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Automatic Smart and Safety Monitoring System for Kitchen Using Internet of Things

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***Abstract*— One of the most important places in any house is the kitchen. Many safety measures has to be taken into account while using the kitchen. The reasons that leads to unexpected explosions are an uncontrolled fire, excessive rise in temperature, the presence of leakage gas etc., The explosions has to be immediately recognized and cleared. The main purpose of the paper is that to identify, address the safety of kitchen. This smart and safety monitoring system is modeled by these types of sensors namely, DTH11 sensor monitors temperature and humidity of the kitchen, IR flame sensor detects the existence of fire in the surroundings of kitchen and the leakage of gas in the kitchen is detected by using MQ-3 sensor. The interfacing of these sensors is done by using Arduino UNO and the controlling of this safety system is done by relay. The different colored LED's indicates different situations that are occurred in the kitchen. In increase in leakage in gas and temperature in the kitchen will be reduced by the performance of the relay. The buzzer will be in ON condition when there is the presence of fire. The monitoring and controlling of this system is done by every 15 seconds. By using the Wi-Fi module the data about kitchen will be transmitted to user.**

Keywords— Arduino UNO; ESP8266; Arduino IDE; Internet of Things; Thingspeak web server

I. INTRODUCTION

Nowadays the use of smart phones, smart security systems, smart watch even more has come into existence. The use of these systems has become a part of life. With considerations of these systems into picture, the kitchen has also become smart. To make any system into a smart system, the use of Internet of Things (IoT) has come into practice and widely used in our day to day life. IoT is a concept of connecting, communicating, commanding and controlling the things by the human world with the help of Wi-Fi interfacing components.

In day-to-day life, human performs numerous activities. One of those activities will includes work done in kitchen. With various activities performed in the kitchen will probably make changes in the weather conditions of the kitchen. The changes in the kitchen includes increase in temperature, the use of gas stove has a risk of making level of gas to high. Based on these conditions, the control of the kitchen done by using IoT. So the kitchen will become smart kitchen and the explosions will be reduced by providing necessary commands through IoT.

II. LITERATURE SURVEY

Several number of projects and research have been made based on smart kitchen. As research by Riva Khannadari and Vu Trieu Minh from Tallinn University of Technology, A B Pantjawathi and F Nugroho Universitas Pendidikan Indonesia. From some previous research, those are mainly revealed a concept of a module making a module that can work by using microcontrollers with a limit number of sensors. In this paper, Arduino UNO and Wi-Fi module has been used. The best explaination of each and every module have been done. ESP8266 Wi-Fi module is used to provide commands to control the system. The organization of the paper is as follows, section 3 explains regarding to implementation phase, section 4 explains results and concludes with section5.

III. IMPLEMENTATION

Arduino Uno is equipped with Atmel 328 microcontroller. This module operates in 5volts. Fig 1. shows the interfacing of sensors like temperature, fire, gas in the system. Data acquired from each sensor will sent to Arduino Uno module is displayed in 16X2 LCD, which is connected to Arduino Uno and sends information to cloud by means of Wi-Fi module ESP8266. The relay, buzzer are also connected for controlling purpose.

The entire module performs the continuous monitoring process of each parameter. The threshold limit for each sensor is allocated, so if there is any variation in data from the sensors exceeds the threshold limit, the automatic actions can be carried out through Think speak web browser respectively.

The temperature sensor sensed is more than its threshold, the pin connected to red LED will be set to HIGH. The intensity of flame is greater than its threshold, the pin connected to yellow LED will be set to HIGH. The leakage in gas is more than its threshold, the pin connected to blue LED will be set to HIGH. The relay used here is a 2-channel relay. The relay fan will be turned ON, if out all if temperature sensor and gas leakage values are more than their threshold values. The turning of alarm will be done, if the flame sensor and gas leakage values are higher than their threshold values respectively.

The sensed data is sent to Arduino Uno and simultaneously displayed in an LCD 16X2 display. The Wi-Fi module must be tethered with our mobile hotspot (or) with internet using the username and password. After tethering, a web browser should be opened and the static IP address must be given. After authenticating, the created web browser will be opened and user can control their environment. The graphical representation of each parameter is also displayed in web browser depending on the time initialized by the user.

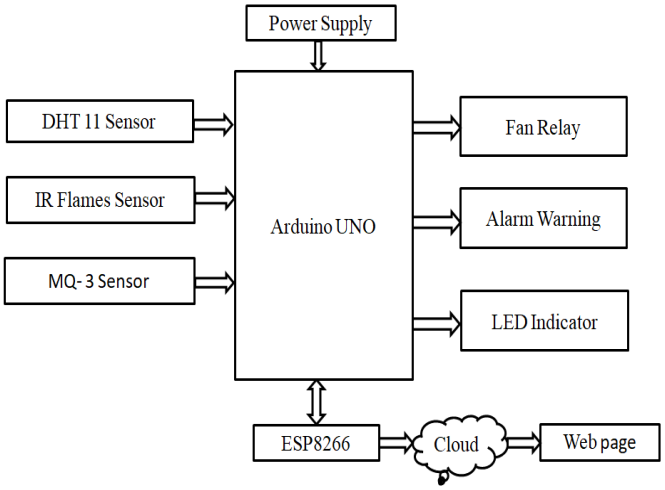


Fig 1. Block Diagram

A. Hardware Implementation

1) Arduino UNO: It has 14 digital I/O pins, 6 analog pins. It uses ATmega328 as its microcontroller. To program the Arduino Uno, the printer cable has to be used. It is most popularly used micro controller .

2) ESP8266: It is a Wi-Fi interface that acts as a microcontroller interfacing module such that it can connects Arduino to Wi-Fi and to create the IP/TCP connections. It requires 3.3v of power supply and has three modes of wifi namely access point, station and both. It has in-built processor, memory and General Input Output Pins(GPIO), they can be used based on the requirement of system. On this system, ESP8266 acts as Wi-Fi guard for Arduino UNO and connects to available hotspot network. This device sends received information from Arduino UNO to respective server.

3) Humidity and Temperature Sensor: It requires a thermistor to measure air and capacitive humidity sensor. Without using analog pins, it sends output through digital pins. The measurement limit of this sensor is upto 60°C.

4) IR Flame Sensor: In this smart and safety alert module, IR Flame Sensor serves as a fire identifier. The sensor addresses the fire based on the spectrum of wave of the IR occurred by fire.

5) Gas Leakage Sensor: MQ-3 gas sensor has high sensitive towards alcohol. The sensitive material of this sensor is SiO_2, which has lower conductivity in air. This sensor is used to detect the presence of harmful gases that are present in the surroundings of the kitchen.

6) Power Supply: The required power for this system is 100-240V, this will be provided with the help of an adapter. This will be directly connected to microcontroller.

B. Software Implementation

1)Arduino IDE: Arduino IDE is an Integrated Development Environment for programming an Arduino UNO. It is a software developed by Arduino. By using this IDE, not only Arduino can be programmed but also several components like ESP8266, connecting Bluetooth etc., can be done.

2)Thingspeak web server: It is a web page which handles as a receiver, displays information to user of the smart and safety kitchen system.

C. Algorithm

- Step 1: Upload code on Arduino UNO.
- Step 2: Read the sensor values.
- Step 3: Set the threshold values for each sensor.
- Step 4: Upload the values into web server with the help of ESP8266 Wi-Fi module.
- Step 5: Take an appropriate action, if the sensor value exceeds the threshold value which was set by the user.
- Step 6: Trigger function will be processed by means of web server

a. Turn on red LED if temp ≥ 25℃.
b. Turn on FAN when there is a gas leak and if fire occurs.
c. Indication of different colors of LED to show the status of the kitchen.

- Step 7: The web page serves as the receiver and displays infromation of the smart and safety kitchen system through Think speak web server.

D. Working

The power supply to Arduino UNO will provided directly from pin3V and pin5V(VCC) of Arduino UNO. DHT11 sensor addresses as a temperature identifier if there is any change in temperature beyond the threshold, MQ-3 sensor serves as a gas detector in case of leakage in LPG gas, IR flame sensor identifies the fire in the kitchen.

The information acquired by the sensors with the changes in the kitchen i.e., beyond threshold limit set by user will be sent to Arduino via its analog and digital pins. Simultaneously,

the changes in the kitchen environment will be displayed in 16X2 LCD display. Arduino UNO acts as main center for controlling this smart and safety monitoring system. Now, the data collected by Arduino UNO which was sent by sensors will be taken for deciding the next action. This received information will be sent directly to Thingspeak web browser via Wi-Fi module.

ESP8266 is used as Wi-Fi provider that connects Arduino UNO via server. The commands for each and every sensor will as follows: in case of fire in the kitchen yellow LED light will be in ON condition with an alarm sound, with increase in temperature red LED light will be in high state with an alarm sound and when there is a leakage in gas, the relay will turn ON the fan. For every time updating of sensor values turns on all LEDs and the buzzer. The updated values will be displayed in 16X2 LCD display, simultaneously can be seen in Think speak web server.

IV. Results

The entire project setup has been shown in Fig 2. which consists of each and every module are equipped which was mentioned in implementation phase.

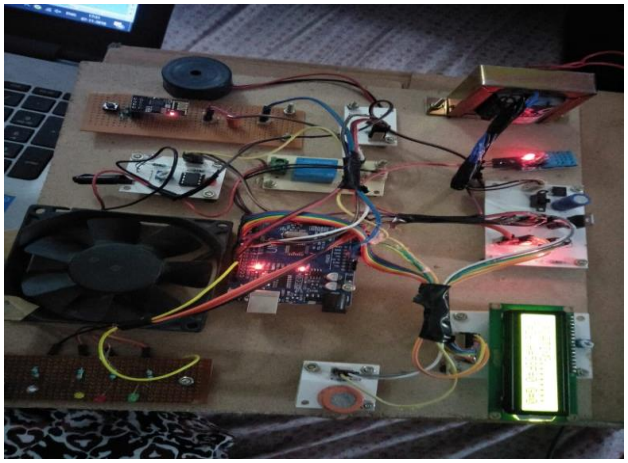


Fig 2. Project Setup

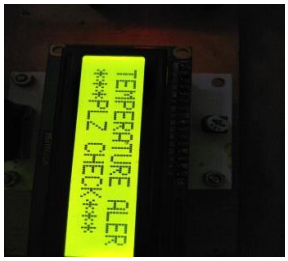
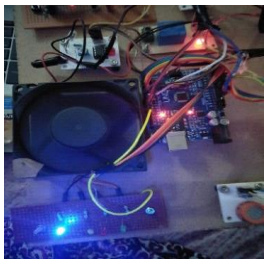


Fig 3. When Temp high -- red LED glows

As mentioned in the flowchart, Fig 3. represents the temperature in the surroundings has been crossed the threshold. So an alert message has been displayed in LCD display with the indication of red LED.



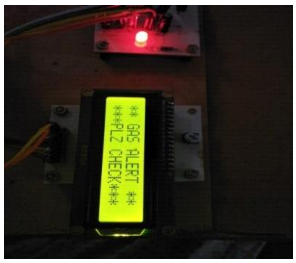


Fig 4. When Gas is High -- Blue LED glows and Fan will ON

Fig 4. shows about the gas alert. The indication of a blue LED represents that there is excess amount of gas present in an environment, so in order to blow out excess gas the fan will turned ON.

Fig 5. indicates the existence of fire. To alert an user, there will be switching ON of an yellow LED.

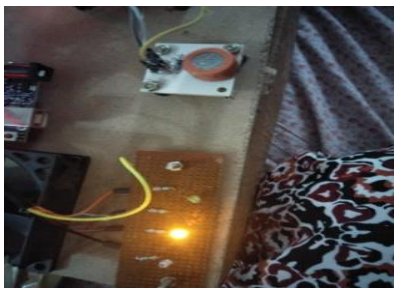


Fig 5. When Fire is High -- Yellow LED glows

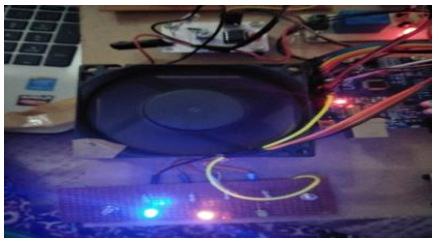


Fig 6. When temp and gas is high-Blue and Red LEDs glows and Fan will ON

Fig 6. represents alertness for an user indicating that the both temperature and gas level in the surroundings are beyond the range. Fig 7. represents that the kitchen is in dangerous situation by turning ON all LEDs along with buzzer sound.

Fig 7. When Gas, Fire, Temp and Humidity are High

Fig 8. Sensors values updating into the Thing speak server

The updating of data about every module into Thing speak web server has been done which was shown in Fig 8. The blue colored graph represents the status of temperature, the green colored graph represents the status of humidity, the pink colored graph tells us about the gas level respectively.

V. CONCLUSION AND FUTURE SCOPE

Depending on the design implementation and test conditions of this smart and safety monitoring system, the following conclusion can be made: Each and every sensor embedded in the system works fine. All the collected data about sensor was displayed in 16X2 LCD display and with graphical representation of change in sensor values was displayed in Thingspeak web browser. In simulated gas, fire, rise in temperature the alerting system works fine. The various number of sensors can be interfaced and the level of security system will be improved. An e-mail alert, SMS can also be send to the authorized user.

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