360 Degree 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. To this end, rapid advances in remote sensing systems including ground-based, unmanned aerial vehicle-based and satellite-based systems have been adopted for effective fire surveillance. In this project, the recently introduced 360-degree sensor cameras are proposed for early fire detection, making it possible to obtain unlimited field of view captures which reduce the number of required sensors and the computational cost and make the systems more efficient. 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.

Keywords:Arduino,Bluetooth Controller , Fire Sensor

INTRODUCTION

1 BACKGROUND

The increasing occurrence of large-scale fires in modern society significantly impacts society and communities in terms of remarkable losses in human lives,infrastructures and properties. Depending on burn severity, wildfires also impactConsideration of these systems is a natural adjunct to a discussion ofhazards and building construction features. The primary components we will examine are fire alarmsystems, fire detection and notification systems, suppression agents and systems. Waterdistribution systems, automatic sprinkler systems, standpipe and hose systems. and portable fire extinguishers. This module will cover a lot of basic material meant to provide the novice inspector a solid foundation on which to build. As was said in the earlier modules, it is only a beginning.

A properly designed, installed, operated, and maintained fire alarm system can reduce thelosses associated with an unwanted fire in any building. These losses include property and, more importantly, human life. The primary motivation for fire alarm system requirements in building and fire codes is to provide early notification to building occupants so they can exit the building, and to notify the fire service so it can respond to the fire. In settings such as hospitals the fire alarm system provides notification to staff so they can respond to the fire emergency. This module will explain the basic features of

fire alarm systems and the inspection of these systems. It should be noted that fire alarm systems also are called protective signaling systems.

Fire Detection Challenges

Usual fire protection systems installed in buildings have the following limitations

2.Fire Extinguishers

Portable fire extinguishers serve as an important line of defense and life safety devicehelping to protect people and property from fire in all built environments including workplace settings, areas occupied by the general public, vehicles, marine areas, and aviation. In a variety of environments, portable fire extinguishers are required by fire, lifesafety, and occupational safety codes to be installed, maintained, serviced regularly, and kept accessible for immediate use of occupants in the area. Such requirements are found in the National Fire Protection

Association 10. Inspection, Testing and Maintenance of Portable Fire Extinguishers. This standard is incorporated by reference in many model codes and federal regulations.

Although many of the codes require that fire extinguisher training be provided to employees, a large portion of those exposed to areas with fire extinguishers are untrainedindividuals, referred to as "novices.""Civilians cannot safely use fire extinguishers" is a common refrain from some in the fireservices. Others believe that civilians using fire extinguishers are more likely to injure themselves, put others at risk, or escalate the situation. This assumption influences how fire codes are written and ultimately impacts the availability of fire extinguishers in public buildings. The reality is that until recently, there was not any research to support or refute this argument. To test these theories, researchers from the Department of Fire Protection Engineering at Worcester Polytechnic Institute (WPI) and the Fire Protection and Safety Engineering Technology Program at Eastern Kentucky University studied whether or not ordinary people with no previous training (novice users) can safely use portable fire extinguishers effectively. The results of the study clearly demonstrated that most novices handle fire extinguishers correctly and are able to pull the pin and discharge the agent. Equally important. 75 percent of novices were able to safely extinguish a simulated fire with an extinguisher prop on Class All setting. Additionally, the study found that with only minimal training. 98 percent of volunteers were able to safely extinguish a fire.

3. Bluetooth operated

The introduction and widespread use of smoke alarms in homes is considered to be a principal factor contributing to the decline in home fire deaths. As significant an achievement as this has been for the nation, there are persistent facets of fire hazards that have eluded solutions. Although socio-economic factors create obvious limits, low-cost technological approaches have markedly reduced and can continue reducing the impact of fire losses in residential occupancies. Few new sensor types were identified that could benefit fire detection, and their potential use is limited by cost and availability. A powerful mathematical technique was briefly disclosed that uses data from one or more sensors to optimize the discrimination of hazardous and nonhazardous conditions. If this is properly implemented using microcontrollers commonly found in modern smoke alarms, nuisance alarms could be greatly reduced, thus relieving the temptation by the resident to disable the offending alarm.

Microcontrollers allow the use of advanced discrimination techniques to be exploited. and they are particularly applicable for multiple channels of data from multiple sensors. Decisions must be made in real time to classify basic conditions such as "fire," for which the alarm is sounded or "nuisance" or "normal" conditions, for which no alarm is given. For systems that include a carbon monoxide sensor, a toxic gas alarm could be added to indicate the presence of that gas, according to UL-2034 specifications, when a fire is not indicated. Approaches for smoke alarms based upon rules involving set concentration thresholds of multiple sensors are cumbersome for the design engineer and possibly inaccurate when in service.

Fires in the households are often triggered by many common factors investigated which are from cooking equipment, smoking in the house, electrical appliances, candles, curious children, faulty wiring and many more. If the fire occurs when the residents are in the house, the possibility to extinguish the fire is a bit high. It is because the residents themselves can take immediate precaution from the fire to be spread all over by using fire extinguisher or call the fireman instantly. The main concern of this project is when the residents are not at home or are not aware of the existence of the fire in the house. Having said that, the home fire alert is purposely designed to alert the house residents whenever any possibilities for having fire disaster prompted in their house.

4.OBJECTIVES

The main objective of this project has been to design a circuit that detects high temperature and consequently triggers an alarm, switch off the mains of the building. send SMS message and extinguish the fire. These objectives were met since the systems works effectively.

LITEATURE SURVEY

A Novel Framework for Early Fire Detection Using Terrestrial and Aerial 360-Degree Images. In Proceedings of the International Conference on Advanced Concepts for Intelligent Vision Systems Author: PanagiotisBarmpoutis

Year of publishing: 2023

Description

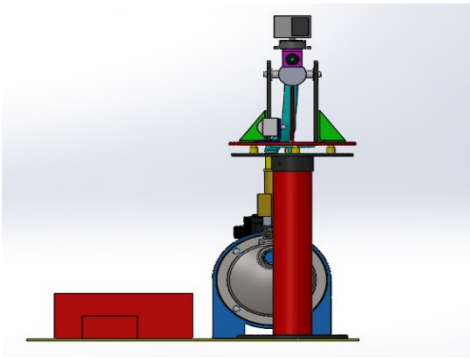
In this paper, in order to contribute to the protection of the value and potential of forest ecosystems and global forest future we propose a novel fire detection framework, which combines recently introduced 360-degree remote sensing technology, multidimensional texture analysis and deep convolutional neural networks. Once 360-degree data are obtained, we convert the

distorted 360-degree equirectangular projection format images to cubemap images. Subsequently, we divide the extracted cubemap images into blocks using two different sizes. This allows us to apply h-LDS multidimensional spatial texture analysis to larger size blocks and then, depending on the probability of fire existence, to smaller size blocks. Thus, we aim to accurately identify the candidate fire regions and simultaneously to reduce the computational time. Finally, the candidate fire regions are fed into a CNN network in order to distinguish between fire-coloured objects and fire. For evaluating the performance of the proposed framework, a dataset, namely "360- FIRE", consisting of 100 images with unlimited field of view that contain synthetic fire. was created. Experimental results demonstrate the potential of the proposed framework. The environmental challenges the world faces nowadays have never been greater or more complex. Global areas that are covered by forests and urban woodlands, which comprise key parts of the global carbon cycle, are threatened by the impacts of climate change and the natural disasters that are intensified and accelerated by it. To this end, to address these impacts on people and nature, it is necessary to efficiently protect the forest ecosystems. by the occurrence of natural disasters maximizing the role of nature in absorbing and avoiding greenhouse gas emissions. Forest fires are one of the most harmful natural disasters affecting life around the world. It is worth mentioning that climate change and drier conditions have led to a marked increase of fire potential across Europe. Thus, computer-based early fire warning systems that incorporate remote sensing technologies have attracted particular attention in the last years. These detection systems consist of visual cameras or multispectral/hyper spectral sensors while the main fire detection challenge lies in the modelling and detection of the chaotic and complex nature of the fire phenomenon and the large variations of flame and smoke appearance in their representations. Detection techniques are based on various color spaces, spectral, spatial and texture characteristics.

However, all the previously computer-based surveillance and monitoring systems for early detection of fire suffer from some limitations. Most of the frameworks taken to date use ground fixed, PTZ or human-controlled cameras with limited field of view. Other approaches require expensive and specialized aerial hardware with complex standard protocols for data collection and complex analysis methods, limiting their potential eventual widespread use by local authorities, forest agencies and experts. Furthermore, the high levels of power, the long operation times and the high computational cost for the analysis that are required for the surveillance of wide areas do not allow the free of operation intervention.

Construction

360 protection system, as we are seeing in the diagram that? A pipe and motor are fixed on the top of the pipe Two circular plates are placed on top of the pipe A DC motor is placed inside the pipe to rotate the plate And four steel balls are placed below the plate to rotate the plate smoothly We have made a nozzle stand on top of the plate, after that it will be ready to extinguish the fire, electricity will be used to run it.



1] Arduino :-Arduino is an open-source electronics platform that uses simple hardware and software to make it easy to use. Arduino boards can read inputs such as light from a sensor or motor activation

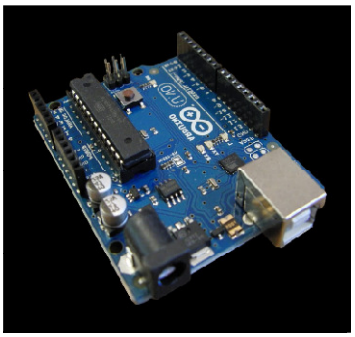


Fig of Arduino

2] 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. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is used to reduce friction. In the ball bearing and roller bearing, to reduce sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance.

Fig of Bearing

The term "bearing" is derived from the verb "to bear"; a bearing being a machine element that allows one part to bear (ie., to support) another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness, and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated bearings for the most demanding applications are very precise components; their manufacture requires some of the highest standards of current technology

3] Piping and Nozzle :-Piping sometimes refers to piping design, the detailed specification of the physical piping layout within a process plant or commercial building. In earlier days, this was sometimes called drafting, technical drawing, engineering drawing, and design, but is today commonly performed by designers that have learned to use automated computer-aided drawing or computer-aided design (CAD) software.

Plumbing is a piping system with which most people are familiar, as it constitutes the form of fluid transportation that is used to provide potable water and fuels to their homes and businesses. Plumbing pipes also remove waste in the form of sewage, and allow venting of sewage gases to the outdoors. Fire sprinkler systems also use piping, and may transport non-potable or potable water, or other fire-suppression fluids.Piping also has many other industrial applications, which are crucial for moving raw and semi-processed fluids for refining into more useful products. Some of the more exotic materials used in pipe construction are Inconel, titanium, chrome-moly and various other steel alloys.

Fig of Piping and Nozzle

A nozzle is a device designed to control the direction or characteristics ofa fluid flow as it exits an enclosed chamber or pipe.. A nozzle is often a pipe or tube of varying cross sectional area, and it can be used to direct or modify the flow of a fluid. Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. In a nozzle, the velocity of fluid increases at the expense of its pressure energy.

4] DC Motor :-Every DC motor has six basic parts axle, rotor (a.k.a.. armature), stator. commutator, field magnet(s), and brushes. In most common DC motors (and all that Beamers will see), the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout with the rotor inside the stator (field) magnets.

A permanent-magnet motor does not have a field winding on the stator frame, instead relying on permanent magnets to provide the magnetic field against which the rotor field interacts to produce torque. Compensating windings in series with the armature may be used on large motors to improve commutation under load. Because this field is fixed, it cannot be adjusted for speed control. Permanent-magnet motors are convenient in miniature motors to eliminate the power consumption of the field winding. Most larger DC motors are of the "dynamo" type, which requires current to flow in field windings to provide the stator magnetic field.

To minimize overall weight and size, miniature permanent-magnet motors may use high energy magnets made with neodymium or other strategic elements. With the higher flux density provided, electric machines with high energy permanent magnets are at leastcompetitive with all optimally designed singly-fed synchronous and induction electric machines.

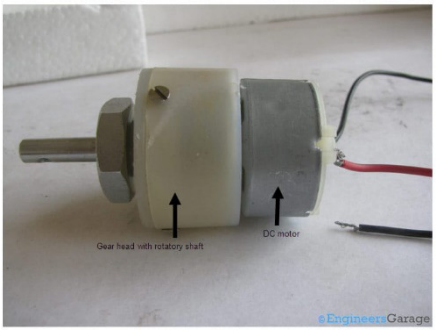


Fig of DC Motor

5]Screws and a Bolts :-Screw and a bolt are similar types of fastener typically made of metal and characterized by a helical ridge, called a male thread (external thread). Screws and bolts are used to fasten materials by the engagement of the screw thread with a similar female thread (internal thread) in a matching part.

Screws are often self-threading (also known as self-tapping) where the thread cuts into the material when the screw is turned, creating an internal thread that helps pull fastened materials together and prevents pull-out. There are many screws for a variety of materials; materials commonly fastened by screws include wood, sheet metal, and plastic. A screw is a combination of simplemachines: it is, in essence, an inclined plane wrapped around a central shaft, but the inclined plane (thread) also comes to a sharp edge around the outside, which acts as a wedge as it pushes into the fastened material, and the shaft and helix also form a wedge at the point. Some screw threads are designed to mate with a complementary thread, called a female thread (internal thread), often in the form of a nut object with an internal thread. Other screw threads are designed to cut a helical groove in a softer material as the screw is inserted. The most common uses of screws are to hold objects together and to position objects.BOLTNUT

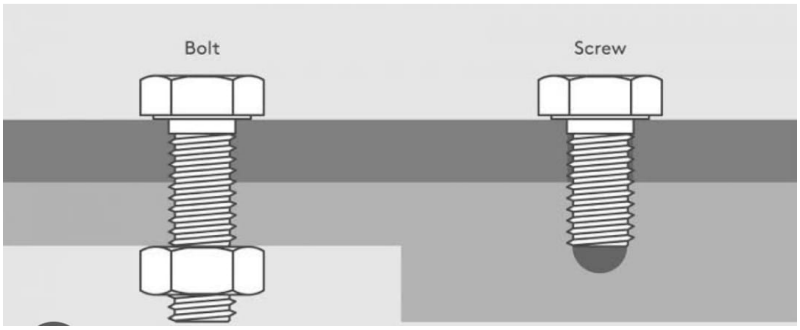


Fig. of Screws and Bolts

A screw will usually have a head on one end that allows it to be turned with a tool. Common tools for driving screws include screwdrivers and wrenches. The head is usually larger than the body of the screw, which keeps the screw from being driven deeper than the length of the screw and to provide a bearing surface. There are exceptions. A carriage bolt has a domed head that is not designed to be driven. A set screw may have

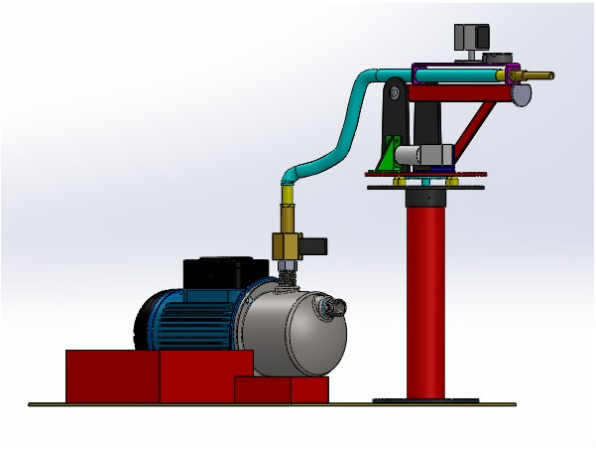
a head the same size or smaller than the outer diameter of the screws thread; a set screw without a head is sometimes called a grub screw. A J-bolt has a J-shaped head that is sunk into concrete to serve as an anchor bolt.

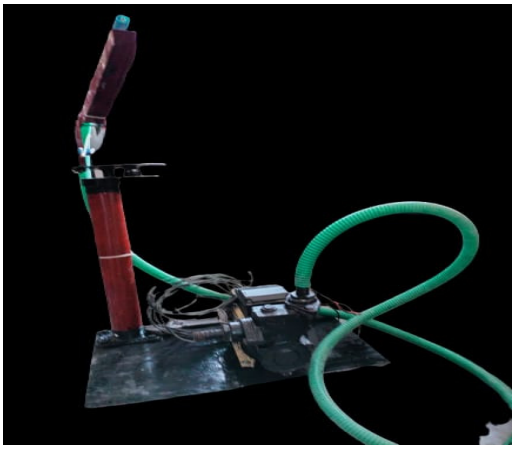
6]Servo Motor :-A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. For this tutorial, we will be discussing only about the DC servo motor working. Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a gear arrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.

Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

Fig of Servo Motor

WORKING PRINCIPLE





Fire monitors and sprayers are an aimable 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 monitors 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. Thereby allowing the user to operate it from a safedistance. The system makes use of a Motor coupled with a powerful sprayer motor with piping system and onboard wireless fire sensing sensor to run this system. Another motor are used to control the nozzle direction movement.

Application:

- Useful for controlling indoor fires.
- Can provide a low cost fire protection system with limited centralized fire protection

Advantages

- Targeted water spraying to avoid water damage in office
- Remote controlled operation ensures operator remains safe
- Adjustable Nozzle for Spray Tuning
- Powerful Long Distance Water Spray

CONCLUSION

Fire has always been a devastating phenomenon but the technology advancements it become easier to tackle it. Firefighters try their best to respond quickly to case of fire and event put their lives at risk of they endeavour to save human life and protect property from the fires. Some attempts have been made to automatic fire fighting for the navy (ship board autonomous fire fighting robot). This paper describes one such solution to the problem of fire fighting with help of 360 degree fire protection system.

In conclusion there are many possible ways to put out fires but it always safer to use the constantly this idea 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.

Future Work

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

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