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Simulation Design of Improved Smoke Detection Circuit

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Abstract:

It is a natural phenomenon and human tendency that many times people neglect to shut off domestic utilities such as lights, fans and home appliances like gas stove, gas heater before leaving their home due to their busy schedule and/or related jobs. This can often lead to accidental short-circuit and fire incidents. The proposed paper aims to detect and alert the owner / security from the prevention of these unforeseen disasters by properly installing fire detection sensors at appropriate locations in the house. The device senses the occurrence of fire and accordingly modifies the level of logic at the sensor's output pin and performs additional tasks by giving an alarm to make appropriate safety measures. Many researchers have presented their work on similar lines but present work is implemented using Arduino (ATmega328p) and Flame sensor. Here an effort is made to make use of the current technology in terms of cost, speed and portability, replacing quite old methods. The circuit's job is to make a sense and send a warning signal while the site catches fires and releases flames. The simulation developed performs both as fire detection system and also as an Automatic Fire Alarm system.

Keywords: Arduino**,** Sensor**,** LED**,** Automatic Fire Alarm.

I. Introduction

There is a continuous monitoring and regulation of home appliances in today's world. It is a common tendency and human nature that many times people fail to turn off domestic utilities such as lights , fans and home appliances such as gas stove when leaving their homes due to their busy schedule and/or related jobs. This can often lead to unpredicted short-circuit and fire accidents. Circuits for fire detection in industries, homes can save people's lives and prevent enormous damage. Therefore, fire control must be used to avoid fire incidents at home and short circuits too. Therefore fire detection using an Arduino microcontroller can help society save human lives.

Authors simulated using fire detection software testing tools. Rapid response to smoldering flames, low fault rate was the design strategy [1].The work is confined to resolve the issues faced by employees at factories during the periods when fire breaks out. They proposed a device using Raspberry Pi 3 which can detect fire and provide information on fire areas. To catch the fire event, the Raspberry Pi controls several Arduino boards which are connected to several motors and cameras. In [2], they addressed the latest technologies which can be used to minimize extremely unfortunate fire-induced accidents.

The fire controlling tool helps in protecting assets along with the company in case of fire to minimize fire in the building and industry. The basic function of a smoke detector is to identify increasing flames in well-timed intervals and trigger the people present in the premises to be informed of an immediate evacuation by alarm [3].

As per [4], the basic aim of the Smoke detection design is to improve people’s life and, in most buildings, the next safety concern is resources, the smoke detection system is the fastest way to extinguish fire, the rate at which the smoke is identified is very critical as the quicker the smoke is identified the good opportunity of extinguishing the fire. These types of systems are useful to act automated to avoid the hazards without disturbing the functionality of the equipment and researchers have explained it in a proper way but with small limitations. Smoke identifying systems which are self-monitoring and are capable of initiating both sound and pictorial warning in a home are therefore necessary.

Smoke detector was evaluated as a fundamental component of modern commercial and residential building's successful fire detection strategy is addressed in [5]. Industries reported large usage of fire detectors in the 1970s and this development was followed by many major research projects that validated the life-safety protection offered by smoke detectors, thus providing significant evidence supporting increased use of smoke detector. This type of system has to be studied properly to understand the type of hazards it can avoid and also the type of methodologies that can be replaced in future for the betterment of the purpose. A very fine smoke detection methodology or strategy is needed in various hazardous conditions to overcome the inherent problems that may arise due to functional changes in the components utilized. Smoke detection program is used to estimate smoke detector reaction [6].

From the article provided in [7], it is reported that "fire loss data shows that 96 per cent were managed and extinguished by these systems in buildings with automatic sprinklers". If there is a fire, the alarm is triggered by the fire detection system which activates the automatic sprinkler system. Installation of a fire protection system in any commercial building is very important [8].

There are issues accompanying automated fire finding methods ascending from improper methods for rapid notification, tolerant of fault sounds and various types of sensors [9]. Various parameters of importance also have to be considered along with the avoiding of the situation and the parameters of the significance have to be categorized to overcome the problems. Researchers researched fire in various settings, such as residential areas and industrial buildings [7], [8], [9].

II. Existing System

The Latest Smoke / Fire Warning System are a fire alarm that has certain requirements in place. The fire alarm is a device that alarms people by sound. It is a device that a person must operate. It is used in factories, hospitals etc. But it has many drawbacks. It cannot meet requirements such as automatically sensing the flames. The major drawback is that when the fire happens, it cannot immediately warn the people. This system takes a lot of time in helping to alert people. It requires huge manpower. Such a fire alarm is shown in Fig.1.

Fig.1: Fire Alarm

III. Proposed Design of Automatic Smoke Detection Circuit Using Flame Sensor

The proposed design application for smoke/fire detection will maintain all requirements necessary in the present world. This system is developed using an Arduino (ATmega328p) and Flame sensor. The designed circuit helps in sending a message to sound an alarm using a buzzer automatically. It also has an additional feature like Flame sensor which senses flame automatically. The proposed design is shown in Fig.2

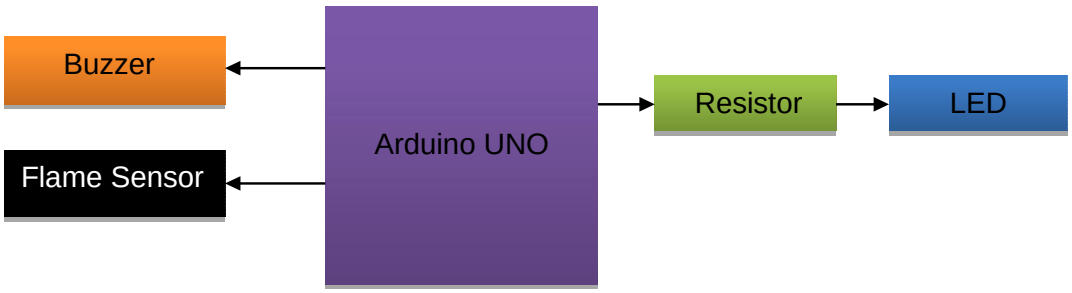

Fig.2: Block diagram of Automatic Smoke Detection circuit using Flame sensor

IV. Software Requirements in Implementation

The software used for monitoring flame sensors is an Arduino IDE platform application. It is used to write and upload programs to Arduino compatible boards. Once the required commands are uploaded, they are configured to give the wanted mechanism of actions as per the need and requirement of the work. This software supports in areas operating fire detection mechanisms, buzzers etc. The software GUI is shown in Fig. 3.

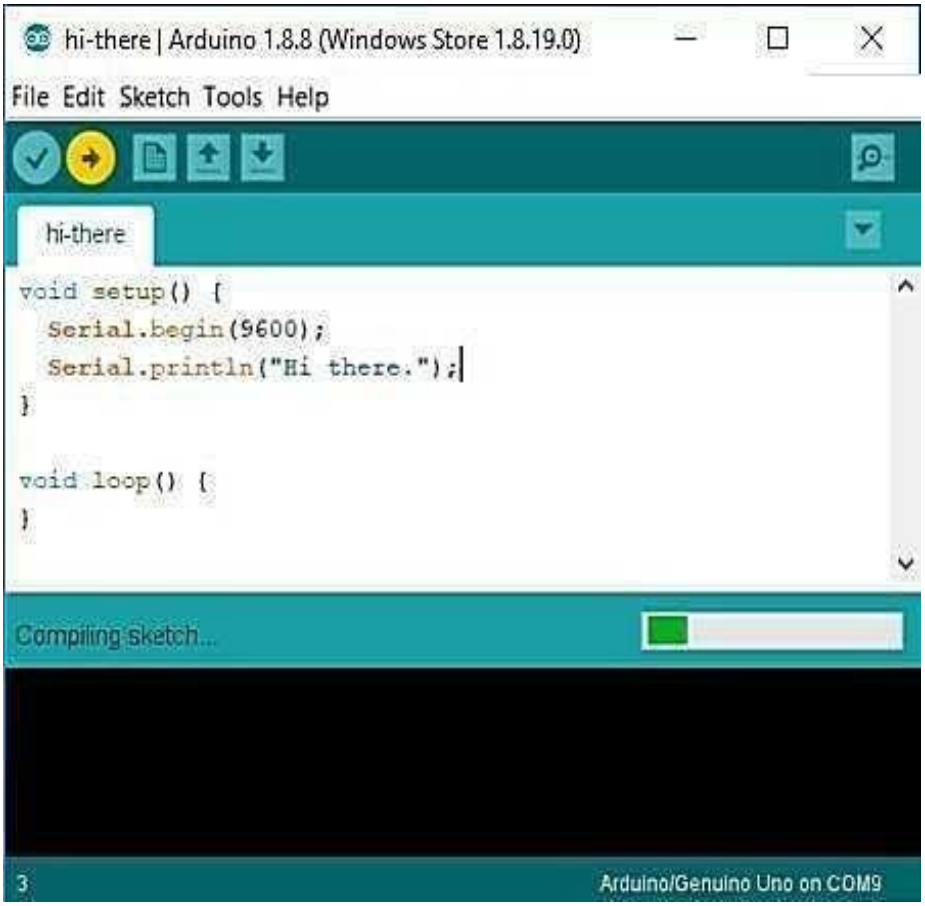

Fig.3: Arduino Software Application

V. Flow Chart of Fire Alarm

The flowchart of the process is shown in Fig.4.This explains the flow of the entire work depending on various modules and their inherent characteristics. The main decision factor is the flame here which decides the flow of the entire work.

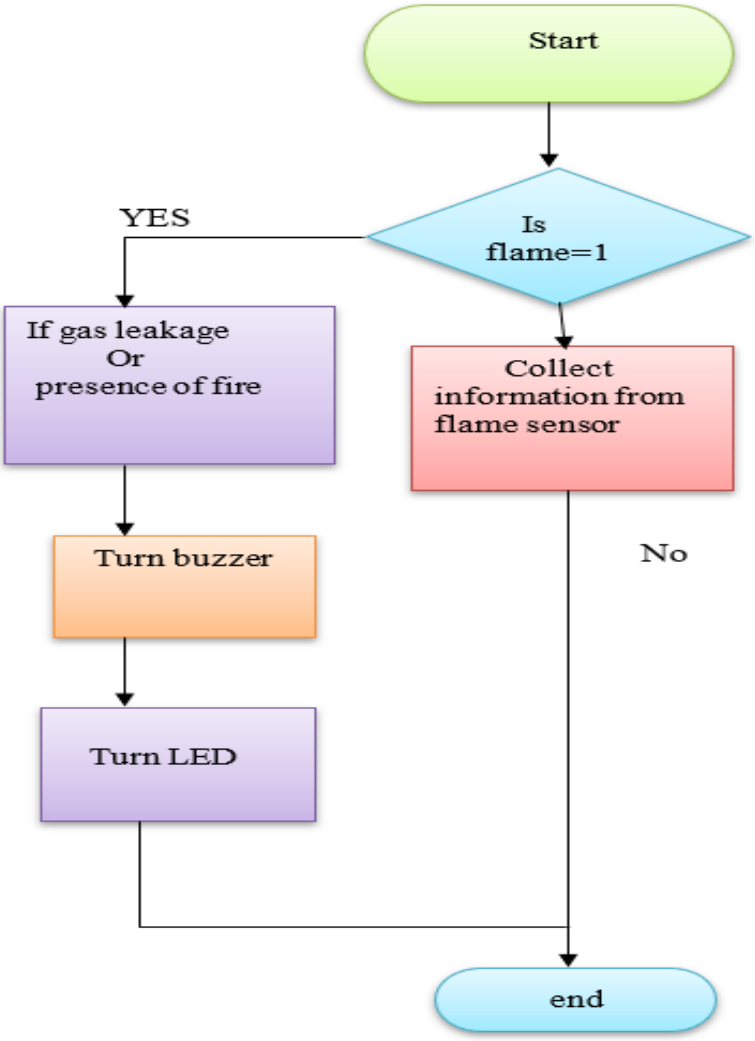

Fig. 4: Flow chart of the Process

VI. Results

The complete test setup for automatic fire detection using flame sensor is shown in Fig. 5.

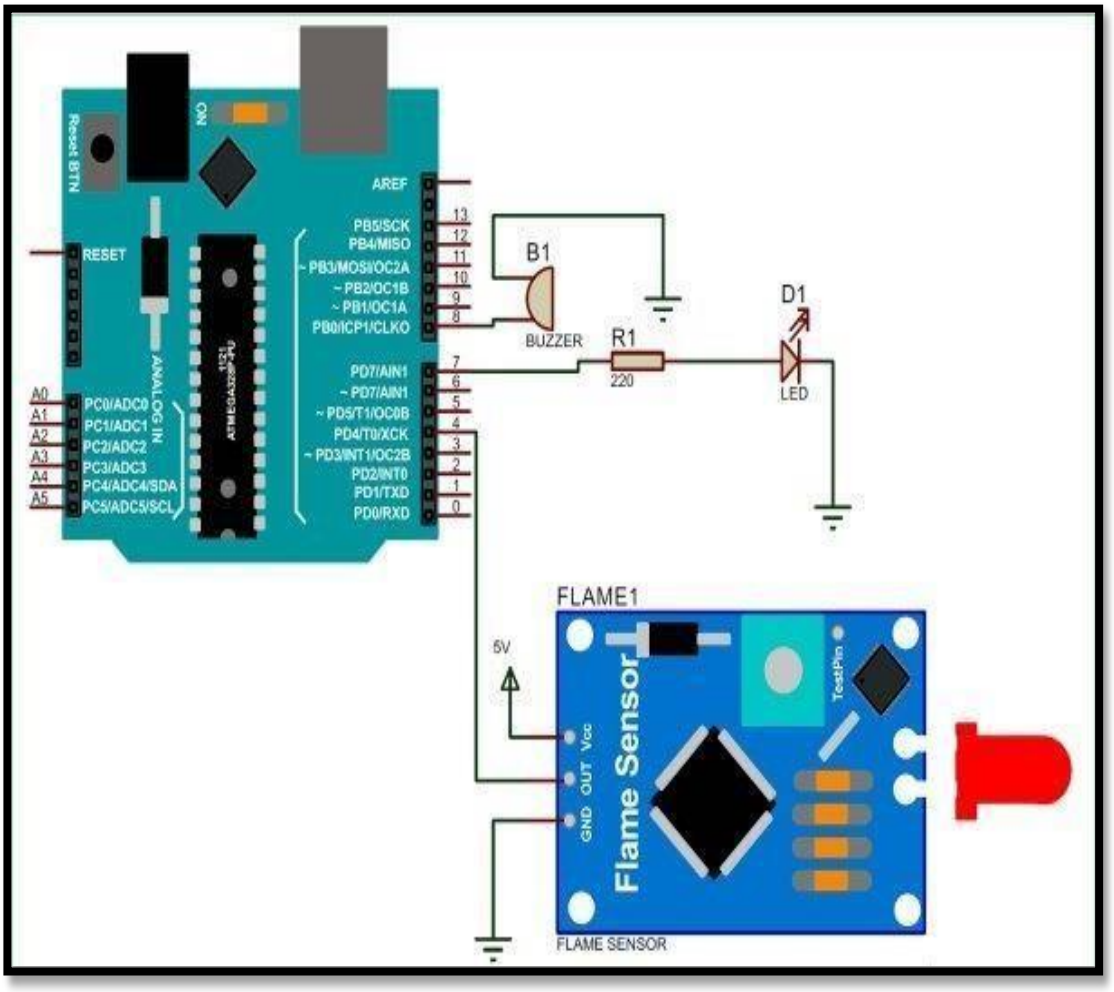

Fig. 5: Setup for proposed system

The software for the required operation is loaded on to the Arduino microcontroller. During the instances of fire the circuit senses and makes people alert through buzzer by sound in reality. The flame sensor senses the presence of a fire or flame depending on the wavelength of the flame emitted by the Infrared (IR).If a flame is detected it gives logic 1 as output, otherwise it gives logic 0 as output. Arduino Uno tests the logic level on the sensor's output button, and performs additional tasks such as triggering the buzzer and LED, sending an alarm.

VII. Conclusion

The proposed work is an automated smoke detector that allows users to monitor fire at home / office by means of a flame sensor, and communication is conducted via buzzer using Arduino Architecture. Along with Buzzer is also implemented is LED which indicates a HIGH / LOW signal .Moreover, it helps to prevent property loss, since doing this it reduces man power. More about our prototype to be implemented with low cost is achievable. Authors would like to provide the solution for Robot Fire Detection in the future. The main aspect of the system is to improve the features of fire detection to prevent failure due to lack of alertness in man, delay in reaching the fire accident site. Additional hardware will also be implemented in future.

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