ABSTRACT

IMPLEMENTATION OF FIRE DETECTION SYSTEM USING FUZZY LOGIC BASED ON MICROCONTROLLER

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20102056

This study aims to design a Microcontroller-based fire detection system that implements Mamdani fuzzy logic. Fires often occur due to human negligence or technical factors, such as electrical short circuits, making them difficult to predict. This system is designed using three main sensors: a DHT11 temperature sensor to monitor temperature, a KY-026 flame sensor to detect the presence of fire, and an MQ-2 smoke sensor to measure gas or smoke concentration. Data obtained from the three sensors is processed by the Arduino Mega 2560 Microcontroller, with the results displayed on a 16x2 LCD screen. The Mamdani fuzzy logic process is used to determine the level of fire hazard which is categorized into four: Safe, Alert, Dangerous, and Critical. The test results show that at cold ambient temperatures (17–49°C), normal, and hot, with moderate smoke thickness, the fire sensor values are in the range of 939–158 nm, 964–124 nm, and 873–95 nm, respectively. When no fire is detected, the system shows the Safe category and the pump is off. However, when a fire is detected, the category increases gradually, from Fire_present and pump on to Dangerous and pump on at cold temperatures, or Very_dangerous and pump on at normal and hot temperatures. The recorded state ranges from 90–167, with the water pump performance ranging from 16.2–92.8, depending on the fire conditions. With this system, potential losses due to fire can be minimized, and the response time to fire can be significantly improved.

Keywords : Microcontroller, Fire Detector, Arduino Mega 2560, MQ2 smoke sensor, fire sensor, temperature sensor, fuzzy logic