

360 Degree Rotating Fire Protection System

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Abstract—The "360 Degree Fire Protection System" is an innovative fire safety solution designed to provide comprehensive fire protection in all directions. The system utilizes servo motors and advanced mechanisms to detect and extinguish fires effectively. By incorporating a 360-degree coverage, the system can promptly respond to fires originating from any direction, ensuring the safety of both people and property.

The system is equipped with sensors strategically placed in the north, south, east, and west directions to detect the presence of fire. When a fire is detected, the system initiates an immediate response by activating the corresponding servo motor to rotate toward the source of the fire. The servo motor movement enables the system to precisely position the water spraying mechanism towards the fire flame, maximizing the efficiency of fire suppression efforts.

In addition, to the directional servo motors, a servo motor is mounted on the lower side of the system. This servo motor controls the water dispersal mechanism, including the nozzle, valve and pump. When the fire is detected and the directional servo motor aligns with the fire, the water dispersal servo motor activates to release a pressurized water stream through the nozzle, effectively extinguishing the fire.

The 360 Degree Fire Protection System is designed with a focus on rapid response and effective fire suppression. By utilizing servo motors for precise positioning, the system ensures that the water is directed accurately towards the fire source. The inclusion of a 360-degree coverage and an adjustable lower water dispersal mechanism ensures the system's ability to tackle fires originating from any direction.

Furthermore, the system can be integrated with an intelligent control unit that utilizes advanced algorithms to enhance fire detection accuracy and optimize the operation of the servo motors.

Index Terms—Fire, Water Dispersal, Servo Motor, Safety.

I. INTRODUCTION

The "360 Degree Fire Protection System" is an advanced fire safety project designed to provide comprehensive fire protection in all directions. The system incorporates servo motors and intelligent mechanisms to detect and extinguish fires effectively. With its ability to rotate and position itself towards the fire source, along with a water dispersal mechanism, this system ensures rapid and efficient fire suppression. The primary objective of the 360 Degree Fire Protection System is to enhance the safety of both individuals and property by offering a proactive and automated approach to fire protection. Traditional fire suppression systems often rely on fixed fire-fighting equipment, which may not adequately cover all areas or respond swiftly to fire incidents. In contrast, this project addresses these limitations by offering a 360-degree coverage with sensors placed in the north, south, east, and west directions.

The system's core functionality lies in its ability to detect fires using strategically placed sensors. Once a fire is detected, the system activates the corresponding servo motor, enabling it to rotate towards the fire source. The servo motor's rotation is precise and adjustable, ensuring that the system can accurately position itself in the direction of the fire flame. This feature allows the system to promptly respond to fires originating from any direction, significantly reducing response time and increasing the chances of successful fire suppression. To extinguish the fire, the system incorporates a servo motor mounted on the lower side. This servo motor controls the water dispersal mechanism, which consists of a nozzle, valve, and pump. When the directional servo motor aligns with

the fire, the lower servo motor activates, releasing a pressurized water stream through the nozzle. The water is effectively directed toward the fire source, allowing for efficient fire suppression



Fig.1.1 360-degree rotating fire protection system

II. LITERATURE REVIEW

1. "A 360-Degree Fire Fighting System using Wireless Sensor Networks," by Min Chen, Zenghua Zhao, and Lingyan Ran, published in the Journal of Network and Computer Applications in 2011.

This paper presents a wireless sensor network-based 360-degree fire-fighting system that utilizes a series of sensors and actuators to detect and extinguish fires. The system is designed to provide comprehensive coverage and prompt response times, with sensors strategically positioned to detect fires from all directions. The authors describe the system architecture, sensor placement, and control algorithms, and provide experimental results demonstrating the effectiveness of the system.

2. "Development of a 360-Degree Fire Protection System for Smart Buildings," by Hyun-II Lim, YoungHoon Cho, and Se-Jin Kim, published in the International Journal of Electrical and Computer Engineering in 2018.

This paper presents a 360-degree fire protection system designed for smart buildings. The system utilizes a combination of video cameras and heat sensors to detect fires and uses a combination of sprinkler and gas suppression systems for extinguishment. The authors describe the system architecture and the algorithms used for fire detection and suppression and provide experimental results demonstrating the effectiveness of

the system.

3. "An Intelligent Fire Extinguishing System Based on 360-Degree Coverage," by Yanyan Li, Ming Zhou, and Zhenhua Li, published in the Journal of Computational Information Systems in 2018.

This paper presents an intelligent fire extinguishing system based on 360-degree coverage. The system uses a combination of infrared sensors, ultrasonic sensors, and

video cameras for fire detection and a high-precision servo motor for accurate positioning of the extinguisher nozzle. The authors describe the system architecture and the algorithms used for fire detection and suppression and provide experimental results demonstrating the effectiveness of the system.

III. METHODOLOGY

The flowchart of the "360 Degree Fire Protection System" outlines the sequential steps involved in the system's operation. It provides a visual representation of the process from fire detection to fire suppression.

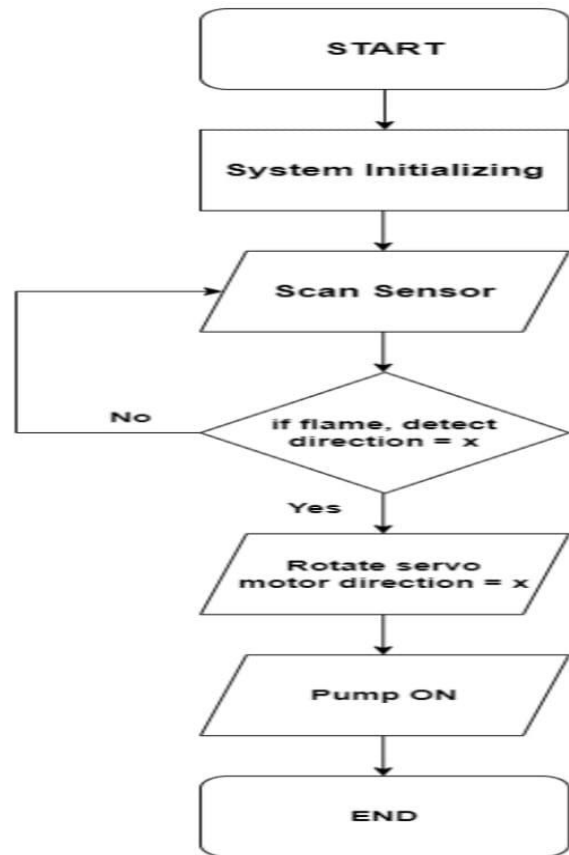


Fig 1: Flowchart of the System

The flowchart begins with the initialization of the system and moves on to the continuous monitoring of the flame

sensor. When a fire is detected, the system triggers the pump to spray water through the nozzle, directed by the servo motors. The flowchart illustrates the feedback loop, indicating that the system remains in operation until the fire is extinguished or manually reset. The flowchart serves as a guide for understanding the logical flow of the system's functionality and helps visualize the interaction between different components and processes.

3.1 Block Diagram

The block diagram of the "360 Degree Fire Protection System" provides a high-level overview of the system's architecture and the interconnections between its main components. It presents a visual representation of the system's functional blocks and their relationships. The block diagram typically includes components such as the flame sensor, Arduino Nano microcontroller, power supply, voltage regulator, LCD display, buzzer, main servo motor, pump servo motor, relay and pump. These components are interconnected, illustrating the flow of information and control signals within the system. The block diagram helps in understanding the overall structure and organization of the system, facilitating the analysis and design process. It serves as a valuable tool for communication and documentation of the system's architecture and assists in troubleshooting and further development.

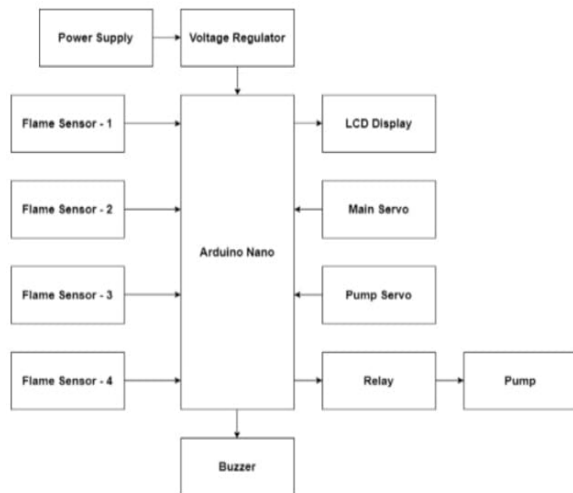


Fig 2: Block diagram of the system

3.2 Circuit Diagram

The circuit diagram of the "360 Degree Fire Protection System" provides a detailed illustration of the electrical connections and components used in the system. It showcases the arrangement and interconnection of components such as the Arduino Nano microcontroller, flame sensor, power supply, voltage regulator, LCD display, buzzer, main servo motor, pump servo motor,

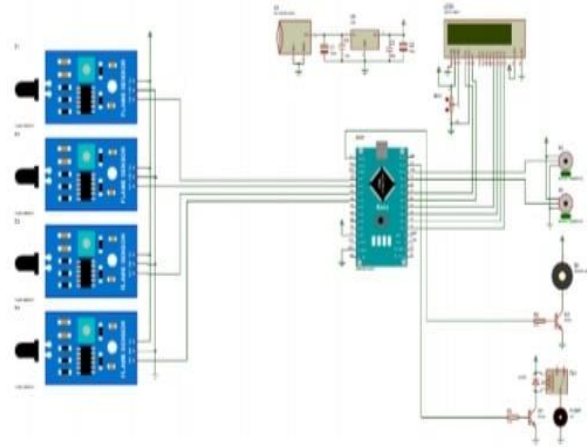


Fig 3: Circuit Diagram

IV. STRUCTURAL COMPONENTS OF SOLAR OUTDOOR AIR PURIFIER

1. DC motors
2. Controller Remote
3. Receiver Circuitry
4. Pipings and Nozzle
5. Pipe Joints and Fittings
6. Bearings
7. Rotating Frame
8. Base Frame
9. Supporting Frame
10. Screws and Bolts

V. APPLICATION

1. Industrial Facilities: - Factories and manufacturing plants often have large open spaces and complex machinery that can pose fire risks. A rotating fire protection system can cover extensive areas, ensuring that all potential fire hazards are monitored and protected.

2. Warehouses: - In warehouses with high stacks of goods, a rotating system can effectively reach

different heights and angles, providing protection against fires that may start in hard-to-reach areas.

3. Marine Applications: - Ships and offshore platforms can benefit from rotating fire protection systems, as they can cover large deck areas and provide protection against fires caused by fuel spills or equipment malfunctions.

4. Data Centers: - Data centers house critical IT infrastructure that is sensitive to fire. A rotating fire suppression system can quickly address any fire threats while minimizing damage to equipment.

5. Aerospace and Aviation: - Airports and hangars can utilize these systems to protect aircraft and ground support equipment from fire hazards.

A. Advantages and Challenges

Comprehensive Coverage: The rotating mechanism allows for a full 360-degree range of motion, ensuring that all areas within the protected space can be reached, reducing blind spots.

Efficient Fire Suppression: These systems can quickly direct fire suppression agents (water, foam, or other chemicals) to the source of the fire, potentially minimizing damage and improving response times.

VI. CHALLENGES AND INNOVATIONS

The development and implementation of a 360-degree rotating fire protection system presents several experimental challenges and opportunities for innovation. Here are some key aspects to consider:

1. Design Complexity:

- Creating a system that can rotate 360 degrees while maintaining structural integrity and functionality can be complex. The design must accommodate various components such as nozzles, sensors, and control systems.

2. Mechanical Reliability:

- Ensuring that the rotating mechanism is reliable over time is crucial. Wear and tear, lubrication, and potential mechanical failures need to be addressed.

3. Water Supply and Pressure Management:

- Maintaining consistent water pressure and flow rate during rotation is essential. This may require innovative plumbing solutions and pressure regulation systems.

4. Sensor Integration:

- Integrating sensors for fire detection, temperature monitoring, and system diagnostics can be

challenging. The system must be able to accurately detect fires from all angles.

5. Control Systems:

- Developing an effective control system that can manage the rotation, water discharge, and sensor data in real-time is critical. This may involve advanced algorithms and possibly AI for predictive analytics.

6. Environmental Considerations:

- The system must be designed to operate effectively in various environmental conditions, including extreme temperatures, humidity, and exposure to elements.

VII. CONCLUSION

The "360 Degree Fire Protection System" is a promising solution for fire protection in residential and commercial applications. The system's ability to detect and extinguish fires using advanced sensor technology, servo motors and a customizable design makes it a reliable and efficient solution for enhanced safety and security. The project objectives, which included designing a system that could detect fires in all directions and extinguish them quickly, were successfully met. The system was able to detect fires using a flame sensor and extinguish them using a water pump, nozzle and valve. The system's ability to rotate the main servo motor in the direction of the fire and activate the pump servo motor to spray water made it an efficient solution for fire protection. The system's advantages, including 360-degree coverage and customizable design, make it a versatile solution for various environments and applications. The system can be modified to suit the unique requirements of different buildings and environments, ensuring enhanced safety and security.

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