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Fire Fighting Robot

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Abstract: Expanding human populace and innovative improvement has prompt increment in flame mishaps and dangers. Unavoidable conditions and physical constraints of person make fire extinguishing a testing and demanding assignment. Fire extinguishing is an exceptionally unsafe undertaking and it might likewise include death toll. Robotics is the rising answer to ensure the safety of the surroundings and human lives. Fire extinguishing robot is an equipment model which can be utilized for extinguishing the fire amid flame mischances. It can decrease the blunders and constraints confronted by the people during the extinguishing process. Our outlined robot can seek the zone, find the fire and extinguish it before it turns out to be out of control. It can explore the building while effectively checking for fire. It can be operated remotely by any individual from anyplace on the planet using mobile phone or a laptop. The robot which we have proposed in this paper has discovered its application in flame dousing operations amid flame mishaps where the likelihood of the servicemen to enter the fire inclined region is less.

Keywords: Fire Fighting Robot, sensors, pump, robotics, fire extinguishing, Raspberry Pi, camera**.**

I. INTRODUCTION

Now-a-days, Robotics is used in each and every field of science and had gained much importance in day to day life. Recently, more and more research takes interest in the robot which can help people in our daily life, such as service robot, office robot, security robot, and so on. We believe that robot will play an important role in our daily life in the future, especially security robot, The main use of robots has so far been in the automation of mass production industries, where the same definable tasks must be performed repeatedly in exactly the same fashion. Also, domestic robots are now available that perform simple tasks such as vacuum cleaning and grass cutting.

The FIRE FIGHTING robot made under this project can move in both forward and reverse direction and can turned in left and right directions. Thus we can operate a robot over a very long distance and there is no need for human to go even near the area on fire. We have used the light dependent resistors for detection of fire. It is the highly sensitive device and is capable for detecting very small fires too. The robot accommodates a water tank and sprinkler on itself to extinguish fire. The main aim of the project will be to design a RF controlled, Fire Fighting

Robot toolkit which can replace the traditional Fire This project uses BCM2836/2837 as its controller. This Robot is also used as a fire extinguisher i.e. it sprinkles the water on to the fire in case of fire accidents. At the same time even if any fire accident occurs the damage can be avoided by sprinkling water. If the fire is detected then the motor gets switched on which in turn switches on the water sprinkler (pump).

The RF modules used here are Transmitter, Receiver, RF Encoder and RF Decoder. The switches are interfaced to the RF transmitter through RF Encoder. The encoder continuously reads the status of the switches, passes the data to the RF transmitter and the transmitter transmits the data. This project uses 12V battery. This project is much useful for mines detection and surveillance applications.

II. LITERATURE SURVEY

Ligang Chen [1]. Ligang Chen proposed a model using stm32f103zet6 MCU as the main control chip, which is suitable for low power consumption and powerful. This model is equipped with the portable fire extinguisher. The robot head is equipped with a camera which help is capturing image and collection of data. NRF24L01 wireless transmission module is used in the robot.

A. Hassanein et.al.,[2], proposed a model uses a PIC micro controller and Arduino Mega micro controller with an additional Bluetooth module. A digital compass GY-26 was used to guide the robot with the degree of rotation from their original position. The Bluetooth module used is Kootek BT2s which is interfaced with MATLAB. The major issue with this model is that there was no accurate movement of the robot.

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M.A. Hossain et.al., [3] proposed a model which includes a camera for collecting the data and sensors. These sensors and camera collects the data and sends the information to the NodeMCU which inturn sends the information to the server. The situation is analysed according to the program and sends the information to the controller.

M. Kanwar and L. Agilandeeswari, [4] proposed a model where the robot sends a fire alert to the cloud. This sends the location of the fire so that with the help of application the person will receive a exit route out of the building. Additionally the sensors gives the level of carbon dioxide so that the authorized person can select water or co2 for extinguishing the fire manually.

L. Mingsong and L. Tugan, [5]. This model is equipped with a 360 degree rotatable camera for video streaming, and IR sensors for detecting the obstacles during movement. This model can be controlled either manual or automatic.
Ambadkar,et.al.,[6], In this proposed model Arduino is the main controlling unit of robot .it is connected with fire sensing unit fire sensing unit consist of temperature sensor and gas sensor .the robot consists of wireless camera which is controlled by user which transfer the front view of robot to the receiving unit .receiving unit consists of XBEE Arduino computer and camera receiving unit .by operating GUI and looking at front view of camera operator can take the decision and operates robot as per the decision in addition to this ,robot also consists of motor driving unit which is controlled by Arduino ,sprinkler pump which sprinkle water to extinguish fire and relay and relay driver circuit.

Prasojo et.al [7], In this proposed model they designed fire extinguisher robot using AT89S52as a controller .relay was utilized to extinguish the fire .to detect the presence of ffire sensor was used .DC motor is used to drive the robot it detects the surrounding obstacle and possessed an ultrasound based navigation system .if the ultrasound system detect obstacle the robot detect fire as far as 5 meters and extinguish the fire successfully.

AlHaza, et.al.,[8], In this proposed model firefighting robot is capable and entering the most dangerous fire . robot fight with fire internally and rescuing people. this robot is capable to climb stairs and also it can withstand with high temperature up to 700degree C for about 60 minutes using multiple thermal isolation technique this robot is equipped to supply gas mask and oxygen breathing bottle for trapped person. it consists of two built in fire extinguishing cylinder flame detection sensor and three mounted IR camera unit.

Dhumatkar et.al [9], In this proposed model thermostat is used to sense the temperature of a system the thermostat does this by switching heating or cooling device on or off or regulating the flow of heat transfer fluid is needed to maintain the exact temperature. DC motor which adjust the voltage by choosing the DC current into on and off cycle which has low voltage. A pump is a device that moves fluids by mechanical action. The wireless remote used for the navigation from remote places IC7442 is used to drive the robot forward the wireless camera is used for making live demonstration of fixed place where human is not available.

Anantha Raj P et.al [10] proposed a model where a node consists of array of sensors and Arduino microcontroller. Many nodes are placed in different locations of the indoor environment where the fire accident possibility is more. Sensor nodes and firefighting mobile robot is connected with central coordinator node through wireless medium.

Central coordinator is a Raspberry Pi processor which controls entire IORT system. If a node detects fire, it will notify central coordinator. Central coordinator sends information to fire safety officers and initiates mobile robot to perform firefighting action.

Fan et al.,[11]. In this model, a method combining Gmapping SLAM algorithm and fire source identification image processing algorithm is proposed, which realizes the functions of firefighting robot autonomous navigation and fire source identification detection. SLAM construction uses RBPF algorithm and effective particle number. The identification and location of the fire source point utilizes a series of image processing techniques.

J. Suresh [12], proposed a model where The Fire-Fighting robot is capable of detecting flames and extinguishing them successfully. The motor controller and Arduino code work together to control the movement of the robot with obstacle avoidance. It can detect the flame more effectively in the buildings and fixed lighting conditions. The robot is designed for the indoor application.

S. Mittal et.al, [13], proposed a model where a robot that could be operated as an extinguisher and be controlled remotely, via wireless communication channel. The robot has ample steering control, maneuverability and weight with large torque to navigate through non-ideal terrain and carry a payload large enough to allow for fire-fighting ability. It has capability to detect the exact direction of the fire source reliably and efficiently.

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S. Ramasubramanian, S. A et.al.,[14], proposed a model where machine learning and deep learning were used to train models for detecting fire from images. Deep learning gave a much accurate result compared to machine learning for a similar amount of data. The relative sizes of the fires were compared to identify the largest fire which must be extinguished first using an appropriate amount of the respective fire extinguishing substance.

Z. Ye et.al., [15] proposed that based on current scenario it can't be independent for extinguishing robot, according to function of intelligent fire fighting robot of power supply, sensor modules & software algorithms and gesture sensors.
S.Gao et.al., [16], proposed that the project was designed manufacturing and tested for experimental firefighting robot in a simulated environment. Improvement in fire resistance, strength and resistance to fatigue. Control algorithms as well as machine learning and neural networks can be integrated to improve work efficiency and stability.

J. J. Jijesh et.al., [17], proposed that the research is mainly focus on design and implementation of automated fire fighting robot. The robot has capacity of versatility to send alert message automatically. The robot has ability to put out fire and clear obstacles using grippers. Robot further using IP camera to carry bi-directional communication.
H.Zhang et.al., [18], proposed that the unmanned firefighting and rescue system can assure personal safety and loss of property to great extent. It can take on auxiliary work in
firefighting work, according to analysis of security of fires, the difficulty of artificial fire rescue and imperfection of fire preventing measures. The paper proposed organic and effective collaboration model based on multi-agent system.

X. P. B. N. et.al., [19], proposed that small controller based adjustable fire place extinguishing has introduced. Result shows that small controller may be having reliable instrument to regulate the hearth device. The development of fireplace fighting is not supported by govt agency. Effort has compelled to create and encourage the use of fireplace fighting automation. The fireplace fighting automation is used in hazardous spaces, compound plants and high-pressure vessels.

III. METHODOLOGY

First process is capturing images by the pi camera. When an image is captured, the raspberry pi looks for the color constituents we have provided in the OpenCv coding (Red, Yellow and orange).The color is detected by calculating its color range in HSV color space .The lower and upper boundary values of the colors are given and when the detected color matches the range in between the thresholds Raspberry pi gives command to the motor driver to run the motors towards the fire for a short time, then the pump and relay starts to eject water from the water storage tank. As long as the fire is detected the water spraying mechanism will work and once the fire is completely quenched the camera will not pick up any given colors so the robot starts rotating 360 degrees to detect fire. Once the camera picks up fire the robot again starts the water spraying mechanism.

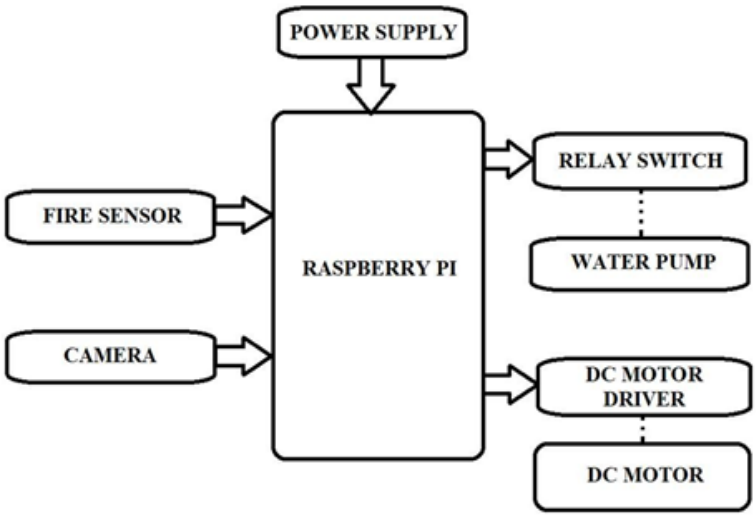

Figure – Block diagram of Fire Fighting Robot

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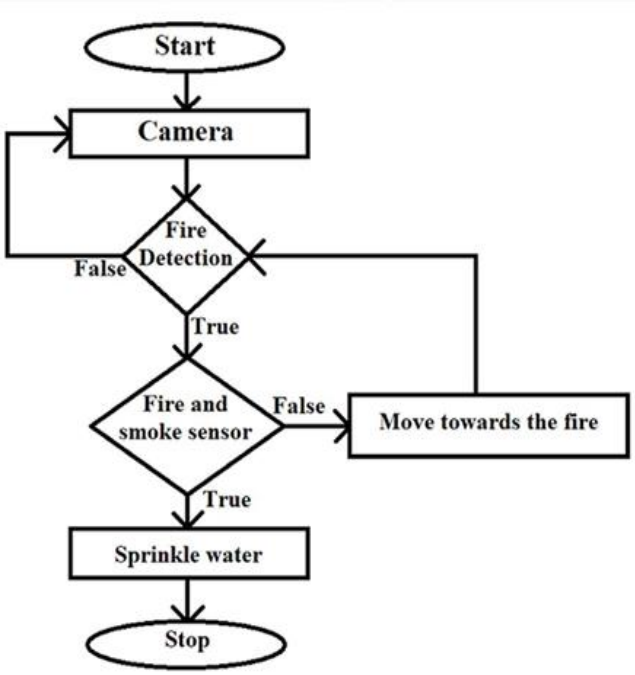

Figure – Flow chart of Fire Fighting Robot

IV. RESULT

Figure – Fire Fighting Robot

Figure – Fire fighting robot extinguishing fire

V. CONCLUSION

The conclusion is to provide security of home, laboratory, office, factory and building which is important to human life. We develop an intelligent multisensory based security system that contains a firefighting system in our daily life. We design the fire detection system, and program the fire detection and fighting procedure using sensor and Machine Learning based method.

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VI. FUTURE SCOPE

In the present condition it can extinguish fire only in the way and not in all the rooms. It can be extended to a real fire extinguisher by replacing the water carrier by carbon-di-oxide carrier and by making it to extinguish fire of all the room using microcontroller programming. Also the robot could not be run through the batteries because at some condition the current requirements for the circuit rises to about 8A which is very high and cannot be obtained using batteries.

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