An Intelligent Remote Controlled Fire Fighting Machine for Autonomous Protection of Human beings

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ABSTRACT: A fire fighting machine is designed, which can extinguish the fire with the help of fire fighter away from the hazardous area. Also it can reach critical areas like damaged and demolished buildings. This helps to turn off fire in any scenario without loss of human life. It also provides the firemen to easily find and put off the fire. It can be operated from a safe distance and it can move into rough terrains inside the building since this design has caterpillar traction in the rover. It has a ventilating system equipped with water mist which is used to eliminate the smoke and reduce the temperature in the premises nominally. There is a fire canon which is attached to the pipeline of the fire extinguishing liquid, which can be raised or lowered to target the fire. It employs LED lighting to get clear visual with regard to ongoing action for monitoring purpose.

KEY WORDS: Fire Extinguisher, remote control, raspberry pi, IR Temperature sensor, Gears, Chain, Relays, Heat Shielding, Ball Bearings and flanges, Battery.

I. INTRODUCTION

In today life, robotics becomes important in assisting by human beings. The use of robotic systems in fire fighting is being increasingly studied due to fire fighters routinely being exposed to dangerous conditions to save lives of victims during fire accidents. A robotic system is a mechanical device that performs a task using sensors to perceive its environment, computer programs to control the robot based on its environment, and a human operator to assist with remote operation. According to a statistics in India, there are about 70 deaths per year for the last seven years. The main goal of this project is to develop a rover which can be used to extinguish fire remotely in an event of any major fire hazard particularly in large scale industries. Major fire accidents do occur in industries like nuclear power plants, petroleum refineries, gas tanks, chemical factories and other large-scale industries resulting in quite serious consequences. Thousands of people have lost their lives in such mishaps. In present fire extinguishing system, there is a big risk of life for fire fighters as they have to fight against fire from regions. Therefore, this paper propose an enhanced technique to control fire through a rover by using remote control.

II.EXISTING WORK

In the present fire fighting system, fire fighters have to fight against fire from very closer. Lot of fire fighters lose their lives in such accidents every day in whole world. So there is necessary to update our present fire fighting system with advanced technology to make job of fire fighters easy and to save their lives. And for this purpose many technical persons/authors had worked on it to improve it. Before deciding our method to implement a novel fire extinguishing vehicle, have studied many research articles.

The first one is" self-operated fire fighting robot" is studied from paper of Swaranlata Bollavarapau and her co-authors. In this, there is a sensor network connected on vehicle to detect flame and according to that the vehicle finds location of fire to extinguish it. But this method results in slow output (take more time to find fire) so takes more time to fulfil the task and accuracy is also less. The second method is "Voice Operated Fire Fighting Vehicle", which is studied from paper of Preeti Dhiman and her co-authors. It is implemented with the help of speech recognition module.

But it is very sensitive to surrounding noise. This may result in error. Sometimes the system doesn't follow the commands from operator due to noise or error.

III. SIGNIFICANCE OF THE SYSTEM

To save guard the fire fighters from dangerous accidents. Safe and efficient operation is ensured. The Presence of fire fighter in the accident prone area is not necessary. Various classes of fires can be extinguished easily. Variety of operation can be performed such as blowing the smoke out, extinguishing the fire, creating a high humid environment i.e. by spraying tiny water droplets in the air surrounding the region.

IV. LITERATURE SURVEY

Kena Pateland BhavnaK.Pancholi designed a Extinguishing Robotic Vehicle Controlled by Android Application. Major fire accidents do occur in industries like nuclear power plants, petroleum refineries, gas tanks, chemical factories and other large-scale industries resulting in quite serious consequences. Thousands of people have lost their lives in such mishaps. Their project is designed to develop a fire fighting robotic vehicle controlled using android application for remote operation. The robotic vehicle is loaded with water tanker and a pump which is controlled over wireless communication to sprinkle water to extinguish fire. An AVR ATMega-32 microcontroller is used for the desired operation. Remote operation is achieved by any smart-phone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based touch screen operation. The application is designed using Android studio in XML and functioning is defined in JAVA. The android device transmitter acts as a remote control that has the advantage of adequate range, while the receiver have Bluetooth device interfaced to the microcontroller to drive output devices to fulfil defined work. The developed system decreases risk factor involved in job of fire fighting and in the experimentation process they have achieved a success rate of approximately 96%.The future challenges involve improving the efficiency of various modules and eliminating the various shortfalls. Wireless camera can be used to visualize fire. To extinguish fire, CO_2 gas cylinders can be used in future. Evgenit Krasnov and Dmitry Bagaev they developed a paper on Conceptual Analysis of Fire Fighting Robots Control Systems Subject to the purpose, the main task for the fire fighting robot can be one of the following for the home fire fighting – robot must make its own way to the source of the fire in the most short time and to extinguish a fire. The field of action is constrained with current floor of house, no interflow shifts are to meant and all doors at the floor are opened for the industrial fire fighting – the main principles are as above, except one thing: the fire fighting compound must be safe not to cause a new accident. In addition, robot have to operate at longer distances for forest fire fighting –robot must make its own way to the source of fire in the woodland, knowing only the coordinates of the fire and to extinguish the it.

V.PROPOSED ASSISTIVE SYSTEM

As fire fighting from very close to fire is very risky task, the advanced system assists fire fighter/operator to work remotely to extinguish fire. By using advanced robotic vehicle, risk factor in fire fighting job decreases to great extent. The proposed system assists fire fighter/operator at remote place (away from fire) with the help of wireless remote.
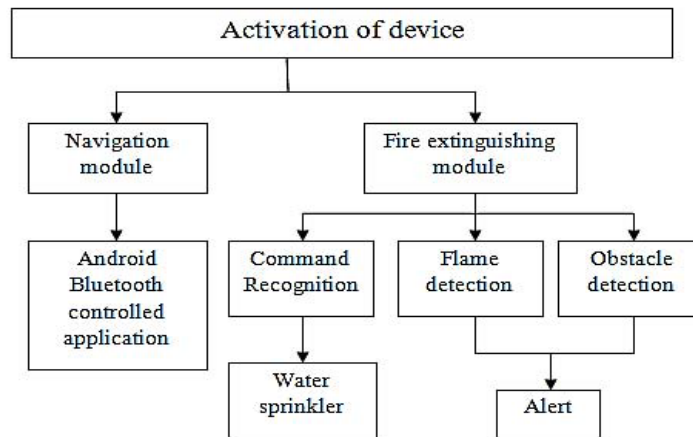
Fig.1. Block Diagram of the proposed system

This shows the block representation of proposed system. It has mainly two modules 1) Navigation module, 2) Extinguishing module. Navigation module (transmitter) is used to navigate robotic vehicle or extinguishing module. Navigation module consists of remote control application. Extinguishing module is a whole fire fighting robotic vehicle (receiver). It has a water sprayer to extinguish fire. It is controlled by received signals from navigation module. Next part of fire extinguishing module is flame detection. This detects flame with respect to temperature which is nearer to the vehicle. Also the feature of control unit is used to control the whole vehicle by using raspberry pi microcontroller. From the above both we can visualize the scenario surrounding the vehicle by using camera. The system functional block diagram is shown in the figure below.
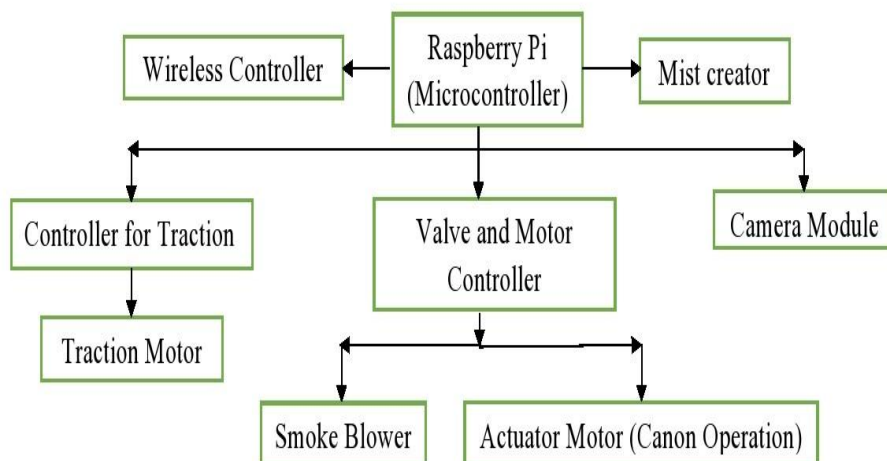

Fig.2. Functional Block Diagram

The below circuit diagram is for the traction system, which is stimulated. Electronic switching system is employed for better performance and response to control different directions of motor operation. It be efficient and also uses PWM speed control technique.BC547 transistor is used to protect the microcontroller circuit from high voltage consumed by the MOSFETs. In the simulation instead of the microcontroller we have introduced the switches to perform the operation of the circuit. Thus the traction control part is completed apart from the programming. The android application Bluetooth is used for developing the control of the rover. To improve the speed control MOSFET drivers can be used to precise control of the speed of the rover.
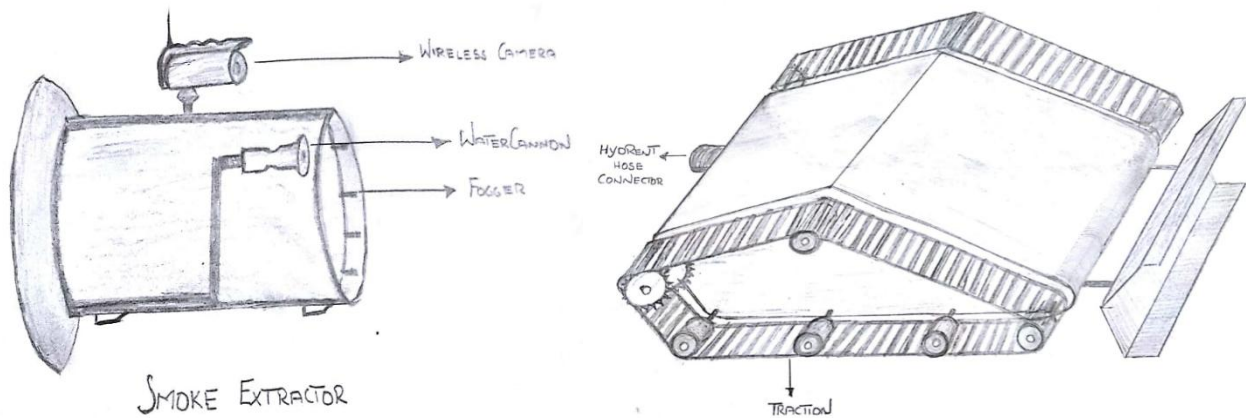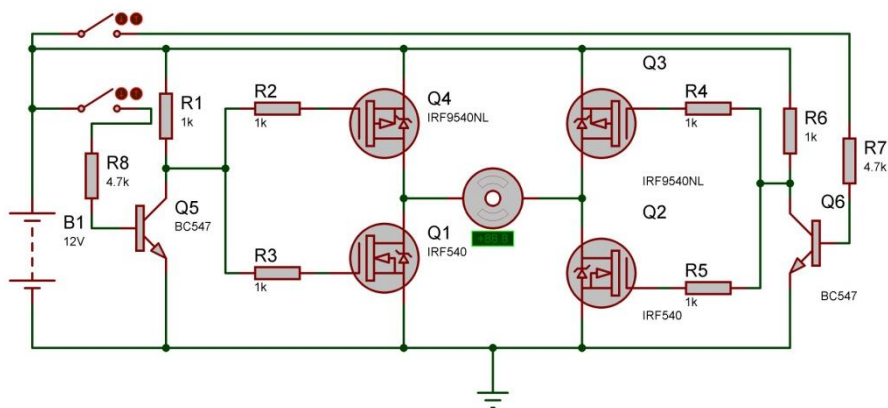
Fig.3. Smoke Extractor Design structure

Fig.4. Simulation model of the proposed traction system

V. ACTIVATION OF WORK

A. WIRELESS CONTROL APPLICATION:

An application which controls the rover traction system, nozzle and the blowers is created. It provides a user friendly layer to interact the user to control the rover efficiently. To reduce the cost, the design is also employed with the Bluetooth to transmit and receive data. The transmitted data is received and processed by the microcontroller. The appropriate values are given to control the rover.

B. SMOKE EXTRACTOR:

It is used to extract the smoke from the building and the visibility is improved and the fire can be visually found. It is controlled by the remote signal given to the microcontroller. By removing the smoke from the area may increase the air circulation and prevent suffocation.

C. CONTROL UNIT:

Raspberry pi 3 b+ is used to control the received and processed message from the remote serial data communication. It also transmits the visual feed of the rover to the user.

D. ACTUATOR CONTROL:

The actuator can be moved up or down respective to the user convenience. This contains the mist creator and the solution canon. The valves are used to switch between the canon and the mist creator. This receives the signal from the microcontroller.
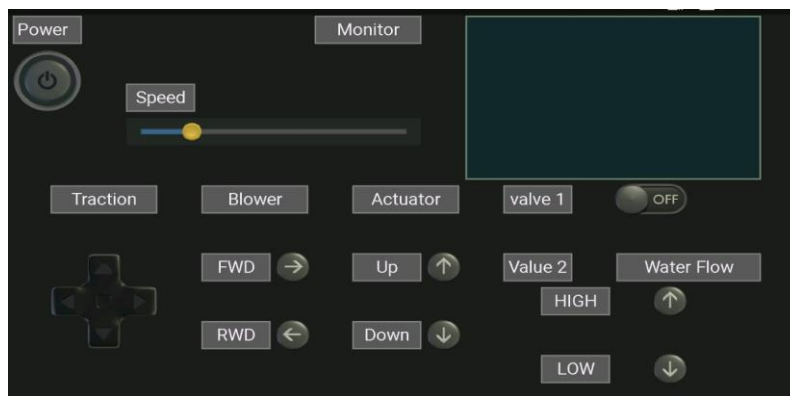
E. REMOTE APPLICATION:

Fig.5. Rover X model for autonomous control

The above screen shot shows the user friendly application to control the rover. The Traction control is given with four way button, blower is capable of operating in both forward and reverse direction. The actuator can be moved up and down, the water flow can be increased or decrease by the valve 2. The valve 1 regulates the solution through mist creator.

VI. EXPERIMENTAL TEST RESULTS

It is implemented in the places where there is dangerous fire accidents occur and to extinguish fire eventually without any loss of life of the brave fire fighters. By remotely controlling the rover it can also reach the place where human cannot reach.

Fig.6. Prototype Model of Rover X model for autonomous control

It has a blower to suck off the smoke produced due the accumulating fire in the area. The mist creator is employed to create a highly moist atmosphere to limit the fire. There is a water cannon to spray the fire extinguishing solution, it uses the caterpillar traction to reach out the place of fire even though the floors are uneven. The design is weightless and there are shielding to prevent heat from messing with the internal circuit and the electronic devices in it. The frame is designed to with stand the weight of the components used in it. The structure is completely designed and fabricated to enhance the structural integrity and to with stand heat. The sprocket is guided with the plate and also with inner adjustable wheel which assist in bear the weight of the rover. The sprocket shaft is attached to a sprocket and to a motor which runs at 2650 rpm (base speed).In which the reduction ratio is 1:4 to increase the torque to move the machine without any struggle. The sides are covered such that there will be no interference of external obstacles inside the traction mechanical system. Behind the water canon there is a motorized valve and solenoid valves to regulate water through the canon and the mist creator and to switch between them.

VII. CONCLUSION AND FUTURE WORK

Thus the fire fighting rover will help the fire fighters to save their lives without any risk. It is very helpful tool to exhaust the fire from the safe distance. It also employs the very interactive user interface and provide the precise movement and control of the rover. Expanding the model to fully automatic mechanism and also the whole arrangement can be made as easy reassembling in any other places. Also, the cost of power supply unit can be reduced by using solar power and also it becomes more users friendly.

REFERENCES

[1] Sija Gopinathan, Athira Krishnan R, Renu Tony, Vishnu M. and Yedhukrishnan, "Wireless Voice Controlled Fire Extinguisher Robot" in International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol.4, No.4, pp. 2483-87, April 2015.

[2] Rohith Punuganti, Anusha Srinivas, Lakshmi F Savanoor and Divya Shreer, "PIC Based Fire Sensing and Extinguishing Robot", Proceedings of IRF International Conference, 30th March-2014, pp. 124127, Pune, India.

[3] Swarnalata Bollavarapau, Neil K. Samuel, Maneesh Shankar and Nihaar Shah, "An Analytical Study of Various Methods Used to Build an Autonomous Fire Extinguishing Robot", International Journal of Engineering Research and Development, Vol.10, No. 4, pp. 43-47, 2014.

[4] Tushar R. Unale, Harshad P. Sankpal, Shripad G. Pujari, Rasika R. Minache and Menka M. Havagondi, "Smart Shopping Trolley", International journal of Emerging Technology and Advanced Engineering(IJETAE), Vol.7, No. 3, pp. 53-57, March 2017.

[5] PreetiDhiman, Noble Tawra, Rakesh Nagar, Rishab Singh and Varun Kaushik, "Voice Operated Intelligent Fire Extinguisher Vehicle", International Journal of Emerging Trends in Electrical and Electronics (IJETEE) Vol. 2, No.2, pp. 43-47, April-2013.

[6] MD Azhar and Dr. K. Sudhakar Reddy, "Android Blue Tooth Base Control Fire Fighting Robot" in (IJITR) International Journal of Innovative Technology and Research, Vol.4, No.5, pp. 3879-3882, September 2016.

[7] Kristi kosasih, Merry Sartika, M. Jimmy Hasugian and Dan Muliady, "An Intelligent Fire Fighting Tank Robot", Electrical Engineering Journal, Vol. 1,No.1, pp- 73-80, 2010.

[8] Sahil S.Shah, Vaibhav K.Shah, Prithvish Mamtora and Mohit Hapani, "firefighting robot" in International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Vol. 2, No.4, pp. 232-234, July – August 2013.

[9] M.Suresh, Dr.R.Meenakumari, P.S.Raghavendran, V.Gowrishankar, P.Karthikeyan, V.Surendar, C.Jagan and N.Krishna Prashant, "Design and Development of Automatic Whiteboard Cleaner for effective cleaning mechanism using Arduino" in International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Vol.6, No.9, pp: 30-33, September 2018.

[10] http://www.robotics.com/robomenu/index.html.

[11] M.Suresh, R.Meenakumari, R.Ashokkumar, T.Alex Stanley Raja, K.Mahendran and A.Pradeep, "Fault Detection and Monitoring of Solar PV Panels using Internet of Things" in International Journal of Industrial Engineering, Vol.2, No.6, pp: 146-149, June 2018.

[12] P.Karthikeyan, M.Suresh, K.Bharathi, U.Keerthana and D.Vinuprakash, " Lab View based speed control of Single Phase Induction motor by V/f control method" in International Journal for Scientific Research and Development, Vol.5, No.12, pp: 1151-1154, March 2018.

[13] M.Suresh, R.Vignesh, R.Jones Rexiya, T.K.G.Santhosh ,"A break free path for ambulance using speed breaker" in International Journal for Scientific Research and Development, Vol.5, No.10, pp: 859-861, Jan 2018.