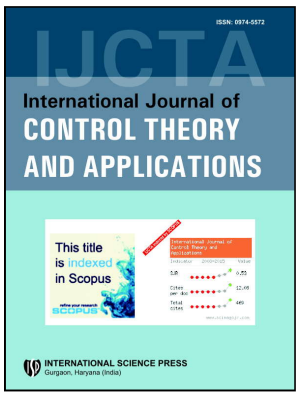

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Fire and Fumes Detection Robot

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Abstract: This project aims at the inspection and monitoring of the industries which involve high risk factor. Industries that produce flammable chemicals or deals with high temperatures comes in a radius of such high risk work places. Therefore, they involves continuous monitoring of the area to sense any kind of change in temperature or change in the composition of air. The area is continuously inspected while the robot moves according to the dimensions fed in the robot. .The robot sends the temperature and gas readings continuously to a http link which is being observed by a human. As soon as the robot senses any unusual change in its surroundings i.e. detects any presence of gases like CO2 and NO2 or fire, it will set an alarm and send a warning to the person continuously analyzing the feedback thorough GPRS. This helps in before time awareness regarding the surroundings and maintain a safe place for the workers to work in. Also it keeps a check of the kind of gases the workers are dealing with therefore, it ensures a healthy and safe environment for the workers.

Keywords: monitoring robot, gas sensing bot, FiFuMoRo1.0, Inspection robot, Industrial safety robot, Bodyguard

1. INTRODUCTION

The world has witnessed some of the most horrifying industrial accidents that have left generations after generations in fear and agony. Some of the accidents have left such an enormous impact on the world that it is next to impossible to forget those mistakes. Industrial mishanter leads to chaos all over and is a complex process leading to social and economic imbalance [5].

People have given numerous theories related to industrial mishaps .One of the theories proposed is known as “The Domino Effect”. In this phenomenon, the author says that similar to a domino stack, where collapsing of one domino leads to collapsing of all the other dominos, the occurrence of one mishap in an industry can cause a lot of other disturbances before we know it especially in a chemical industry [4].This effect can be experienced in those industries which deals with toxics or explosives where one bad step can lead to a large scale disaster. To avoid such accidents, new technologies were developed to increase industrial safety.

People took help of innovative technologies and sciences in Mechatronics and took help from robots to do their task more effectively and efficiently. This not only lessen the burden on human labor but also reduced

the injury risks [6]. New technologies with immense supervision and control are being designed just for fulfilling one motive which is human death reduction. The world witness road accidents every minute around the globe and the reason is either lack of awareness or lack of safety equipment worn by the person. The most horrendous of the accidents are considered to be in two wheelers and reason behind is mostly due to lack of safety gear like helmets. Therefore technology again steps in to prevent deadly accidents from occurring again. The idea was to make a RFID and FSR based system which allows the vehicle to start on the condition that the person must wear a protective helmet gear. If the helmet is not worn, the vehicle will not start [14].Sensors are also used in home automation which allows to vary numerous parameters like humidity , light, temperature etc. So to save energy and electricity , people have developed hybrid control methods using sensors and PID controllers for controlling humidity and Light sensitivity for a room based on RF control methods[15].People have used robots for security purposes in homes for detection of presence of gases , fire and even intruder alert using GSM and RF interfacing or other means which can alert the owner beforehand[8-11].One of the ideas involved a robot consists of three sensors which are ultraviolet, temperature and smoke sensors which are used for fire detection by applying Taylor method in which it compares equations of different order and is further used for better fire recognition analysis and moreover displays it for user using Internet via GSM [1]. This process is complex which involves various algorithms that can be difficult for a lay man to understand. The other paper describes the reduction of uncertainty of fire detection by using infrared sensor and vision images given by computer which is fitted on a UAV.In this method, data association is a main problem.[2].Moreover , UAVs cannot be used in industries as they require an open space to operate.Ishida proposed that different number of gas sensors are present on a robot and using the input of sufficient gas sensors , comparison between different readings is made to find out where the actual gas leakage is present .This method increases the speed of detection and is faster than conventional methods .[3]. Robots with cameras and airflow sensors as well as gas sensors are also developed which looks for individual object and checks for gas leakage. Although this method is next level, it is also very time consuming [7].Other robots involve early phase of smoke identification which reduces the accident risk [10].

2. PROPOSED ALGORITHM

The system of fire and fumes monitoring robot consists of following main parts:

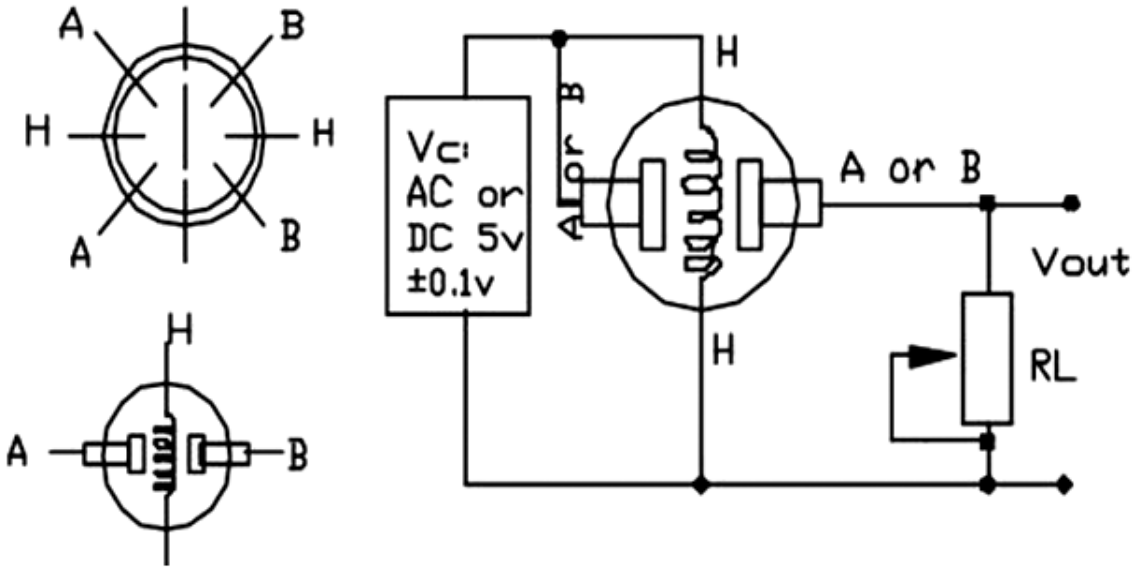

Figure 1: symbol and circuit of gas sensor

Gas Sensors: This sensor senses the change in composition of gas present in the environment. MQ-135 is one type of gas sensor which senses the composition of noxious gases which includes NH3, NOx, smoke, benzene, alcohol etc. It gives both digital and analog output.

The supply required for the sensor is +5V.

Temperature Sensor: Temperature sensor senses the change in temperature of the room. LM35 is the most widely used temperature sensor as the range of the sensor lies between -55°C to +150°C. It has low self-heating therefore the probability of error occurrence is low.

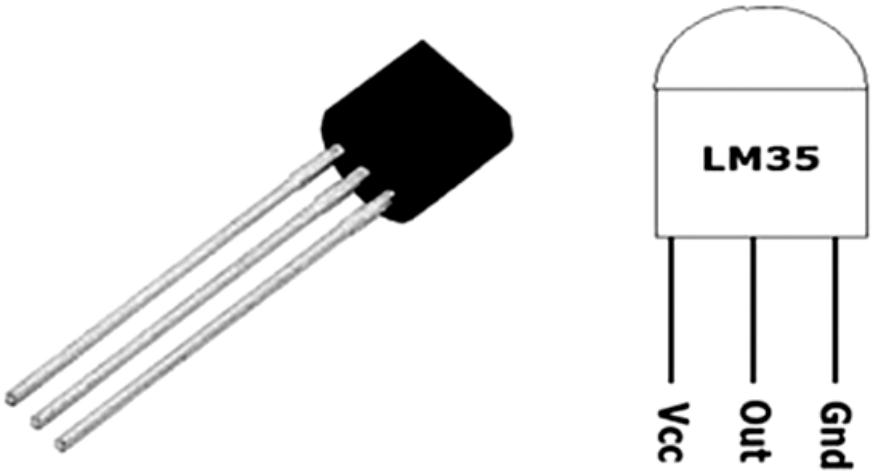

Figure 2: Temperature sensor symbol

IR Sensors: IR sensors are used to avoid any obstacle in the pre-defined path followed by the robot. If IR sensor detects an obstacle, a command is sent to the controller that stops the robot on its position. Once the obstacle is removed, the system continues to move on the path.

Encoders: Encoders are used to follow the pre-defined path. The distance to be covered is converted into number of revolutions and is feeded into the encoders. The rays are passed through the spaces between the spikes of the encoders. Once the given number of revolutions is completed the system is programmed to turn left or right as per the requirement

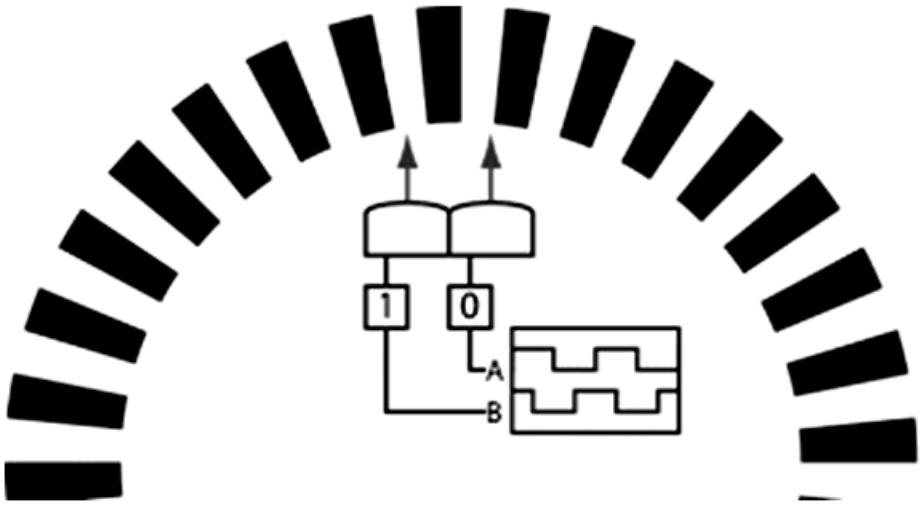

Figure 3: Encoder working

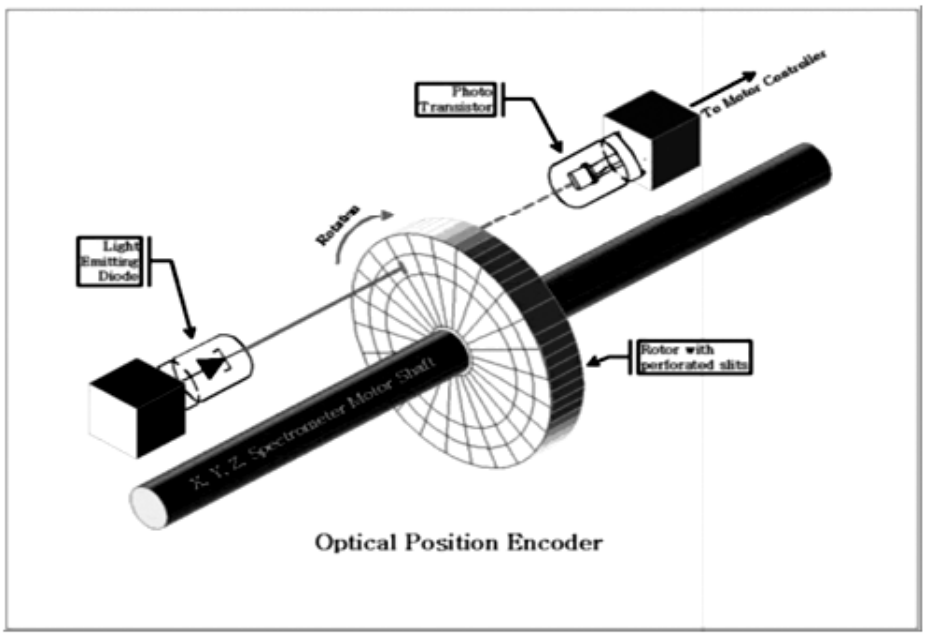

Figure 4: Optical Position Encoder

2.1. Server Description

The results or readings recorded by the gas and temperature sensors are displayed on LCD as well as on the specific internet protocol. The readings are sent to the website using GPRS that will use SIM 900.

2.2. Autonomous Mode

The robot works only in autonomous mode and continuously monitors the area to prevent any life loss. The system is programmed by using Arduino UNO. The distance to be travelled as well as the directions are feeded into the robot through programming of Arduino.

2.3. Architecture of the system

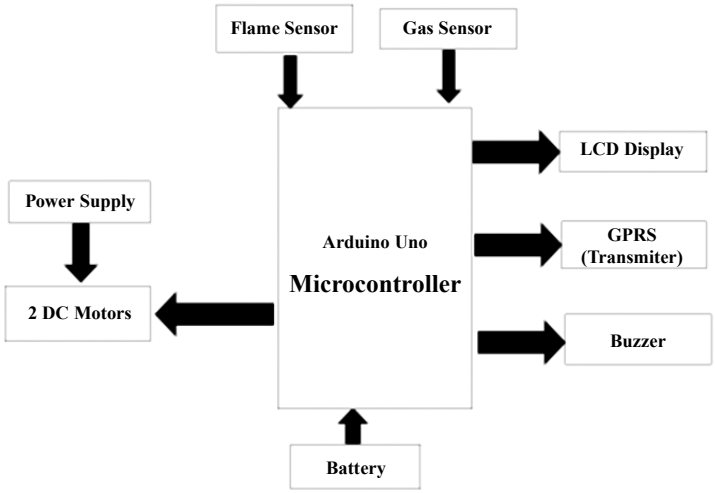

Figure 5: Block diagram of Robot

2.4. Circuit Digram

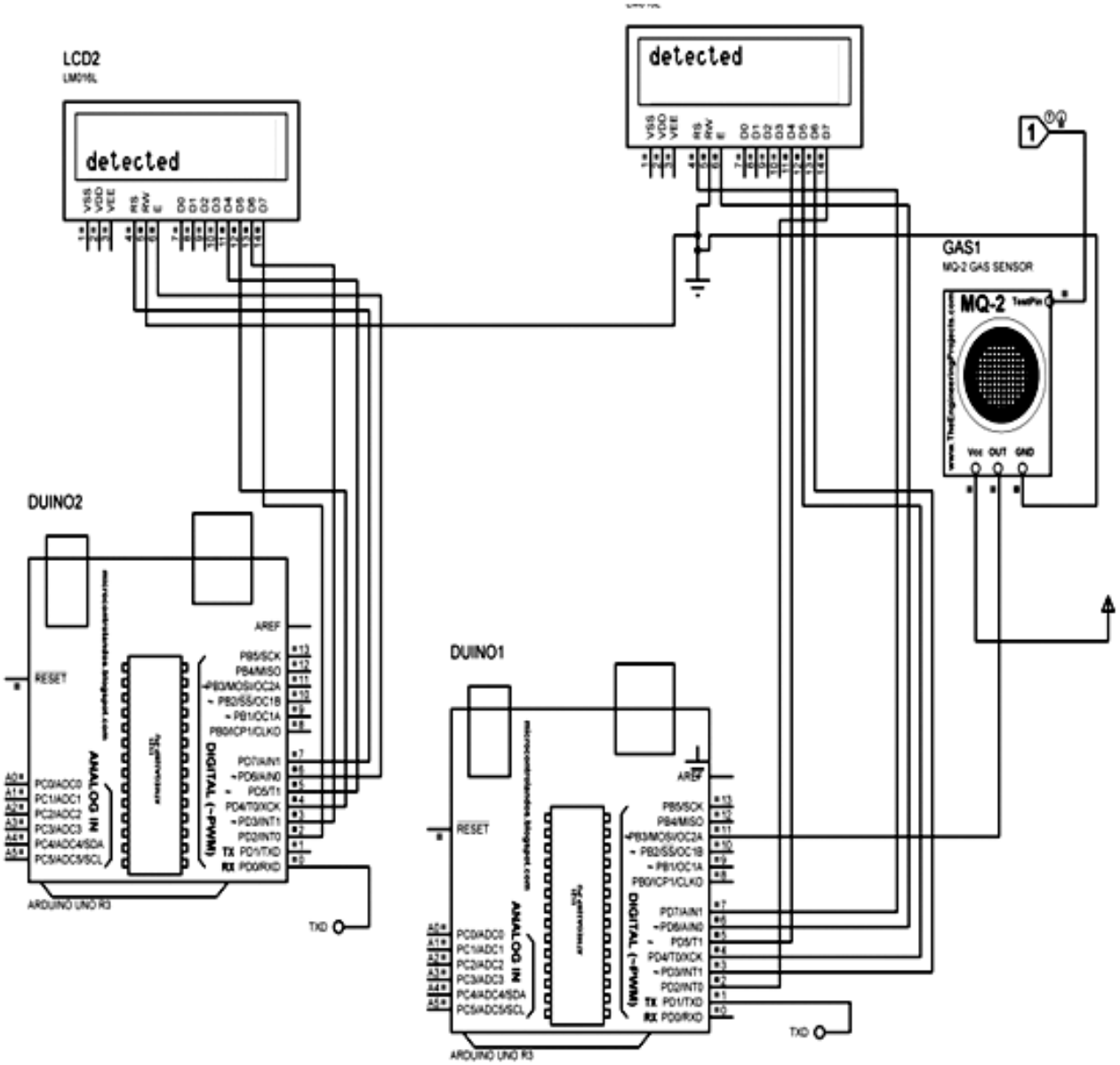

Figure 6: Proteus circuit design for Gas detection

3. EXPERIMENT AND RESULT

The following circuit in fig 6 and fig 7 is successfully tested and simulated on Proteus software as shown in fig 8 and fig 9. This test successfully show the working of our model in which the sensor readings in transmitter Arduino is received by the Reciever Aduino and same data is displayed on both the LCDs.

3.1. Proteus Design

4. CONCLUSION

By making a fire and gas detection bot, we can monitor the temperature and atmosphere change continuously and thereby preventing the mere reason of ignition , hence it will not only warn when temperatures will rise but also

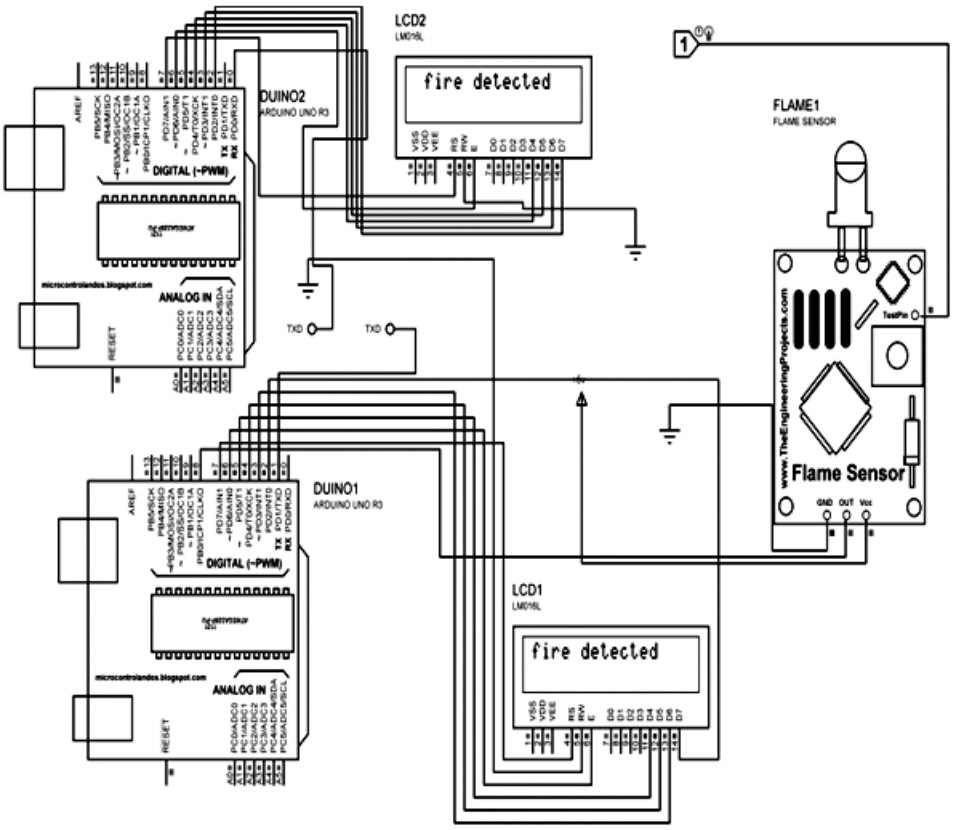

Figure 7: Proteus circuit for flame detection

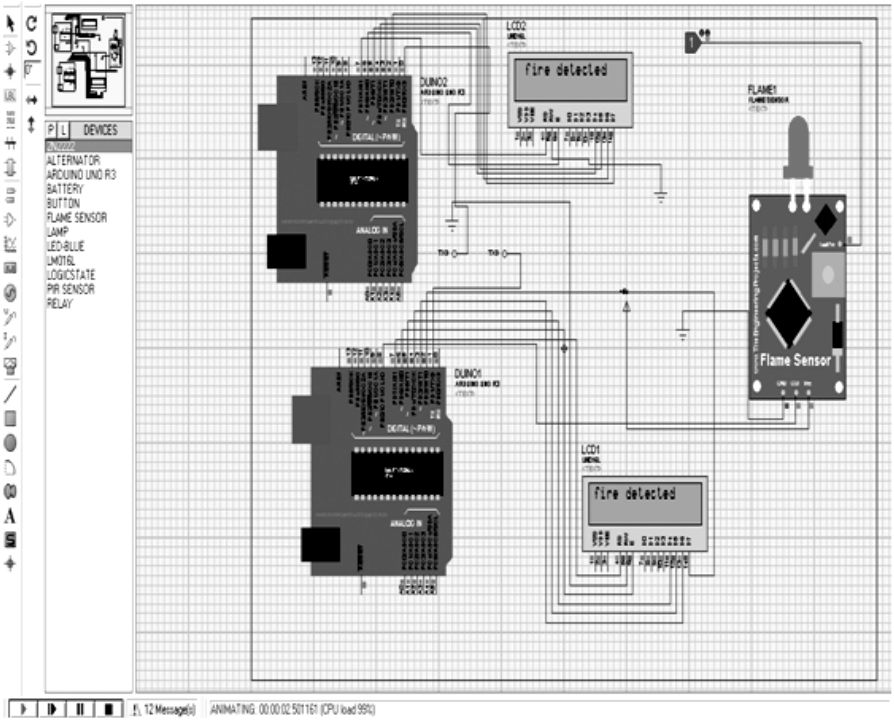

Figure 8: Proteus Simulation on detection of fire

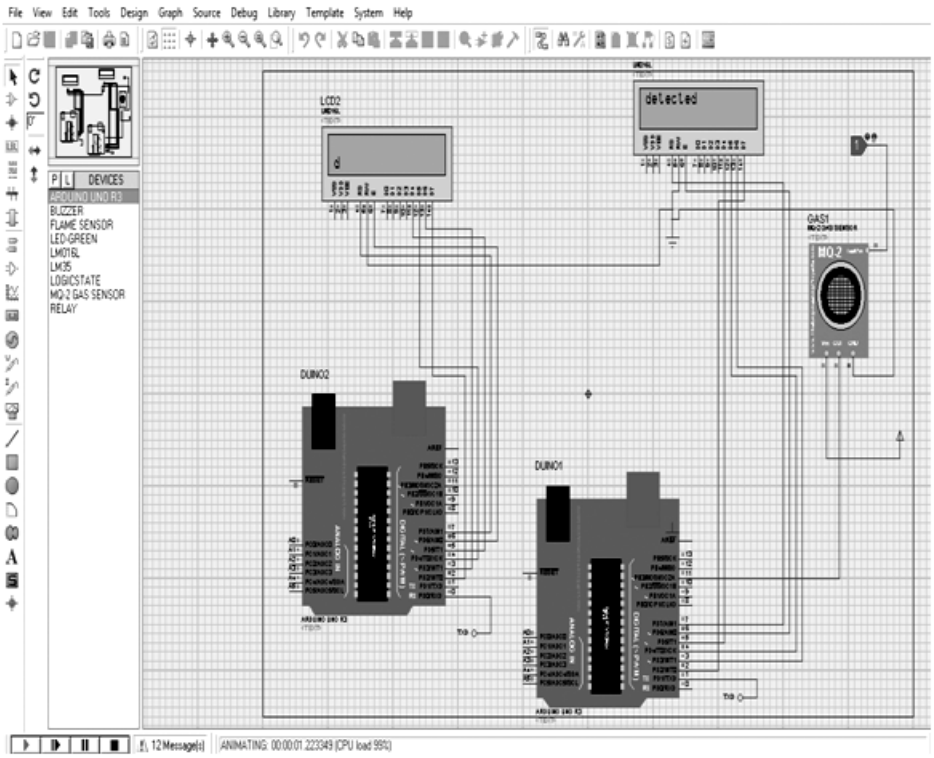

Figure 9: Proteus simulation for gas sensor

keep a regular check on the air composition detecting toxic gases if present. This robot can help in monitoring and inspection of industrial areas continuously especially those industries which involve high risk factors like chemical industries, firework industries or all those industries which deal with high temperatures and noxious gases. Further improvement can be made in this project by using a Zigbee module instead of a GPRS. Also , we can further send the warning to fire fighting stations , hospitals and the owner as soon as the temperature seems to rise.

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