"Smart Fire Fighting Vehicle."

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Abstract

Consumption of fossil fuels to meet increasing demand of globalization is increased considerably resulting in depletion of fossil fuel reserves. Stringent environmental norms and increase in greenhouse gases emissions has forced researchers to search alternatives to fossil fuels. Biodiesel (Methyl Ester) is one of the alternatives that can be used as fuel in conventional diesel engine without any design modifications. This paper deals with synthesizing good quality of Methyl Ester from Mexicana seeds which is available cheaply in rural areas and grown in marginal lands. Different blends of Undi and waste cooking/fired oil are prepared in order to investigate the properties of blends and if necessary eco-friendly additives are added with blends. Also, it deals with validation of properties of synthesized and waste cooking/fired oil Methyl ester according to ASTM 6751-96 standards.

Keywords: ASTM, Biodiesel, Fire oil, Engine, Vehicle

INTRODUCTION

The paper presented here is based on fire fighting robot. It has term that has since been used refer to a machine that performs works to assist people or work that humans which find difficult or undesirable. They can perform repetitive tasks more quickly, cheaply and accurately than humans. Robotics has gained popularity due to the advancement of many technologies of computing and non-technology making humanoid is easier and comfortable. The fire fighting robot is designed to search for a fire in a small floor plan house of the specific dimension. Mobile remote is attached to the head of the robot to provide safetyS from the fire prone area. The robot also has the capability to avoid obstacles and upon detection of fire, it forwards a message to a predefined number. The robot moves through a model structure and if fire still exists, it can be extinguished with the help of pump and sprays. Casualties and property damage from fire continue to exist in fire disasters and new measures are continuously introduced. Toxic gases and flames continue to threaten disaster victims and rescue workers alike. While a range of fire-fighting robots have been developed and put in action worldwide, they have not yet contributed greatly to the fight. Most robots assist only in small ways, helping fight fires from a distance or monitoring outside fire scenes. An indoor fire-fighting robot can perform rescue operations without risking personnel, including fire extinguishing and helping people at risk.[1]

Fire fighting and rescuing the human beings is a risky job. Fire Fighters have to face many dangerous situations while extinguishing the fire. Fire Fighters extinguish fires in buildings, drag heavy hoses, climb high ladders, and carry victims from one building to another. They must do their job for long and irregular working hours. Fire fighters also face unfriendly environment like high temperature, dust and

low humidity etc. Besides these, they must fight against life threatening situations like explosion and collapse buildings. To detect fire in the disaster-prone area and extinguishes fire on detection.[2]Our task as Engineers was to design and build a
prototype system that could autonomously detect and extinguish a fire. Also aims at minimizing air pollution. It is the Robot that can move through a model structure, find a lit candle and then extinguish it with help of a blowing technique. Our research paper describes the design of a small autonomous Fire Fighting Robot. Wehave worked on the same paper at our college presenting a synopsis showing its basic construction and working. The Fire Fighting Robot is designed to search for a fire ina small floor plan of a house of the specific dimensions, extinguish the fire with the help of the front fan of a toy hovercraft, and then return to the front of the house. The fire detection to be put into use is relatively free of false alarms, it is anticipated that it will not overreact in non-fire simulations. This mission is divided into smaller tasks, and each task is implemented in the most efficient manner such as self-autonomous start of the robot, navigation of the robot in every room step by step, finds the fire in a specific room, approaches the fire at a very fixed distance, extinguishes it and finally returning to the front of the house.[3]

A robot is an automated device which performs functions usually attributed to humans or machines tasked with repetitive or flexible set of actions. Numerous studies have shown that robot can be beneficial in medicine, rehabilitation, rescue operation and industry. Over the years, robotics has been introduced in various industries. The industrial robots are multi-function manipulators designed for more specialized materials, divisions, gadgets or devices through various programmatic movements to perform various tasks. In line with the Fourth Industrial Revolution (4IR), there is demand for a one system that can control, communicate and integrate different robots regardless of their types and specifications. Machine learning has also heated up interest in robotics, although only a portion of recent development in robotics can be associated with machine learning. Recent robotic development paper has embedded machine learning algorithms to increase the intelligence in robots.Productivity in industry while reducing the cost and electronic waste in a long run.With the ever-increasing technology, the developments are increasing in the face
of the situations that cause human life. Every day, the robot industry emerges as a model that is produced as an alternative to human element in a new branch. Flying, robots, wheeled robots legged robots, android robots, underwater robots are just some of them. The growing world population is bringing involuntary problems together. Fires are among the most important of these problems. Robot industry has a lot of work in this area. Some of these are fixed mobile robots with different features, which are equipped with different sensors that detect before the fire is out, mobile rescue robots as fire search and rescue equipment, mobile locating robots used for fire detection, fire extinguishing robots in many different models designed to assist fire-fighters in the fire. [5]

Problem definition& need of paper:
Cultural property management is entrusted with the responsibility of protecting and preserving an institution's buildings, collections, operations and occupants. Constant attention is required to minimize adverse impact due to climate, pollution, theft, vandalism, insects, mold and fire. Because of the speed and totality of the destructive forces of fire, it constitutes one of the more serious threats. Vandalized or environmentally damaged structures can be repaired, and stolen objects recovered. Items destroyed by fire, however, are gone forever. An uncontrolled fire can obliterate an entire room's contents within a few minutes and completely burn out a building in a couple hours. Hence it has become very necessary to control and cease the fire to protect the Life and costlier things. For that purpose, we planned to design and fabricate the fire-fighting robot. Autonomous robot scan act on their own, independent of any controller. Robotics sensor systems to make robots smarter and more perceptive.

1.2. Objective:

The main objective is to suggest for making firefighting robot. The following are important points regarding this objective of study –
Study existing system and its design.

1) To perform the most rigid operation with high speed firefighting application.

2) To make Construction for intelligent fire extinguisher vehicle system.

3) To make a firefighting robot in which Water Flow through Fire sensing technology & it is having Movement of the Robot in all forward & reverse directions.

4) To increase safety associated with firefighting.

5) To be capable of traversing an area without any concerns about inhaling smoke or burning at any point during the exploration.

6) Decrease the time taken to traverse a map with potential fire.

Scope of paper:

The scope of paper is design and fabrication of a firefighting robot.for used firefighting application at the place of inhaling smoke or burning at any point duringthe exploration.

CONSTRUCTION

Components are used for manufacturing the machine are:

Table 1. Material Requirement.

SR. NO.	COMPONENTS
1.	Frame
2	Wheel
3.	Tank
4.	Servo motor
5.	Relay (Switch)
6.	Geared Motor
7.	Circuit Parts
8.	Remote Control Used
9.	DC Gear Pump
10.	12 VDC Battery
11.	Controller and module
12.	Motor Driver

WORKING

As this system is used at the time of remote operated fire fighting work. In normal travelling of vehicle, the motor will control by wireless remote either forward or reverse direction. When any fire will be coming in front of the vehicle then the installed DC pump gets on for fire extinguisher. This control unit operates the relay according to the input signal. The module operated by DC pump unit for protecting & fighting the vehicle from impact fire. The remote unit uses one more motor driver button for driving one DC Motor for arm operation with a boom mounted on its shaft for rotation of sprayer nozzle. At the end of the shaft a nozzle is connected to a water tanks mounted water pump which is powered from contacts of a remote supply. Thus, in the event of a fire the robotic vehicle is moved over to the location by operating the forward & backward button etc. After it reaches the site the nozzle mounted motor takes position through the water on the fire from the water tank mounted DC pump actuated by the remote. Thus, the fire can be extinguished.

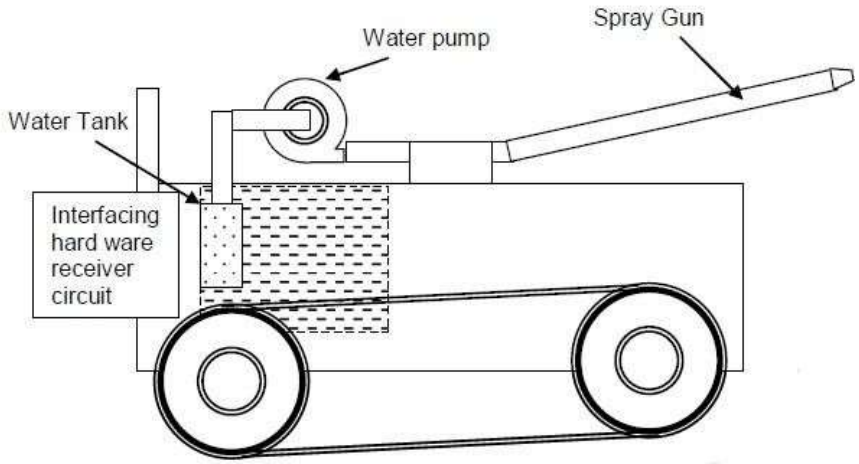

Fig.1. Concept of the Firefighting Robot.

DESIGN

5.1. Approach to mechanical design of system.

In design the of parts we shall adopt the following approach;

Selection of appropriate material.

- Assuming an appropriate dimension as per system design.
- Design check for failure of component under any possible system of forces.

Mechanical design:

In mechanical design the components are listed down and stored on the basis of their procurement in two categories.

- Design parts
- Parts to be purchased.

For designed parts detailed design is done and dimensions there obtained are compared to next dimensions which are already available in market. This simplifies the assembly as well as the post production and maintenance work. The various tolerances on work are specified. The process charts are prepared and passed to manufacturing stage. The parts to be purchased directly are selected from various catalogues and are specified so as to have case of procurement. In mechanical design at the first stage selection of appropriate material for the part to be designed for specific application is done. This selection is based on standard catalogues or data books;

eg:- PSG Design Data Books, SKF Bearing Catalogue etc.

In Mechanical Engineering, Machine Design is subjected to creating new or Advanced machines. This involves improving the existing machines to better machines. The Machine design procedure will require so many factors need to be considered. These factors we can call them as the steps or a procedure. There are several steps involved in designing a machine either it is a new machine or an existing one or it can be the development of the existing machine. Let's see the different steps involved

in the machine design/Machine design Procedure / General Procedure in machine design with the following schematic diagram

1. Identifying the need for the Equipment or a Machine
2. Selecting the possible Mechanisms
3. Analysis of Forces
4. Selection of Materials
5. Design of Elements
6. Modification
7. Detailed Drawings
8. Production
9. Quality Checking

- **Identifying the need for the Equipment or a Machine:**

Recognizing the solution for a problem by giving a complete statement of the problem by identifying the aim and purpose of why the machine is needed to be designed.

- **Selecting the possible Mechanisms:**

Synthesise the different mechanism and choose the best mechanism for the required motions among the different mechanisms.

- **Analysis of Forces:**

Analyse the different system of forces in the motion of the machine members and power transmissions among the different machine elements.

- **Selection of Materials:**

Select the best-suited materials for the different components in the machine and we should keep an eye on the availability of the materials as well.

- **Design of Elements:**

We should design a machine that should accept the operation conditions as well as it should withstand for a longer life. For that, we need to analyses the size and stresses acting in different elements in the machine by considering the forces acting on the machine elements. we should check these stresses with the permissible stress of each material we have used in the making of machine elements.

- **Modification:**

To reduce the overall cost of the productions and due to the availability of the resources, we should make some considerations to accommodate the changes. we should modify the size or any other modification needs to happen. this is the case we need to be ready to do modification in the design.

- **Detailed Drawings:**

We can say this is the final stage for determining what kind of machine we are going to build. Once we have done with the detailing of each and every component and assembly and subassemblies drawings, we should proceed with the manufacturing.

- **Production:**

As per the drawing, the components will be manufactured in the manufacturing units. and assembled as per the detailed drawings. her everything will be produced and sent them to the next step quality checking (QC). If any difference is there then it should come back for the reproduction.

- **Quality Checking & Testing:**

This is the final step to determine whether the production of each machine element is as per the detailed drawings we have provided.

5.2. Motor selection:

T = Torque transmitted by the motor N.m.

F = Load of Scissor mechanism = 1 kg = 9.81 N. (Assume)

R = gear Dia. = 40mm.

T = Fx R

= 9.81 X 40

T = 0.3924 N.m.

P = Power of motor

N = Speed of the motor = 60 rpm. (Assume)

$$P = \frac{2 \Pi N T}{}$$

$$= \frac{2\ \Pi \times 60 \times 0.3924}{60}$$

P = 2.4654 Watt.

Thus selecting a motor of the following specifications

- **DC Geared motor**
- **Power =50 watt**
- **Speed= 60 rpm**

Motor Torque

$$\mathbf{P = \frac{2\ \Pi\ N\ T}{60}}$$

$$T = \frac{60 \times 50}{2\ \Pi \times 60}$$

T = 7.96N-m

Power is transmitted from the motor shaft to the input shaft by means of an gear drive,

5.3. Screw design:

Lead screw design X-Y Slide.

For screw material C40 yield stress σy= 330 N/mm^2

Ultimate shear stresses = 0.5 σy=165 N/mm^2

Tensional shear stress T = Π/16 x τ xd^3

$$\Rightarrow \tau = \frac{16xT}{\Pi x d^3}$$

$$7.96 \times 10^3 = \frac{16 \times 165}{\Pi \times d^3}$$

dc =6.2626mm **select dc=7 mm.**

Nominal dia. d= 10mm.

Core dia. dc=7mm.

Pitch p = 3mm.

Operating load W= 150 N.

Coeff. Of friction μ = 0.11 (For steel lubricated screw)

Coeff. Of friction μc = 0.125 (Forcoller)

$$\lambda = \tan^{-1} \frac{L}{\Pi \times dc} = \frac{Nt \times p}{\Pi \times dc} \qquad (N_t = 1)$$

$$\lambda = \tan^{-1} \frac{1 \times 3}{\Pi \times 7}$$

$\lambda = 7.7682^0$ **(For single start)**

$\mu_1 = \frac{\mu}{\cos\beta}$

$= \frac{0.11}{\cos 14.5}$

$\mu_1 = 0.1136$

$\Phi_1 = \tan^{-1}\mu_1$

$= \tan^{-1}0.1136$

$\Phi_1 = 6.4820^0$

Efficiency for screw

$\eta_s = \frac{\tan\lambda}{\tan(\Phi 1 + \lambda)}$

$= \frac{\tan 7.7682}{\tan(6.4820 + 7.7682)}$

$\eta_s = 0.5371$

$\eta_s = 53.71\%$

5.4. Pump Design:

Item dimensions = 16.5 X 10.2 X 6.4 centimeters

ADVANTAGES & APPLICATIONS

Advantages:

1) This type of robot is easily available, and the cost is also at a perishable level.
2) It can be controlled easily by any unskilled person. The operation of the robot is at advanced level and can move with speed.
3) Human life is unthreatened and can help to protect lives of human beings by not letting them into contact of fire.
4) Easy to manufacture &low-cost system.

Applications:

1) In fire fighting application.
2) In plant nurseries for watering and safe gardening the plants.
3) If we attach a bomb detector sensor to it, then this robot can also be used in bombs detection work.

CONCLUSION:

Like big fire fighting vehicles, this small size fire fighting robot system will work. Unlike big vehicles this robot can be controlled from long distance if its not possible to a person to go directly In fire.

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