Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 4, Issue. 3, March 2015, pg.353 – 359

RESEARCH ARTICLE

Design of an Intelligent System Operating Based on Radio Waves for Detecting of Gas Emissions

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Abstract— This system can fully prevent from human and financial losses that may cause by a variety of toxic and flammable gases. Its application of this system is in residential, commercial office, factories and etc. The mechanism of system is by radio waves. This system for preventing probable risks simultaneously cuts the electricity and gases of selected environments, the horn of alarm risk brought to sound, and automatically conditioning the ambient air.

Keywords— Fire Suppression; Radio Waves; Intelligent System; Gas Emission

I. INTRODUCTION

Fire is one of the most common operating that annually causes the Fatality and financial damage in homes, factories and commercial centers [1]. Another reason to control gas leak and prevent of fire through this way is that in most cases can be cause poisoning and death, that this damage is irreparable. Because it is the most important asset of any office or factory is manpower.

The concept of fire can be well understood and explained using a simple model called the Fire Triangle [2, 4]. As seen in Fig. 1 the fire triangle the three factors contributing to cause a fire are:

- **Heat or Sparks**
- **Fuel materials**
- **Oxygen or Air**

A fire is caused if all the three factors are present in mixture in the required concentration. Reverse is true for stopping the fire to happen i.e. if any one of the factor is eliminated or the concentration of any one can be kept below the required level then fire can be eliminated.

Fig. 1 Fire triangle diagram.

▪ **Heat or Sparks**

- Heat is a common ignition source.
- Ignition sources are plenty
  - Although we can eliminate ignition sources, it is almost inevitable that an ignition source will be available if there is a large release of flammable material that cannot be diluted quickly.

▪ **Fuel materials**

Typical cases where fuel occurs are – if there is a leak, during filling operations, transfer operations, or excessive dusts [5].

- Although we often cannot always eliminate these sources we can reduce the possibilities by having good ventilation to keep vapors from building up.
- Often we locate things out-doors, use grating on floors so vapors don't build up.

▪ **Oxygen or Air**

- Oxygen is the most common oxidizer, especially that found in ambient air.
- For oxygen, we often use "inerting" with nitrogen, helium blankets over flammable materials to reduce O2 content below that where you can have combustion.

As mentioned, if one of these factors is eliminated; the fire did not occur and in the system that we want to introduce, we can almost completely remove the heat and sparks agents. Almost the heat and sparks creates in two ways:

- **Electric Current (Switching – short circuit and current…)**
- **Gas Supply System (flame heater…)**

In this system before the fire, both of the factors are inhibited, the horn of warning alarm aware of the attendee from the potential risks and also quickly ventilate the ambient air and it can be said certainly prevent the each fire caused by gas.

II. METHOD OF IMPLEMENTATION

Points to be observed in practice (Fig. 2):

A- This system can be protect the environment and people from more than 20 types of flammable toxic gas and fumes emissions from fire. Type of gas detection depends on the type and number of differential sensors. (For example, General combustion gases such as LPG and low pressure of natural gas are considered like Methane, propane, butane with TGS813 sensor [3].

B- Tank outlet valves and gas piping used the electric type.

C- Since the power consumption is very low, Rechargeable batteries are used for power supply circuit and transmitter and in time of power outage, the system continues to operate correctly.

D- After fuse for protecting environment placed the decreasing Trans and Diode Bridge for supplying the separate power receiver.

E- The receiver has four electronic relay circuits that each relay is supply with a 12 volt Dc power and also has an open and closed blade and has the ability to pass voltage to 220 volt AC [6].

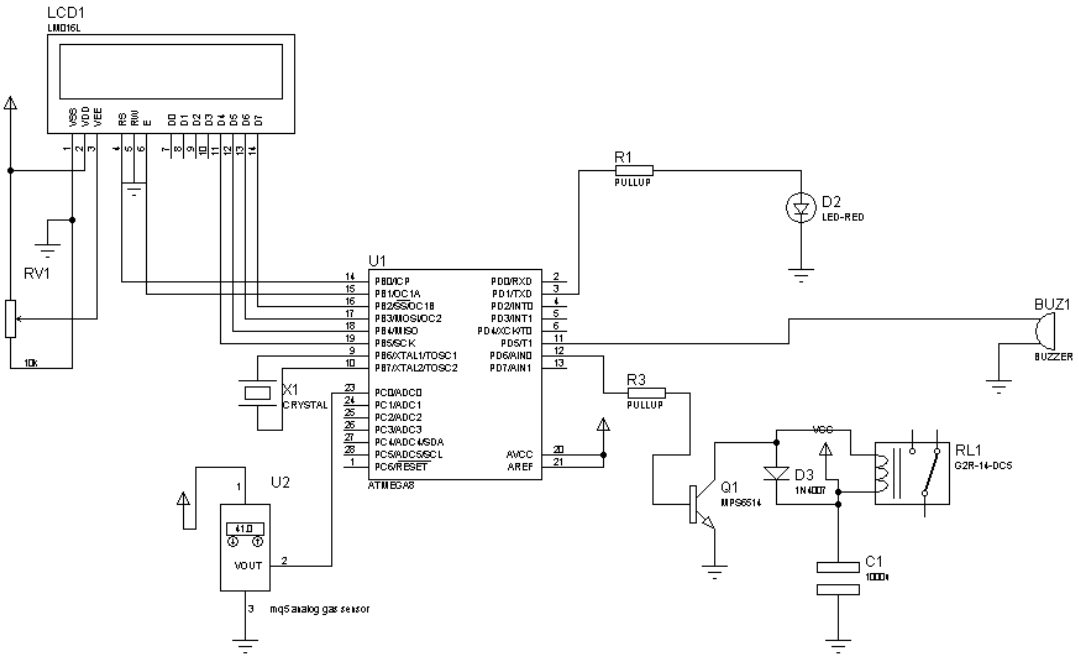

Fig. 2 Circuit diagram of an intelligent system for detecting of gas emissions.

III. THE DESIGN AND OPERATION OF PROPOSED SYSTEM TOPOLOGY

The sensor is to be installed based on the location and needs (Detection of gas) to detect the presence of gas in space. After realizing the presence of gas in the environment, the orbit sensors act and Infrared LED illuminated and to adjacent infrared receiver circuit send the command of contact relay that located in radio transmitter power supply next to IR receiver and the transmitter will start to send a signal (Fig. 3). The receiver circuit receives the frequency. Now, several things will happen (Fig. 4) [7, 8].

1- The receiver circuit to close blade Electronic relay number one by considering the need after fuse and after the Power transformer, the receiver located in factory or homes or Administrative offices and given the outage power of desired location.

2- Whenever the power is cut off at any part or the whole building, the electronic valves of desired places is also cut that prevent the entering the fluid or gas thorough gas system into the environment .

3-one warning alarm that supply with battery rechargeable or transformer and bridge diode locate at any necessary part of environment. The first recipient of open blade put in on the way that by commanding receiver the embedded warning alarm in system will be sounded and aware of people from probable risks [9, 10].

Note: the supplying of warning alarm should be only by two cases, otherwise, by cutting the power of desired location the warning alarm also cut and audio warning circuit does not work.

4- It is branch supply from the phase and null along the main fuse and its phase wire passes through the second relay of open blade with null wire separately is joint to the ventilation fans in environment that this fans start to work with radio receiver command and relay contact number two and free from the ambient air from any type of gas.

Note: the ventilation fans only install in prescribed method otherwise in time of probable risk by cut off power, the ventilation fans dose not work.

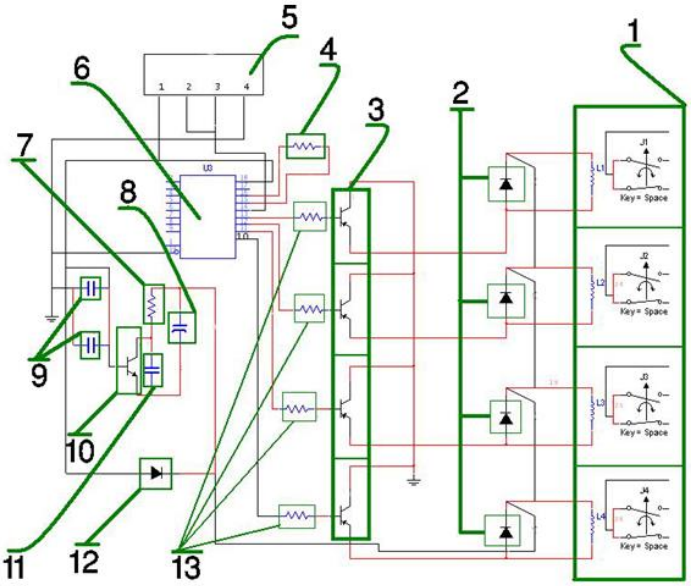

Fig. 3 The diagram of radio receiver circuit.

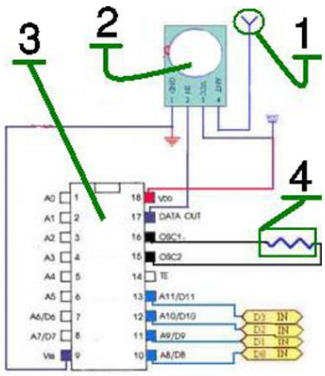

Fig. 4 The diagram of radio transmitter circuit.

IV. SPECIAL ACHIEVEMENTS AND APPLICATION OF PROPOSED SYSTEM

1- The Complete protection of buildings of commercial, industrial, residential, office against any fire that caused by a gas.

2- To prevent poisoning and death of people caused by toxic gases.

3- In factories and industrial centers if gas leaks or fires occur and it is not possible to approach the accident site, this system quickly detect gas leak and smokes and automatically shut off the main valves of inlet gas system.

4- By this system, needs to fire fighting system is very low. Because as soon as the existence of gas or smoke from fire in environment quickly cut the electricity and gas system and the warning alarm is sounded and in the same time ventilate the ambient air that implementation this steps for protecting the fire is so effective. It should be noted that the fire-fighting system is very expensive compared to the system.

5- Protect homes against fire appliances: The system detects smoke from a fire and shut the electricity and gas systems of homes (that this work for preventing the fire spread is so beneficial) and operate the air conditioner and important from all of above, aware people from fire.

Note: when the system cut the home`s electricity, actually prevent the power (fire agent) to the afire applicant (Fig. 5).

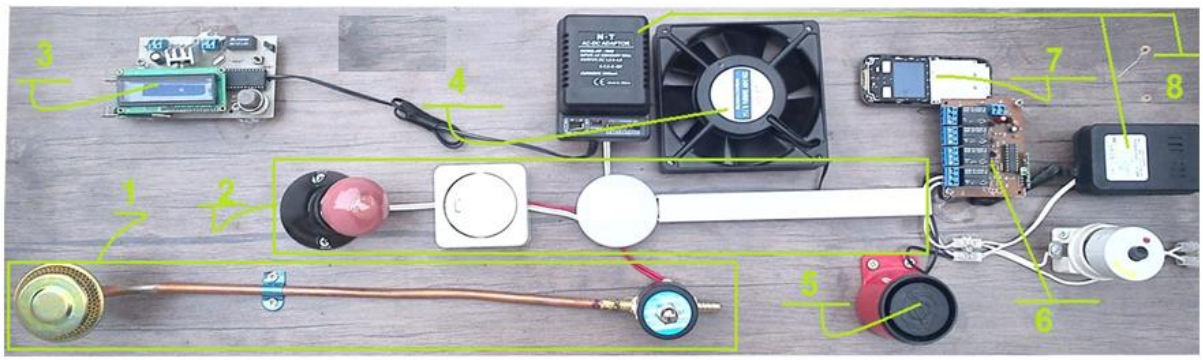

Fig. 5 The example of implementation system.

V. THE PROPOSED HYBRID TOPOLOGY OF FACTS DEVICES

The importance and benefits of this system:

- ☒ Prevent and deal with all kinds of fires caused by gas factor and Synthetic of electrical Appliances.
- ☒ The price of project in comparison to other systems is cheap.
- ☒ High sensitivity and fast reaction system.
- ☒ Prevent from poisoning and death cause by gas emission.
- ☒ This system launches automatically but shut off manually that this means aware of people from the probable risks.
- ☒ The full Protection of the environment and people against gas.

ACKNOWLEDGEMENTS

The authors acknowledge financial support from Department of Electrical Engineering, Beyza Branch, Islamic Azad University, Beyza, Iran.

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