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EARLY GAS LEAKAGE DETECTION AND FIRE ALARM SYSTEM

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ABSTRACT

The presence of gas leaks, gas tanks, and grease might aggravate fire in the Universiti Teknologi MARA Pulau Pinang (UiTMCPP) hotel kitchen. Gas leakages are sometimes detected late, and this may cause an explosion inside the kitchen. This project thus includes early gas leakage detection and a fire alarm system to prevent fire explosions in the hotel kitchen using gas sensors, temperature sensor and flame sensor. It is observed in the UiTMCPP hotel kitchen that there is no monitoring system to monitor current gas readings in the kitchen area. Thus, this project provides an LCD to monitor data on current temperature and gas leakage by displaying it on the LCD. When there is a gas leakage or fire, the alarm system will go off immediately and warn the user through the LCD, buzzer, and LED. The system is also equipped with an automatic shut-off valve for safety and gas shut-off control in the gas feed pipe. UiTMCPP hotel kitchen has been constantly used for activities that involve staff and students. This project is intended to serve as an early warning system if any dangerous situation occurs during their activities in the hotel kitchen. The methods used in this project are based on the Proteus Software for the simulation and Arduino Software for the coding. The PCB is designed and developed for the onboard connection of the system.

Keywords: Temperature sensor, Gas Sensor, Flame Sensor, UiTMCPP hotel kitchen.

1. INTRODUCTION

Fire is an observable result of combustion, which is a unique type of chemical reaction. For combustion to occur, the fuel ignition temperature must be reached. Depending on the availability of oxygen, combustion might be slow or rapid. The rapid combustion that produces a flame is known as "burning." The presence of gas leaks, gas tanks, and grease might aggravate a fire in the kitchen (Umaru et al., 2016; Nasir et al. 2020; Jebamalar Leavline et al. 2017). When they reach the flash point, cooking oil and grease will ignite and burn vigorously. This will cause the oil to spill and spread the fire, as opposed to extinguishing it. An early fire alarm and gas leakage detection in the UiTMCPP hotel kitchen is a project designed to monitor current temperature and gas leakage data by LCD.

2. FINDINGS

Early detection of fire may save the lives of students, instructors and chefs while they work in the kitchen. This type of automatic system can also save them from a dangerous blast and prevent accidents. Having this system also allows the user to detect early gas leakage, preventing an explosion that can cause fire and smoke that affects one's health. Air hazards or air pollution due to the smoke created by the fire damaging one's airways and might cause lung disease. An

early gas leakage detection system will also inform staff and students to vacate the area faster when there is any danger detected in the hotel kitchen. This will create a habit of being more aware of gas and temperature readings even while doing activities in the kitchen.

3. METHODOLOGY

An early fire alarm and gas leakage detection in UiTMCPP hotel kitchen is a project designed to monitor current temperature and gas leakage data by LCD. This design is built with three (3) inputs and three (3) outputs as well as an actuator, which are the temperature sensor, gas sensor, and flame sensor for inputs, LED, LCD, and buzzer as outputs, while the servo motor acts as the actuator of this system. The simulation of this project consists of an Arduino Uno as a microcontroller to write device control commands, an MQ2 sensor as a gas sensor, a temperature sensor to measure the temperature of space, a flame sensor as a flame detector, LED, LCD, buzzer, and servo motor as an indicator (Umaru et al. 2016; Ramya et al. 2012). This project specifically aims to be an early fire alarm and gas leakage detection in the kitchen and notifies the user by displaying the data of current temperature and gas leakage. The data provided will also give peace of mind to the users in the space as they can monitor it through the LCD.

The readings of the current temperature and gas in the hotel kitchen are read. When the temperature in the kitchen exceeds 60 °C, the red LED illuminates the LCDs "DANGER". When the temperature in the kitchen is between 45 °C and 60 °C, the yellow LED will light up and the LCD will display the current temperature reading as well as "WARNING". When the temperature in the kitchen is between room temperature and 45 °C, the green LED will illuminate, and the LCDs current temperature reading is "SAFE". Table 1 shows the indicator for temperature sensor readings.

Temperature Reading (°C)	**LED Indicator**	**Indicator**
Less thank 45°C	Green	Safe
Between 45°C to 65°C	Yellow	Warning
Above 60°C	Red	Danger

Table 1 Temperature Reading

When the gas reading in kitchen rises more than 2000PPM, the red LED will light up and the LCD will display "DANGER", the servo motor acts an automatic shut off function for the gas valve. When the gas reading in the kitchen is between 1000PPM and 2000PPM, the yellow LED will light up and the LCD will display the current temperature reading as well as display "WARNING.". When the gas reading is between 300 and 1000 ppm, the green LED illuminates and the LCD displays the current temperature reading as well as "SAFE". Table 2 shows the indicator for gas sensor readings.

Gas Reading (PPM)	LED Indicator	Indicator
300 - 1000	Green	Safe
1001 - 2000	Yellow	Warning
2001 and above	Red	Danger

Table 2 Gas Reading

When "DANGER" is displayed, it indicates that the current situation in the kitchen is dangerous, staff and students must leave the building as soon as possible. If the LCD displays "WARNING", staff and students should be in an alert state, while they must also be aware of current temperature readings while in a "SAFE" state, indicating that the current state is safe for activities. For the flame sensor, when there is a raging fire detected in the kitchen, the flame sensor will be activated. The red LED will illuminate, and the buzzer will produce sound. When there is no fire detected in the kitchen, the flame sensor will not be activated. The red LED will not illuminate, and the buzzer will be turned off. The buzzer is set to be loud enough for all the kitchen staff and students to hear and vacate the kitchen as soon as possible.

4. CONCLUSION

In short, this system device is a choice in every kitchen. This system can save many lives because it alerts us when danger is imminent. In UiTMCPP hotel kitchen, there was no gas leakage system and no fire alarm warning system to display the reading of temperature, flame and gas sensor on the LCD before. Through this project, gas sensors, temperature sensors and flame sensors will take action to notify the user when necessary. This system will alert the user by showing an unstable reading on the device when something undesirable is going on such as a gas leak. So, users can contact the authorities for further action. Fire can also be avoided when sensors detect temperatures above standards and sound a buzzer as a safety alarm, which can save many lives.

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