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IoT Based Fire Extinguisher Rover

MOHAMMED ASLAM R, VEERABADRAIAH K S, VARUN A V, MANASA K M, SIDDESH & MUTTURAJ.

Students Department of Electronics and Communication Engineering.
D R R Govt polytechnic college, Davangere, Karnataka

MISS SOUMY R
Lecture Dept of Electronics and
Communication Engineering
D R R Govt polytechnic college, Davangere, Karnataka
Davangere, Karnataka

Abstract: The objective of the paper is to study, analyze and design a fire detection and extinguisher system. This topic was acceptable because it covered a basic and important aspect in our modern life. The author has gained the valuable experience in the field of fire detection and alarm system from studying and conducting the project. The objectives of the project were to provide information on fire alarm system and the extinguishing techniques used in India and around the globe, to show the differences and similarity between the systems and the lack in existing systems used for fire detection. Secondly, in the practical part, the objective was to build a demo system to demonstrate how a basic fire alarm system works and the improvements can be added to it to make better systems to detect and extinguish fire in order to reduce the casualties and loss of capital. To achieve the purpose of this thesis, the author studied the main standards on fire detection and alarm systems in India and around the world. For the practical part, NodeMCU-ESP32 and Blynk Application are used as the control unit with other necessary components.

Keywords

Node MCU-ESP32,

Blynk Application,

Fire Detection,

Fire Alarm System

INTRODUCTION

In our current life, hearthplace safety has grown to be a pinnacle concern, because there are continually hearthplace risks round us which could purpose a high-quality lack of assets and human life. Therefore, having a hearthplace alarm device performs a critical role, which help save you and deal with in time when hearthplace occurs.

Fire detection and alarm structures (FDAS) are all established and brought with the equal essential goal in mind: to find out a hearthplace; powerful alarm and offer statistics to the inhabitants; warn and deliver statistics to first responders. How those goals are glad is depend upon the unique situations – and also, the same old of the location of thesector under consideration. warn and give information to first responders. A hearthplace alarm device is one of the primary.

structures this is required to be mounted in every family and constructing in lots of countries. Having the device mounted enables alert human beings of a probable hearthplace, deliver them early warnings; robotically name the emergency offerings and contacts, decrease the time it takes for the hearthplace branch to come; lower the dangers of fake hearthplace alarm

II. RELATED WORK

Development in surveillance robots has been ongoing for the past few years. New and improved technologies are implemented in the systems for better performance and to ensure the safety of lives and properties from getting hampered. Shantanu K. Dixit, Mr. S. B. Dhayagonde proposed a robot that could be controlled by the internet and can detect living human bodies using a PIR sensor. This robot was built for rescue operations and users can

also access the video transmitted by the robot camera from anywhere .I. worked on a system namely Arduino Uno-based surveillance robot, that could be controlled by PC via the internet. The proposed robot contained a video camera, GSM, and GPS modules. The proposed robot could capture images and stream video footage through the camera
1-6654-9365-9/22/$31.00 ©2022 IEEE 1 that could monitor the fire affected area or debris area and identify human bodies by using the camera. This robot can also detect harmful gas and smoke and notify the user . The difference between our work and the above mention work is that this robot has unique features compared to other existing robots. It can be used for multitasking purposes like industrial, residential, and forest fire extinguishers, poisonous and harmful gas leakage detection and monitoring collapsed buildings and debris areas via camera surveillance. The robot is IoT-based and the user can control the robot from anywhere manually. The robot is also very costefficient and easy to control compared to the previously mentioned researches.

III. PROPOSED METHODOLOGY

Our goal is to create an autonomous firefighting robot addressing key constraints: size, weight, cost, and operational efficiency. Current robotic systems fall short in meeting optimal standards due to these factors. Our approach involves evaluating and enhancing these elements to develop a pragmatic and cost-effective solution, ultimately contributing to safer and more efficient rescue operation.

To construct an autonomous firefighting robot, gather hardware components including an ESP32 microcontroller, flame and smoke sensors, DC motors, motor driver, water pump, servo motor, and Blynk app. Design and assemble the robot chassis, mounting hardware components as per a schematic diagram. Install Arduino IDE, write code for sensor and motor control, and create a Blynk app for remote control. Test sensors, motors, water pump, and app functionality. Deploy the robot in a safe setting, monitoring its performance and making necessary adjustments [3]. Utilize flame and smoke sensors to trigger water pump and alarm respectively. Employ DC motors and motor driver for robot movement, while the water pump and servo motor extinguish fire by directing the water nozzle toward the detected flame

The methodology likely begins with a recognition of the risks associated with firefighting and rescue missions for human responders. This involves acknowledging the inherent dangers faced by firefighters in extinguishing fires and rescuing victims.

From employs Automatic and Homemade modes. In Automatic mode, robots independently execute predefined commands using advanced algorithms for fire detection and suppression. Homemade mode allows manual control, offering flexibility in navigating challenges We wanted to figure out how to detect fires inside buildings. So, we put cameras in each room, pointing them towards the floor. These cameras are placed low down and face straight out, making a 90-degree angle with the floor.

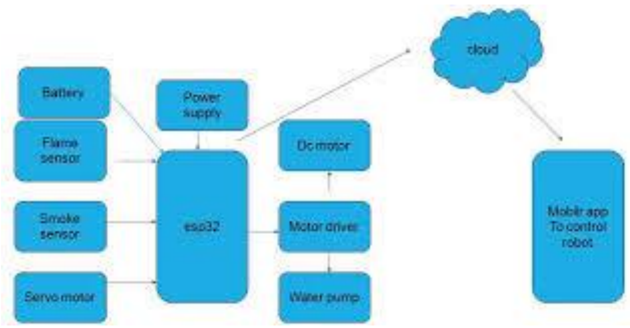

Fig. 1 Block Diagram of the iot based fire exhaussing robot

In this proposed system, the involves employing a firefighting robot equipped with multiple sensors to detect fire incidents. The Proximity Infrared Sensor, flame sensor, ultrasonic sensor, and MQ2 (LPG) sensor collectively contribute to accurate fire detection. Upon detection, the robot utilizes actuators, specifically motors, to move towards the source of the fire. The buzzer serves as an alert mechanism, notifying surrounding individuals about the potential danger

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Classification

The IoT-based fire fighting robot is a sophisticated autonomous system designed to detect, extinguish, and mitigate fires in various environments. Leveraging Internet of Things (IoT) technology, it utilizes sensors to detect heat, smoke, and flames, transmitting real-time data to a central control system. Equipped with advanced algorithms, it navigates through spaces, identifies fire locations, and deploys extinguishing agents such as water or foam. This innovative solution enhances firefighting capabilities by providing rapid response and effective suppression while minimizing human risk

User interface of the proposed system

In this system the following steps are used for developing the user interface, where user can detect the specific fire detection using iot technology.

Step1 Upon login, users are greeted with an overview dashboard displaying critical information such as robot status, environmental conditions, and any detected fire incidents.
Step2: Users can access a detailed real-time monitoring interface showing live feeds from the robot's sensors, including temperature, smoke density, and camera footage.

Step3: The interface offers interactive controls for manual intervention, enabling users to direct the robot's movements, adjust sensor settings, or initiate firefighting procedures. activate auxiliary systems, or communicate with on-site personnel through integrated messaging features.

IV. RESULTS

Results and analysis for a fire fighting robot prototype can include several aspects such as performance, effectiveness, and limitations. Performance can be evaluated by testing the robot's movement capabilities, speed, and agility. This can be done by setting up a track with obstacles and measuring the time taken by the robot to complete the task. Additionally, the accuracy of the flame sensors and the response time of the water pump can be evaluated to assess the effectiveness of the robot in detecting and extinguishing fires.

Effectiveness can be evaluated by testing the robot's ability to detect fires and prevent them from spreading. This can be done by setting up a controlled fire in a safe environment and testing how quickly the robot detects and responds to it.

The amount of water required to extinguish the fire can also be measured to assess the effectiveness of the water pump and tank. Limitations of the robot can also be analyzed. For example, the range of the Bluetooth module used for wireless control can be tested to assess the maximum distance at which the robot can be controlled. Additionally, the robot's ability to navigate through different terrains and obstacles can also be evaluated to identify any limitations or improvements that can be made. The robot was able to detect the fire using flame sensors and navigate towards it using a pre-programmed path. The water pump was triggered using a relay and water was sprinkled on the fire, effectively extinguishing it. The live feed from the ESP32-CAM was also tested and found to be clear and reliable. The wireless communication system also proved to be a valuable feature, as it allowed the robot to be controlled remotely from a safe distance. This is particularly important in hazardous environments where human intervention may be dangerous.

However, some limitations were identified during the testing phase. One of the main limitations was the accuracy of the flame sensors, which sometimes resulted in false alarms or delayed detection of fires. This could be due to various factors such as the angle of the flame or the intensity of the ambient light. To improve the accuracy of the flame sensors, it is suggested to use multiple sensors and calibrate them regularly. Additionally, the water pump and nozzle system could be improved to provide more accurate and efficient water sprinkling on the fire.

This could be achieved by using more powerful water pumps and nozzles, as well as by improving the positioning and direction of the nozzles. Furthermore, the robot's mobility could be enhanced by using more powerful motors or by designing a more efficient wheel system. Overall, the fire fighting robot has great potential to be an effective solution for fire incidents in hazardous environments. Further research and development are needed to address the limitations and improve the performance of the robot.

V. CONCLUSION

the proposed IoT-based fire fighting robot system offers a comprehensive solution for enhancing fire response capabilities in various environments. By integrating advanced sensors, real-time data transmission, and user-friendly interface controls, the system empowers users to monitor, analyze, and intervene effectively during fire emergencies. Its intuitive interface provides instant access to critical information, facilitating rapid decision-making and coordination of firefighting efforts. With features such as remote control and intervention capabilities, the system enables efficient deployment of resources while minimizing human risk. Overall, this innovative solution represents a significant advancement in fire safety technology, promising to improve emergency response outcomes and safeguard lives and property in the face of fire hazards.

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