

Hybrid Power Based Fire Fighting Robot

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ABSTRACT

Robotics is one of the fastest growing engineering fields of today. Robots are designed to remove the human factor from labor intensive or dangerous work and also to act in inaccessible environment. The use of robots is more common today than ever before and it is no longer exclusively used by the heavy production industries. The need Fire extinguisher Robot that can detect and extinguish a fire on its own is long past due. With the invention of such a device, people 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 a fire. Also aims at minimizing air pollution. In this Project we design a wireless mobile controlled Robot. It is the Robot that can move through a model structure, find a burning and then extinguish it with help of a Water spray. The need Fire extinguisher Robot that can detect and extinguish a fire on its own is long past due. With the invention of such a device, people 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 a fire. In this Project we design a Solar powered features for uninterrupted power supply. wireless mobile controlled Robot. It is the Robot that can move through a model structure, find a burning and then extinguish it with help of a Water spray.

Keyword: - Arduino uno Controller, LCD display, BT Module, Automatic Fire detection, Buzzer etc.

1. INTRODUCTION

Robotics is one of the fastest growing engineering fields of today. Robots are designed to remove the human factor from labor intensive or dangerous work and also to act in inaccessible environment. The use of robots is more common today than ever before and it is no longer exclusively used by the heavy production industries. The need Fire extinguisher Robot that can detect and extinguish a fire on its own is long past due. With the invention of such a device, people 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 a fire. Also aims at minimizing air pollution. In this Project we design a wireless controlled Robot. It is the Robot that can move through a model structure, find a burning and then extinguish it with help of a Water Jet. The project is designed to develop a firefighting robot using BT (Bluetooth) technology for remote operation. The robotic vehicle is loaded with water tanker and a pump which is controlled over wireless communication to throw water. An Arduino uno controller is used for the desired operation. At the transmitting end using push buttons, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right etc. At the receiving end three motors are interfaced to the microcontroller where two of them are used for the movement of the vehicle and the remaining one to position the arm of the robot. The BT transmitter acts as a BT remote control that has the advantage of adequate range (up to 30 meters) with proper antenna, while the receiver decodes before feeding it to another microcontroller to drive DC motors via motor driver IC for necessary work. A water tank along with water pump is mounted on the robot body and its operation is carried out from the microcontroller output through appropriate signal from the transmitting end. The whole operation is controlled by an Arduino uno

controller. A motor driver IC is interfaced to the microcontroller through which the controller drives the motors. 2 Further the project can be enhanced by interfacing it with a wireless camera so that the person controlling it can view operation of the robot remotely on a screen.

1.1 Need of the Project

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 robots can act on their own, independent of any controller. The basic idea is to program the robot to respond a certain way to outside stimuli. The very simple bump-and-go robot is a good illustration of how this works. This sort of robot has a bumper sensor to detect obstacles. When you turn the robot on, it zips along in a straight line. When it finally hits an obstacle, the impact pushes in its bumper sensor. The robot's programming tells it to back up, turn to the right and move forward again, in response to every bump. In this way, the robot changes direction any time it encounters an obstacle. Advanced robots use more elaborate versions of this same idea. Roboticists create new programs and sensor systems to make robots smarter and more perceptive. Today, robots can effectively navigate a variety of environments.

1.2 Statement of the Project

- ◆ The project is designed to develop a firefighting robot using RF module for remote operation.
- ◆ The robotic vehicle is loaded with water tanker and a pump which is controlled over wireless communication to throw water.
- ◆ At the transmitting end using RF module, commands are sent to the receiver to control the movement.
- ◆ When the robot faces a fire then it extinguishes fire with the help of pump motor connected to a water tank mounted on its body.
- ◆ Remote operation is achieved by Radio Frequency technology.
- ◆ The RF transmitter acts as a remote control that has the advantage of adequate range.

2. METHODOLOGY

The project uses HT12E Encoder which converts 4-bit data to serial output which is then fed to the RF module for transmitting the same to be received by the receiver RF module the output of which is fed to HT12D the serial decoder IC, the output of which is fed to controller. The transmitting end MC is connected to a set of pushbuttons. Thus, while a particular button is pressed the program executed delivers corresponding 4-bit data which are then transmitted serially at port 1. 4 The data so received at the receiver end of port 1 operates the motor through motor driver IC L293D as required being interfaced from the Microcontroller output port 2. The transmitter is powered by a 6v battery in series with a silicon diode to finally develop required voltage for microcontroller circuit. The receiver is powered by a 12v battery in series with a silicon diode to protect the circuits from accidental reverse battery connection. 5V DC out of the 12V available from regulator IC 7805 is fed to the controller, decoder, the motor driver IC L293D pin 8 for operation of the motor. The receiving unit uses one more motor driver IC L293D for driving one DC Motor for arm operation with a boom mounted on its shaft. At the end of the shaft a nozzle is connected to a water tanks mounted water pump which is powered from "NO" contacts of a relay that is driven by transistor Q1 from the output of MC pin 15, thus in the event of a fire the robotic vehicle is moved over to the location by operating the left, right, 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 relay RL1. Thus, the fire can be extinguished.

3. PROJECT DESCRIPTION

3.1 Block Diagram

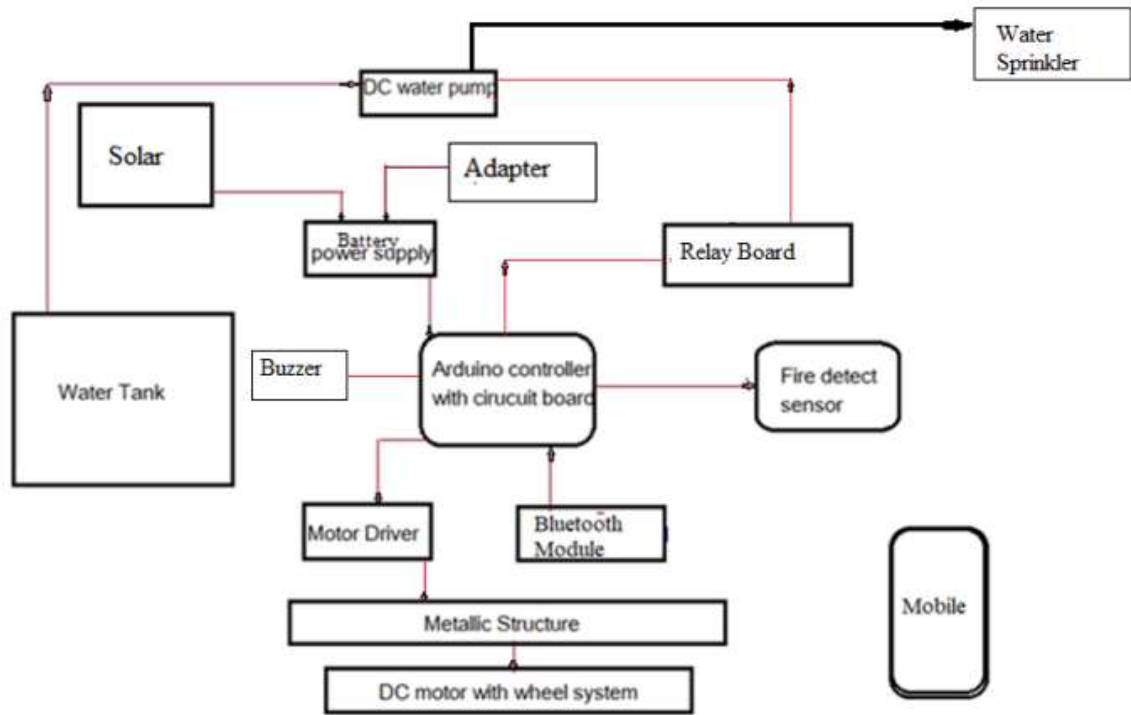


Fig. -1: Proposed block diagram of system

3.2 System Architecture

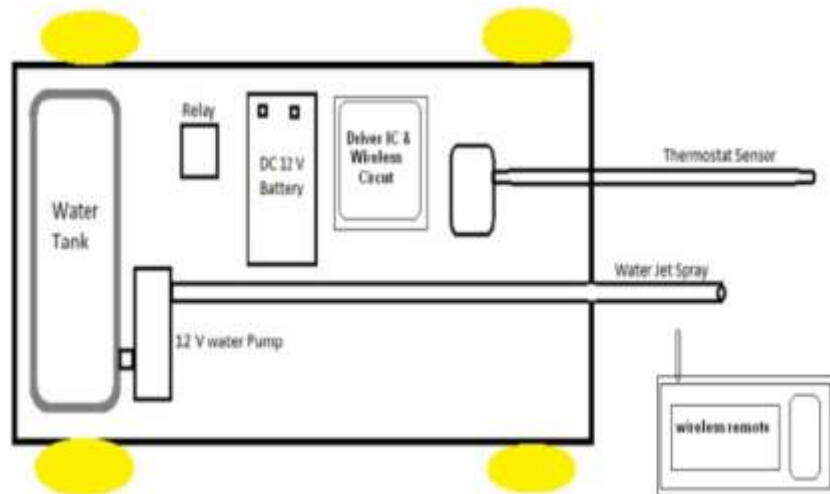


Fig. -2: System Architecture

3.3 Circuit Diagram

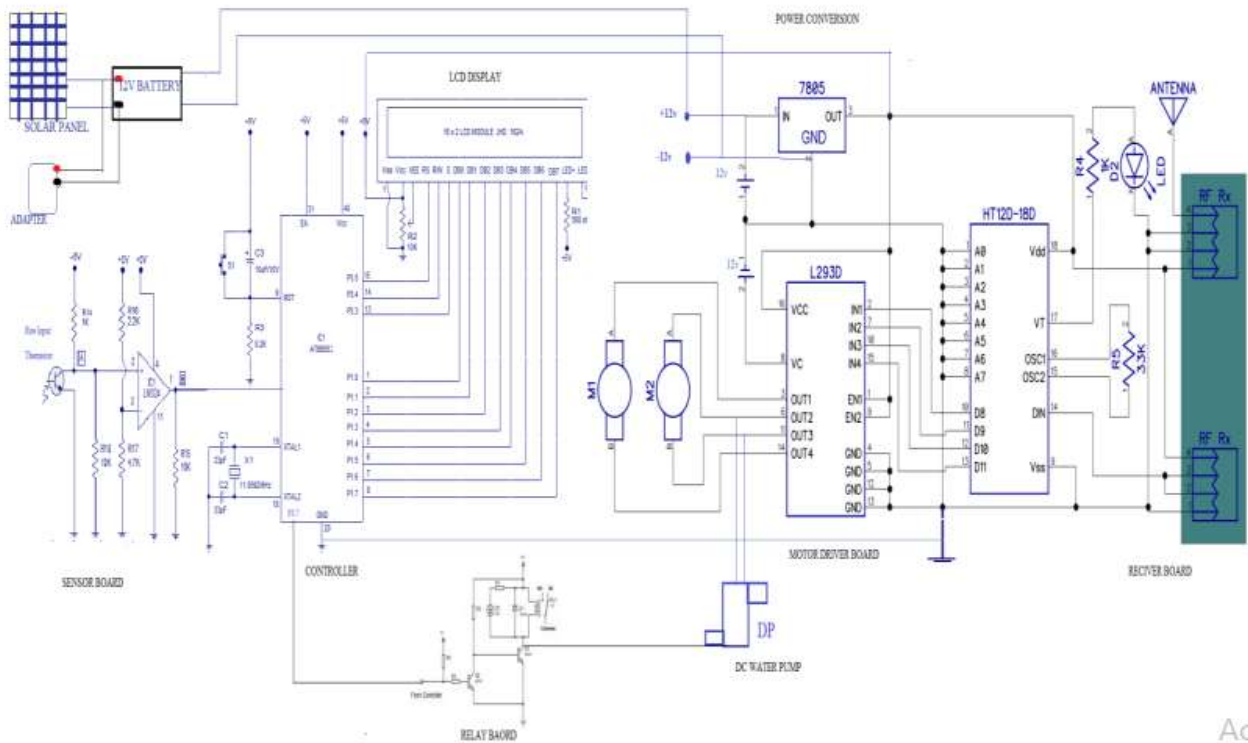


Fig. -3: Circuit Diagram

3. COMPONENTS

There are number of components are used for the working of the robot. These systems make the motion and functioning of system possible. Different component performs different operation like actuation, transmission, control, motion etc. To perform this function following component are used which is explain in subsection.

- Adapter □
- Battery □
- Bluetooth module
- Arduino Uno
- Relay Board
- Solar Panel
- Motor Driver
- DC Motor
- Dc water pump
- Wheels
- Frame
- LCD display
- Wireless camera
- Others

4. CONCLUSION

Thus, we will be developing a robot which will be used for solar powered fire fighting purpose. This proposes a great chance for automation and will be useful at places where human cannot reach or is dangerous. This Project presents a firefighting robot using RF communication and it is designed and implemented with Atmel 89S52 or 8051 microcontrollers (MCU) in embedded system domain. Experimental work has been carried out carefully. The result shows that higher efficiency is indeed achieved using the embedded system. The proposed method is verified to be highly beneficial for the security purpose and industrial purpose. At present the robot is capable of throwing water with high flow rate only. At future the robot will also capable of throwing water with controlled robotic arms and the object detection using cameras on it. It can be used as further extension of the project to achieve all the features.



Fig. -2: Hybrid Power Based Fire Fighting Robot

5. REFERENCES

- [1] Swati Deshmukh, Karishma Matte and Rashmi Pandhare, "Wireless Fire Fighting Robot", International journal for research in emerging science and technology, vol.-2, pp.373 - 375, March2015.
- [2] Muhamad Bukhari Al-Mukmin Bin Mohamad Zahar, Report of "Design and Development of Automatic Fire-Fighting Robot", Mechanical Engineering (Structure and Material), pp. 1 - 8, year 2011.
- [3] Joe Davis, Ray Klundt and Paul Limpisathian., Report of "Fire Fighting Robot", The University of Akron, The Department of Electrical and Computer Engineering, pp. 1-95, January 25 2010.
- [4] William Dubel, Hector Gongora, Kevin Bechtold, Daisy Diaz, Report on "An Autonomous Firefighting Robot", Department of Electrical and Computer Engineering, Florida International University, Miami, FL 33199.
- [5] Dr. Wael Abdulmajeed, Dr. Ali Mahdi and Karzan Taqi, "Human Wireless Controlling Fire Fighting Robot (FFR) With 3-Axis Hose", International Journal of Advanced Computer Technology (IJACT), Vol. 2, No. 3, pp. 1-8.
- [6] Adeel ur Rehman, Dan-Sorin Neculescu, Jurek Sasiadek, "Robotic Based Fire Detection in Smart Manufacturing Facilities", IFAC-Papers Online 48-3, pp. 1640 - 1645, year 2015.
- [7] Omesh Kumar M, Aditi Sharma and Rashmi Gupta, "Implementing 3600 Rotation of Robot on Its Axis", International Journal of Computer Applications (0975 - 8887), Vol. 45, No. 17, pp. 20 - 24, May 2012.
- [8] Sahil Shah, Vaibhav Shah, Prithvish Mamtora and Mohit Hapani, "Fire Fighting Robot", International Journal of Emerging Trends & Technology in Computer Science, Vol. 2, 2013, pp. 232-234, July - August 2013.
- [9] Gerald Weed, Michael Schumacher, Shawn McVay and Jack Landes, Report of "Pokey the Fire Fighting Robot", pp. 1-66, May 11, 1999.

- [10] Saravanan P., Soni Ishawarya, “Android controlled intergrated semi-autonomous firefighting robot”, International journal of innovative science Engg. and Technology 2015. 48
- [11] S. Jakthi Priyanka, R. Sangeetha, “Android controlled firefighting robot”, Ineternational journal of innovative science Engg. and Technology, Volumn 3, 2017.
- [12] Nagesh MS, Deepika T V, Stafford Michahial, Dr M Shivakumar, “Fire Extinguishing Robot”, International Journal of Advanced Research in Computer and Communication Engineering, Vol. 5, Issue 12, December 2016
- [13] Sushrut Khajuria, Rakesh Johar, Varenym Sharma, Abhideep Bhatti, “Arduino Based Fire Fighter Robot”, International Journal of Scientific Engineering and Research (IJSER), Volume 5 Issue 5, May 2017
- [14] Khaled Sailan, Prof. Dr. Ing. Klaus- Dieter Kuhnert “Obstacle avoidance stratergy using fuzzy logic steering control of amphibious autonomous vehicle”, International journal of innovative science Engg. and Technology, Volumn 2, 2015
- [15] J Jalani¹, D Misman¹, A S Sadun¹ and L C Hong¹, “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 2019, Sabah, Malaysia .

