IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 12, May 2023

360 Degree Rotating Fire Protection System

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Abstract: *Large factories, warehouses, and industrial production facilities always run the risk of fires breaking out. Lack of appropriate firefighting measures could result in disastrous consequences and along with financial losses and might even lead to massive loss of human life. Usual fire protection systems installed in buildings have the following disadvantage. They spray small amounts of water from each sprinkler which may not be enough to put out the fire. The sprinklers are not targeted and spray an entire floor or building ruining computers, furniture and paperwork. While this sprayer gun can spray water in desired quantity only at fire outbreak point to stop fire without ruining complete office furniture and electronics. This demo version is made to be remote controlled from few meters but future version will operate remotely from fire department.*

Keywords: Motor, Pipe, Bearings, Nozzle, Remote, Control System

I. INTRODUCTION

Nowadays, machinery and robotic design become important in helping human. This Fire Protection Robot was design to help people in any destructive burnt situation where this robot can extinguish burnt area immediately using autonomous system. This autonomous system will be designed using programming in PIC18F4550 and others additional circuit. In real life, destructive burnt area often happens without our realization. Therefore, this type of robot will require a high demand in the market because of its usefulness to the human as well as the environment transmit fire information to cell phone using controller. The objective of the project will be to design a SMS electronic Fire Protection Robot toolkit which can replace the traditional Fire Protection Robot. The toolkit sends the fire and send SMS to owner of the house, the system is made efficient by SIMs so that the SMS can be received by number of devices boards in a locality using techniques of time division multiple access.

II. MATERIAL SELECTION

2.1 DC Motor Selection: DC motors are widely used in various industries and applications due to their unique characteristics and advantages. Here are some reasons for DC motor selection:

1. Speed control: DC motors offer excellent speed control capabilities, allowing precise regulation of motor speed. By adjusting the voltage applied to the motor, the speed can be easily varied, making DC motors suitable for applications where speed control is critical, such as in robotics, conveyors, and machine tools. High starting torque: DC motors provide high starting torque, which is beneficial in applications where the motor needs to overcome initial resistance or inertia. This characteristic makes them ideal for driving heavy loads or starting machinery that requires a significant amount of force during startup.

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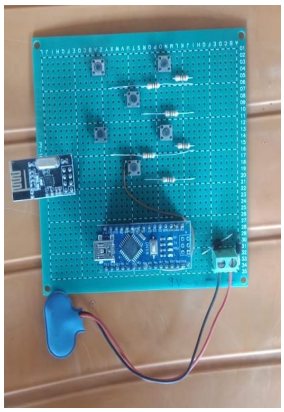
It is a Single Phase pump that is used for pumping water. This product works at a speed of 2880 rpm. The power rating of this pump is 0.5 kW. Its dimensions are 315x190x250 mm. This pump has a suction capacity of 25ft. The material used in the motor body is cast iron. It is operated at the voltage of 180-240V single phase energy supply. This range of centrifugal pumps is ideally suited for the supply of water to domestic & industrial places

2.2 DC Geared Motor: A geared motor is a specific type of electrical motor that is designed to producehigh torque while maintaining the low speed motor output. A gear motor can be either an
AC or a DC electric motor. In this project we are using a DC geared motor which has the output about 10-30 revolutions per minute. Gear motors are primarily used to reduce speed in a series of gears, which in turn creates more torque. Gear motors are commonly used in commercial applications where a piece of equipment needs to be able to exert a high amount of force in order to move very heavy object. Examples of these types of equipment would include a crane or lift jack, and in smaller applications like Pick and Place
Rovers also.

2.3.Relay driver: Relay is an electromagnetic switch which is used to defer two circuits electrically and connect magnetically. When Arduino transmit the signal then relay driver receive signal and start its work. They are frequently used to interface an electronic circuit to an electrical circuit which works at extremely high voltage. For instance, a hand-off can make a 5V DC battery circuit to switch 230V AC mains circuit. In this way a little sensor circuit can drive, say, a fan or an electric knob.

2.4.RF Control Remote : The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude ShiftKeying (ASK).



2.5 Bearing: A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction.

2.6 Base Frame: Most of the larger high speed compressor models are mounted on Base frames. Compressors are mounted on the Base frame to carry its weight, to maintain its alignment and to assist in carrying the dynamic loads which every compressor generates. Compressors base frame needs an effective design technology to ensure that the base frame as designed performs the required functions, and maintains its integrity. There is also a need to maximize the life of the compressor base frame under the loads to which it is exposed. One of the main reasons for the failure of base frame is lack of rigidity and the stress concentrations.

2.7 Receiver Circuit: Optical receivers can be classified as high-impedance, fransimpedance, and low impedance depending on the pre-amplifier design. When the timing of the optical signal is known, an integrate-and-dump pre-

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amplifier design can be used Low-impedance receivers have a broad bandwidth, but poor sensitivity. High impedance receivers have much better sensitivity, but they fail to achieve a useful bandwidth. The transimpedance receiver, which uses negative feedback to broaden the bandwidth while maintaining a reasonable sensitivity, provides a good compromise between the two extremes. In addition, the use of feedback self biases the pre-amplifier to the high gain region of operation. The integrate-and-dump pre-amplifier can potentially provide much better sensitivity tian all of the other pre-amplifiers

III. CALCULATION

For 1⁄2 hp water pump calculation -
Water pump horse power = TDH ×Qx Specific gravity 3960

TDH = Total dynamic Head + Friction losses Assume, overall TDH = 70
Q= discharge of water
Q = 10 gpm Specific gravity = 1
Water pump Horse power= 70 x 10 × 1 3960 =0.18 H P

Horse Power of motor = Horse power of water
Pump Efficiency = 0.18
0.5 =0.36HP
From these value we will use 1⁄2 hp water pump motor

360 Degree Rotating Fire Protection System
For de motor calculation :
F= force = 9.81N
D= displacement= 0.152 m
W=workdone=?
W=Fx D = 9.81 x 0.152 Work = 1.49112 N.m
P = mechanical power = f x d/t Mechanical power = 149.112 nm/s

Factor of safety :
Factor of safety = maximum stress Working stress
= 100/50 Factor of safty = 2.

IV. NEEDS

A 360-degree rotating fire protection system is designed to provide comprehensive fire suppression coverage in a wide range of environments. Here are some of the needs and advantages of such a system:

1. Complete Coverage: A 360-degree rotating fire protection system ensures that every corner of the protected area is covered, leaving no blind spots. This is particularly important in large open spaces, such as warehouses, industrial facilities, or open-plan offices, where conventional fixed fire protection systems may have limitations in reaching certain areas.
2. Rapid Response: With its ability to rotate and cover a large area, a 360-degree system can quickly detect and respond to fires. It minimizes the time needed to identify the fire location, reducing the risk of fire spreading and causing extensive damage.
3. Flexibility and Adaptability: The rotating feature of the system allows it to be adaptable to changing environments. It can be customized to specific needs and adjusted as the layout of the protected area changes. This flexibility makes it suitable for various applications and ensures optimal fire protection.
4. Enhanced Safety: By providing comprehensive coverage, a 360-degree rotating system enhances safety for occupants, employees, and valuable assets. It helps to minimize the risks associated with fires, including property damage, injuries, and loss of life.

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5. Reduced Water Usage: Many 360-degree rotating fire protection systems employ advanced technologies, such as high-pressure water mist or gas suppression agents. These systems utilize water or extinguishing agents more efficiently compared to traditional sprinkler systems, reducing water damage and environmental impact.
6. Remote Monitoring and Control: Modern rotating fire protection systems often incorporate intelligent monitoring and control capabilities. They can be integrated into fire alarm systems and central monitoring stations, allowing remote monitoring, quick response, and automated operation for efficient fire protection management.
7. Compliance with Regulations: Depending on the industry and location, there may be specific fire safety regulations and codes that require comprehensive fire protection coverage. A 360-degree rotating fire protection system can help meet these requirements and ensure compliance.

Overall, a 360-degree rotating fire protection system addresses the need for comprehensive and efficient fire suppression in large spaces, offering improved safety, reduced damage, and enhanced fire protection management.

V. PROJECT METHODOLOGY

This project is designed with,
Hardware Requirements:
Components to be used:
• DC motors
• Battery
• Pump Motor
• Relay
• RF Control Remote
• Receiver Circuitry
• Piping and Nozzle
• Pipe Joints and Fittings
• Bearings
• Rotating Frame
• Base Frame
• Supporting Frame
• Screws and Bolts
• Transistor
• Capacitor
Arduno NANO

5.1 Arduino NANO:

The Arduino Nano is a small, breadboard-friendly board based on the ATmega328P microcontroller. It has similar functionality to the Arduino Uno, but with a smaller form factor and a lower cost. The Nano is compatible with the Arduino IDEand can be programmed using C++ code. It
has 14 digital input/output pins, 8 analog input pins, and a micro-USB connector for power and data communication. It also includes a 16 MHz crystal oscillator and a mini-USB connector for programming. One of the key features of the Nano is its smallsize, which makes it easy to use in projects where space is limited. It can be powered by aUSB connection, or by an external power source connected to the Vin pin. The Nano also has a built-in voltage regulator, allowing it to be powered by a range of voltages between 7 and 12 volts.
Overall, the Arduino Nano is a versatile and compact board that is suitable for a wide range of electronics projects. Its low cost and ease of use make it a popular choice among hobbyists and professionals alike.

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VI. APPLICATIONS

1. Industrial Facilities
2. Warehouse and Storage Facilities
3. Data Centers
4. Commercials Buildings and Complex
5. Healthcare Centers
6. Transportation Facilities
7. School, Colleges

VII. DESIGN OF PROJECTS

Front View:

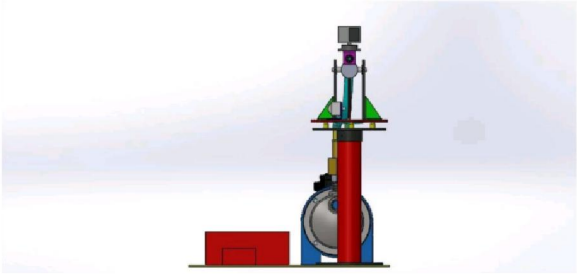

Fig.A

Side View:

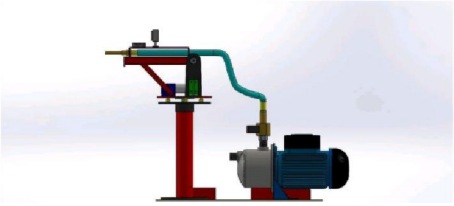

Fig.B

VIII. CONCLUSION

- To reduce the involvement of fire fighters thereby
- Decreasing the risk of physical injuries and life threats.
- Comparing this prototype with the existing technology we implement the sensor and wireless technology. Nowadays the fire fighting technologies are fully manual.
- in scope of future we implement wireless technology to control the fires.

IX. FUTURE WORK

In future work, an efficient approach for early fire detection from images by combining a powerful deep learning technique with multidimensional texture analysis using Linear Dynamical Systems (LDS) is propose.

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