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AUTOMATED FIRE & GAS DETECTION MANAGEMENT SYSTEM USING NODE MCU

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Abstract: ***Fire and gas leakage monitoring system is a system designed to detect potential fire and gas leakage risks in the environment. It usually consists of sensors and control units that detect the presence of combustible gases and hazardous materials, as well as smoke and fire. The system can then alert the appropriate personnel or take other appropriate actions, such as automatically triggering fire suppression systems or closing off areas of the building to prevent further spread of the fire or gas. This system can be used in residential, commercial, industrial and public safety settings. Industrial fires pose a significant threat to business operations. They can cause extensive property damage and loss of life, disrupt production and supply chains, and have a negative impact on the environment. Fire spread can be rapid and unpredictable, leading to potentially catastrophic results. The leakage of gas in industrial settings can have serious consequences. Gas leaks can be extremely dangerous and create hazardous working conditions, leading to potential fires, explosions, and the release of toxic gases and chemicals into the air. Additionally, gas leaks can lead to costly repairs, operational downtime, and a decrease in productivity. The effects of gas leakage can extend beyond the premises of an industrial facility and put the environment, public health, and the safety of workers at risk. The presented fire suppression mechanism is a self-monitoring system that detects the existence of fire, gas, temperature between a specific range of wavelength and suppresses the fire by spreading water flowing via multiple sprinkler-heads. The controlling unit used to manipulate the fire suppression mechanism is an Arduino Uno. The major advantage of this system is its capability to detect fire fast and run water through dedicated pipes using solenoid valve.***

Keywords: Fire Management, Gas Detection, Arduino Uno, Sensors.

1.INTRODUCTION:

A Fire Management System is a set of tools and processes that are designed to help prevent, detect, and manage the spread of a wildfire. The system is typically composed of a combination of components such as sensors, weather stations, infrared cameras, communication systems, and other technological devices, as well as management strategies and procedures. Fire Management Systems help emergency personnel identify, monitor, and respond to wildfires with improved accuracy and efficiency. These systems can also be used for prescribed burning and other forms of wildfire prevention and management.

Fire has been a danger to assets and population through ages. In very recent times there have been multiple cases of fire throughout Dhaka city damaging properties worth millions and moreover taking away lives of innocent people. Narrow lanes and many flammable materials can cause fire to spread out quickly. This makes work harder for Fire brigade to operate on the inside. Although there are water-sprinkler systems intended to extinguish the fire, it takes a large sum of fire to trigger those mechanisms. We motivated ourselves to build a technology that can reduce the fire hazard to a minimum by detecting fire fast whilst being cost-effective.

The presented fire suppression mechanism is a self-monitoring system that detects the existence of fire, gas, temperature between a specific range of wavelength and suppresses the fire by spreading water flowing via multiple sprinkler-heads. The controlling unit used to manipulate the fire suppression mechanism is an Arduino Uno. The major advantage of this system is its capability to detect fire fast and run water through dedicated pipes using solenoid valve. Fire is an undesirable event that could cause a great loss of social wealth, human life, and confidential amenities. To prevent these losses, various extinguishing systems have already been developed, such as sprinkler heads with temperature sensitive valve and temperature sensor-based systems. These systems come with a high chance of delayed sensing and human error that can mislead the sensing and hence the whole system in general.

2. LITERATURE SURVEY:

In the recent past, a few fire warning and alarm systems have been presented based on a combination of a smoke sensor and an alarm device to design a life-safety system. However, such fire alarm systems are sometimes error-prone and can react to non-actual indicators of fire presence classified as false warnings. There is a need for high-quality and intelligent fire alarm systems that use multiple sensor values (such as a signal from a flame

detector, humidity, heat, and smoke sensors, etc.) to detect true incidents of fire. An Adaptive neuro-fuzzy Inference System (ANFIS) is used in this paper to calculate the maximum likelihood of the true presence of fire and generate fire alert. The novel idea proposed in this paper is to use ANFIS for the identification of a true fire incident by using change rate of smoke, the change rate of temperature, and humidity in the presence of fire. The model consists of sensors to collect vital data from sensor nodes where Fuzzy logic converts the raw data in a linguistic variable which is trained in ANFIS to get the probability of fire occurrence. The proposed idea also generates alerts with a message sent directly to the user's smartphone. Our system uses small size, cost effective sensors and ensures that this solution is reproducible. MATLAB-based simulation is used for the experiments and the results show a satisfactory output. Firefighting is an important and hazardous job. A fire fighter can be able to extinguish fire quickly, averting the damages and reduce losses. Technology has joined the gap between firefighting and machines using some effective method. The purpose of this thesis is to establish a system that can detect fire and extinguish it in the shortest time subject to a few effective factors. In this case, the system aims to put out the fire before it spreads increasing the security of home, laboratory, office, factory and building that is important to human life. We develop an intelligent sensor and camera system security system that contains a fire extinguishing capacity in our daily life. The name of the system is "Automated Fire Extinguishing System with GSM Alarm." The ieee southeast on 2003 Hardware Competition tests the minds of college students all over the nation with the challenge of extinguishing a fire located in a simulated house autonomously. To any one unfamiliar with robotics, for a robot to be autonomous means the robot must operate Abstract On its own independent of any human. This system can detect abnormal and dangerous situation and notify us this paper establishes the necessities, conditions, design problems, solutions and future plans for the firefighting system. First, we design a system with extinguisher. This system includes structure, avoidance obstacle, software development system, fire detection and others. We implement some computer program to detect only fire. We implement the system and if fire accident is true, the fire extinguisher system can find out the fire source by the proposed method and move to fire source to fight the fire using extinguisher.

3. PROPOSED SYSTEM:

Our fire suppression system, on the other hand, is extremely well thought out; it has no chance of human error as it is fully self- sufficient. The room or the area will have dedicated overhead sprinklers connected to the water supply through its dedicated solenoid valve which controls the flow of water in the pipelines. The triggering devices of this system are the flame sensors, when they detect fire, an alarm will go off.

The Algorithm set in the MCU will come into work and an optimal voltage will be provided to the solenoid valve through a relay, hence water will rush out the sprinklers to extinguish the fire in no time. The sensors used are highly sensitive, thus it will detect fire even before it reaches a point of concern. Unlike other

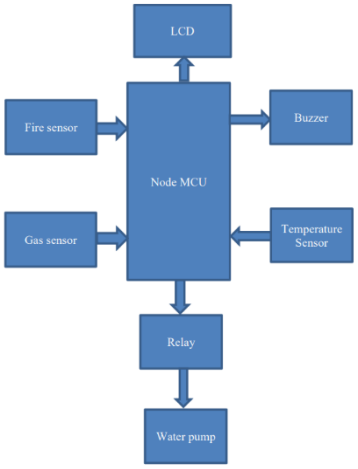


Figure 3.1 Block Diagram

systems, the components we used are readily available and reasonable in price. Also, the system has been tested to extinguish fire in real world scale. Our automated fire suppression system can be used both for commercial and residential purposes. The buzzer will use to intimate the sound for gas, fire, temperature.

4. MODULE LIST:

4.1 LCD:

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

4.2 GAS SENSORS:

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability. They are often part of a larger embedded system, such as hazmat and security systems, and they are normally connected to an audible alarm or interface. Because gas sensors are constantly interacting with air and other gasses, they have to be calibrated more often than many other types of sensors. Depending on their intended environments and functions, the physical makeup and sensing process can vary notably between sensors. One of the most commonly used gas sensors for toxic identification and smoke detection is the metal oxide-based gas sensor. This type of sensor employs a chemiresistor which comes in contact and reacts with target gasses. Metal oxide gas sensors increase their electrical resistance as they come into contact with gasses such as carbon monoxide,

hydrogen, methane, and butane. Most home-based smoke detection systems are oxide-based sensors.

4.3 DS18B20 TEMPERATURE SENSOR:

The DS18B20 is a 1-wire programmable Temperature sensor from maxim integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines or soil etc. The constriction of the sensor is rugged and also can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from -55°C to +125° with a decent accuracy of ±5°C. Each sensor has a unique address and requires 22 only one pin of the MCU to transfer data so it a very good choice for measuring temperature at multiple points without compromising much of your digital pins on the microcontroller.

4.4 RELAY:

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.

4.5 EXHAUST FAN:

A DC motor is a motor that transforms electrical energy into mechanical energy by drawing in direct current. DC motors induce a rotation movement in the machine by electromagnetism. DC motors have inductors (electromagnet) within them that create a magnetic field that aids the rotation of the motor. The electromagnet is a piece of iron with wire coil windings around it. This coil has current running through its terminals. This alignment has two stationary magnets on both the sides of the electromagnet. The opposing and attractive forces of these magnets create a torque.

4.6 WATER PUMP:

Micro DC 3-6V Micro Submersible Pump Mini water pump For Fountain Garden Mini water circulation System DIY project. This is a low cost, small size Submersible Pump Motor which can be operated from a 3 ~ 6V power supply. It can take up to 120 liters per hour with very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than the motor. Dry 28 run may damage the motor due to heating and it will also produce noise.

4.7 NODE MCU ESP8266:

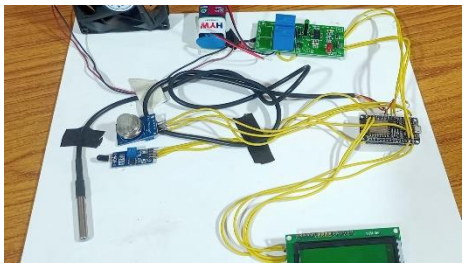
The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge from existing micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pinouts. With a micro-USB cable, you can connect Node MCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly

5. SYSTEM DESIGN:

6. RESULTS:

Node MCU has nine digital pins or data pins (D0 – D8). From D0 Data is transferred to Flame sensor.3V3(5V Power supply pin) is connected to VCC pin. GND is connected to GND pin. Gas sensor (D1) is connected to D0.3V3 is connected to VCC.D2 &D3 is directly connected to Display. Vin pin is the power supply pin. Temperature sensor is directly connected to the D5 pin. D6 connected to intake 1 and D6 connected to intake 2Vin

Figure 5.1 System Design



is connected with 12V pin. When the flame is detected automatically the temperature increases which is sensed by the flame sensor and the temperature sensor. Then water pump is automatically turned on and the fire is extinguished. On the other hand, if there is leakage of gas is also sensed by the gas sensor (MQ9) and exhaust fans is turned on. We are using Two 5V relay. One relay is connected to exhaust fan another relay is connected to water pump. When gas is detected, the data is transferred to Node MCU, it will automatically trigger the relay and initiate the extinguish process.

7.CONCLUSION:

Leakage detection and monitoring systems are designed to detect and monitor natural gas leaks in various industrial and residential applications. These systems use sensors, such as infrared (IR) cameras, acoustic detectors, and gas detectors to detect natural gas leaks. They also use advanced algorithms to analyze and interpret the data collected by the sensors. The data is then used to identify and locate any leaks that may be present. Leakage detection and monitoring systems can be used to monitor pipelines and other equipment, as well as to detect and report leaks in residential and commercial buildings. This can help to prevent dangerous situations and ensure compliance with safety regulations. The developed system was intended for many future applications in Bangladesh. It can be of great value to the government as they can implement the system in designated places and provide safety and security to the general public of our country. Places such as factories, especially garments factories, banks, and slum areas will be hugely benefitted if they implement this system on their premises.

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