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Cigarette Smoke Alarm System via Website

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Abstract

This paper discussed on the design of a Cigarette Smoke Alarm System via Website. It is an innovation from the present smoke alarm, whereby this Cigarette Smoke Alarm System via Website will specifically detect the presence of cigarette smoke and will alert the authorities by a website connected to a Wi-Fi, to ensure prompt action after detection. The main components used in this system are the MQ sensors which will detect the presence of cigarette smoke, the Wi-Fi shield and Arduino Uno microcontroller that act as an interface between the components. This project will help reduce the possibility of people exposed to the poisonous gases from cigarette smoke especially in an indoor space.

Keywords: *Cigarette Smoke; Alarm System; Website; Wi-Fi;*

I. INTRODUCTION

People are aware on the danger of smoking cigarette and the exposure of the gases towards health. In Malaysia, although the prohibition of smoking had been enforced to protect the community from the many harmful effects of cigarettes, people continue to smoke in indoor and outdoor areas that are known as the 'non-smoking zone'. The authorities are facing problems to penalise the smokers because they are unable to identify the location of smokers while smoking at the prohibited non-smoking areas. This will cause some delay for enforcers to arrive at the location. In addition, the current smoke detector is not able to detect cigarette smoke and this is known by the society. Hence, there enforcements of smoke free areas cannot be properly enforced. The advantage of our newly designed Cigarette smoke alarm system via website is that it is built to detect the presence of cigarette smoke. This alarm will also produce a buzzing sound and instantaneously alert the authorities through a website built for this application.

This system is designed to help the authorities/ workplaces/ companies to detect smokers that smoke at prohibited smoking areas and at the same time will indirectly help to reduce the percentage of people expose to cigarette smoke. A gas sensor will sense certain gases produce from the smoke such as carbon monoxide gas, ammonia gas and hydrogen cyanide then, it will trigger an alarm. The gas sensor will sense the concentration of certain gases in air by using a variety of technologies. The sensor response serves as the reference level or scale and for this project it will be measured by using parts per million (PPM). The smaller the value of PPM, the will result in higher sensitivity of sensor. Hence, when the sensor's response surpassescertain point, an alarm system will activate. In addition, an alerting message will be sent to the authority via a website through a Wi-Fi connection. At the same time, this uses the current technique of designing a system which uses the Internet of Things (IoT).

The IoTis highly used in engineering.It is a system which comprised of physical devices,

vehicles, buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data(Bansal, Arora, & Suri, 2018). It allows the sensors or actuator to be remotely controlled. By applying this method, it helps reduce the time taken for the authorities to detect smokers at their smoking location. This is done by producing an alertmessage through Wi-Fi connectivity to the website database on their personal computer (PC). On top of that, the website was designed and coded using Dreamweaver, Wampserver software and Notepad which was written in C++ language.

The main objective of this system was to detect the presence of gases produced by cigarette smoke. Secondly, it was to design an alarm system that will alert the authorities by sending messages automatically via a database server.

II. LITERITURE REVIEW

Cigarette smoke releases numerous kinds of toxic gases. The six (6) most dangerous gases that are produced include nicotine, carbon monoxide, hydrogen cyanide, tar, formaldehyde and benzene. (Fowles & Dybing, 2003)These gases may lead to detrimental health effects not only to the smokers themselves but also to the surrounding people exposed to it. This is known as the secondhand smokers. Secondhand smokers (also called environmental tobacco smoke, involuntary smoke, and passive smoke) is the combination of "sidestream" smoke (the smoke given off by a burning tobacco product) and "mainstream" smoke (the smoke exhaled by a smoker) [3]. People are exposed to secondhand smoke in homes, cars, the workplace, and public places, such as restaurants, and recreational settings (Venn & Britton, 2007). Four out of 10 or 7.6 million adults are exposed to secondhand smoke inside their houses, four of 10 or 2.3 million adults at workplace and seven of 10 or 8.6 million adults at public places like restaurant (Ooi, Teh, Tam, Sadasivan, & Kadirvelu, 2014).

There are a few studies that were previously conducted looking into this area. For example, Liss (2016) invented a Tobacco Smoke Detector which is a disposable, self-contained tobacco smoke detector, comprised of a sensor incorporated with a reagent capable of undergoing one or more chemical reactions by interacting with one or more compounds unique to tobacco smoke. The smokedetector detects the presence of tobacco smoke by the change in color of the indicator of the sensor whenever there is an occurrence of at least one chemical reaction. As compared to this project, cigarette smoke is detected using MQ sensors. These sensors provide the concentration of the gaseous in cigarette smoke in unit of parts per million (ppm). On the other hand J. BelBruno and A. Crane (2013) developed a sensor that can measure ambient nicotine level at real time.(Liu, Antwi-Boampong, BelBruno, Crane, & Tanski, 2013). A nicotine sensing film comprised of a conductive polymer polyaniline was linked to a reporting layer, which record changes in chemicalresistance

due to the adsorption of nicotine. Experiments carried out in a microprocessor-controlled smoking chamber using side stream smoke from standard reference cigarettes; up to 10 cigarettes were smoked simultaneously. The exposure chamber was calibrated for total suspended particle, carbon monoxide, and nicotine concentrations.

Previous studies had looked into the matter of exposure of nicotine, nonetheless none had looked into the extent of second hand smoke particles and gaseous in real time data. Similarly, they failed to measure the main component gaseous in cigarette smoke. In contrast, our project measured gases particles in parts per million (ppm). One ppm is equivalent to 1 milligram per litre of water (mg/l) or 1 milligram of something per kilogram soil (mg/kg). Smokers with expired CO values of 11–21 parts per million (ppm) are defined as mild smokers, whereas those with expired CO values of more than 21 ppm are defined as heavy smokers (GROMAN, BLAUENSTEINER, KUNZE, &

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SCHOBERBERGER, 2000). In addition, this project employed the method of Internet of Things (IoT). This refers to the possibility of connecting sensors, actuators or any device to the Internet (Tozlu, Senel, Mao, & Keshavarzian, 2012). A Wi-Fi shield is used to connect the Arduino to the server where all data from the sensors are being transferred and displayed in the website, which can be viewed by users/ authorities simultaneously.

III. METHODOLOGY

Prior to the technical parts, a thorough research was done to gain better understanding on the detail parts of the project. These includeunderstanding of how the sensor operates and the connection of the sensors to the Arduino. Besides that, the types of gases produced by the cigarette smoke were identified. Afterwards, the processes of configuring the sensors were conducted. Sensors are highly sensitive, which means that any slight error may malfunction the sensor. The sensors that were used in this project were MQ- 7 that detects carbon monoxide gas, MQ-135 detects ammonia gas and MQ-4 detects methane gas.

Figure 1: MQ Sensor

The sensors consist of four pins which are Vcc, ground, Analog Output (AOUT) and Digital Output (DOUT) as shown in Figure 1. The AOUT pin is connected to the Analog pin on the Arduino Uno along with theVcc and ground. This MQ sensor operates at 5V input current or Vcc. After finishing the configuration process, a set of coding were written to instruct the components. The coding was completed using Arduino IDE and were burnt into an Arduino Uno(Arduino & Genuino). Arduino Uno is a microcontroller board that is based on ATMega328P and it consists of 14 digital input/output pins, of which six (6) can be used as PWM outputs, six (6) as analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, as ICSP header and a reset button as shown in Figure 2.

Figure 2: Arduino UNO

This project used six (6) main components as the input and output which were the MQ sensors (MQ-135, MQ- 7 and MQ-4), Arduino UNO, Light Emitting Diodes (LED), Wi-Fi shield, buzzer and a fan. The MQ sensors were connected to the analog output pins on the Arduino Uno and other components which is fan, LED and buzzer was connected to the PWM output pins. An external power supply were used to operate the fan as it consume a higher voltage input of 12V, while the Arduino Uno can only operate at 5V. The schematic diagrams on these connecting components are shown in Figure 3.

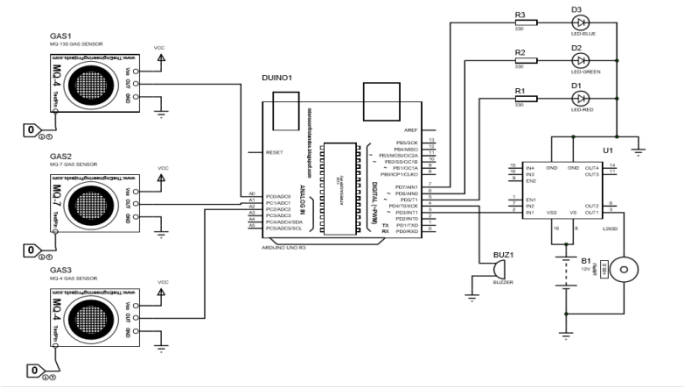

Figure 3: Schematic Diagram

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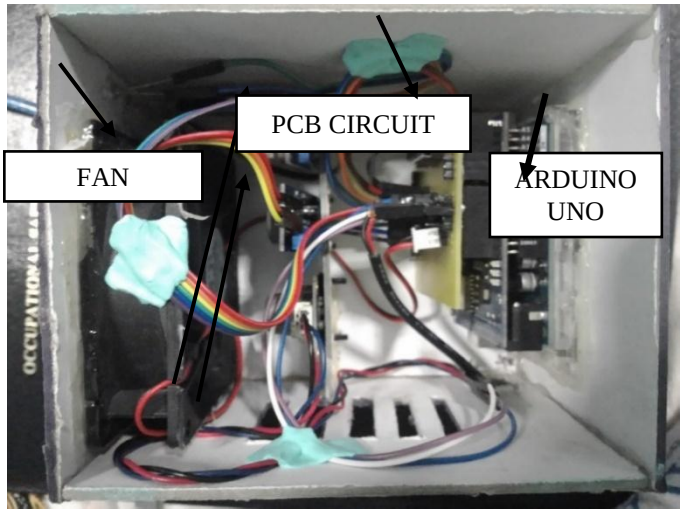

Figure 4: The connection between the Arduino UNO, Wi-Fi shield and the circuit

Next, testing and troubleshooting were done to test the circuit operation, followed by website designing. Before that, the Wi-Fi shield was connected to the Arduino Uno to verify the interface between these two components. A Wampserver software are used to build the database for the website and the PHPmyAdmin software was also used to handle the administration of MySQL over the web where MySQL is the language for adding, accessing and managing the contents of the database. The process of designing the website was conducted using Adobe Dreamweaver software as shown in Figure 6.

Figure 5: Wampserser and Adobe Dreamweaver software

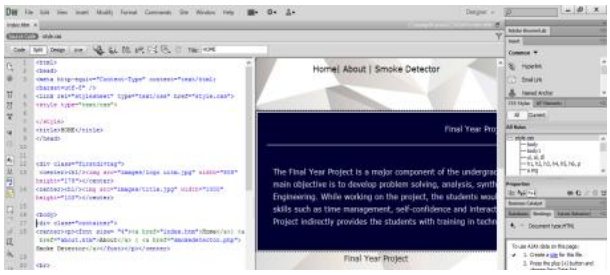

Figure 6: Web design using Adobe Dreamweaver

Finally, after completing the website design, all the components of the software and hardware were tested. The process of data transfer and synchronization process of transferring from sensor to the Arduino and then to the website were observed. This was the final testing and troubleshooting process for the overall system.

Figure 7 shows the stages of processes in the Cigarette Smoke Alarm System via Website which was comprised of input, process and output. The input for this system came from the MQ sensors. All the data were then processed in the Arduino Uno to produce an output. The output of this system includes the LED andthe buzzer that will trigger when the sensor detects the presence of cigarette smoke. The data will be sent to the website wirelessly through Wi-Fi connection.

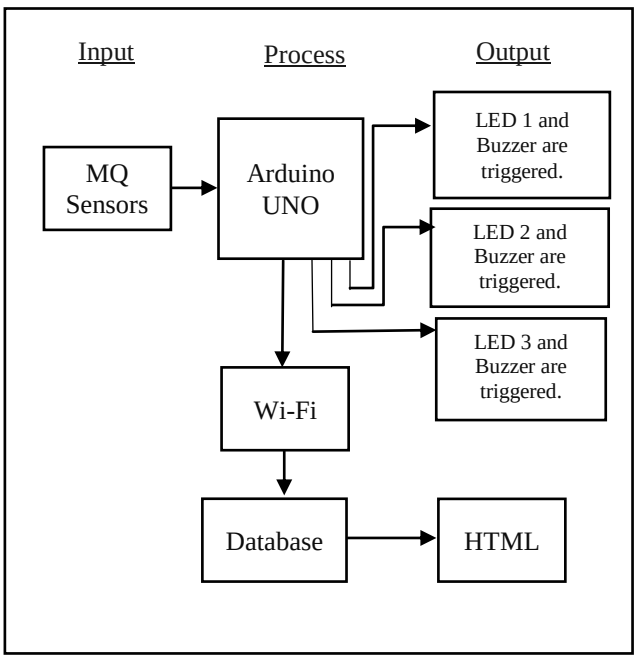

Figure 7: Block Diagram of Cigarette Smoke Alarm System via Website

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First, the system operates when the MQ sensors detect the presence of gaseous and if this is definite, the buzzer will trigger and the LED will light up. Each MQ sensor has its own purposes, where for MQ-135 and MQ-7, the gessoes detected must be above 200ppm while for MQ-4 the gas detected must be above 400ppm. This is because, each of these sensors have different range of sensitivities. MQ-135 and MQ-7 have a sensitivity that ranged from 10 to 1000ppm and MQ-4 has a sensitivity of 200 to 1000ppm. Then, all the value or data are sent to the localhost to be displayed in the website. Figure below shows the flow of the process for the system.

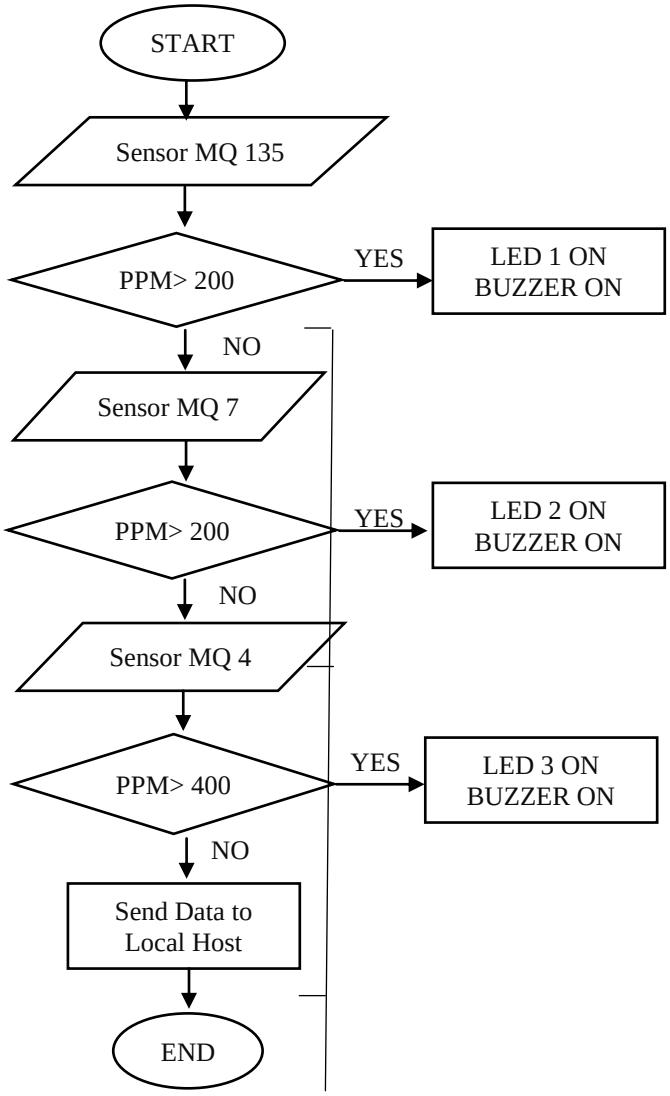

Figure 7: Flow Chart of the Cigarette Smoke Alarm System via Website

IV. RESULT & DISCUSSION

The results show that when the concentration of gaseous exceeded certain ppm value, it will set off an alarmand lighten the LED. There are three (3) LEDs and each of these acts as an indicator for the MQ sensors. Meanwhile, the value in each MQ sensor wastransferred to the database through Wi-Fi connection. The website acts as a monitoring means for the authority to detect any smoking activity inside the premises.

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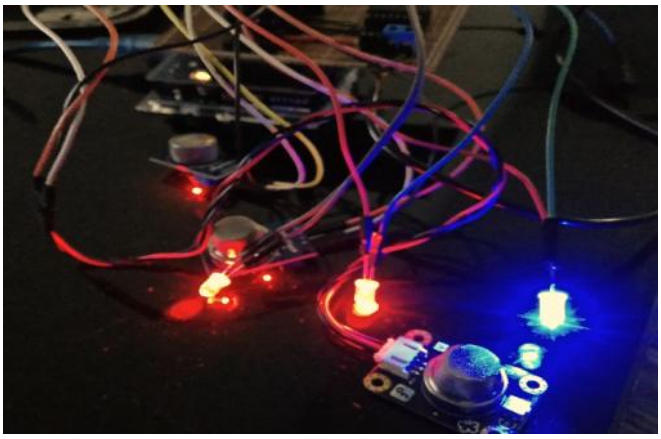

Figure 8: LED light on

Figure 9 shows the LED lights switched on when the concentration value of the gases exceeded the normal point. As mentioned before, each sensor will be complimented with an LED. The LED will only light up when the sensor senses certain amount of concentration of gases that exceeds normal value. When the concentration of thegases fall back to its normal value, the LED will automatically switched off.

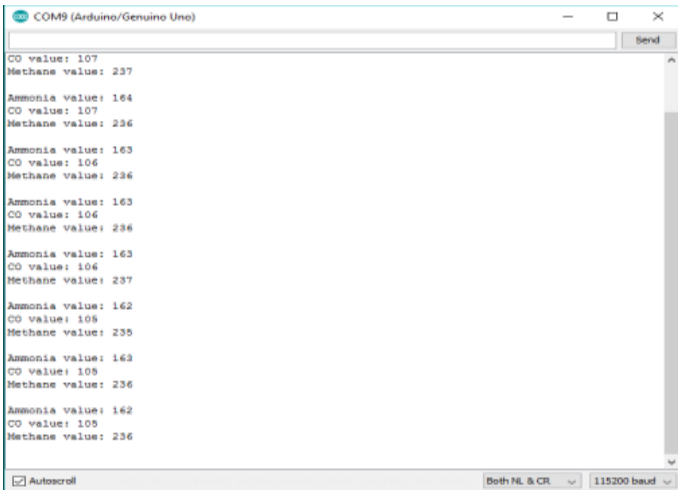

Figure 9: Result of PPM value of the gases

Figure 10 shows the PPM concentration of the gases. These values will be shown in the serial monitor of Arduino IDE before it is being sent to the database website. Figure 11 below shows the PPM value that is being displayed in the database website. The process of transferring data from Arduino to the website will take a few seconds. This delay is caused by the conversion of different languages i.e. from Arduino to the website. The value displayed on the website can be compared with the serial monitor.

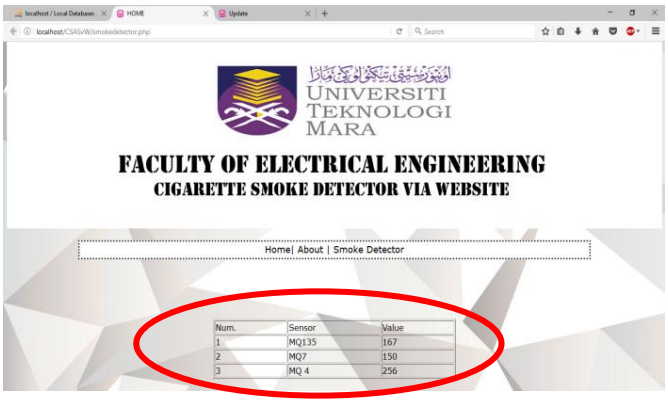

Figure 10: Value displayed in the website

V. CONCLUSION

This project is an innovation from the present smoke detector which only detects the presence of smoke from fire. Our sensor in addition will enable users to be alerted via the website and will assist employers in companies, health authorities to enforce smoke free workplace and indoor public places with the smallest PPM detected. This may later reduce the number of second hand smokers in the population. . It is a simple yet very functional tool as it only uses gas sensors, as its main components. It is able to detect a very minute exposure to poisonous gaseous equivalent to those found in cigarette smoke in ppm. In general the main components are a buzzer that will act as alarm system, Arduino Mega 2560 as the microcontroller, a Wampserver and Dreamweaver software to create and design the website. Finally, an ArduinoWi-Fi shield is required for Wi-Fi connection and to enable connecting from the hardware to the website.

VI. RECOMMENDATION

For future studies, the sensitivity of the sensor should be increased so that it may to detect the presence of the gases at its lowestconcentrations. Furthermore, the size of the cigarette smoke alarm system can be reduced to reduce its bulkiness and to

ease installation. A backup storage should be created to save all important data. These data includedthe date and time of the alarm system is activated and when it detects the presence of cigarette smoke. This information will be useful for the purpose of reporting and enforcement.

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