National Conference on TVET for Undergraduate Students

e-Proceedings NCTS 2022
NATIONAL CONFERENCE ON TVET FOR
UNDERGRADUATE STUDENTS

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2022

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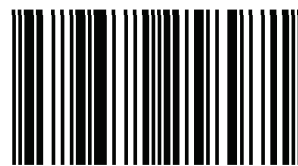
DEVELOPMENT FORMALDEHYDE GAS LEAKAGE DETECTOR USING MQ-135 SENSOR IN THE LABORATORY ROOM

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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

1. 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. (Zain S. M., 2019).

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. (IARC, 2006) 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, the 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. (ATSDR, 2015)

2. Methodology

This paragraph of the study discusses the development of a product based on first and second that is aimed at the detector of formaldehyde gas will detect the leakage and alert the workers in the laboratory. There were, several methods are employed in this chapter to fulfill the task. In making a project, this step must be done before the project is done. In order to generate a high-quality project, it is critical that these processes be completed with caution. Figure (1) displays the block diagram of a formaldehyde gas detector that is intended for laboratory workers at histology that exposed for extended periods of time due to the nature of their employment, which might result health. The device has the ability to detect and alert the user if leakage occur.
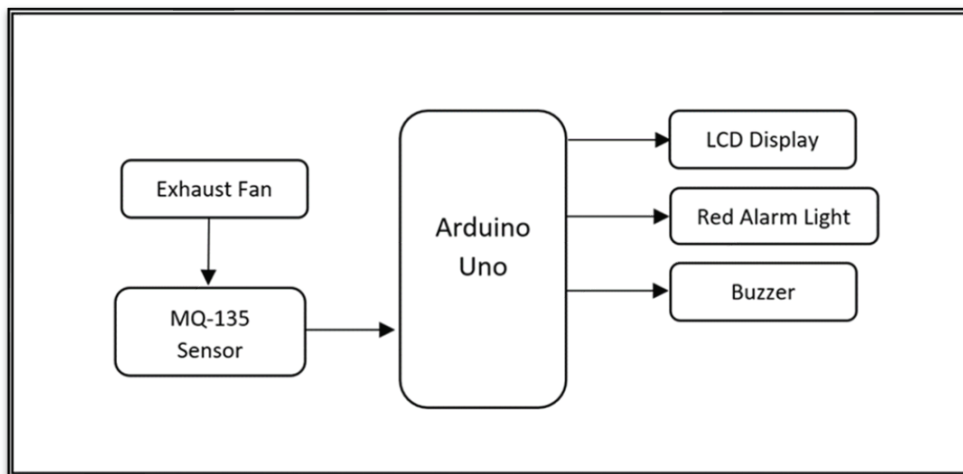
Figure 1: Block Diagram of Formaldehyde Gas Leakage Detector

Figure 1 shown a block diagram that 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.

Tinkercad was used to make the prototype of the model and make sure that the user could imagine using the portable. Tinkercad is an online set of tools developed by Autodesk that makes it possible for inexperienced users to construct three-dimensional models. The perspective of the product is shown in Figure 2, the following below shows design of gas leakage detector using MQ-135 sensor in the laboratory room. The 3D design was sketch by using an online 3D design software, Tinkercad..
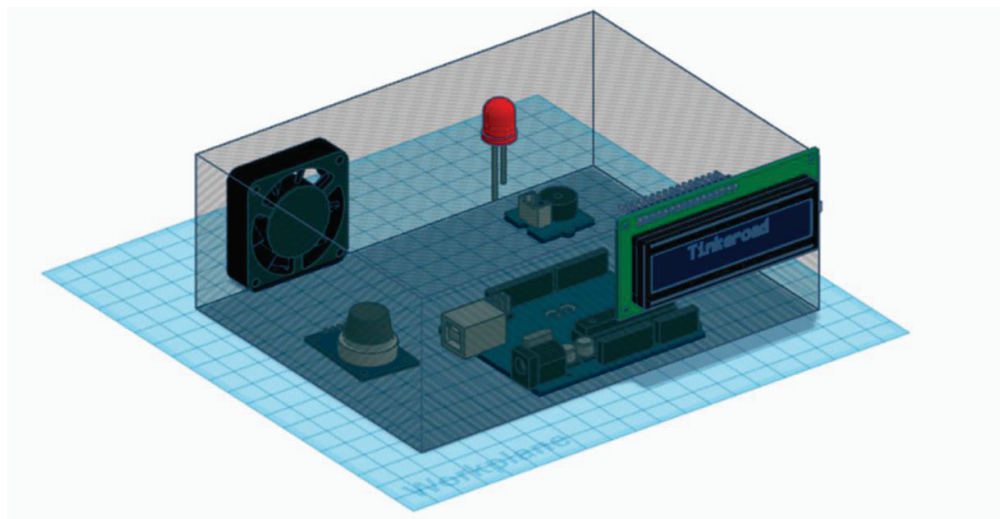
Figure 2: View of product

3. Result and Discussion

In this section, the results of the developed product Formaldehyde Gas Leakage Using MQ-135 Sensor in the Laboratory Room are described in detail based on the hardware implementation, application interface, and standard operating procedure for using the product.

3.1 Developed Formaldehyde Gas Leakage Using MQ-135 Sensor

As can be seen in Figure 3, the items that were developed as a direct result of this project were highly successful in its development. The operation of detecting formaldehyde gas leakage using MQ-135 sensor, air will be absorbed 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 300ppm concentration

Figure 3: Developed product.

As can be seen in the diagram below in Figure 6, show 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.
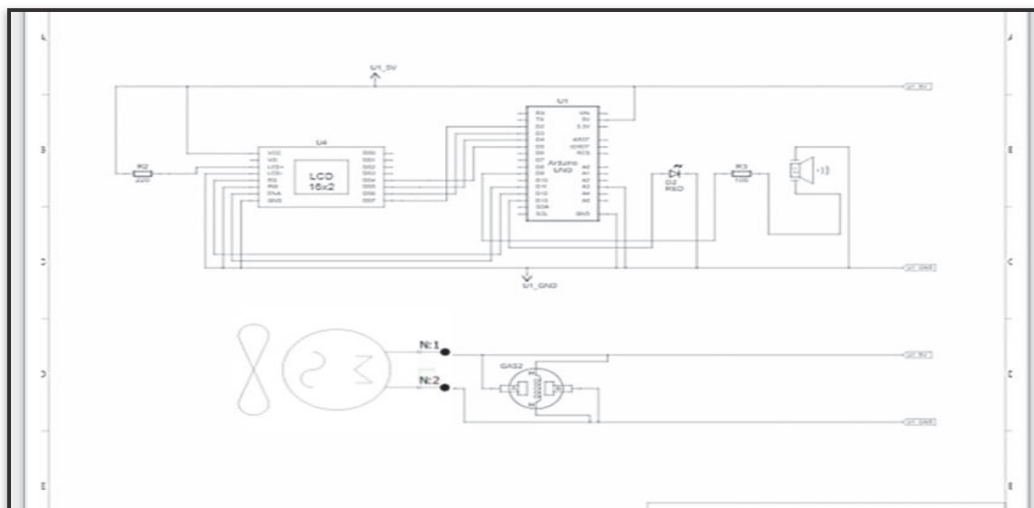
Figure 4: Schematic diagram of project

3.2   Standard Operating Procedure of Product

This part explained in detail the standard operating procedures (SOP) for Formaldehyde Gas Leakage Detector using MQ-135 Sensor in The Laboratory Room. The project starts with, based on functions of detecting formaldehyde gas leakage using MQ-135 sensor, air will be absorbed 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 300ppm 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.

4. Conclusion

This study developed to develop gas leakage detector of formaldehyde gas with alert system Formaldehyde gas can cause irritation of the skin, eyes, nose, and throat.[5] High levels of exposure may cause some types of cancers. On all occasion gases are used, it is possible that a gas could be leaking into the room or contiguous areas. Gas detectors can be used to detect formaldehyde gas leakage and in fault to alert the user before the gas widely spread and endangering the public. It also helps the early detection of gas before the concentration of gas reaches the dangerous level. There were a few ideas made to improve the product's use, despite the fact that it was successfully produced. This was despite the fact that there were no problems with the product's construction. Increase the sensitivity of the warning system in the event that

there is a leakage, so that it can notify the person in charge even if nobody is in the laboratory.

5. Acknowledgement

I am overwhelmed with humility and gratitude for everyone who assisted me in concretizing my concepts beyond the level of simplicity and into something substantial. I would like to express my gratitude to my supervisor, Dr.Hjh Wan Rosemehah Binti Wan Omar, for providing me with the opportunity to complete this project which also assisted me in conducting extensive research and enlightened me to a great number of new things. By supporting and penetrating, they assisted me in achieving one of my life goals. I appreciate the advice I was given.

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