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ijirset@gmail.com

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360 Degree Rotating Fire Protection System

Dr. Vishnu Agrawal¹, Abhishek Joshi², Navneet R Vaishnav³, Rajendra Singh⁴

Professor, Department of Mechanical Engineering, Geetanjali Institute of Technical Studies, Udaipur(Raj), India¹

Assistant Professor, Department of Mechanical Engineering, Geetanjali Institute of Technical Studies,
Udaipur(Raj), India²

U.G. Student, Department of Mechanical Engineering, Geetanjali Institute of Technical Studies, Udaipur(Raj), India³.

ABSTRACT: Large factories, warehouses, and industrial production facilities always run the risk of fires breaking out. Lack of appropriate fire fighting measures could result in disastrous consequences and along with financial losses and might even lead to massive loss of human life. Fire monitors and sprayers are an amiable and controllable high-capacity water jet used to deal with large fires. Unlike Fire extinguishers, Fire Monitors are permanently installed and cannot be moved. While traditional fire monitor systems need a human operator to change the direction of the water jet and aim it appropriately, this fire monitor has been equipped with RF control and an onboard camera. Thereby allowing the user to operate it from a safe distance. The system makes use of 2 x Motors coupled with a powerful sprayer motor with piping system and onboard wireless streaming camera to run this system. The 2 motors are used to control the nozzle direction movement.

KEYWORDS: Arduino Nano, Water Sprinkler, Stepper Motor, Microcontroller.

I. INTRODUCTION

Large factories, warehouses, and industrial production facilities always run the risk of fires breaking out. Lack of appropriate fire fighting 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 qty 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 dept.

Fire monitors and sprayers are an amiable and controllable high-capacity water jet used to deal with large fires. Unlike Fire extinguishers, Fire Monitors are permanently installed and cannot be moved. While traditional fire monitor systems need a human operator to change the direction of the water jet and aim it appropriately, this fire monitor has been equipped with RF control and an onboard camera. There by allowing the user to operate it from a safe distance. The system makes use of 2 x Motors coupled with a powerful sprayer motor with piping system and onboard wireless streaming camera to run this system. The 2 motors are used to control the nozzle direction movement. The user may use a wireless remote to transmit movement commands. The receiver circuitry mounted on system receives users commands and operates the motors to achieve desired motion. Also the receiver operates the pump motor to start and stop the spray. The sprayer nozzle can also be adjusted to adjust the water spray outlet. The sprayer mechanism is built to operate in a 2 DOF operation to adjust position in x and Y directions and achieve a 360 Degree water spray coverage.



II. COMPONENT DESCRIPTION

In this device we are using several types of components which are mentioned below: -

1. Arduino Nano

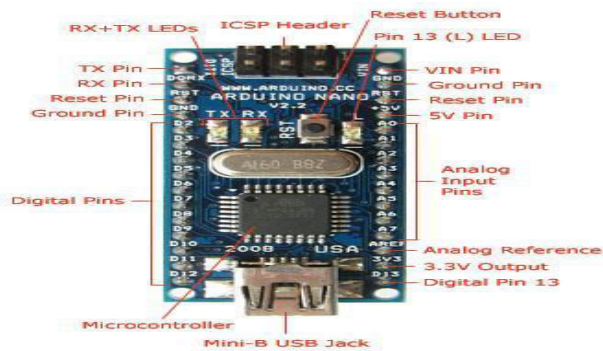
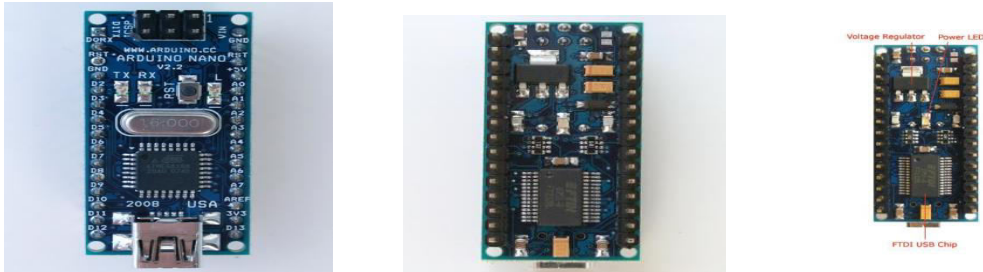


Fig.1 Arduino Nano

Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano3.0) or ATmega168 (Arduino Nano2.x). It has more or less the same function ability of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of as standard one. The Nano was designed and is being produced by Gravitech.

2. Stepper Motor

NEMA 17 is a **hybrid stepping motor** with a 1.8° step angle (200 steps/revolution). Each phase draws 1.2 A at 4 V, allowing for a holding torque of 3.2 kg-cm. NEMA 17 Stepper motor is generally used in Printers, CNC machines and Laser Cutters.

Pin Configuration

N O.	Pin Name	Wire Colour	Description
1	Coil 1	Black	This motor has six wires, connected to two split windings. Black, Yellow, Green wires is part of first winding while Red, White and Blue is part of second winding.
2	Coil 2	Yellow	
3	Coil 3	Green	
4	Coil 4	Red	
5	Coil 5	White	
6	Coil 6	Blue	

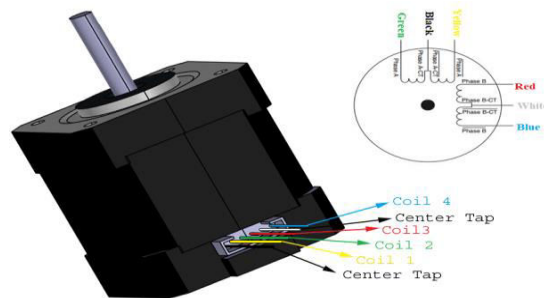


Fig 2 Stepper Motor

3. 16x2 LCD Display

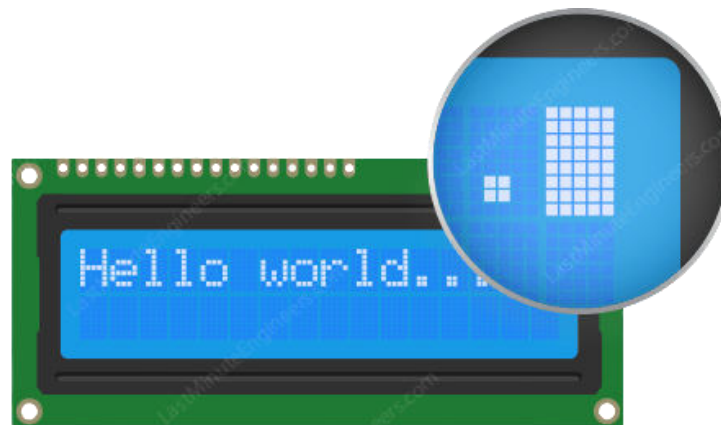


Fig.3 16x2 LCD Display

Want your Arduino projects to display status messages or sensor readings? Then these LCD displays might be the perfect fit. They are extremely common and a fast way to add a readable interface to your project. This tutorial will cover everything you need to know to get up and running with Character LCDs. Not just 16x2(1602) but any character LCDs (for example, 16x4, 16x1, 20x4 etc.) that are based on parallel interface LCD controller chip from Hitachi called the HD44780. Because, the Arduino community has already developed a library to handle HD44780 LCDs; so we'll have them interfaced in no time. These LCDs are ideal for displaying text/characters only, hence the name 'Character LCD'. The display has an LED backlight and can display 32 ASCII characters in two rows with 16 characters on each row.

If you look closely, you can actually see the little rectangles for each character on the display and the pixels that make up a character. Each of these rectangles is a grid of 5x8 pixels. Although they display only text, they do come in many sizes and colors: for example, 16x1, 16x4, 20x4, with white text on blue background, with black text on green and many more. The good news is that all of these displays are 'swappable' – if you build your project with one you can just unplug it and use another size/color LCD of your choice. Your code may have to adjust to the larger size but at least the wiring is the same!

16x2 Character LCD Pin out

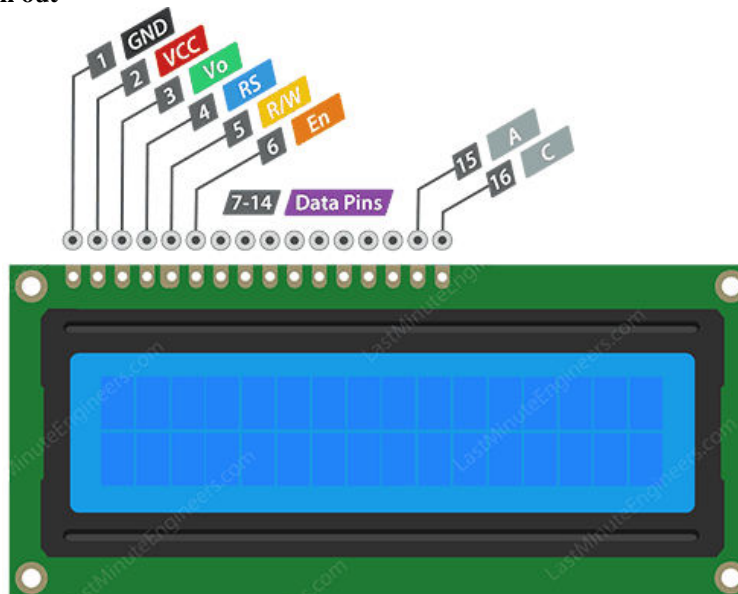


Fig.4 16x2 Character LCD Pin out

4. DPDT Switch

A DPDT switch (double-pole, double-throw) is an electromechanical switch that can be formed by adding a pole to the SPDT switch. This is very easy to install because it is available with a locking system that can lock & unlock the switch directly in a remote cabinet without using any Nut-Bolts or screw for fitting. This article discusses an overview of a DPDT switch and its working with applications.

A DPDT or Double Pole Double Throw switch includes two inputs & four outputs where every input has two equivalent outputs. This switch is very versatile because each terminal in this switch can be either in one of two positions. The inputs of this switch can connect to four different outputs, so it can redirect a circuit into two different modes of operation. This switch is the combination of two SPDT switches.

This switch is very helpful in changing the polarity of the voltage applied. So it is used where we require dissimilar outputs. This switch has three states like ON, OFF & ON but the main disparity between the two ON states is the polarity which is quite opposite to each other.

5. A4988 Stepper Motor Driver Module



Fig 4 A4988 Stepper Motor Driver Module



The A4988 stepper motor driver carrier is a breakout board for Allegro’s easy-to-use A4988 micro stepping bipolar stepper motor driver and is a drop-in replacement for the A4983 stepper motor driver carrier. The driver features adjustable current limiting, over current protection, and five different micro step resolutions. It operates from 8 – 35 V and can deliver up to 2 A per coil. Note: This board is a drop-in replacement for the original A4983 stepper motor driver carrier. The newer A4988 offers over current protection and has an internal 100k pull-down on the MS1 micro step selection pin, but it is otherwise virtually identical to the A4983.

Pin Configuration

Pin Name	Description
VDD & GND	Connected to 5V and GND of Controller
VMOT & GND	Used to power the motor
1A, 1B, 2A, 2B	Connected to the 4 coils of motor
DIRECTION	Motor Direction Control pin
STEP	Steps Control Pin
MS1, MS2, MS3	Micro step Selection Pins
SLEEP	Pins For Controlling Power States
RESET	
ENABLE	

6. Led Diode

LEDs are everywhere – in our phones, in our cars, and even in our homes. Whenever an electronic device lights up, there is a good chance that an LED is behind it. LEDs are like tiny light bulbs. Low energy consumption, small size, rapid switching and long lifespan make them ideal for mobile devices and other low-power applications. LED stands for Light Emitting Diode. They are a special type of diode that convert electrical energy into light. They have very similar electrical characteristics to a normal PN Junction diode. That’s why the symbol of LED is similar to the normal PN junction diode except that it contains arrows pointing away from the diode indicating that light is being emitted by the diode.

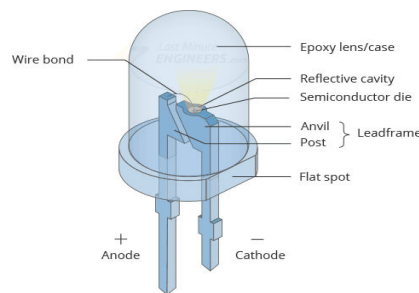


Fig.5 Led Diode

III. METHODOLOGY

The system makes use of 2 x Motors coupled with a powerful sprayer motor with piping system and onboard wireless streaming camera to run this system. The 2 motors are used to control the nozzle direction movement.

The user may use a wireless remote to transmit movement commands. The receiver circuitry mounted on system receives users commands and operates the motors to achieve desired motion. Also the receiver operates the pump motor to start and stop the spray.



The sprayer nozzle can also be adjusted to adjust the water spray outlet. The sprayer mechanism is built to operate in a 2 DOF operation to adjust position in x and Y directions and achieve a 360 Degree water spray coverage.

IV. WORKING

The system makes use of 2 x Motors coupled with a powerful sprayer motor with piping system and onboard wireless streaming camera to run this system. The 2 motors are used to control the nozzle direction movement. The user may use a wireless remote to transmit movement commands. The receiver circuitry mounted on system receives users commands and operates the motors to achieve desired motion. Also the receiver operates the pump motor to start and stop the spray. The sprayer nozzle can also be adjusted to adjust the water spray outlet. The sprayer mechanism is built to operate in a 2 DOF operation to adjust position in x and Y directions and achieve a 360 Degree water spray coverage.

V. CONCLUSION

The project has been completed with success and therefore the output results are verified. The results are inside the expected output. The project has been checked with each code and hardware testing tools. During this work "Microcontroller, Current transformer, Potential transformer" are chosen to prove for additional applicable and supposed application. The project has enough avenues for future improvement. The project could be a epitome model that fulfils all the logical needs. The project with marginal enhancements is directly applicable for real-time applications. Fire monitors and sprayers are an amiable and controllable high-capacity water jet used to deal with large fires. Unlike Fire extinguishers, Fire Monitors are permanently installed and cannot be moved. While traditional fire monitor systems need a human operator to change the direction of the water jet and aim it appropriately, this fire monitor has been equipped with RF control and an onboard camera. There by allowing the user to operate it from a safe distance. The project is additional adaptability towards continuous performance and peripheral up gradations. This work is applied to style of industrial and industrial applications.

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