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NodeMCU based Fire Detector System

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ABSTRACT
About 7% of all house fires start in a bedroom. It leads to damage of all plush objects and also loss of life. To avoid that or to minimize the damage caused by fire outbreak an IOT technology is used to control such a kind of risk. NodeMcu based IoT fire detector is the solution for this kind of issue. In this model, we have fitted a fire indicator by making practical and effective use of NodeMCU which is connected with a smoke sensor and buzzer. The smoke sensor detects if there's any smoke produced because of ingesting any type of gas or fire. Buzzer interfaced with it makes an alert sound. A fire warning can also be activated by a little smoke from the flame of burning candle or fire lamps or a burning cigarette which may be used in any family. The buzzer gets stopped itself at whatever point the temperatures falls to comfortable indoor temperature and the amount of smoke decreases. NodeMCU fire finder serves best because at whatever point it indicates fire or smoke, then it immediately alarms the admin or user about the fire through the Thingspeak *module. At whatever point a fire happens, the user gets the alert notification through smartphone.*

Keywords:-*IoT, NodeMCU, Smoke Sensor, ThingSpeak, Buzzer, Fire detection.*

INTRODUCTION

IOT stands for "Internet Of Things" which means to connect the physical objects or things to the digital world by fixing various sensors, software connected to a central hub that measures the criterion and boundary of the real world as they keep varying and can make a database of the readings or values gathered. Once the data gets to the cloud, software processes it and then it decides to perform an action, such as sending an alert or transfer of data without the need of the user. The Internet of Things refers to inter-connecting and inter-relating objects, devices and people through wireless network, it rose itself as the New business technique in different sectors.

IOT devices are used in our daily life to monitor and control the mechanical, electrical and electronic systems used in buildings and homes.

In this paper, it is explained that a quick response for fire incidents is solved and examined by using IoT based model. One of the major problems that security must deal with is the fire outbreak that can happen in everywhere including houses, schools, factories, offices and many other places. Fire is one of the big reasons of fortuitous deaths in the world claiming valuable lives and expensive property. Hence, fire detector systems are essential in alerting people in time before fire engulfs their homes. They help in detecting fire at an early stage so that many lives and property can be saved. However, fire detector systems, today, require a lot of wiring and labor to be installed. This thing intimidates the users to place it in their homes. Hence, we have planned to make an IoT based wireless fire detector system which is not very difficult to place. As, IOT now-onwards is becoming very famous in the commercial

market its systems and components associated with it is becoming more popular and that includes the (wireless sensor network) which is used for security purposes and in this case it is used for protection against fire outbreak. Wireless sensor network here, does its job by monitoring the surrounding conditions and has achieved a big amount of attention now-a-days and it is also very well established. We have used a NodeMCU, for which we get an inbuilt Wi-Fi and for simulation we have used Arduino as the NodeMCU was not available in the *TinkerCad* software for implementation.

A wireless sensor network is formed from proper spaced and positioned nodes provided with a sensing device to check and to measure attributes of the physical environment at different locations. Each of these nodes consists of a microcontroller (NodeMCU) connected to smoke detector sensors that continuously sense the surrounding environment to detect the presence of fire. These nodes generate their own WiFi network. At the stage when fire is detected by this node, it sends a signal to a center node that is reminded to send the SMS to the fire-fighter office and the user, and then it informs the user and alerts the house by processing a local buzzer, when it is switched on. The buzzer keeps going on till the degree of temperature is high. It stops buzzing on its own when the temperature falls to ordinary value and smoke amount decreases.

This system is very useful whenever the user is not in the proximity of the affected area. Sometimes it takes so much time for the fire fighter officers to reach where fire outburst has taken place and start their work on eliminating the fire. Thus, this model and buzzer will contribute as an early alarm system which will send an email confirmation to our mobile phones, fire department and the nearby hospitals if any sudden appearance of fire has been occurred. By this we get to know about the situation happening at the location clearly and before it gets very late, we tend to avoid the consequences and damages in some cases where the fire outburst is observed after a long time from its explosion. The proposed system includes easy and simple architecture with all basic and cost effective equipment in which the Wi-Fi is inbuilt in the NodeMCU only and then it transfers data into the user's mobile phone through ThingSpeak.

REQUIRED COMPONENTS

- Arduino Uno board
- Embedded system: NodeMCU
- Smoke Sensor(MQ2)
- Connecting wires
- Red LED
- Power supply
- Buzzer
- 4k-ohm Resistor
- Breadboard

Arduino Uno: The Arduino is a microcontroller-based open source electronic prototyping board which can be programmed with an easy-to-use IOT Library Arduino IDE. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE. The main components of Arduino UNO board are: 1. USB connector, 2. Power Port, 3. Microcontroller, 4. Analog input pins, 5. Digital pins, 6. Reset switch 7. Crystal oscillator 8. USB interface chip, 9. Tx and Rx LEDs. The board operates at a voltage of 5 volts, but it can withstand till a maximum voltage of 20 volts. The microcontroller used on the UNO board is Atmega328P by Atmel. It has 6 analog input pins, named as "Analog 0 to 5". The quartz oscillator ticks 16 million times a second. On each tick, the microcontroller performs one operation.

Fig.1:-*Arduino UNO board*

NodeMCU: The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). It is a low-cost single-board microcontroller based open source IOT platform. It has a memory of 128kBytes and a storage of 4MB. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. The firmware uses the Lua scripting language. The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. It also provides access to the GPIO (General Purpose Input/Output).

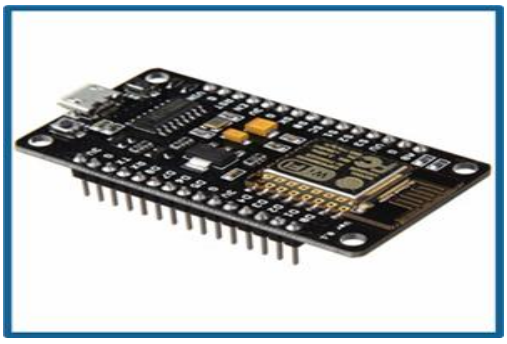

Fig.2:-*Wi-Fi based NodeMCU*

Smoke Sensor (MQ2): MQ2 gas sensor is an electronic sensor which is used for sensing and testing the presence of any poisonous, inflammable or dangerous gases in the air or surroundings such as LPG, chlorine, methane, nitrogen dioxide, ethanol, smog and carbon monoxide. In the market, this sensor is also available by the name "chemiresistor". The resistance of the sensing material present in it keeps on changing whenever it gets in touch with any kind of gases. Its detection zone is 300-10000 ppmm. It operates at temperature -20 to 50 degree C.

Fig.3:-*Smoke/Gas Sensor*

Cloud System: *ThingSpeak* is known as an open IoT platform which contains MATLAB analytics that provides us with the facilities to accumulate, view, and examine live data streams into the cloud. We can also send data to ThingSpeak from our devices, where we can produce a quick visualization of our live data, and can also send warning notifications.

Fig.4:- *ThingSpeak*

HARDWARE DESIGN

The block diagram of the paper is quite simple which has a few basic components but it is quite efficient in producing the result as required.

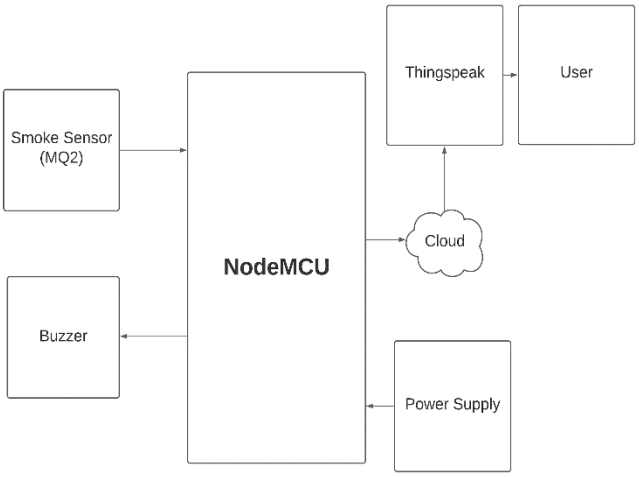

Fig.5:-*Block diagram of proposed system.*

FLOWCHART

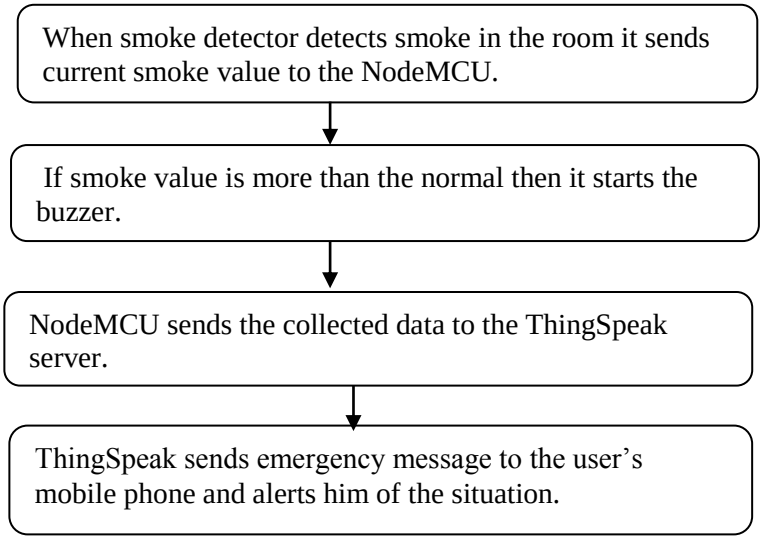

Fig.6:-*Shows process steps of the system*

PROPOSED SYSTEM

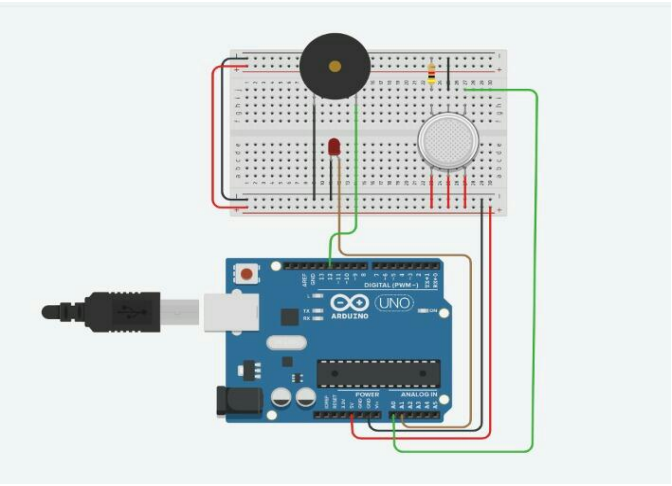

Fig.7:-*Circuit Diagram of the system.*

The above proposed system requires no manpower as it is completely automated. Arduino is used for controlling the whole process. LED is connected to analog pin1 and smoke sensor is connected to analog input pin0. A resistor is connected to sensor to calculate value. The smoke sensor senses the data and if received values is above the threshold value the LED gets ON. If smoke is detected then buzzer gets ON. The NodeMCU collects the readings from the sensor, and differentiate them with the threshold value. If the figures shown by the sensor is about to reach the limit, the Arduino/NodeMCU performs necessary actions. It thus sends all the database to *ThingSpeak* via cloud system. It sends a warning SMS to the user's mobile phone to inform him about the situation, it can be also be used to send a notification to the fire stations and hospitals in case of any fire outbreak. The software used for writing programs is Arduino IDE an open source software that can be embedded onto the board. In this code, which is being written in C++ language we are having two main functions void setup() & void loop(). The code helps us to give the desired output during simulation.

CONCLUSION

The main aim was to develop an automatic fire alarm system to safeguard the user and their surroundings and to provide an early alarm system to avoid serious damaged due to such type of incidents.

Our proposed system was capable of achieving its main goals which were mainly building an IoT-based fire alarm system. It is capable of detecting the presence of fire, communicating with the concerned parties by calling them when a fire is detected.

This model constantly monitors the fire signal and sends warning alert to the user. Receiving and responding is done via SMS to the user. Using this product will help these people as they will be informed quickly about the incident and also to the nearest fire department will be notified in an effective way. It is low cost and installation is also easy.

The system can become more efficient and useful if a relay motor is set up with the camera for taking the picture of the affected place in whatever angle the fire is detected and to also keep an eye if any unknown person is found at the scene. This system can also be outfitted with water sprinklers which will be valuable for controlling small amount of fires. It can also be improved by adding some more sensors. Thus, this model can be installed by single-family residences so they are able to activate it from convenient locations themselves, and it must alert residents in all portions of the house. We hope that this system helps to reduce loss of life and property at a remarkable point.

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