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A Survey on Firefighting Robot

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***Abstract*:** *Fire event is a calamity that can cause the deficiency of human existence, property loss, and enduring in adequacy to the injured or casualties. Fire men are principally entrusted to deal with the fire occurrence, yetregularly they are presented to the higher dangers when quenching fire particularly in dangerous conditions, for example, in atomic force plants, oil treatment facilities, and gas tanks. Additionally, they are confronted with different troubles especially when the fire happens in a tight and limitedregion, as itis important to investigate the vestiges of structures and obstructions to smother the fire and spare the person in question. Our basic aim on Fire fighting Robot surveyis to comparedifferentparameters in system with respect to Sensors, Water Indicators, Monitoring of system. This survey can help to extinguish a fire using manually and automated mode which can be very helpful and convenient.*

***Key Word*:** *Fire fighting Robot, Robotics, Arduino UNO, Flame Sensor, Servo Motor, Fire-extinguishing, Android app.*

I.INTRODUCTION

According to the National Crime Records Bureau (NCRB), it is found that approximately 1 lakh deaths have been caused because of fire accidents in India since the last 10 years. Although there are innumerable precautions taken for such calamities, these hazards take place much frequently. Whenever a fire tragedy happens, to save people and to extinguish the fire we are forced to use human resources which are not necessarily safe. With the advancement of technology especially in Robotics it is very much possible to implement robots with humans for fighting the fire. It will improve the efficiency of fire-fighters and would also prevent them from risking human lives. So, there are systems that are built for extinguishing fire and other peripheral activities and objectives needed to achieve.

II.SURVEY OBJECTIVES

The main objective of our survey is to look into the existing systems that have been developed to Extinguish fire on the site of fire-accidents that use robotics. This is to study how exactly use this technology to achieve the objective of extinguishing fire and being advantageous to the people to use it on real time situations. Also, to make sure and research upon the limitations and how this system can be made reliable.

III.LITERATURE REVIEWS

Anam Sheikh, Gopal Purohit, Vaishnavi C. Raut, Rehan Rashid Abdul, Prof. C. H. Kidile (2022) had presented a Fire Fighting Robot that was totally automatic system baseand could extinguish the fire without any human intervention[1]. The robot carries four main functions[1]. Firstly, it initializes the sensors as the power is supplied[1]. Then the robot starts sensing the surrounding to check the level of temperature and identify the fireplace[1]. After that, robot sends the information about the sensed fire by the sensor and system navigate itself towards the fireplace[1].

Prince, Ahmed Tamim Zabir, Kabir, Kazi Shahadat, Nabil, Md. Abdullah (2021) had presented the simulated system design of the fully automated robot that could extinguish fire using the software Proteus 8.9 Professional and Arduino IDE[4]. It is designed in a way that it could sense any kind of fire/smoke with the help of sensors and extinguish it by spraying water continuously until the fire/smoke goes off[4]. It used Arduino UNO,s 3 Flame sensor, Gas Sensor, Buzzer, DC Motor, Servo Motor, L293D, DC Pump and Logic State Switch[4]. Firstly, the coding of the Arduino Uno was done in Arduino IDE[4]. Then, in the Proteus software the connections were made by selecting the components according to the need[4]. The 5V supply voltage was given in each flame and gas sensors and 12V to the L293D[4]. Then the Virtual Terminal is used to monitor the expected output and connect its TX pin to the RX pin of microcontroller and RX pin to the TX pin of the microcontroller[4]. After connecting all the connection, hex file of the code is provided in the Arduino Uno as input and simulation is executed.

Authors N. Tejaswi, Dr. A. Ranganayakulu, G. Lakshmi Kumari, E. Alekhya, K. Tejasri A. Pradeep Sai (2020) had presented a fire extinguishing robot that uses an Android application for controlling the system[3]. This system is controlled manually[3]. In some cases, due to wrong readings of the sensors, the robot can fail to perform its task of extinguishing the fire[3]. In this paper, the RF based firefighting robot is designed to be operated wirelessly and more efficiently[3]. The entire working of the system is based upon ARM processor [3]. It is controlled manually using a mobile application and extinguishes the fire[3]. An oscillator provides an A.C. motion over its yield terminals without requiring any contribution[3]. The power supply is provided to the system[3]. The fire sensor senses the fire and the sprays the water on it[3]. The system uses Bluetooth module for the vehicle to operate using the app[3]. The app can be used to control the vehicle moment and also the manual operations[3].

J Jalani1, D Misman1, A S Sadun1 and L C Hong1 have also done a similar project[5]. In their model, the flame sensors can solely activate to notice fireplace once the robot is on.[5] The in-operation voltage for the flame sensing element is 5V[5]. Voltage provide for these sensors is from Arduino that is provided by victimization of 7.4V Li-ion reversible battery[5]. The voltage can decrease once the sensors notice fireplace[5]. The voltage will decrease from 4.8V to 0.1V, if the voltage continues to decrease till reached 0.1V, the sensing element can recognize the input as "fire" and send digital knowledge to Arduino[5]. The Arduino can confirm that sensors are causing the info and send commands to the motor driver for activated the DC motor, therefore the DC motor triggered consistent with that sensing element detective work fireplace initial[5]. The robot can move toward the fireplace till it reaches and puts off the fire[5]. Once the robot reached the destination, it will start to pump the water from the storage tank[5].

Aftab Nagarji, Aniket Vani, Pratik Kumathe, Prof. N. S. Nadaf, International Research Journal of Modernization in Engineering Technology and Science ,ISSN: 2582-5208, Volume:04, Issue:07, July-2022[6]. This robots main operation is to find fire and move towards it to extinguish it from a secure distance[6]. This robot's movement and behavior are going to be totally controlled by Arduino microcontroller[6]. This vehicle-shaped automaton can find and extinguish fires by moving right, left, front, and rear[6]. The project goals are to develop a Fighter automated robot that may be accustomed to extinguish fire automatically, and works with Bluetooth[6]. Implementation of this automaton is with high temperature to assess the affectability of distinguishing that subsequently cancels the flame by utilizing water instrument[6].

Diwanji, M., Hisvankar, S., & Khandelwal, C. have also made a similar model[7]. Three flame sensors namely left flame sensor, right flame sensor and centre flame sensor are interfaced with the Arduino Uno board as the input components [7]. L293D motor driver module is used for driving the two geared DC motors namely the Left DC Motor and the Right DC Motor[7]. These motors are used to give direction to the robot according to the fire i.e. the input received from the flame sensors[7]. The 12V DC Pump driven by an external battery through a 5V Relay Module is used to extinguish fire[7]. A servo motor (SG90) is used to give axial direction to spray the water on fire[7].

IV.METHODOLOGY

There are many technologies that have been used to develop the Fire Extinguishing Robot. The main aim of the system is to Extinguish the fire that has been caught on the site. Also, these systems are made with an objective to respond quickly to the incident. Fig. 1. shows basic working.

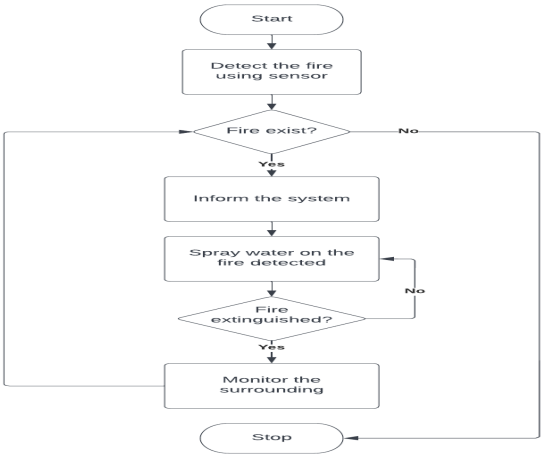

Fig. 1. Flow Chart of the system

The System will initialize the sensors of the robot that will be used to determine the flames on the site of accident. When the flames will be detected by the system, it will notify the system about it. Then the system will detect the direction at which fire is been detected from. The vehicle will be commanded to move to that direction and then the water will be sprayed on the flames. Then the system will monitor the surrounding. It will determine if the fire exists at any other place on the site. If there are flames at other places then the vehicle will move towards that direction. And again, it will perform the same procedure. It will perform this function until the fire on the site is completely extinguished. The studied systems were based on two types one is automatic mode and the other system was based on manual mode.

The system that was developed by authors Anam Sheikh, Gopal Purohit, Vaishnavi. C. Raut, Rehan Rashid Abdul, Prof. C. H. Kidile, was based on automatic mode was implemented using Arduino UNO. It takes the sensor input for detecting the fire or smoke with the help of IR sensors and then computes it. This computation operation is performed using Arduino UNO gives commands to the system to move to that fire place. The movement of vehicles is done using BO motor. The water is sprinkled on the fire flames using Mini submersible water pump and the fire was extinguished. The operation of sensing flames, moving vehicle to that directing and then extinguishing the fire using water is performed by the machine itself without any human help.

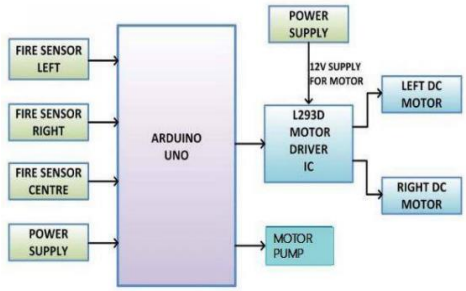

Fig. no. 2. System based on automatic control implemented using Arduino UNO

The system that was controlled manually for the performance of the operation to achieve the objectives. This system was implemented using ARM microcontroller. This microcontroller is usually used in perform IoT devices for the better operationality as it is known as "Centre of IoT Revolution". It acts as a main brain in the system for computation and communication between user commands and system. It also uses LCD display for printing which operation is exactly being performed according to the commands given.

Bluetooth technology is used for the wireless control operation of the mobile application and the device. The application is designed using Android for its user-friendly feature. The user will be controlling the system to control it manually using the app. The user will give commands through the app and it will be executed by the system smoothly. All the commands that are useful for the system to achieve its objectives will be specified in the application which has to be just selected by the user.

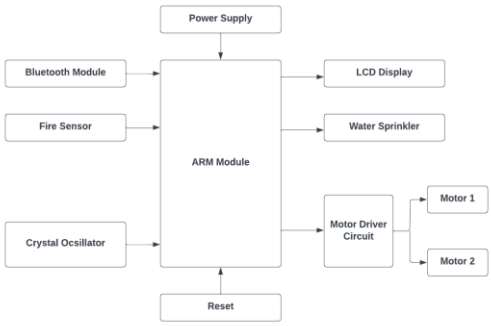

Fig. no. 3. Block Diagram of the Manual system implemented using ARM microcontroller

V.CONCLUSION

Fire extinguishing is a critical task and can also harm person who is trying to extinguish it. With the help of robotics, the system can be implemented that can extinguish fire. So that the human beings don't need to be physically be present to extinguish the fire on site. Or there are also the systems that could extinguish the fire on its own by detecting it and by spraying water.

The system that we had studied are either automated or manually operated. One of the manually operated system was basically developed because the system built on automated has some limitations like sensors getting failed or not reading the proper data or can also face issues in functionality. The systems also can be developed by using both the technologies in a single system. So that system can be operated in either automated mode or manually by using mobile application. The working of the system can also be improved if a camera is used to monitor surrounding of the system. The other enhancements like battery indication and water level indication can also be implemented.

The system that can be developed by considering the loopholes of the existing systems and would overcome them to give a reliable system to some extent. The system based on fully automated fire-fighting robot developed by authors Anam Sheikh, Gopal Purohit, Vaishnavi. C. Raut, Rehan Rashid Abdul, Prof. C. H. Kidile had used BO motors for vehicle movement, that are slower in speed but we can also use 12V DC motor for better results. Also, the water pump can be used of 12V instead of the 9V that they have used. In other system that was based on the fully manual controlled system using the software application developed by authors N. Tejaswi, Dr. A. Ranganayakulu, G. Lakshmi Kumari, E. Alekhya, K. Tejasri A. Pradeep Sai, used Bluetooth module with ARM processor. As ARM is not expandible we can use Arduino Uno so that it becomes easy to expand it in future if needed additionally, it's cost-effective and easily programmable. Also there are many techniques that can be used like mixing water that would extinguish the fire with some formula that would extinguish the fire quickly. These are the ways that we found out would help in developing an enhanced, effective and reliable system than the existing ones.

This survey of the existing system helped us in getting idea about how the fire extinguishing system is implemented. It made us think about what limitations these system must be having and what enhancements can be made to overcome these limitations, to get better results. The Fire Extinguishing robots will achieve its objectives by using technology in a better way and also make the procedure easy in low cost.

References

[1]. *Anam Sheikh, Gopal Purohit, Vaishnavi.C.Raut, Rehan Rashid Abdul, Prof. C. H. Kidile, 2022, "Arduino Based Firefighting Robot", Volume 10, ISSN: 2321-9653, Issue V May 2022- www.ijraset.com*

[2]. *S. Kavitha, Krishnarajendrasagar, Mohamed Tousif, Nishanth C.R., Likith V., "Fire Fighting Robot", 2021, "Fire Fighting Robot", Volume 6, ISSN No:-2456-2165, Issue 5, May – 2021, International Journal of Innovative Science and Research Technology*

[3]. *N. Tejaswi, Dr. A. Ranganayakulu, G. Lakshmi Kumari, E. Alekhya, K. Tejasri, A. Pradeep, FIRE FIGHTING ROBOT USING ANDROID APPLICATION, ISSN: 0950-0707*

[4]. *Prince, Ahmed Tamim Zabir, Kabir, Kazi Shahadat, Nabil, Md. Abdullah, Ratul, S.M. ZobaeirAkando, Rafat, SadmanSakib, Raisa, Tabassum Tasin, Tahrim H M, Jahan Nushrat, Raza Kala, "Fire Fighting Robot", ISSN: 0950-0707, Volume IX, Issue III, MARCH 2020*

[5]. *J Jalani, D Misman, A S Sadun1 and L C Hong, "Automatic fire fighting robot with notification", IOP Conference Series: Materials Science and Engineering, Volume 637, The 3rd International Conference on Robotics and Mechantronics (ICRoM 2019) 9–11 August 2020*

[6]. *Aftab Nagarji, Aniket Vani, Pratik Kumathe, Prof. N.S.Nadaf, 2022, "FIRE FIGHTING ROBOTIC VEHICLE USING ARDUINO", ISSN: 2582-5208, Volume:04, Issue:07, July-2022*

[7]. *Diwanji, M., Hisvankar, S., & Khandelwal, C. (2019). Autonomous Fire Detecting and Extinguishing Robot. 2019 2nd International Conference on Intelligent Communication and Computational Techniques (ICCT).*

[8]. *Sumitra Motade, Aditi Suresh Bidwai, Komal Jaysing Kale, Ankita Mahadev Mahajan, "FIRE FIGHTING ROBOT USING ANDROID APPLICATION", ISSN (Online) 2456-0774, Volume 4, Issue 11, ICCEME 2019-2020*

[9]. *Brinda Ramesh Bhanderi, Lajaree Manohar Khachane, Megha Manoj Menon, Prof. Bharat Patil, "Autonomous Fire Fighting Robot", ISSN NO : 0363-8057, VOLUME 8, ISSUE 5, 2022*

[10]. *Ankita Wakade, Kirti Khopkar, Vrushalee Yadav, Prof. U. D. Dattasamaje, "ANDROID CONTROLLED FIRE FIGHTING ROBOT", ISSN 2348 –1269, VOLUME 6, ISSUE 2, APRIL– JUNE 2019*