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Fire detection and extinguisher robot

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ABSTRACT

Fire detection and Extinguisher Robot is a Hardware based model used to extinguish the fire during fire accidents. It works in two modes autonomous mode and manual mode. In manual mode, the robot can be operated by use of remote control and live streaming camera. In autonomous mode, Robot has been developed which features to move in the direction with respect to the fire intensity. The flame sensing capability of the robot is varied by the flame sensor, above which the robot starts responding to the fire. The temperature sensor provides a backup to the flame sensor if needed in vast circumstances. The most added advantage of this Robot is that it turns ON automatically as it detects the fire around its surroundings, using flame sensor and tries to extinguish by moving in the direction with respect to the fire. The Robot shield is coated with aluminium boards that are capable of withstanding very high temperatures. The Robot finds its applications in Rescue operations during fire accidents, where the possibility for servicemen to enter the fire-prone areas is very less and also during wars to perform rescue functions.

Keywords— Fire Accidents, Robotics, Smart Sensors, Extinguisher Robot, Safety

1. INTRODUCTION

Robotics is one of the fastest growing engineering fields of today. Robots are designed to reduce the humane efforts and also to remove the human factor from labor-intensive or from dangerous work and to also act in an inaccessible environment. The use of robots is more common today. Exclusively used by the heavy production industries. From the past few years, we can see there are almost 62 deaths per day due to fire accidents, according to the National Crime Record Bureau. This is why the fire extinguisher robot that can detect and extinguish a fire on its own is more in need, with the invention of such a device human life and property can be saved at a much higher rate

with relatively minimal damage caused by the fire. Our task as engineers was to design and build a prototype system that could autonomously detect and extinguish the fire and also manually extinguish a fire using a remote control with the live streaming camera. Also aims at minimizing air pollution by extinguishing the fire in less time. We have to design a wireless controlled robot so that robot is used instead of humans, which can be controlled from a distance or which can perform actions intelligently by itself, which will reduce the risk of this task of fire fighting. The robot should be capable of performing the following functions in order to perform more efficiently during fire extinguishing operation:

1. Automatic detection of the location of the fire.
2. Obstacle avoidance.
3. Stair climbing capability.
4. Manual monitoring of the robot using a camera.
5. Extinguishing of Fire.

2. LITERATURE SURVEY

The paper [1] presents the case of an adult white man found dead in a psychiatric institution with fine white powder (monoammonium phosphate) deposited over the entire face after he in-sufflated the contents of a dry chemical fire extinguisher. The fine white powder was present within the mouth and sinuses and lined the upper airways. On opening the thoracic cavity, approximately 500 g of fine white powder was present within the right thoracic cavity. The esophagus was ruptured. Traumatic emphysema of the posterior sternum wall was present (pneumomediastinum). The ethmoid bones were fractured by the barotrauma. On the polarization of the lung tissue, birefringent material was noted deposited along the bronchovascular sheaths and in a subpleural distribution. Death was probably due to a combination of barotrauma and asphyxia. The case study provides strong evidence in support of the etiology and pathophysiology of the Macklin effect. It also provides for the first visual evidence of the phenomenon.

According to the invention [2], The upcoming techniques related to sprinklers design was briefly discussed. The design of sprinkler is highly essential for proper fire extinguishing. Accurate positioning techniques are important parameters and design challenge.

The paper [3] discuss about automatic fire extinguisher providing a simplified operation method for easily pulling out a safety pin while a handle is strongly grasped and allowing a spray hose to automatically aim a flame, and, furthermore, which is easily recognizable even from a distance when the safety pin is separated at normal times. The automatic fire extinguisher includes a main body vessel in which a fire extinguishing agent is filled, a lower handle coupled to a plug disposed on an upper portion of the main body vessel, and an upper handle coupled to the lower handle through a first hinge shaft. Also, lots of research contributions are available in the fire extinguishing techniques. The theoretical and methodological contribution were analysed and smart sensor based fire extinguisher methodology is proposed.

3. STRUCTURE DESIGN

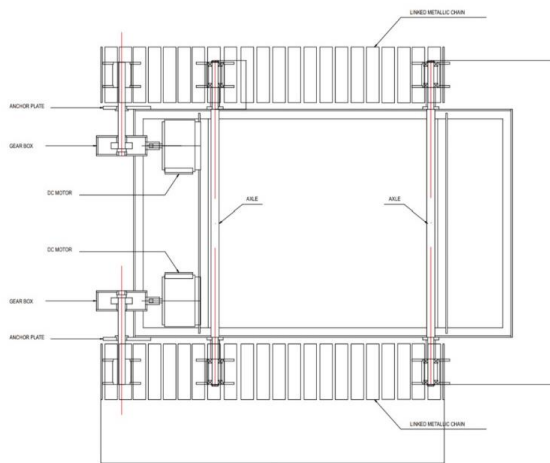


Fig. 1: Plan View

The entire design is made up of a mild steel material as it is cost effective. The design consists of a basic frame it is supporting structure, along with its conveyor belt is used for the movement. The axle is used, to support the conveyor belt. Gearbox is connected to the dc motor in order to increase the torque of the robot.

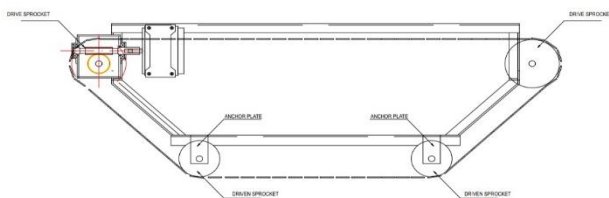


Fig. 2: Gearbox and motor assembled

Fig.1.1 shows the gearbox and the motor assembled on the basic structure. The drive sprocket is used to drive the conveyor belt. This drive sprocket is fixed to the frame using the anchor plate. Figure 3 is the rear view of the robot.

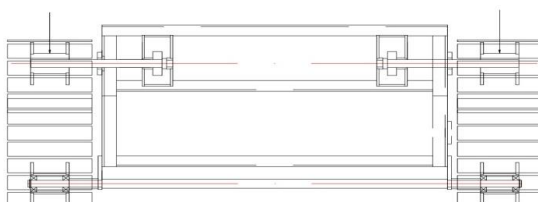


Fig. 3: Rear view

4. BLOCK DIAGRAM

4.1 Fire detection module

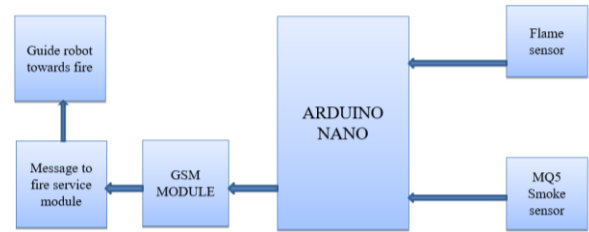


Fig. 4: Block diagram

The fire detection module is used to identify the presence of the fire in the room. It uses the smoke sensor which is MQ5 sensor to detect the gas which is released by the fire during the fire accidents. The flame sensor is used to detect the fire. If the flame is detected the message is sent to the robot. Later the relevant operation is done.

4.2 Remote control module

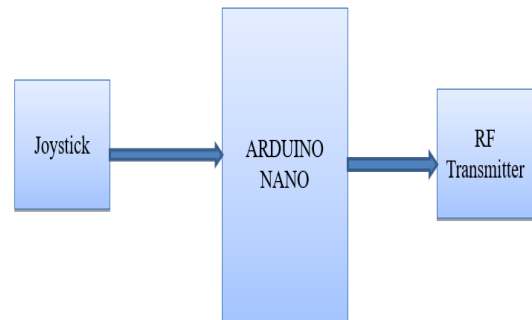


Fig. 5: Remote control module

Figure 5 shows the remote control module, it consists of Arduino nano, joystick to control the motions of the robot and RF module is used for wireless communication.

4.3. Robot controlling circuit

an RF module which can be used by the servicemen at a distance of 200 meters away from robot to inspect and guide the robot to locate the fire source in disaster-prone areas and hence gains the improved control in handling the situation in fire extinguishing.

5. CONCLUSIONS

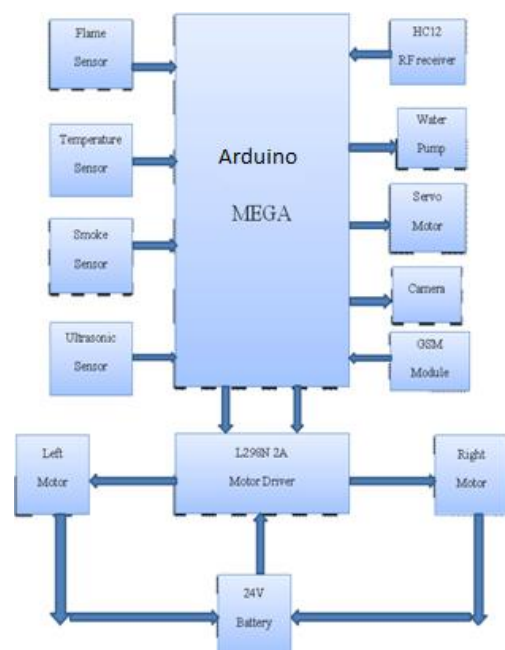


Fig. 6: System

Figure 6 consists of an Arduino Mega, it is the main controller in the robot controlling circuit. All the hardware sensors like a flame, temperature, ultrasonic sensors are integrated and used to detect the fire and to avoid the obstacles during the movement of the robot in the autonomous mode.

6. METHODOLOGY

The robot will be designed to work in two modes, autonomous and manual mode.

In autonomous mode, the robot movement is controlled through the use of flame sensor deployed in all four directions with the separation of 90 degrees from each other. On these sensor readings the robot will spot the location of fire and hence starts to move towards the fire source, with the help of ultrasonic sensor mounted on the front of robot to avoid any obstacle found on the path in movement towards fire and also through the aid of temperature sensor it will maintain a significant distance from fire source and hence perform the action of fire extinguisher through the use of water pump automatically.

During the manual mode of operation, the robot can be wirelessly controlled at a distance, to remotely monitor areas where the possibility of human beings to enter is very less. This is achieved through the use of Cameras with night vision capacity mounted on the robot. The visuals from the camera can be transmitted from the robot through the use of the Robot can be operated in two modes Autonomous and Manual. In

Autonomous mode, the robot will detect the fire using a flame sensor and this sensor data is used by the controller to guide the robot and extinguishes the fire using water pumping action. In manual mode, the robot is controlled wirelessly using an RF module. The user gets the surveillance by the camera mounted on the robot and he can guide accordingly to the place where the fire is present. The robot is capable of climbing stairs with water tank.

7. REFERENCES

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