International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-9 Issue-3 September 2020

Voice Controlled Fire Fighting Robot

Chaarumathi P, Divya S.R, Divyajothi R, Mehareethaa K.V, Kamalkumar V

Abstract*: Even though there are a lot of advancements in technology, there have been an increased number of devastating losses in the field of fire-fighting. Fire accidents that occur in industries like atomic power plants, petroleum refineries, chemical factories and other large-scale fire industries end in quite serious consequences which can cause injuries or even death of individuals. Therefore, this paper is enhanced to develop an automated fire extinguishing robotic vehicle that saves the lives of firefighters and other persons in those areas. The proposed robotic vehicle is controlled using specified speech commands. The language input is more familiar which makes interaction with the robotic vehicle much easier. The advantages of voice-controlled robots are hands-free and rapid data input operations. The speech recognition process is done in such a way that it recognizes specified commands from the user and the designed robot navigates based on the instructions via the speech commands. The fire can be extinguished using a water tank that is fitted along with the robotic vehicle. Consequently, the site of fire is live monitored using ESP 32 and the status of the fire zone is updated to the user through message.

Keywords*: Arduino, ESP32, Fire extinguishing, Live monitoring.

I. INTRODUCTION

Lately, extinguishing fires is a dangerous issue. Various analysts are chipping away at different techniques for fire stifling. Creator Ratnesh Malik et al. has developed a methodology towards a sort of putting out fires. The robot is arranged and created so that it can douse the fire. The robot is totally self-initiated. It completes thoughts like environmental distinguishing and care, relative motor control. The robot gets information from its sensors and interfaced segments. Photosensitive sensors are utilized to recognize fire dependent on their sources. At the point when the fire is perceived, the robot alerts the environmental factors. Around then, it starts water to be sprinkled on the fire. The use of sensors and microcontrollers permits it to perceive fire normally at the very least delay. This robot is used at a piece of zones that are in high danger. [1]

Swati Deshmukh et al have built up a remote firefighting robot. It includes a framework that can perceive fire and pass it over. It can explore in a forward and reverse way and turn left or right. Thusly, a fireman can work with it over significant distances. These resistors are very delicate and are prepared for perceiving a little measure of fire. It is a brilliant multi-sensor based security framework. [2] A mobile controlled robot with fire detecting sensors was built by Lakshay Arora which includes a cell phone that controls a robot by making a call to the mobile phone which is added to the robot. Other than the call activation period, if any key is pushed on the phone, the tone contrasted with the key pushed is heard at the furthest edge of the call that is determined to the robot. The robot faculties Dual-Tone Multiple-Frequency (DTMF) tone with the help of a phone mounted on the robot. The got code is set up by the microcontroller and from that point forward, the robot performs according to the requisites. In the proposed structure, DTMF development is used to situate the position of the motor at a necessary point with different sensors, each playing out its operations. [3] Arpit Sharma et al have built up the Android Phone controlled Robot that makes use of Bluetooth. Various strategies for Human-Machine communication through signals are presented. Signals are gotten by utilizing an accelerometer. The paper analyzes the development to find movements using an android propelled mobile which has an inbuilt Bluetooth module and an accelerometer to control the vitality of the robot. The Microcontroller controls the different indications of the Bluetooth module. Favorable circumstances like easy interfacing, minimization of space occupied and weight-less can make it a better alternative when contrasted with the other models. [4] Saravanan P has developed an Integrated Semi-Autonomous Fire Fighting Mobile robot. The System takes control of four D.C. motors that are energized by Atmega2560 and constrained by course structure. The course structure comprises of fused ultrasonic sensors and infrared sensors. The robot is fitted with a distinct camera that records video and communicates it. The fire area comprises of LDR and temperature sensor. In the occasion when there is a fire, the sensor recognizes it and the robot will arrive at the wellspring of root of the fire and douses it. The smothering system comprises of a BLDC motor with a water holder. The SABOT is utilized for uncommon conditions and it contains a GUI support through which robots can be provided orders. [5]

Revised Manuscript Received on August 28, 2020.

***** Correspondence Author

Mehareethaa K.V*, Department of Electrical and Electrical Engineering, KPR Institute of Engineering and Technology, Coimbatore, India. E-mail: kvmeha@gmail.com

Chaarumathi P, Department of Electrical and Electrical Engineering, KPR Institute of Engineering and Technology, Coimbatore, India. E-mail: chaarupalani26@gmail.com

Divya S.R, Department of Electrical and Electrical Engineering, KPR Institute of Engineering and Technology, Coimbatore, India. E-mail: srdivya1612@gmail.com

Divyajothi R, Department of Electrical and Electrical Engineering, KPR Institute of Engineering and Technology, Coimbatore, India. E-mail: divyajoe28@gmail.com

Kamalkumar V, Department of Electrical and Electrical Engineering, KPR Institute of Engineering and Technology, Coimbatore, India. E-mail: kamalkumar.v@kpriet.ac.in

All the above papers have their issues, this paper is enhanced to overcome those issues and to propose a fire fighting robot that is operated using speech commands which is entirely an easy interfaceable and quick access process.

II. METHODOLOGY

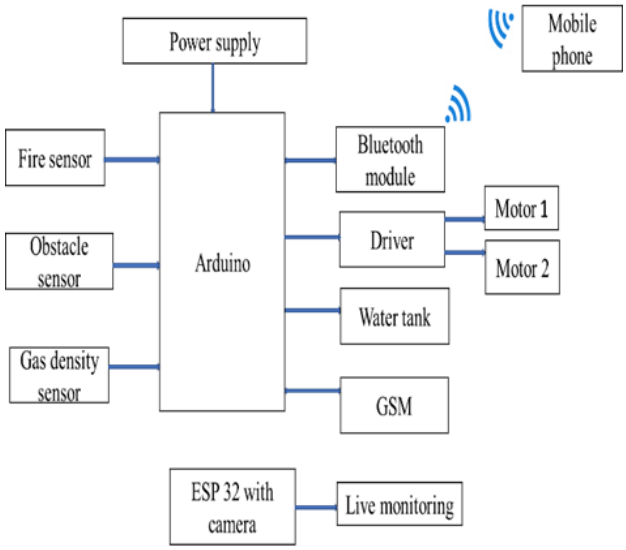

Fig. 1. Block diagram of the proposed model

Fig. 1 shows the block diagram of the proposed model of our project. The proposed model consists of two sections. The one with Arduino as the main controller and the other with ESP32. The Arduino controller controls and gives information about the fire accident, obstacles in the up-roaching way and gas density around the area. These are made possible through signals from sensors interfaced with the controller. The Global System for Mobile communications (GSM) is used to pass the information gained from various sensors to the firefighter. According to the message received, the firefighter passes the speech commands through the Bluetooth module connected wirelessly using a mobile phone. The second section consists of ESP32 which has both WiFi accessibility and camera access. This is used for live monitoring the fire site which can be viewed by the firefighter away from the fire accident zone. Whenever the fire is detected through the flame sensor, the water tank attached to the robotic vehicle sprinkles water all around the site. The above-described sections are assembled over a robotic vehicle chassis. The robotic vehicle consists of four wheels that are operated using the motor drivers. Thus, the entire robotic vehicle is navigated using voice commands and the fire is extinguished using water tank.

A. Temperature Sensor

The thermistor is used as a temperature sensor. Usually, the temperature increases when the voltage signal produced by the temperature sensor increases. The temperature sensor is used to sense the smoke and fog in the environmental surroundings. If the sensed value is 1, it indicates that there are no fire accidents. If any fire accidents occurred, it shows the value as 0. Then the sensor sends SMS to the concerned person about the status of the fire-prone area.

Fig. 2. Temperature Sensor

B. Ultrasonic Sensor

The obstacle sensor used here is ultrasonic sensor. The distance between the obstacle and the sensor is calculated by the ultrasonic sensor. It performs this function using ultrasonic waves. The ultrasonic waves are those whose frequencies are about 20000 hertz. It is used to detect the obstacles in the path of the robotic vehicle. If it detects the obstacles in its path, it automatically stops the robot's movement.

Fig. 3. Ulrasonic Sensor

C. Gas Density Sensor

The gas density sensor used here is smoke detecting sensor. It senses smoke and can be used a fire indicator. It can be used for high pressure and high-temperature applications. A gas density sensor is used to detect the gases in the atmosphere. They can be used for both indoor and outdoor environments. Very fine particles like cigarette smoke can be effectively detected using a gas density sensor and it is generally used in the air purifier system.

Fig. 4. Gas Density Sensor

D. ESP32 Module

ESP32 can be operated at a temperature ranging from -400C to +1250C and it is capable of operating reliably in an industrial environment. ESP32 is developed for mobile phones, wearable electronics and IoT applications. It is used to achieve ultralow power consumption and it has a high level of integration with inbuilt antenna switches, RF balun, low noise receive amplifier, filters, and power management modules. It is a wifi module that is used to give the live stream of that particular area. It has access to hybrid wifi and Bluetooth chip.

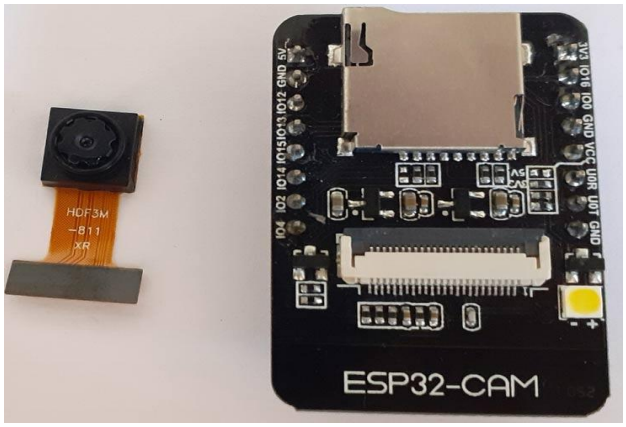

Fig. 5.ESP32 Module

E. Arduino

Arduino Uno is an 8-bit ATmega328P microcontroller. Besides ATmega328P, it has other components such as a crystal oscillator, voltage regulator, serial communication, etc., to support the microcontroller. It can be used to communicate with a PC, another Arduino or other microcontrollers. Arduino Uno can be programmed using Arduino IDE. It is used in the prototyping of electronic products and systems. Here, Arduino Uno is used to controlling the various sensors such as ultrasonic sensor, gas density sensor and temperature sensor. It provides the status of the fire zone to the firefighter as a message. It also controls the HC-05 Bluetooth module that is connected to the firefighter mobile phone through an application that uses Bluetooth. This application is used to provide commands to the robotic vehicle.

Fig. 6. Arduino Board

III. RESULT AND DISCUSSION

The results are accomplished as per the proposed model. The status of the fire zone is sensed by the signals obtained from various sensors connected to the Arduino controller and updated to the user through GSM connected. Fire can be extinguished by sprinkling water whenever the fire gets sensed. The overall status of the fire site is live monitored using ESP32. Robotic vehicle motion is entirely controlled using voice commands like “forward”, “reverse”, “left” and “right” which is given wirelessly to the robot using an inbuilt mobile app.

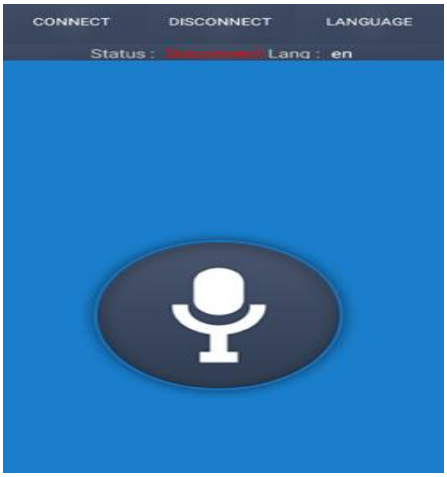

Fig. 7. Home screen of Arduino Voice Control App

The above fig. 7 shows the home screen of the Arduino voice control app that helps in processing the given speech commands to the Arduino using the HC-05 Bluetooth module.

Fig. 8.Hardware Model

The above fig. 8 shows the prototype model of a voice controlled firefighting robot.

IV. CONCLUSION

This paper presents our proposal on the concept of developing a voice-controlled fire-fighting robot. The advantages of our proposed paper include an easy user interface, quick access and rapid-fire extinguishing process. It helps in minimizing the work of firefighters and saving their lives. The proposed model can be further enhanced by replacing the material used for the robot with materials suitable for fire-resistant, maximum strength and fatigue resistant. The ESP32 can be replaced by a 360^{o} camera to view the entire site at a time. The water can be replaced with some chemical agents that can easily extinguish the fire occurred or with foam that is filled in a tank as a fire extinguishing agent.

REFERENCES

1. Ratnesh Malik, “Fire Fighting Robot: An Approach”, Indian Streams Research Journal Vol.2, Issue.II/March; 12pp.1-4
2. Swati A. Deshmukh, Karishma A. Matte and Rashmi A. Pandhare, “Wireless Fire Fighting Robot”, International Journal For Research In Emerging Science and Technology.
3. Lakshay Arora, Prof.Amol Joglekar, “Cell Phone Controlled Robot with Fire Detection Sensors”, (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (3), 2015, 2954-2958.
4. Arpit Sharma, Reetesh Verma, Saurabh Gupta and Sukhdeep Kaur Bhatia, “Android Phone Controlled Robot Using Bluetooth”, International Journal of Electronic and Electrical Engineering. ISSN 0974-2174, Volume 7, Number 5 (2014), pp. 443-448
5. Saravanan P, “Design and Development of Integrated Semi-Autonomous Fire Fighting Mobile Robot”, International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 4, Issue 2, March 2015.
6. Guiseppe Riccardi (2015), ‘Active Learning: Theory and Applications to Automatic Speech Recognition’, IEEE Transaction of Speech and Audio Processing, Vol. 13, No. 4, pp 1-8.
7. Shantanu Chakrabarthy “Robust Speech Feature Extraction by Growth Transformation in reproducing kernel Hillber space”, IEEE Transactions on Audio Speech and Language Processing, Vol.15, No 6, June2007.
8. T. Aprille and T. Trick, “Steady-State Analysis of Nonlinear Circuits with Periodic Inputs”, Proceedings of the IEEE, vol. 60, no.1, pp.108-114, January 2015.
9. Rakib, T. and Sarkar, M.R., “Design and fabrication of an autonomous fire fighting robot with multisensor fire detection using PID controller”, 2016 5th IEEE International Conference on Informatics, Electronics and Vision (ICIEV), May 13-14, 2016, Bangladesh, pp. 909-914.
10. Suresh, J., “Fire-fighting robot”, 2017 IEEE International Conference on Computational Intelligence in Data Science (ICCIDS), June 2-3, 2017, India, pp. 1-4.

AUTHORS PROFILE

Chaarumathi P is pursuing Bachelor of Engineering at KPR Institute of Engineering and Technology. She belongs to the department of Electrical and Electronics Engineering. She is a final year student.

Divya S.R is pursuing Bachelor of Engineering at KPR Institute of Engineering and Technology. She belongs to the department of Electrical and Electronics Engineering. She is a final year student.

Divyajothi R is pursuing Bachelor of Engineering at KPR Institute of Engineering and Technology. She belongs to the department of Electrical and Electronics Engineering. She is a final year student.

Mehareethaa K.V is pursuing Bachelor of Engineering at KPR Institute of Engineering and Technology. She belongs to the department of Electrical and Electronics Engineering. She is a final year student.

Kamalkumar V received the B.E in Electrical and Electronics Engineering from Sri Krishna College of Engineering and Technology, Coimbatore, India, in 2007, M.E. degree in VLSI Design from Government College of Technology, Coimbatore, India, in 2010. He is currently working as Assistant Professor in KPR Institute of Engineering and Technology. He is doing his Ph.D. in part time from Anna University, Chennai. His current research interests include optimization algorithms, area optimization.