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Future Smart Kitchen: A Modern Comfortable Packaging

Dharmadas Mandal[1], Subhajit Bhowmick[2], Arnab Karmakar[2]

[1]Department of Electrical Engineering, Techno Main Saltlake, Kolkata – 700091, INDIA
[2]Department of Electronics and Instrumentation Engineering, Techno Main Saltlake, Kolkata – 700091, INDIA

ABSTRACT

In this paper it has been demonstrated that IoT (Internet of Thing) based solution can be used to improve the safety and utility of home kitchen or Commercial kitchens. Work has been done towards finding an integrated solution for the problems (Fire, smoke, hazards, etc.) that are very common now-a- days and these may lead to accidents and even loss of life. Using various sensors and a IoT controller, the system has been designed for giving the control to the user's mobile so that any kind of accidents can be stopped beforehand. The user will have access to the parameters (Temperature, smoke, sudden movement etc.) in real time. The user will be notified when parameters go out the safe limits. There will also be additions equipment that can be activated remotely in case of an accident to minimize the loss ensuring the safety. The controlling can be transferred based on the requirement and only authorized used it possible. The mobile and IoT connections is possible through Wi-Fi or internet at both ends. The user can control the operations using a app which will establish connection between the mobile and IoT through internet.

Keywords: Digital and Humidity Sensor, IR Sensor, MQ2 Sensor, Flame Sensor and IoT.

I. INTRODUCTION

Projects regarding smart kitchens use IoT to monitor the level of gas in cylinder and send notification to supplier for refill automatically when gas in cylinder is exhausted [1-2]. For stress free cooking, augmented reality (AR) technology is combined with computer vision (CV) technology that allows sensing of actual kitchen environment and producing a video tutorial of the chosen recipe [3]. Safety in kitchen can be maintained by using gas sensor which automatically turns off the gas knob when gas level is high [4]. It also includes monitoring the temperature and smoke level in the kitchen to prevent hazards [5]. In Raspberry-pi based kitchen monitoring system, the LED will glow when the light intensity decreases and otherwise it will be off. The gas level and pressure of kitchen will also be detected through different sensors. If gas level exceeds the threshold value, exhaust fan will be turned on. An email and an alert message will be sent via GSM network automatically [6]. To get comfortable environment at home, user can set TV to his favourite channel, switch on-off lights and control A.C from his office desk. Even intrusion detection can be possible with the help of motion sensor and it can be controlled using smart phones [7-8]. In this work, an IoT-based smart kitchen is demonstrated for home and commercial kitchens to get integrated solutions for problems (Fire, smoke, etc.) that lead to several accidents. Using an IoT controller and various sensors like IR sensor, gas sensor (MQ2), fire Sensors, etc, the system has been designed to give control to the user's hand so that any accident can be prevented. IR sensor will open the door and activates exhaust fan1 and light, helpful for disabled and aged people. Gas sensor will control the gas using the exhaust fans, DHT11 will sense the temperature, fire sensors can sense the radiation due to massive fire breakouts and the suitable action will be taken. If the fire is detected, exhaust fan1 and buzzer will be on, and the sprinkler will discharge water. Also, the fire brigade will receive an alert message. All the data will be sent to the cloud. Even if the door is closed and one or more variables are out of limit, all-controlling actions will occur automatically.

II. METHODOLOGY

In this paper, we have used various sensors to sense environment variables, processor (NodeMCU) which controls processing and build communication with Wi-Fi, and relays with the range of 250 V and 10 amps. Fig.1 shows the block diagram of the whole system. In the system we are using the following sensors: -

- IR Sensor: For sensing human presence indirectly.
- Gas Sensor (MQ2): It is a analog sensor. Continuously measures gas concentration. It can also measure the higher spike of gas concentration at any instant.
- DHT11: It measures normal temperature and humidity.
- Fire Sensor: It can sense the radiation due to massive fire breakout and send the value to the processor.

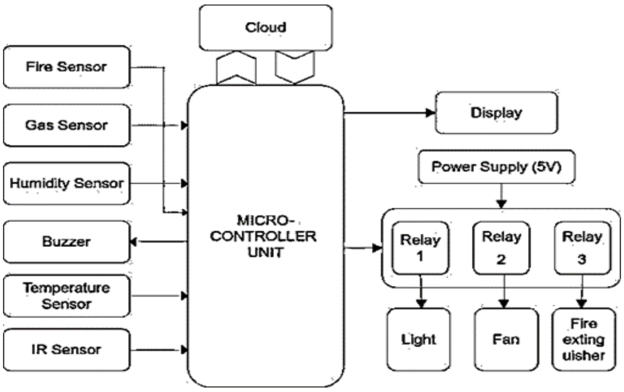

Fig. 1 System Block Diagram

We are using 4 channels relay so the outputs are: -
•Default fan in channel 1.
• Extra fan which will on due to the excess gas or fire in channel 2.
•We are using buzzer in the channel 3 for fire alert.
•Default light in channel 4.

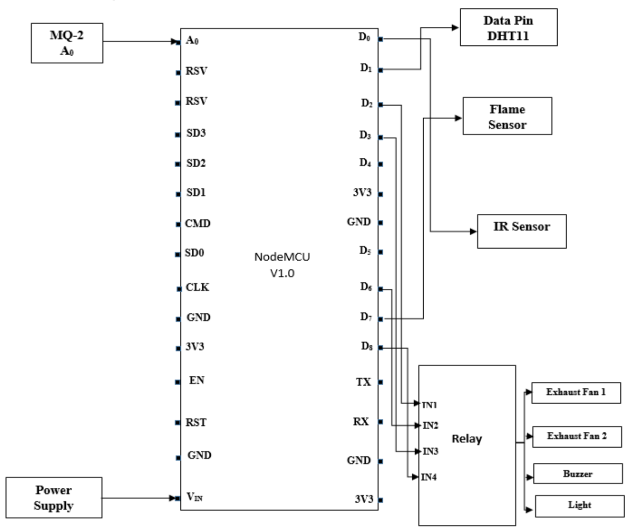

Fig. 2 System Circuit Diagram

For the communication we are using Wi-Fi, this connects automatically to the blyink app and ubidots. We are using MQTT protocol in ubidots due to high reliability. When the person opens the door IR sensor senses and default fan and default light will be on. If the gas concentration is high, then Default fan and extra fan both will be on to remove the gas.
If the fire is detected, then default fan and extra fan and buzzer (relay output 3) will be on. Even if the door is closed and one or more variables are out of limit, all controlling actions will be taken automatically. We can control 3 relay outputs manually using blynk app. Fig.2 shows the System Circuit Diagram.

- Default fan (Relay output 1)
- Extra fan (Relay output 2)
- Default light (Relay output 4)
- Relay output 3 is not controlled manually because it's purpose is to alert when there is fire.

III. WORKFLOW

The NodeMCU microcontroller unit which is Wi-Fi enabled and connects to Wi-Fi available through ssid and password, is used, through the Wi-Fi information can be sent to or received from cloud systems. For measuring temperature and humidity, DHT11 digital sensor is used, whose input is connected to one of the digital pin of NodeMCU, the pin works as input. To detect the presence of any person indirectly, Infrared sensor is used. The output devices whose states depend on the inputs of the sensors or can be controlled remotely. To observe the values in a graphical form, Ubidots IoT server is used, for observing and controlling of output devices, blynk app service is used. The work flow diagram of MQ-2 gas sensor, infrared sensor, flame sensor, blynk app and DHT 11 sensor are shown in Fig. 3(a-e) respectively. To enable this remote monitoring both IoT deceive and mobile or computer should be connected to internet.

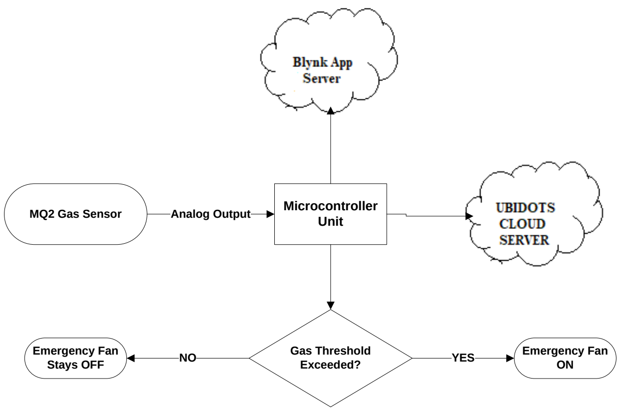

Fig. 3(a). MQ-2 gas sensor work flow

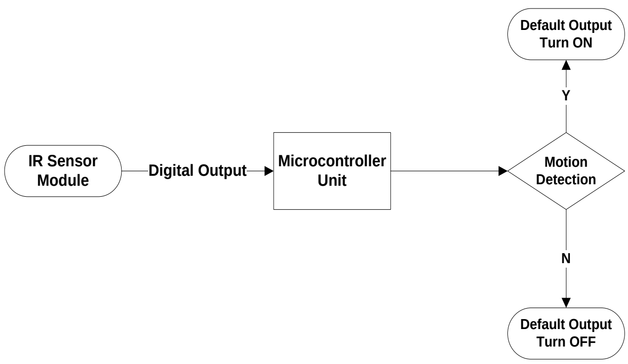

Fig. 3(b). Infrared sensor work flow

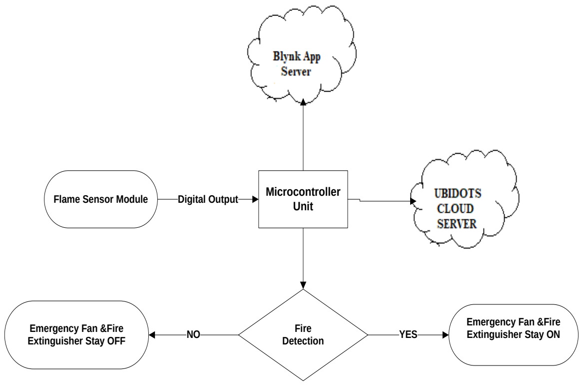

Fig. 3(c). Flame sensor work flow

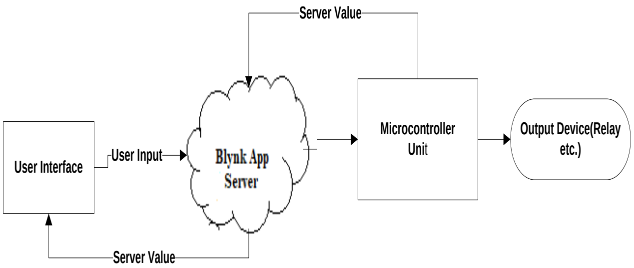

Fig. 3(d). Blynk app work flow

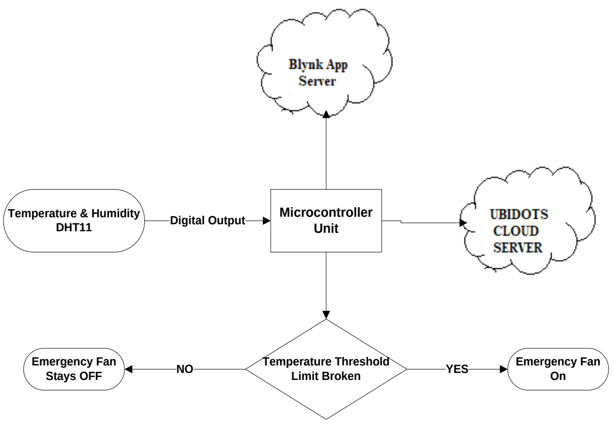

Fig. 3(e). DHT 11 work flow

IV. RESULTS and DISCUSSIONS

The proposed devices are installed in a household kitchen. First the sensor inputs are sent to NodeMCU and then they are send to the Ubidots IoT server and they are shown in a graphical format. The output of flame, humidity, temperature and gas sensing device are shown in Fig. 4 (a-d) respectively. Now the values are read form the server using computer/mobile and they are shown in the serial monitor and based on the read values corresponding output devices either turn on or off. Fig. 5 shows the real time values of various sensors data that can be controlled by the buttons in the app. This device can be used in houses and public buildings like hotels and eating places. Use of IoT in kitchen automation makes the system capable of protection over gas leakage detection, temperature detection and movement detection. In this system we are using temperature sensor for temperature detection, gas sensors to detect the leakage of gasoline and IR sensor to come across the motion. All of the data collected by these sensors are stored in the servers. It also keeps the log and status of the system, which helps the user to alert about the condition of the system. To detect any kind of danger some threshold values are set for the system, if anything goes wrong (crossing its threshold value), it will be alerted and the appropriate action will be made by the system which will prevent any kind of danger. We can use this type of system in numerous programs like home automation, clinic management, army management, and business programs by doing some modifications. One of the adjustments is to provide the machine with a dual power delivery i.e., include a battery supply further to the utility energy supply. To make it more diverse we can add authentication, password-based access to make the controllability more secure.

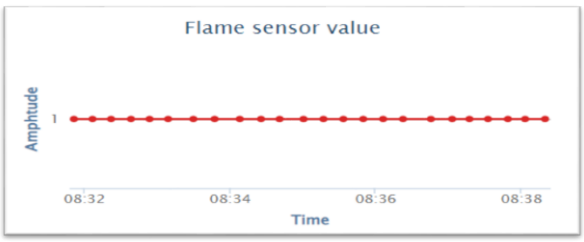

Fig. 4 (a) Flame sensor value in ubidots

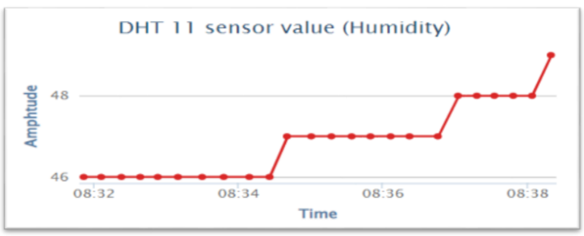

Fig. 4 (b) DHT 11 sensor value (Humidity) in ubidots,

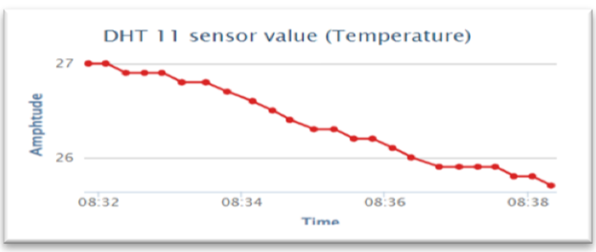

Fig. 4 (c) DHT 11 sensor value (Temperature) in ubidots,

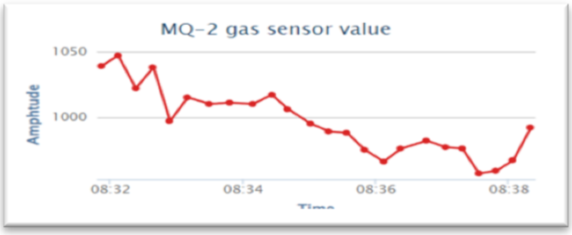

Fig. 4 (d) MQ-2 gas sensor value in Ubidots

Fig. 5. Real time monitoring and control

IV. CONCLUSION

We have implemented a scaled-down system in hardware. Scaling up the system to industry standards for future scope can be done byS using industry grade relay and power converters. This system can be used with high voltage output devices that are required in real time applications. A dedicated power supply can be used to power the system, sensor and relay with proper voltage. In case of fire, automated fire extinguishing system driven by high voltage output devices (like motor, etc.) can be used in real time situations. For more complex controlling and more users, the system can be modified to handle higher tasks by upgrading hardware and/or software.

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