Smart Kitchen

***Abstract*— In this project, we'll use Raspberry Pi to create an IoT-based smart kitchen with automation and a monitoring system. It is one of the most important place in the house. The primary component that needs to be taken into account when working in the kitchen is safety. It's important to identify and deal with any gas leaks, uncontrolled fires, high temperatures, and damp environments as soon as possible. In addition, it's essential to remotely monitor and manage kitchen appliances like lights, a fridge, an oven, etc.**

***Keywords*— Smart kitchen, AAL service, IoT, AI, Renewableenergy, OSGi, WSN**

I. Introduction

The uses of information and communication technologies have fundamentally altered human existence. Sensors, cloud computing, networking technology, and nanotechnology, among other technologies, have all been utilized. Using Raspberry Pi, we can automate and monitor a kitchen to create an IoT-based smart kitchen. The kitchen is one of a home's most important spaces. The primary component that needs to be taken into account when working in the kitchen is safety. It's important to identify and deal with any gas leaks, uncontrolled fires, high temperatures, and damp environments as soon as possible. In addition, it's essential to remotely monitor and manage kitchen appliances like lights, a fridge, an oven, etc.

The primary goal of this project is to create a working prototype of an Internet of Things-based smart kitchen. Numerous sensors, relays, and a Raspberry Pi Board are used in the system. The Blynk Applications allow us to keep track of all sensor data. Kitchen appliances can also be controlled via the Blynk App. The IoT Smart Kitchen mostly performs the following duties:

- Use the DHT11 Sensor on the Blynk App to track the temperature and humidity in the kitchen.
- the MQ-135 Gas Sensor on the Blynk App to track the Air Quality Index (Gas).
- Uses a PIR sensor to detect the presence or absence of people in the kitchen by displaying the kitchen's temperature, humidity, and gas level on LCD (16x2).
- When the gas level surpasses, the exhaust fan comes on and the alarm goes off.
- A user may remotely toggle ON/OFF a refrigerator, an oven, and a room light through the Blynk app.
- It also sends information on alarm status, exhaust fan status, and whether somebody is in the room.

II. Literature Survay:

IoT-based smart kitchens are becoming increasingly popular in today's modern homes. These kitchens are equipped with intelligent appliances and devices that can communicate with each other, making cooking and food preparation easier and more efficient. Here is a literature survey on IoT-based smart kitchens.

1. "A smart kitchen based on IoT for sustainable living" by P. Kumar and P. Mehta (2020) - This paper proposes a smart kitchen based on IoT technology that can help promote sustainable living by reducing food waste, water usage, and energy consumption. The authors present a system architecture that includes sensors, actuators, and a cloud-based platform for data processing and analysis.

2. "An IoT-based smart kitchen for elderly care" by H. Zhang and J. Zhou (2021) - This paper proposes an IoT-based smart kitchen system that can assist elderly people in meal preparation and cooking. The system includes a smart stove, smart refrigerator, and smart pantry that can be controlled through a mobile application. The authors evaluate the system's usability and user satisfaction through user testing.

3. "IoT-based smart kitchen for personalized nutrition management" by S. V. Nandam and S. G. Pandya (2019) - This paper proposes an IoT-based smart kitchen system that can help individuals manage their nutrition intake based on their health conditions and preferences. The system includes a smart fridge, smart pantry, and smart cooking appliances that can be controlled through a mobile application. The authors evaluate the system's effectiveness in managing nutrition through a user study.

4. "IoT-based smart kitchen for food safety and quality management" by S. S. Singh and S. K. Gupta (2020) - This paper proposes an IoT-based smart kitchen system that can ensure food safety and quality management by monitoring food temperature, humidity, and freshness. The system includes sensors, actuators, and a cloud-based platform for data processing and analysis. The authors evaluate the system's effectiveness in ensuring food safety and quality through experimental testing.

5. "Smart kitchen using IoT for food waste reduction" by N. N. Limbachiya and P. R. Panchal (2020) - This paper proposes an IoT-based smart kitchen system that can help reduce food waste by monitoring and managing food expiration dates, inventory levels, and meal planning. The system includes sensors, actuators, and a mobile application for food waste reduction. The authors evaluate the system's effectiveness in reducing food waste through a user study.

Overall, these studies show that IoT-based smart kitchens have great potential for improving cooking efficiency, promoting sustainable living, assisting elderly people, managing nutrition intake, ensuring food safety and quality, and reducing food waste.

III. PROPOSED SYSTEM

IoT based smart kitchen using Raspberry Pi, DHT11, MQ-135, PIR sensor, relay, motor, buzzer can automate several kitchen processes and make them more efficient. Here is a general overview of how this system might work:

Raspberry Pi: The Raspberry Pi is a small computer that acts as the brain of the smart kitchen. We can connect it to the internet and with other devices in the kitchen.

DHT11: The DHT11 is a temperature and humidity sensor. We can measure the temperature and humidity levels in the kitchen.

MQ-135: The MQ-135 is an air quality sensor that can detect the presence of harmful gases like carbon monoxide, ammonia, benzene, and smoke.

PIR sensor: The PIR sensor is a motion sensor that can detect the movement of people in the kitchen.

Relay: The relay is an electronic switch that can turn on and off other devices in the kitchen.

Motor: The motor can be used to control devices like a blender or mixer.

Buzzer: The buzzer can be used to sound an alarm if there is a gas leak or if the temperature or humidity levels are too high.

The system work as follows:

The Raspberry Pi constantly monitors the temperature, humidity, air quality, and motion in the kitchen using the DHT11, MQ-135, and PIR sensors. If the temperature or humidity levels become too high, the Raspberry Pi can turn on the motor of the exhaust fan to remove gas and smoke from the kitchen. If the air quality sensor detects the presence of harmful gases, the Raspberry Pi can sound the buzzer and turn on the motor of the exhaust fan to remove the gases from the kitchen. If the PIR sensor detects movement in the kitchen, the Raspberry Pi can turn on the lights or turn on the motor of the blender or mixer if required. The relay can be used to turn on and off devices like a rice cooker or slow cooker according to the set schedule. Overall, this system can make the kitchen more efficient and safer by automating several processes and alerting the user if there are any potential hazards.

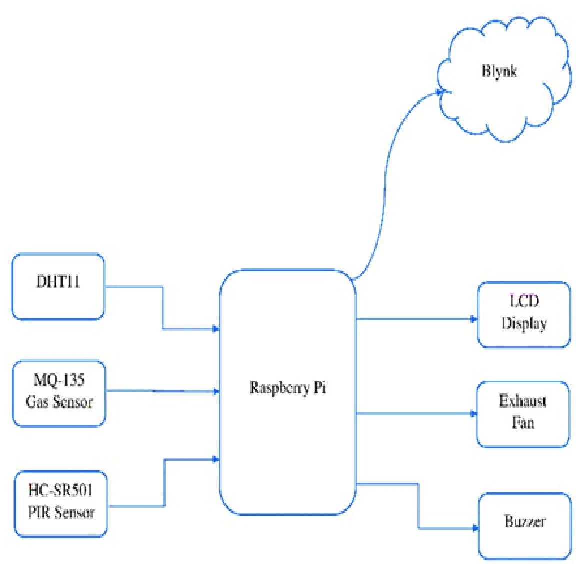

Figure 1: Block diagram of Smart Kitchen

IV. Hardware Implementation

A. Hardware Description

In this circuit, the Raspberry Pi, DHT11, MQ-135, PIR sensor, buzzer, LCD, and Relay module are all essential parts. As the brain of the smart kitchen, the Raspberry Pi is a little computer. Both the internet and other kitchen appliances may be accessed through it, and it can talk to both. Using a capacitive humidity sensor and a thermistor, the DHT11 gauges the air quality. The DHT11 produces data as a digital output instead of requiring analogue inputs. It only monitors temperatures up to 60 degrees Celsius, despite the sensor's ease of use.

For temperature and humidity monitoring in this Hardware system, the DHT11 is used. A device that locates gas leaks is known as a gas leak detector (MQ-135). The MQ-135 gas sensor may be used to find a gas leak in the kitchen. Even though it starts slowly, it reacts quickly when there is a gas leak. To adjust the sensitivity of this sensor, a potentiometer is included. If a gas leak is discovered, the conductivity of the sensor rises according to the quantity of gas concentration measured. To identify whether somebody is in the kitchen, the PIR will be employed. This sensor determines whether there is human activity by analyzing the infrared emission from the person. In this system the power source is connected to the microcontroller.

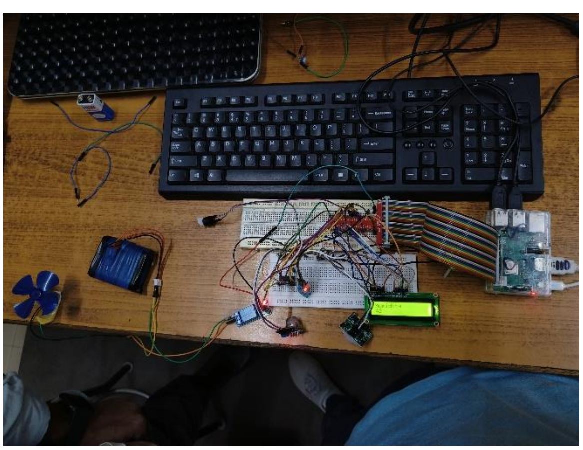

Figure 2: Schematic of this system and hardware implementation

B. Software Description

The software can be written in Python or any other programming language that supports Raspberry Pi. The code can be used to read the sensor data, control the relay, motor, and buzzer, and communicate with the cloud or mobile app for remote monitoring and control of the smart kitchen.

V. Real-Time Implementation

PIR sensors are used to detect people, DHT11 to detect temperature changes, MQ-135 to detect LPG gas leaks, and Raspberry Pi will be monitoring all these sensors in the kitchen. Data from the sensor will be transmitted directly to the Raspberry Pi via digital or analogue interfaces. The Raspberry Pi acts as the controlling hub in this system, processing all sensor data and using it as a guide for the subsequent action. Additionally, the Blynk app will receive data from the controller. Due to the Wi-Fi shield that the Raspberry Pi has, it may connect to the server online. A fan, a light, or a motor can all be managed by a relay. The relay will automatically switch ON / OFF the device.

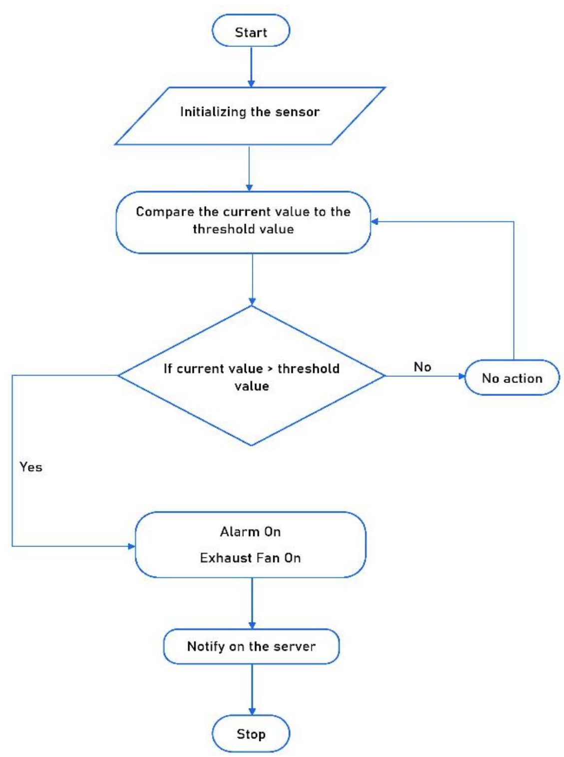

Figure 3: Flow Chart of implementation

Fig. 2 shows how all the components are assembled, and when the DHT11 sensor detects air temperature and humidity level, the exhaust fan will switch on, a leak of gas is detected by the MQ-135 sensor, and when the thingspeak program receives data when we will enter the channel Id in the program. When there is a gas leak or a fire, the exhaust fan turns ON and a sound will be produced by buzzer. The thingspeak program will store data sent by the Raspberry Pi over a Wi-Fi connection.

The thingspeak program also has a section that allows you to manipulate the components tied to the Raspberry Pi Information and display it on the LCD. We can also see the values on the shell of Python Software that displays the information received by the Controller. A trigger feature is available on the thingspeak website. The trigger function will send a command to the relay module to do that specific duty based on the sensor readings that have been obtained.

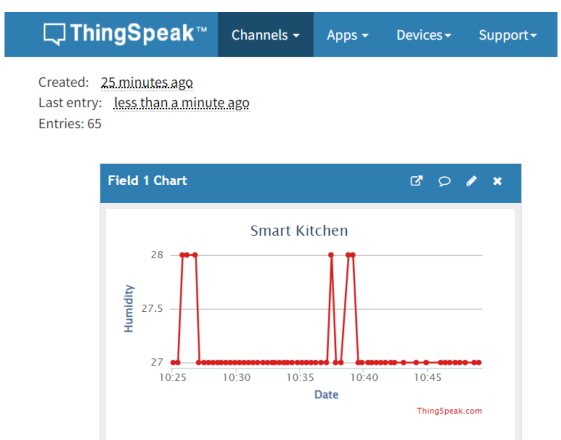

Figure 4(a): Result on Thingspeak website

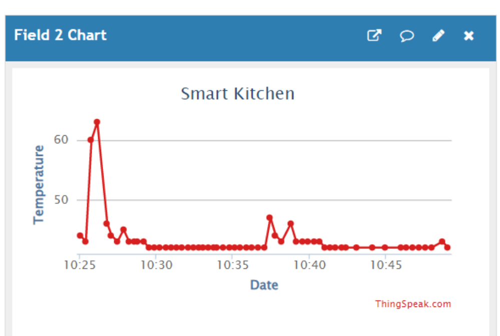

Figure 4(b): Result on Thingspeak website

In Figure 4, we can see the result on thingspeak website, graph 1 shows the temperature variations and graph 2 shows humidity variations.

VI. CONCLUSION

The proposed smart kitchen system concept can ensure safety, affordability, accessibility, and sustainability without any harm to human health. It is designed for monitoring and controlling the entire kitchen's parameters. This system is highly effective, economical, and user-friendly. With the use of the internet of things (IoT) facility, the 'n' number of sensor nodes can be interconnected over the system which is supported by Wireless Sensor Network (WSN) and can be accessed wirelessly through the application. The IoT has significantly opened new avenues of research and learning.

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