ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2015

Wireless Voice Controlled Fire Extinguisher Robot

Sija Gopinathan[1], Athira Krishnan R[2], Renu Tony[3], Vishnu M[4], Yedhukrishnan[5]

Assistant Professor, Dept. of EEE, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India[1]

U.G. Student, Dept. of EEE, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India [2]

U.G. Student, Dept. of EEE, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India[3]

U.G Student, Dept. of EEE, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India [4]

U.G Student, Dept. of EEE, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India[5]

ABSTRACT: The need for a device that can detect and extinguish a fire on its own is long past due. Many house fires originate when someone is either sleeping or not home. 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 main objective was to design and build a prototype system that could autonomously detect and extinguish fire. The controlling device of the prototype is PIC microcontrollers. Speech recognition module, wireless transceiver modules, fan, DC motors and buzzer are interfaced to Microcontroller. When the user fed the voice commands to the speech recognition module, the microcontroller interfaced to it reads the command and sends relevant data of that command wirelessly using transceiver module. This data is received by the transceiver module on the robotic vehicle and feds it to microcontroller which acts accordingly on motors and fan. The vehicle is mounted with a camera which helps in viewing the live images on TV. Also, the vehicle is capable of detecting fire and alerts the user through buzzer. To perform this intelligent task, PIC 16F73 is loaded with a program written in embedded C language.

KEYWORDS:Microcontroller, Prototype, Flame sensor, Speech recognition module.

I.INTRODUCTION

Fire-fighting is an important but dangerous occupation. A fire-fighter must be able to get to a fire quickly and safely extinguish the fire, preventing further damage and reduce fatalities. Technology has finally bridged the gap between fire fighting and machines allowing for a more efficient and effective method of fire fighting. Robots designed to find a fire, before it rages out of control, could one day work with fire fighters greatly reducing the risk of injury to victims. Our world is currently facing the global warming whereby the average temperature of our earth atmosphere and oceans is increasing year by year. Studies shows that our earth mean surface temperature has increased about 0.8C which about two-third of increase occurring since 1980 [1]. The global warming of the earth may lead to more forest fire and fire disaster occur as everything gets more flammable due to the high temperature of our earth atmosphere. Therefore, fire extinguishing robot is needed to reduce all the damage cause by natural or human made fire disaster. The project aims at designing an intelligent live video feedback voice operated fire extinguishing robotic vehicle which can be controlled wirelessly.

II.LITERATURE SURVEY

Boo Siew Khoo et.al [1] presents an automated fire extinguishing robot (FireDroid) which can detect flame and extinguish the flame. When fire occurs in a house, the fire extinguishing robot will be able to sense the flame and move to the fire location. After fire location is locked and flame distance is measured, water is being pumped out from the water tank and fire is extinguished completely. Su, K.L et.al [2] proposed a multi-sensor fire detection algorithm (MSFDA) for intelligent building. The fire-fighting robot is constructed using Aluminium frame. There are six systems in the fire-fighting robot, including structure, avoidance obstacle and driver system, software development system, fire detection and remote supervising system. They designed the fire detection system using three flame sensors in the fire-fighting robot. The adaptive fusion method is proposed

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2015

for fire detection of fire-fighting robot. If fire accident is true, the robot can find out fire source using the proposed method by fire detection system, and move to fire source to fight the fire. Sang-Uk Park et.al [3] developed a system that uses a High-Speed Downlink Packet Access (HSDPA) network to transmit images, showing the view from a fire-fighting robot. The fire-fighting robots and remote controllers are equipped with industrial computers, and image-transmitting and image-receiving programs function according to various protocols to allow communication between the robots and controllers. Tong Feng et.al [4] presents an ultrasonic obstacle avoidance system used for fire-fighting robot. To meet the need of obstacle detection in hostile fire field under heavy smoke and high temperature condition, the transducer, STC circuit and anti-jamming processing are specially designed. Avanzato et.al [5] designed an autonomous mobile robot that navigates through a maze searching for a fire (simulated by a burning candle), detects the candle's flame, extinguishes the flame, and returns to a designated starting location in the maze. Sampath, B.S [6] developed a robot which features to move in the direction with respect to the fire intensity. The robot shield was coated with calcium silicate boards that are capable of withstanding very high temperatures. The robot turns ON automatically as it detects the fire round its surroundings using thermocouple and tries to extinguish it by moving in the direction with respect to the fire.

After going through all these papers, we came to a conclusion to do a project on building a fire-fighting robot that can be controlled through our voice. The robot consists of a flame sensor to detect flame and a speech recognition module to provide the necessary voice commands for the movement of robot to fire location.

III.BLOCK DIAGRAM

The block schematic representation of the project is illustrated here. The block diagram is divided into four parts for simplicity, namely the power supply module, transmitter, receiver and TV module.

Power supply module

To drive the all the components 5V dc and 12V dc are required. The power supply module is illustrated in Fig.1. The mains give the 230V ac. The 230V ac is stepped down to 12V ac by using step down transformer. Then the output is given to the full wave rectifier. The rectifier eliminates the negative peak voltage of the input voltage .The output of the rectifier is the pulsating dc. The error pulses are eliminating by using capacitor filter. Then the output at the parallel of the capacitor is the 12V dc. But the Micro Controller works on 5V dc .To convert the 12V dc into 5V dc a regulator is used. The output of the regulator is constant irrespective of the input voltage.

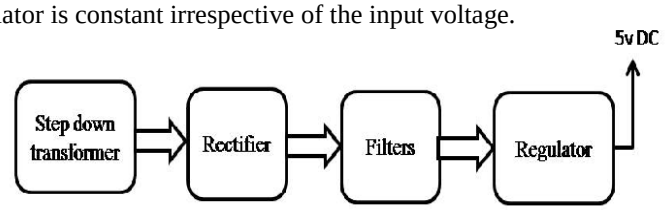

Fig.1 Power Supply Module

Controlling part and TV module

The controlling devices of the whole system are Microcontrollers. Speech recognition module, wireless transceiver modules, fan, DC motors and buzzer are interfaced to Microcontroller. The transmitter and receiver unit is illustrated in Fig.2 and 3. When the user feed the voice commands to the speech recognition module, the microcontroller interfaced to it reads the command and sends relevant data of that command wirelessly using transceiver module.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2015

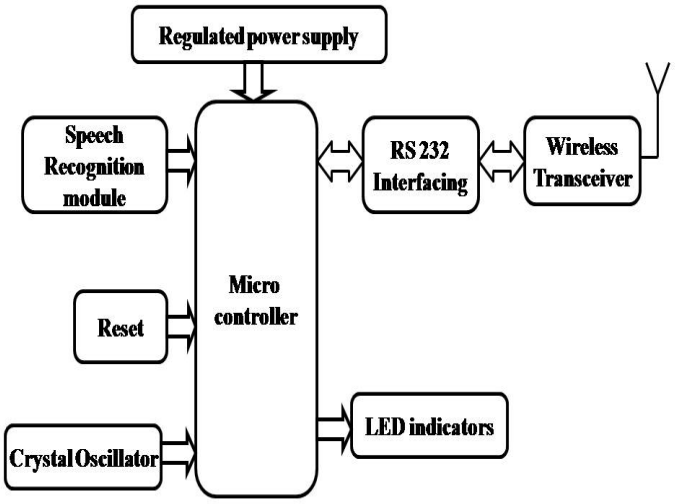

Fig.2 Transmitter Unit

The microcontroller requires the reset logic circuit for protection of the internal program and internal clock in case of power failure. A sudden change in the power may cause data error resulting in the corruption of the internal program. The reset logic circuit contains one capacitor and a resistor. [4] This data is received by the transceiver module on the robotic vehicle and feds it to microcontroller which acts accordingly on motors and fan.

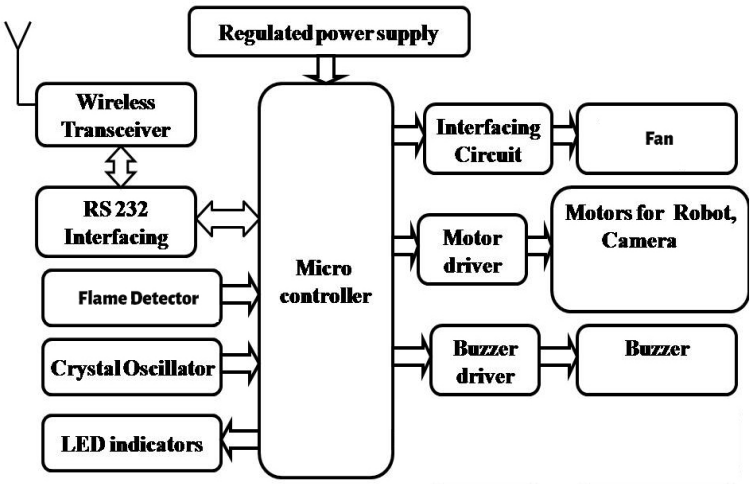

Fig.3 Receiver Unit

The vehicle is mounted with a camera which helps in viewing the live images on TV as shown in Fig.4. To perform this intelligent task, Microcontroller is loaded with a program written in embedded C language.

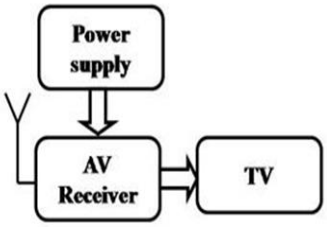

Fig.4 TV unit

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2015

A predetermined warning message will be sent to respective personals to intimate the occurrence of fire accident. The buzzer provided to the circuit sounds. The microcontroller drives two motors. One motor is used to provide movement to the Robot to move in forward direction to reach the destination point and the other is used to operate the fan to extinguish fire. After extinguishing fire the robot will go back to the original position on proper commands.

IV.WORKING

Here we have used a PIC16F793, 2 - L293D, 3- DC motors, Speech Recognition module. Instructions can be given through the speech recognition module as shown in Fig.5. The speech recognition module converts their speech to commands. The commands used here are 'Forward' for forward, 'Backward' for backward, 'Right' for right and 'Left' for left movement of the robotic vehicle. The command 'Down' is used to stop the robotic vehicle and 'Up' command is used to extinguish the fire. If a voice input Forward is given, the speech recognition module will send command E to the PIC and the motors are activated to move forward. For voice input Backward, Command F is send to PIC. For Left and Right voice command, A and B are respectively sent to PIC. For Down command, D is send to PIC and C is send to PIC by speech recognition module for Up command.

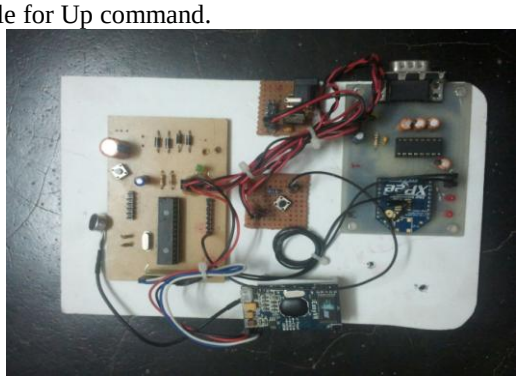

Fig.5 Transmitter

The PIC then sends a high signal to L293D driver and the 2 DC motors are rotated in the forward direction. If the instruction is Left or Right, one motor should be rotated in the forward direction and the other in the Backward direction to turn the vehicle. The command E is used to toggle the pump for extinguishing there. When the command is given the PIC send a high signal to driver and the pump is turned on. Since Toggling is used if the command E is given again the pump will be stopped. The vehicle can be stopped by using command S Stop. The robotic vehicle is shown in Fig.6. Robot uses microcontroller to drive flame sensor, L293D motor driver and the 2 DC motors. To drive all components 5V dc and 12V dc are required. The mains 230V ac is stepped down to 12V ac by using step down transformer. This output ac is given to the full wave rectifier. The rectifier eliminates the negative peak voltage of the input voltage, ie, 12V ac. The output of the rectifier is pulsating dc. The error pulses are eliminated by using a capacitor filter. Then the output across the capacitor is the 12V dc. But the microcontroller works on 5V dc .To convert 12V dc into 5V dc, a regulator (7805) is used. The output of the regulator is constant irrespective of the input voltage. The microcontroller requires the reset logic circuit for protection of the internal program and internal clock in case of power failure. The reset logic circuit contains one capacitor and a resistor.

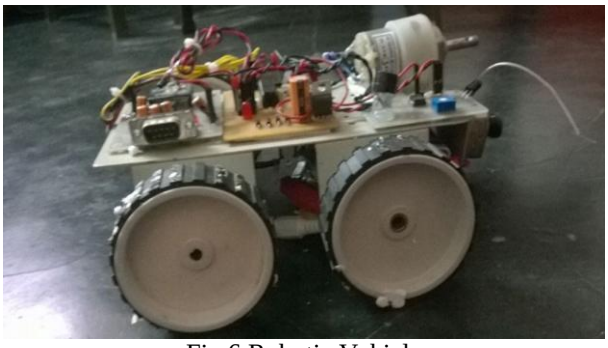

Fig.6 Robotic Vehicle

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 4, April 2015

The flame sensor senses the light intensity of the flame within the room. The sensor will give information to the micro controller if it senses flame. The microcontroller pin bit will go high when fire is present. The fan rotates thereby extinguishing fire. The microcontroller will always scan the input signal of sensor. If the sensor give the data about fire to the microcontroller, the motor is activated hence the fan rotates. The buzzer provided to the circuit sounds, activated when the flame is detected by the sensor. The microcontroller drives three motors. Two motors are used to provide movement to the Robot to move in forward and backward direction respectively to reach the destination point and the third one is used to drive the fan. After extinguishing fire the robot will go back to the original position on giving commands.

V.RESULT AND DISCUSSION

The robotic vehicle, i.e. transmitter section and the speech recognition module, i.e. receiver section had been designed and the programs were burned into both the Pic microcontrollers at receiver and transmitter section. The project is successfully tested for all the voice commands and it also detected the fire with the help of a flame sensor. Once the flame is detected, a buzzer is activated and a motor drives the fan. Instructions can be given through the speech recognition module. The speech recognition module converts their speech to commands. The commands used here are 'Forward' for forward, 'Backward' for backward, 'Right' for right and 'Left' for left movement of the robotic vehicle. The command 'Down' is used to stop the robotic vehicle and 'Up' command is used to extinguish the fire. A camera is provided to get the live video feedback of the room for the smooth movement of the robot.

INPUT	OUTPUT
Forward	Forward
Backward	Backward
Left	Left
Right	Right
Up	Extinguish
Down	Stop

Fig.7 Experimental Result

VI.CONCLUSION

We have presented a live video feedback wireless controlled fire extinguisher with a speech recognition module. The security system of the home and building contains fire fighting robot security vehicle, zigbee module and speech recognition module. The main controller of the fire fighting robot is microprocessor. We program C language to control the robotic vehicle to acquire flame sensor data, and run the vehicle towards fire by giving directions using speech recognition module. Once the flame is detected by flame sensor, buzzer is activated. The fan is activated in automatic mode. In the case of manual mode, flame is not sensed. The user have to give the necessary commands to operate the fan through speech recognition module in case of fire.

REFERENCES

[1] Boo Siew Khoo, SiewWen Chin, Leong Yee Soo, Edwin Chuah, " FireDroid- An Automated Fire Extinguishing Robot", 2013 IEEE International Conference on Control System, Computing and Engineering, 29 Nov. - 1 Dec. 2013, pp: 356 – 360.
[2] Su, K.L et al., "Automatic Fire Detection System Using Adaptive Fusion Algorithm for Fire Fighting Robot", Systems Man and Cybernetics, 2006.SMC '06.IEEE International Conference Publications, vol.2, no.7, Oct.2006, pp: 966-971.
[3] Sang-Uk Park et al., "Wireless image communication system for firefighting robots", Computer and Automation Engineering (ICCAE), IEEE International Conference Publications, vol.3, Feb.2010, pp: 254-256.
[4] Tong feng et al., "An ultrasonic obstacle avoidance system for fire fighting robot", Intelligent Control and Automation, IEEE International Conference Publications, vol.2, 2002, pp: 1219-1222.
[5] Avanzato et al., "Fire-fighting mobile robotics and interdisciplinary design-comparative perspectives Pack", IEEE Trans. Education., vol. 47, no. 3, Aug. 2004, pp. 369-376.
[6] Sampath, B.S., "Automatic fire extinguisher robot", Ubiquitous Robots and Ambient Intelligence (URAI) 2011, 23 Nov.-26 Nov. 2011, pp: 215 - 218