vançn, have been the accomplished the participation framework by the utilizing A notice as a strategy for the advising clients, identified with framework. The introduced Arduino gadget which was

modified with Android Studio takes got gas, fire, the temperature, and dampness signals from the sensors. So as to pre-screen the capacity of event of a fire, when it recognizes that the gathered information with control levels surpass a predefined edge it will empower the correspondence with WIFI organize and send the notice alert message to the versatile clients.

In 2017 , Mahmut Durgun, Seyit Alperen Celtek, Levent Gökrem, planned a simple establishment and no door required. The framework involves a remote temperature arrange which is minimal effort and low control , every remote temperature sensor hub faculties and transmits the varieties in the neighborhood temperature to cloud database. The cloud server gets the information and stores it in a table and plotting the varieties at the same time. The trap of remote temperature checking and alert framework enables the temperature varieties to be seen and the caution is controlled at whatever point client need from anyplace in the world.also when the enormous temperature of varieties occure, frameworks will promptly the   run alert which is 90 dB and the   make an impression on client.

Methodology:
The Node of MCU is an the open source of the IoT stage. It is the incorporates firmwares which keep running on the ESP8266 Wi-Fi SoC from Espressif Systems, and the equipment which depends on ESP-12 module. Nodemcu resembles brandname of a board that has a wifi module ESP8266 and some related circuit. ESP8266 module in order has a smaller scale controller with wifi. You can program ESP8266 utilizing Arduino, NodeMCU IDE or ESP8266 SDK.NodeMcu is improvement board for ESP8266, Which is wifi chip with 32bit microcontroller. The ESP8266 has 17 GPIO pins (0-16), be that as it may, you can just utilize 11 of them, since 6 pins (GPIO 6 - 11) are utilized to associate the glimmer memory chip. Working framework is XTOS, Memory (128kBytes), Storage is 4Mbytes, Powered by USB, Power Voltage is 3.3v ,5v (utilized with 3.3v Regulator which inbuilt on Board utilizing Pin VIN), IDE Used isArduino IDE, Interfacing Protocols is Serial, SPI, I2C. It contains everything the expected to help microcontroller; essentially, interface it to a PC the with a USB link or power it with an AC-to-DC connector, or battery to begin. To the make the association ,between arduino IDE

and hub mcu we make the accompanying advances:

1-Download Arduino IDE.

2-Open you IDE and snap on "Record - > Preferences".

3-In "Aditional Boards Manager URLs" include this line and snap "alright".

4-Go to "Devices - > Board - > Boards Manager", type "ESP8266" and introduce it.

5-Go again to "Devices - > Board" and select "Nonexclusive ESP8266 Module".
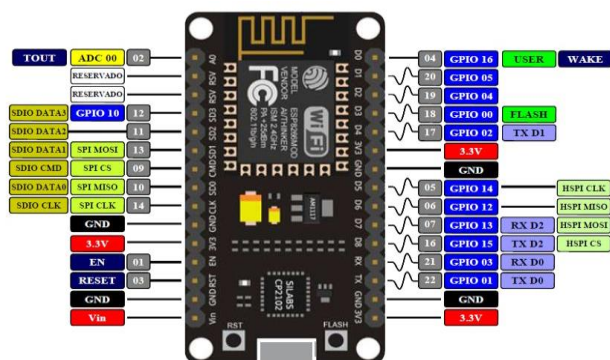
Figure(1)

Figure(1) demonstrates the Arduino Node mcu ESP8266 board

Figure(2)

Figure(2) shows the direct connection between Node mcu and PC through USB cable

DHT-11 Sensor:

It is an ultra ease computerized temperature and moistness sensor. It uses a thermistor and specific sensor to gauge ,the encompassing air, and lets ,out a computerized sign on the information, stick (no simple info pins required). Its genuinely easy, to use, yet requires cautious planning to snatch information.

DHT11 / DHT22 Working Principle:

The DHT11 computes relative moistness by estimating the electrical opposition between two cathodes. The mugginess detecting part of the DHT11 is a dampness holding substrate with the cathodes connected to the surface. They comprise of a dampness detecting segment, a NTC temperature sensor (or

thermistor) and an IC on the posterior of the sensor. A thermistor, is really a variable resistor that a changes its obstructions with change of temperature.

Connection of DHT-11 with Node mcu:

Figure(3) shows the connection between DHT11 and Node mcu
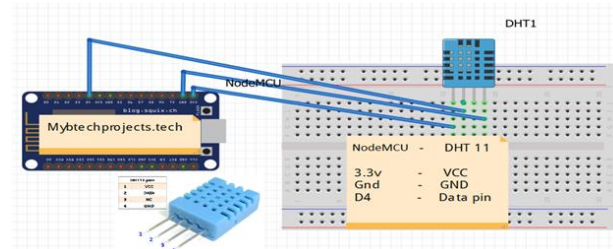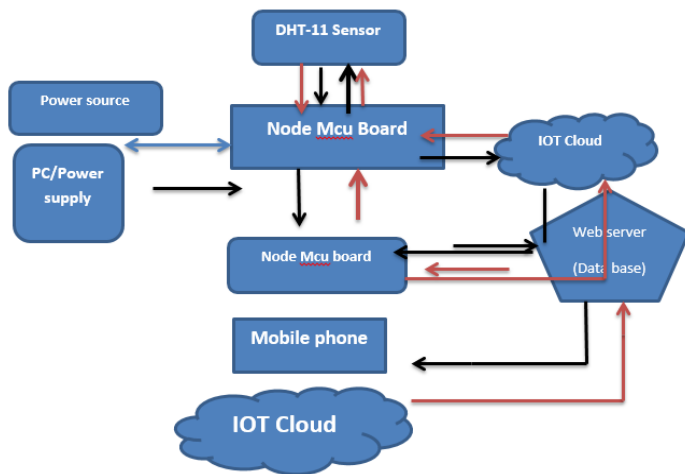

Figure(3)

The wiring associations are the made as pursues : Pin 1 of the DHT11 a goes into +3v of the Node a MCU. Stick 2 of the a DHT11 goes into a Digital Pin D4 of the a Node MCU. Stick 3 of the DHT11 goes into Ground Pin (GND) of the a Node MCU.

**Figure(4) shows more detailed explaination between the sensor and node mcu**
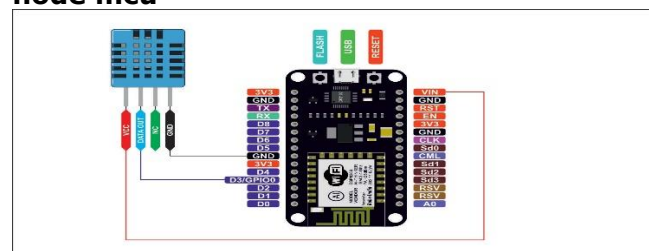
Figure(4)

The constant databases can be utilized in this task where we simply need to interface a controller (Node mcu) which can be associated with web and can almost certainly trade information with cloud server. The server information can be helpful in observing ongoing framework conduct, database investigation, factual examination and handling, and elucidation for sometime later case. There are heaps of IoT Hardware Platforms and Cloud stages accessible to fill this need[16]

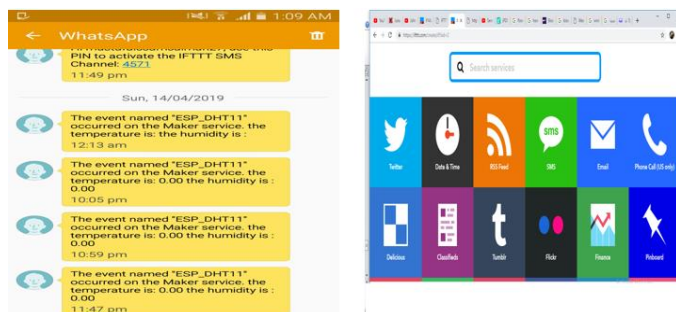Figure(5). Explains the process steps of the proposed system

Results :
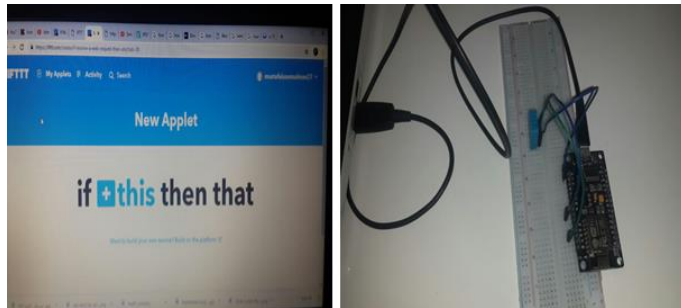
Figure(6) shows the connection process to receive a message

Figure(6)

The(DHT-11 sensor) is connected (Node mcu) wich in turn is connected to wifi network , by internet connection the Node mcu became able to be connected with (IFTTT) web server ,this server will save the temperature and humidity values that is sent from the Node mcu , and sends these values to our mobile phones as a notification message . A notification message will be sent to us wherever we are and it doesnt matter if our mobile phones were connected to internet or not , a notification message will ne sent to us depending on our phone number and the code number of our country which is all saved in (IFTTT) web server in the service of (SMS messages) that is included in contents of this server.

Conclusion:

The design and implementation of the wireless fire detection system is customizable and flexible. This wireless detection mechanism lower in cost-effective than the available fire detection systems in the traditional market. Our remote flame recognition framework a has high precision rate , and rushes to distinguish changes in temperature and stickiness degrees which empower consistent incorporation with the a clients and gives more a tightly security. In our nation, private and government associations are especially worried about protection from flame flare-ups . Numerous organizations are keen on utilizing this kind of remote location component since the framework which is accessible have low establishment cost. Because of the minimal effort of the framework, numerous little firms can manage the cost of such frameworks. Remembering the establishment cost we wanted to build up the framework that ought to stay moderate to both huge and little firms. This structure can be improved by progressively serious advancement and extra highlights, for example, more sensors can be added to the framework. Therefore we don't have to keep the framework with only one sensor if this can be utilized to screen a few areas. One of the fundamental points of interest of this framework is its adaptability. A few different frameworks can be executed with this framework. The framework is secure. Remote location frameworks are exceptional and the sensor can screen and distinguish an acurate degrees of temperature and moistness during testing.

References

(1) Ransing, Rasika S., and Manita Rajput. "Smart home for elderly care, based on Wireless Sensor Network." 2015 International Conference on Nascent Technologies in the Engineering Field (ICNTE). IEEE, 2015.

(2) Islam, Taoufikul, Hafiz Abdur Rahman, and Minhaz Ahmed Syrus. "Fire detection system with indoor localization using ZigBee based wireless sensor network." 2015 International Conference on Informatics, Electronics & Vision (ICIEV). IEEE, 2015.

(3) Muheden, Karwan, Ebubekir Erdem, and Sercan Vançin. "Design and implementation of the mobile fire alarm system using wireless sensor networks." 2016 IEEE 17th International Symposium on Computational Intelligence and Informatics (CINTI). IEEE, 2016.

(4) Ogudo, K.A.; Muwawa Jean Nestor, D.; Ibrahim Khalaf, O.; Daei Kasmaei, H. A Device Performance and Data Analytics Concept for Smartphones' IoT Services and Machine-Type Communication in Cellular Networks. Symmetry 2019, 11, 593.

(5) Zhang, Lei, and Gaofeng Wang. "Design and implementation of automatic fire alarm system based on wireless sensor networks." Proceedings. The 2009 International Symposium on Information Processing (ISIP 2009). Academy Publisher, 2009.

(6) GHAIDA MUTTASHAR ABDULSAHIB and OSAMAH IBRAHIM KHALAF, 2018. AN IMPROVED ALGORITHM TO FIRE DETECTION IN FOREST BY USING WIRELESS SENSOR NETWORKS.International Journal of Civil Engineering & Technology (IJCIET) - Scopus Indexed.Volume:9,Issue:11,Pages:369-377.

(7) Othman, Mohd Fauzi, and Khairunnisa Shazali. "Wireless sensor network applications: A study in environment monitoring system." Procedia Engineering 41 (2012): 1204-1210.

(8) Bouabdellah, Kechar, Houache Noureddine, and Sekhri Larbi. "Using wireless sensor networks for reliable forest fires detection." Procedia Computer Science 19 (2013): 794-801.

(9) Herutomo, Anton, et al. "Forest fire detection system reliability test using wireless sensor network and OpenMTC communication platform." 2015 3rd International conference on information and communication technology (ICoICT). IEEE, 2015.

(10) Barrett, Steven F. "Arduino microcontroller processing for everyone!." Synthesis Lectures on Digital Circuits and Systems 8.4 (2013): 1-513.

(11) Bento, Antonio Carlos. "IoT: NodeMCU 12e X Arduino Uno, Results of an experimental and comparative survey." International Journal 6.1 (2018).

(12) Ayman Dawood Salman1, Osamah Ibrahim Khalaf and Ghaida Muttashar Abdulsahib, 2019. An adaptive intelligent alarm system for wireless sensor network. Indonesian Journal of Electrical Engineering and Computer Science, Vol. 15, No. 1, July 2019, pp. 142~147

(13) Mahmut Durgun, Seyit Alperen Celtek, Levent Gökrem "The design and implementation of web of low-power wireless temperature monitoring and alarm system" July 2017 with 16 Reads, DOI: 10.1109/AIACT.2017.8020055.

(14) Osamah Ibrahim Khalaf, Ghaida Muttashar Abdulsahib and Muayed Sadik, 2018. A Modified Algorithm for Improving Lifetime WSN. Journal of Engineering and Applied Sciences, 13: 9277-9282

(15) Osamah Ibrahem Khalaf, Ghaidaa Muttasher et al., "Improving video Transmission Over Heterogeneous Network by Using ARQ and FEC Error Correction Algorithm", vol. 30, no.8, pp.24-27, Nov 2015

(16) Osamah Ibrahim Khalaf, Bayan Mahdi Sabbar''An overview on wireless sensor networks and finding optimal location of node'',Periodicals of Engineering and Natural Sciences, Vol 7, No 3 (2019)

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