

A Brief Summary on Auto Firefighter

Manash Dey, Shivam Kumar, Somnath Roy, Prateek Pawar, Amit Kumar

Abstract: This paper is focused on the development and implementation of design for an unmanned robot that can detect a fire, move to the location of fire by itself, and use water spray to extinguish the fire. Some research on the development of such prototypes which can detect and extinguish the fire has already been done. Hence, the main focus of this paper will be to develop an optimum design which could be practically implemented to bring about to real use by Human Firefighters. The robots are machines which can perform particular tasks repeatedly, efficiently and tirelessly. The human race has been using robots for easing their tasks for a long time. Still, there are some tasks like emotional thinking and rescue operations which are not being performed yet. But soon, they will be seen doing these human tasks also. The robot which we will be trying to develop will have a water reservoir with it. It will be equipped with Microcontrollers, Communication Devices and Sensors to allow it to perform tasks smartly.

Keywords: Robot, Fire, Microcontrollers, Sensors, Water Reservoir

I. INTRODUCTION

Since, when the early man first discovered fire it's been used by humans for many purposes. In ancient times, it was used to cook food, keep away wild animals, source of light at night but in the modern world, the purpose of using fire has been changed a little bit. But the fire that was useful at that time, is still of significant importance today. Fire can cause havoc when it goes out of control. It can engulf anything which comes in its path. Thanks to the angels called Firefighters. Their job is very dangerous. Hundreds of firefighters are injured badly on duty. It is called the line of duty death, also abbreviated as LODD. It means demise in the fire administration or the police administration while on the job at a crisis or drill. By and large, there are more than 100 LODDs in the United States every year. At the point when a local group of fire-fighters loses a part in a LODD, it generally flies its banner at half-staff, and individuals spread their identifications with a grieving band. The New York City Fire Department has a custom of declaring passings with four arrangement of five ringers (the four fives, 5-5-5-5).[1] Studies on the utilization of humanoid robots are effectively done to limit firemen's wounds and passings just as expanding profitability, wellbeing, productivity and nature of the undertaking given. Robots can be partitioned into a few gatherings,

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for example, Tele-robots, Telepresence robots, Mobile robots, Autonomous robots and Androids robots. Telepresence robots are like a telerobot with the principle distinction of giving input from video, sound and other information. [2]

II. LITERATURE REVIEW

Sharavanan S, Nithiya Devi, Venkat Raja R, T.Venugopal has succeeded to develop an autonomously working robot that is sufficient enough to detect and extinguish fire. Their paper is named 'Fire Fighting Robot'. It used thermal sensors for detection, Arduino UNO R3 for processing with a range of 10m. It used a temperature sensor and a manual Bluetooth method and an ultrasonic sensor to move near to the flame

Tushar Nandkishor Satbhai, Rahul M. Karande, Anant Vijay Patil, Prof. Manish Patil in their research on 'Fire Fighting Robot' has developed a robotic vehicle equipped with a water spraying jet that finds and fights fire using RF communication. The prime components used in their model are a Microcontroller and a buzzer interfaced along with it, wireless transceiver modules, water jet spray and DC motors.

Makhare Sonal, Mane Bharat, Sapkal Saraswati, Prof. U. Bansude in their paper named 'Fire Fighting Robot' have used the technology of web servers to implement the idea. The robot is carrying sensors such as Temperature to detect high temperatures, Smoke/gas sensor to detect the smoke, IR sensor to detect the hindrances in the path.

Abdülkadir ÇAKIR, Nyan Farooq Ezzulddin in their paper titled 'Fire-Extinguishing Robot Design by Using Arduino' has invested amounts of energy to plan a robot ready to movement by utilizing the (rotor engine), past the obstructions by(sensor MZ80), discover the fire by (fire sensor), and douse the fire by(fan), and it advances related to the quest for the fire to control it and send message to the versatile or tablet by utilizing (Bluetooth HC-05) when it found the fire and the entirety of this is constrained by the microcontroller (Arduino UNO).

III. METHODOLOGY AND WORKING PRINCIPLE

The MUROC's rule has to be followed while designing the robot to ensure its effectiveness in serving the purpose. This rule puts a constraint over the size of the robot upto a volume of 40cm x 15cm x 15cm and weighing not more than 5 Kg. The robot is required to suck table tennis balls which serve here as humans to be rescued and five emergency candles of height ranging from 2in to 6in. It should also be able to move in the maze with ease.

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A. Mechanical Aspects

The structure of the model was designed using Solidworks 2017. To make it move effortlessly it has a skeletal design similar to that of a 4 wheeled car, two at rear side and two wheels at the front side for the symmetry.

A rotation of up to 360 degrees and a stabilising effect is produced by the wheels. Since the acrylic sheet can resist heat of up to 200° C, the electronic circuit and other parts prone to damage by high temperature and water are enclosed within a covered casing made up of acrylic sheet. To enable mounting of different sensing devices and other parts, the acrylic body is provided with holes.

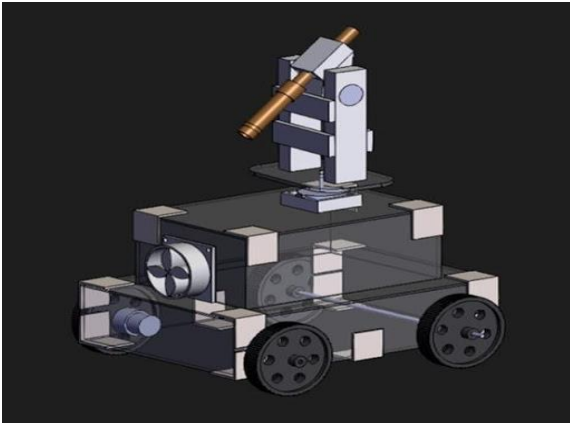


Fig. 1. Isometric View

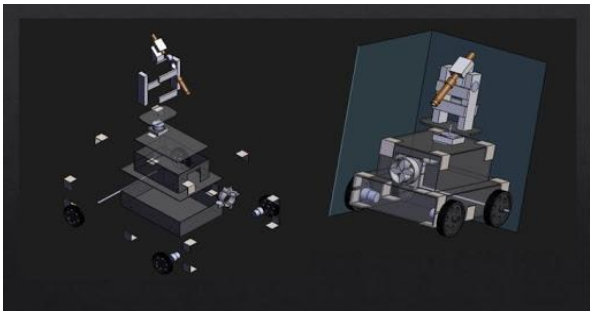


Fig. 2. Expanded View

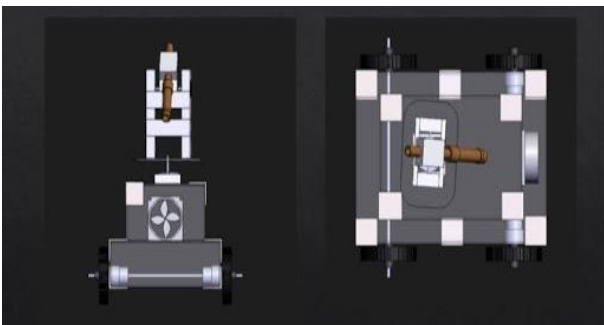


Fig. 3. Front & Top View

B. Electronic Aspects

IR sensor will be used for obstacle detection and Temperature Sensor will be used to detect the fires.

- IR sensor: IR stands for Infrared. Infrared Sensor is a device that can sense radiation that falls under the infrared zone of the spectrum. The infrared waves are not visible to the human eye. Their temperature as well as wavelength is higher than that of visible light. It can be Active or Passive. The active IR sensor can emit and detect on the other hand the Passive one doesn't emit, it can only detect. The Passive Infrared

detector(PID) measures the infrared radiation from objects in the produced field by IR indicator. It recognizes changes in the measure of IR radiation, which relies outwardly on attributes and temperature of the items before the locator.[4][9]

- Flame sensor: The flame of the fire is actually radiation of wavelength 760nm to 1100nm. A sensing device called 'Flame Sensor' is used to detect these radiations. This will give the information about the location of the fire. In this way, it can be used as an eye for the robot. It detects at an angle of 60° and the proximity range for detection is 20cm to 100cm with voltages of 4.8V to 1V respectively. It has two pins called DO(Digital Output) and AO(Analog Output). The flame or no flame data is given by the DO pins while the accurate wavelength is processed by the AO pins.[2]
- Smoke Sensor: When the fire is accompanied by the smoke instead of fame, a Smoke sensor will detect it.[4]

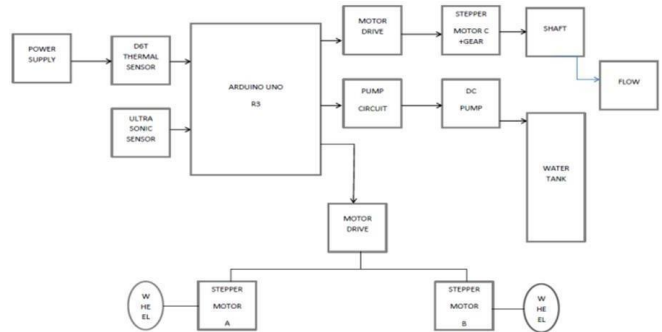


Fig. 4. Block Diagram

C. Programming Aspects

All the information from the robot is sent to the Android telephone by means of Bluetooth module interfaced to the controller and is then sent to the web server from Android Telephone. With the goal that one can control the robot development left/directly from the web server.

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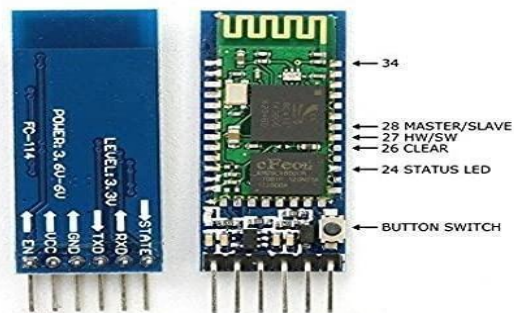


Fig. 5. Bluetooth Module

IV. RESULT AND DISCUSSION

The project has resulted in successfully working prototype of a Robotic Vehicle having sensors and communication devices. It can detect and navigate to the location of fire and curb it.

Although, this prototype works by water sprinkling technique but other methods can also be thought of to extinguish the flame.

As the technology develops it will become more efficient in detection and navigate work. This is just a prototype and there seems nowhere comparable to real human firefighters but we must keep in mind that the material and components used in making the prototype are small, less efficient and just enough to serve the purpose. By using appropriate components and material, it can be thought to work for actual purposes.

V. CONCLUSION

This design strategy can be a great answer in using the auto firefighter robot to help the masses in critical situations. The proposed robot can move in different directions i.e forward, backward, left, right. It helps in reducing human workload. This Robot detects the fire and blows it with the help of an exhaust pipe using the pump. To extinguish the fire, the robot has to reach the location and it moves towards the target. This way robots can find problems and help prevent them.

FUTURE SCOPE

The future to pass on complex and dangerous tasks to robots over humans is simply a lifeline. For such development in automation, fire fighting will surely be benefitted. Keeping in mind the number of humans who have given up their lives or lost their body functioning in firefighting, the system is certainly a boon to the industry. The project on the surface level seems promising and the design layouts provided suggest that the project content can be used in future developments. In reality, a practical 'Auto Fire Fighter' system must include robotic concepts of the advanced industry. Further, this vehicle can be efficiently derived for use while it's flying.

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AUTHORS PROFILE



Manash Dey B.Tech (Mechanical Engineering) and M.Tech (Thermal System) is presently serving as Assistant Professor in the Department of Mechanical Engineering JEMTEC, Greater Noida, having a teaching Experience of over 8 years. He has published 36 Papers in International Reputed Journals. Presented 3papers in International Reputed Conference also has about 12 Papers published in National Reputed Journals. He has also guided about

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Prateek Pawar is a Final year student of BTech. Mechanical Engineering. He is an avid learner and has a keen interest in trending technologies. He aspires to create a better world by making education and technologies accessible in the remotest locations possible. He has contributed to publishing a review paper on 'Tri-Tilter Mechanism', published in the International Journal of Research in Engineering and

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Somnath Roy is pursuing Mechanical Engineering from JIMS Engineering Management Technical Campus. He has a keen interest in Gaming and recent development in Android Games. He likes discussing the trends in Security Solutions and aspires to become a Military Officer. He likes playing football in basketball and cricket. He has previously worked to co-publish a review paper on 'Tri-Tilter Mechanism' in the International Journal of Research

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