PROPOSAL ON FORMALDEHYDE GAS LEAKAGE DETECTOR USING MQ-135 SENSOR IN THE LABORATORY ROOM

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***Abstract* — Healthcare workers in contact with formaldehyde in histopathology laboratories are at greater risk than other individuals. Formaldehyde gas is relatively difficult to detect by the human senses. Healthcare workers in contact with formaldehyde in histopathology and anatomy laboratories are at greater risk than other individuals because they are exposed to higher amounts of formaldehyde on a daily basis, either through inhalation or direct contact with the skin. It is difficult to make measurements of safe levels of formaldehyde gas. Exposure to very high levels of formaldehyde over many years has been linked to rare nose and throat cancers in workers. This project is proposed to design and develop a formaldehyde leakage detector for monitoring and to analyses formaldehyde reading for safety precaution. The component that use is exhaust fan and MQ- 135 as an input, Arduino Uno is the processor that control the input and output, and for the output are buzzer, red alarm light and LCD display. As a result, exhaust fan will absorb air in surrounding into the box device, then the buzzer and red-light alarm will trig to give alert to the people in the laboratory if leakage occur to 10ppm concentration in air, when accurately measuring, the proper alarm point for the gas detector and the LCD display will display the information of the leakage if leakage occur. This project will come out successful by detecting the gas leakage. Therefore, it may help the laboratory worker to aware about formaldehyde leakage and help to track the position of leakage and smoothing out their daily work.**

Keywords: Formaldehyde Gas, Alert, Concentration of Gas

INTRODUCTION

Formaldehyde is used widely in medical applications worldwide, including as a tissue preservative in pathology laboratories, as a sterilizing agent, and as a dis-infectant in operating rooms. It is considered an occupational indoor air pollutant because it volatilizes easily and is emitted into the working environment.

Healthcare workers in contact with formaldehyde in histopathology and anatomy laboratories are at greater risk than other individuals because they are exposed to higher amounts of formaldehyde on a daily basis, either through inhalation or direct contact with the skin.

Development of formaldehyde gas leakage detector using MQ-135 sensor in the laboratory room is to develops a circuit that detecting formaldehyde gas leakage using MQ-135 sensor, the buzzer and red light alarm will trig to give alert to the people in the laboratory if leakage occur to 10ppm concentration in air thus the exhaust fan will remove the leaking gas away from the leaking area. Research stated that when accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

Formaldehyde is mostly used in specialized applications as a tissue fixative and embalming agent. Formaldehyde acts as a preservative or a fixative for tissue or cells. Cross-linking of primary amino groups is required for this process. At normal temperature, 4% formaldehyde solution fixes pathological tissue specimens at a rate of around one millimeter per hour.

1.0 Literature review

The aim of literature reviews is to provide commentary on works published by educational publishers of papers and journals on issues connected to and beneficial to the formaldehyde gas leak detector using MQ-135 sensor in the laboratory.

1.1 Introduction of Formaldehyde Gas

Formaldehyde is a colorless gas, flammable and highly reactive at room temperature. In ambient air, formaldehyde is quickly photo-oxidized in carbon dioxide. It also reacts very quickly with the hydroxyl radicals to give formic acid. The half-life estimated for these reactions is about one hour depending on the environmental conditions. It can be emitted slowly into the air because we cannot detect the formaldehyde gas that mix within the air.

Cross-linking of primary amino groups is required for this process. At normal temperature, 4% formaldehyde solution fixes pathological tissue specimens at a rate of around one millimeter per hour. Additionally, additional specialist applications include disinfection and biocide. A solution of formaldehyde in water can be used as a disinfectant, since it destroys the majority of bacteria and fungus, including their spores. It is a vaccination component that is used to inactivate toxins, pathogens, disinfectants, and cure parasites using formaldehyde.

The concentration of formaldehyde which is immediately risky to life and health is 100 ppm. Concentrations above 50 ppm can cause intense pulmonary reactions within minutes. These consist of pulmonary edema, pneumonia, and bronchial irritation which could bring to death.

1.2 Exposure to Formaldehyde and Its Potential Human Health Hazards

Nearly a widely used chemical, formaldehyde is normally present in both indoor and outdoor air. The rapid growth of formaldehyde-related industries in the past two decades reflects the result of its increased use in building materials and other commercial sectors. Consequently, formaldehyde is encountered almost every day from large segments of society due to its various sources. Formaldehyde (HCHO) is an important chemical, widely used not only in construction (wood processing, furniture, textiles, and carpeting) but also in various industries. It is also a byproduct of certain natural and anthropogenic activities.

2.0 Methodology

This chapter explained the fundamental usage of the proposal, which included block diagram, and the device's operation was demonstrated using a flow chart to demonstrate its operation. The product is built using an overview graphic of the device's functionality and a Tinkercad 3D drawing.

2.1 Block Diagram

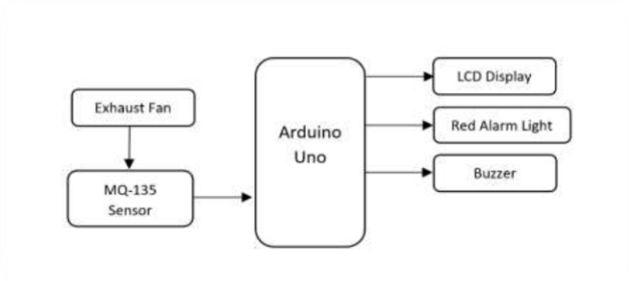

Figure 2. Block Diagram of the proposal

the block diagram consists of a processor, input, and output. There is an exhaust fan and MQ-135 sensor on the input side, while on the processor side, Arduino uno is used and on the output side, there is an LCD display, red alarm light and buzzer. From the input, the exhaust fan will absorb the air into the device that has a sensor which is detect the present of formaldehyde gas. The output will trig the buzzer and alarm light to inform to the workers about the leakage of formaldehyde and the LCD display will display the information of the leakage if leakage occur.

2.2 Schematic Diagram

Tinkercad by Autodesk is an online circuit simulation and 3D design application. It enables the creation of 3D models that can be downloaded and printed with a 3D printer. Tinkercad offers a user-friendly interface and several hands-on trainings designed for novices. Tinkercad Circuits is utilized because it enables the exploration, connection, and coding of virtual creations with an infinite toolbox of simulated components.

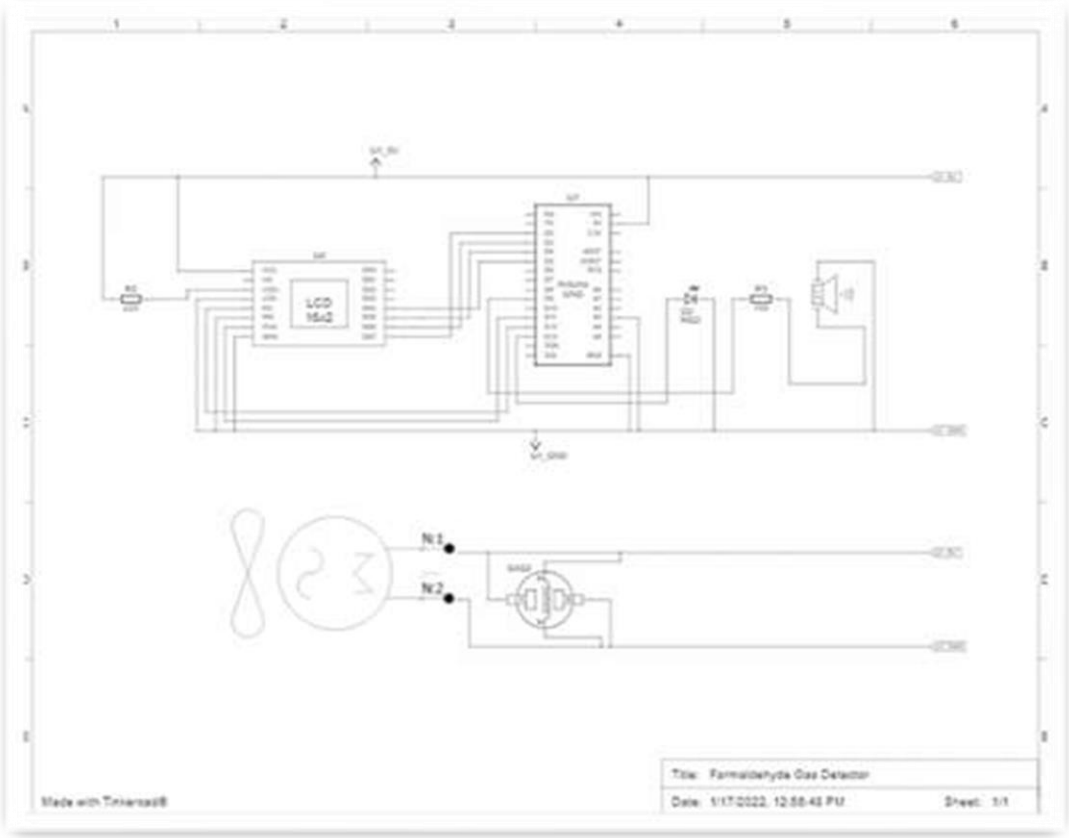

Figure 3. Using Proteus Profes software to draw a schematic

2.3 Circuit operation

The circuit diagram of the formaldehyde gas leakage detector. Exhaust fans have 2 terminal which is anode (+) and cathode (-) to rotate the motor and spin the fan blade. For the anode it connects to the 5V pin for power supply and cathode connect to grounding (GND) pin for safety to prevent an electronic device's chassis from delivering an electrical shock. For the MQ-135 sensor, has 4 pins where each pin has its own function. Each pin consists of a 5V pin to supply the power, a ground pin to protect the sensor from electric shock, an analog pin, and a digital pin to get the reading. For this project, analog pins are used to get more accurate readings. Then, Arduino Uno works as processor to process all the data that receive from the input and issue the result on output based on the coding that has embedded into the processor. Buzzer, red alarm light and LCD display acts as an output to show the result that receive from the input and then process by the processor. Buzzer and alarm light consists of 2 terminal which is anode and cathode, and both connected to the 5V pin and grounding (GND) pin. Last, the LCD display have 16 pins and each pin have their own function. The pins used are pins 1 to 6 and 11 to 16.

2.4 Scenario of Project

The model was created using Tinkercad to create the prototype shown in Figure 4 and to ensure that the user can imagine using the portable. Tinkercad is an online collection of Autodesk software tools that allow complete beginners to create 3D models. This CAD software is built on constructive solid geometry (CSG), which enables users to build complex models by combining simpler objects. As a result, this 3D modelling software is simple to use. The software allows users to create models that are compatible with 3D printing, making it an excellent choice for those new to the technology.

In Figure 4, shows design of design on formaldehyde gas leakage detector using MQ-135 sensor in the laboratory room with different angle of point view. The 3D design was sketch by using Tinkercad Autodesk.

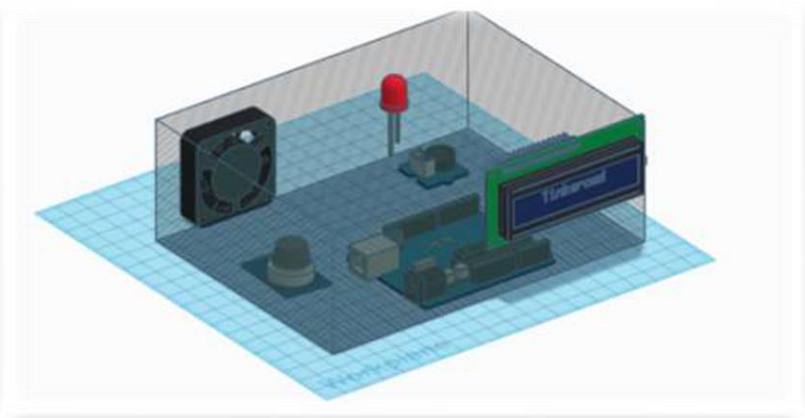

Figure 4. Full view of the Project

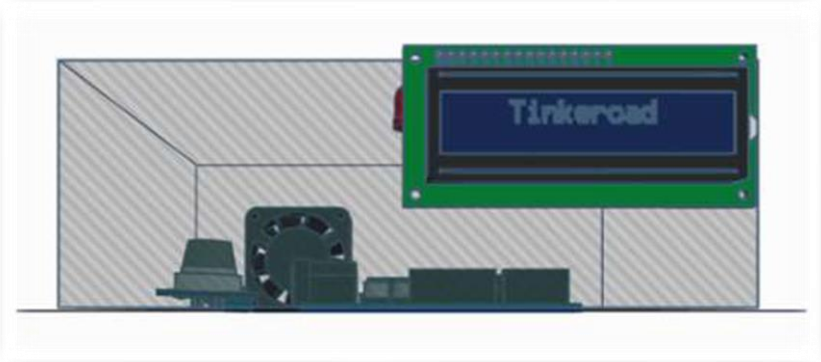

Figure 5. Front view of the Project

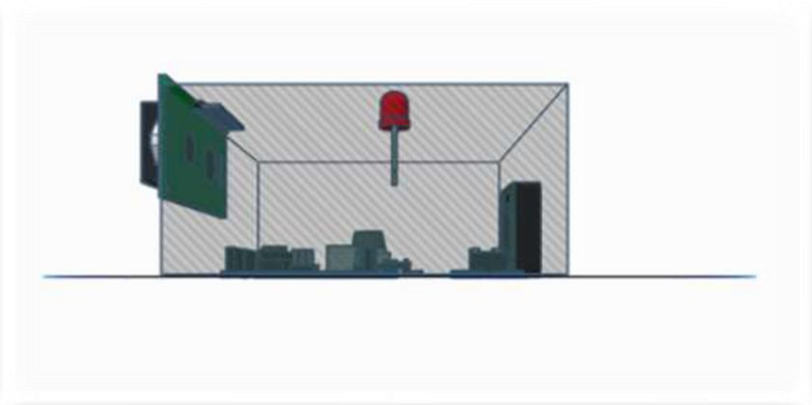

Figure 6. Right Side View of the Project

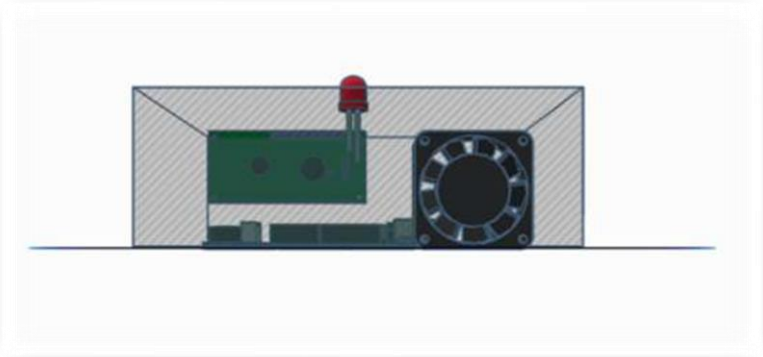

Figure 7. Back Side View of the Project

2.5 Flow Chart

As illustrated in Figure 6 The project's flowchart begins with air absorb into the exhaust fan and if the present of detecting formaldehyde gas leakage using MQ-135 sensor, the buzzer and redlight alarm will trig to give alert to the people in the laboratory if leakage occur to 10ppm concentration. Research stated that when accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence. Therefore, it will help the laboratory worker to aware about formaldehyde leakage and help to track the position of leakage and smoothing out their daily work.

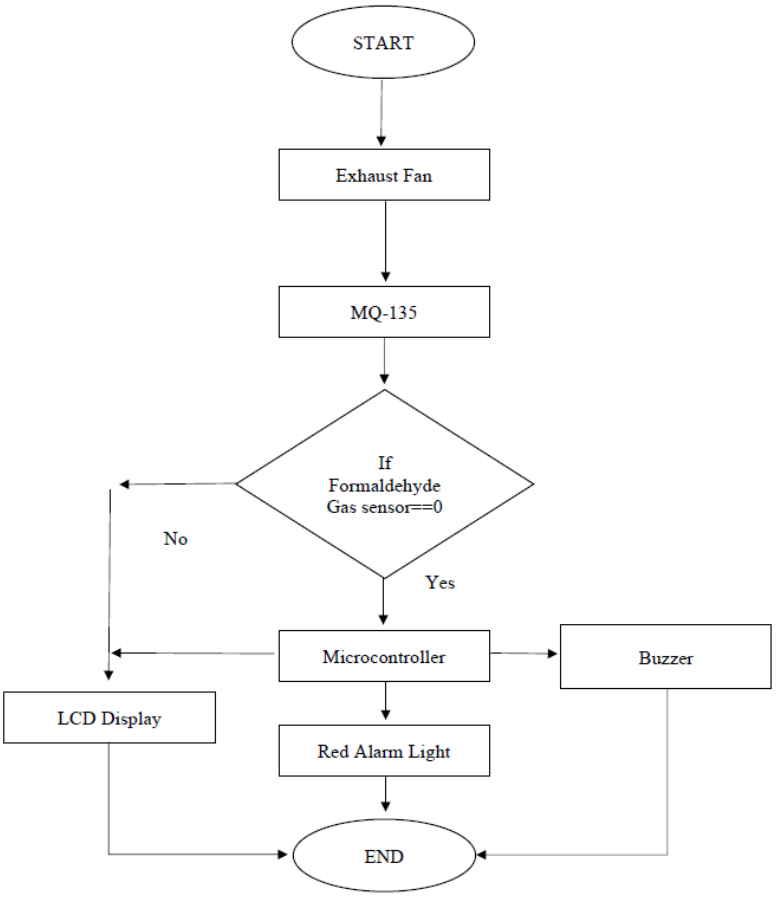

Figure 8. Flowchart of the operation

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