PROTOTYPE OF AIR PURIFIER TO REDUCE AIR CONTAMINANTS AND ELIMINATE INSECTS BASED ON ESP32 AT UNIVERSITAS HARAPAN MEDAN

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ABSTRACT- Lifestyles have undergone significant changes; people spend more time indoors, and poor air quality occurs not only outdoors but also potentially indoors. According to the EPA, indoor pollution is in the third position of environmental factors affecting human health. in order to meet the need for cleaner air than before, the existing air filtration system is an important thing to pay attention to. Handling the filtration method to deal with pollutants will be a long-term requirement. The problem studied in this study is how to build an air filtration system in a room that can work efficiently without having to replace the filter media such as a HEPA filter, the design of this tool does not use a HEPA filter in general but uses dew dispersion from a mist maker, this tool is designed to be able to capture air particles and combine them with particles of air. This tool is designed to be able to display the value of CO2 conductivity, temperature, and humidity through an application on an Android device and an LCD on an air purifier device.

Kata kunci : *Air Purifier*, IoT, Arduino, *Ozon Generator* .

1. INTRODUCTION

Lifestyles have undergone significant changes, and people are spending more time indoors. So that awareness of air quality increases, poor air quality does not only occur outdoors but also has the potential to be indoors. According to the Environmental Protection Agency of America (EPA), indoor air pollution is in the third position of environmental factors that affect human health [1].

The existing air filtration system in the room is an important thing to note. Handling the filtration method to deal with pollutants will be a long-term requirement. People can be exposed to various microbes in the indoor environment. Maus et al. (2001) studied the effect of filters on microbial survival, and they reported that microbes could stay alive for a long time in HEPA filters[2]. Therefore air purifiers using HEPA filters should have regular maintenance for maximum filtering results. In some previous studies, an ozone generator can be used as a pest and insect control device, and an ozone generator is used as a substitute for pesticides [3]. Pesticides will leave residues and will fall to the ground; there is a pest control device and fruit and vegetable preservative that uses ozonation technology utilizing the high voltage generated by the coil. Ozone is an active substance that, when reacted, can kill bacteria. Ozone technology was developed using a sterilization treatment method using ozone water [4].

The manufacture of air purifiers without using HEPA can be the latest innovative solution to replace the HEPA filter with water which no longer requires filter replacement at a certain time, the manufacture of this air purifier requires a special tool that works to combine particles in air and water particles, the authors get the principle discovery process - technological principles of an object or system, through an analysis of its work or called reverse engineering of a wet scrubber chimney, the basic principle of a wet scrubber chimney is to spray water on pollutants that will be released from the chimney media which will function as a particle catcher before being released into the air [5]. With this method, it is hoped that the air purifier can work without having to replace the filter but only replace the water in the tool and can reduce insect disturbances. From some of the problems above, it is necessary to design a more efficient air purifier, so the manufacture of "a prototype of an air purifier to reduce air contaminants and eliminate insect nuisance" becomes the main discussion.

2. METHODOLOGY

The research method used in this study follows the IoT Product Life Cycle, which starts from the device topology design (Design), equipment installation (Deploy), performance monitoring (Manage), and device deactivation (Decommission) [6], [7].

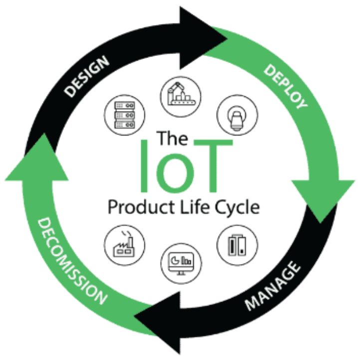

Figure 1. IoT Product Life Cycle
Source [19,20]

2.1 Design

At this stage, the design of the device circuit and the block diagram of the air purifier device will be made. The circuit design is made using the fritzing application, and the block diagram design is made using Microsoft Word using the shape tools. The design is divided into two categories, namely monitoring devices and controlling devices. In the monitoring device, two sensors are used, which are connected directly to the ESP-32 microcontroller, namely the DHT-11 and MQ-135 sensors. DHT-11 is a sensor that can detect two inputs, namely humidity (humidity) and temperature (temperature) [8]. MQ-135 is a sensor that can detect the conductivity of CO2 in the air [9]. In the controlling device, several tools are used, such as a 12V DC fan, blower fan, ultrasonic mist maker, and ozone generator, which are connected to a four-channel relay that is connected to a microcontroller. The function of the relay in this controlling device is to turn on/off the mist maker, ozone generator, and dc fan [10]. A dc fan is used as a tool to suck air from the outside to enter the device. A mist maker is used to carry out the process of decompression water into a water dew particle which will be used as a filtration medium [11]. The ozone generator is used as a sterilizer so that data from the sensor can be seen by the user via a smartphone device, and the microcontroller must be connected to the MQTT Arduino Cloud IoT network using the internet network. Therefore we need a Hotspot / AP as a media liaison to the internet network [12]. The architectural design can be seen in Figure 2, while the block diagram can be seen in Figure 3.

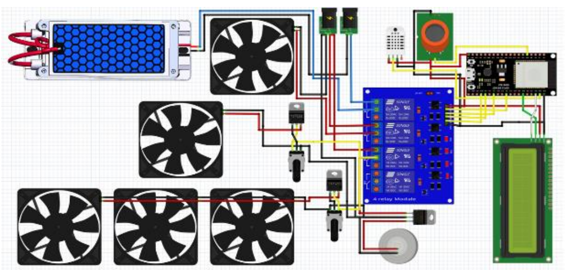

Figure 2. Devices Schematic
Source from research's results

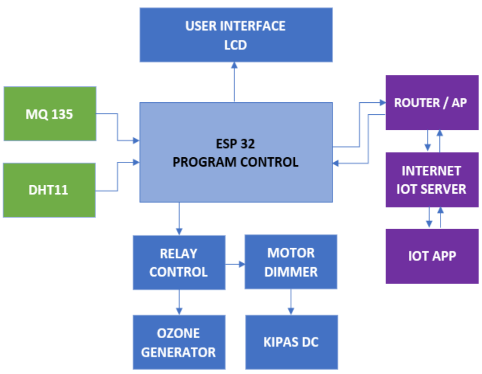

Figure 3. System Diagram Blok
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2.2 Deploy

At this stage, the architectural design and block diagrams that have been designed are implemented into the air purifier model. Installation of tools is carried out according to the set of devices..

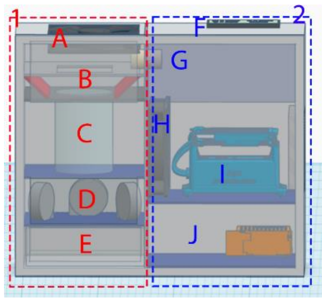

Figure 4. Scheme Implementation into Model
Source from research's results

There are two parts to the tool design model, namely, the air filter and air sterilizer. In part a, there is a 12V fan measuring 12CM which functions as an intake; in part b, there is an air and dew collector, and part c has a transparent pipe as an air intermediary medium so that it can go down, in section d there are three suction fans to draw air through the pipe, in section e there is a place to accommodate dirt for the rest of the filtration process. Furthermore, in part 2, there is part f as LCD monitoring; in part g, there is a mist maker; part h is a blower fan to blow the ozone generator; and in part j, there is a 12V adapter and electrical circuit.

2.3 Manage

At this stage, the researcher will monitor the functions of the tools that have been installed. Maintenance is carried out when the tool does not work according to its function.

2.4 Decomission

At this stage, if a device whose performance has decreased, such as running out of water, is found, the researcher must carry out the process of filling water on the device or cleaning the device.

3. RESULT AND DISCUSSION

3.1 System Workflow

The workflow of the system created is as follows: ESP32 connects to the internet via a WiFi network; if it is not connected, then the connecting process will continue if it is connected, then the device reads the value on the MQ-135 and DHT11 sensors, this input is entered in the Gas variable, temp, kelp, then the variable was displayed on the LCD with a description of the contamination displaying the gas value, T displaying the temperature value, K displaying the humidity value, the data is also sent to the Arduino cloud, next reads relay input one if the input conditions are not met then read the relay input 2, but if the input condition on relay 1 is on, then the cleaning fan will turn on, and the mist maker module will turn on, then read the input relay 2, if the input condition is not met then the process is immediately completed, but if the input condition for relay 2 is on then the exhaust fan is on, and the ozone module generator will turn on is complete.

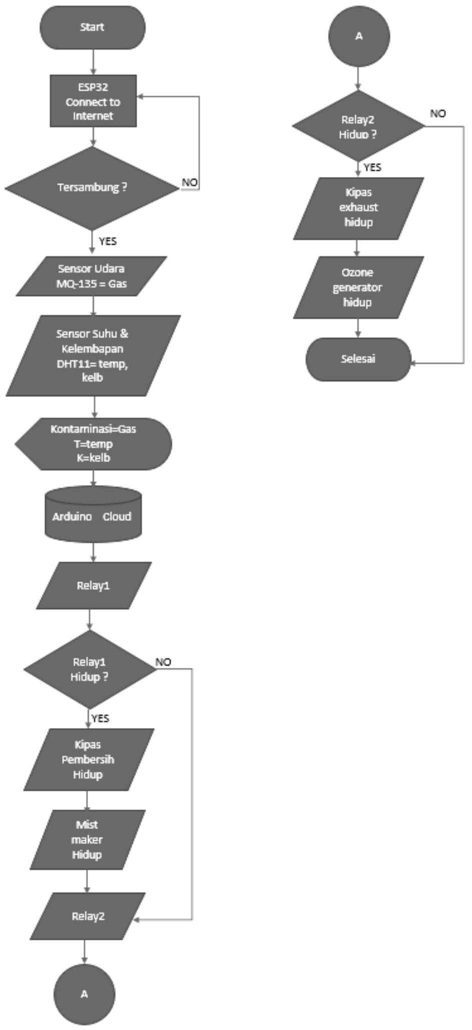

Figure 5. System Flowchart
Source from research's results

3.2 Sensor Calibration

To get the right data accuracy from the sensor, it is necessary to calibrate the sensor; in this study, the MQ-135 sensor was calibrated in order to get the correct Co2 conductivity information [13]. The author reads the sensor value in a clean room resulting in a value of 873-1055, then the information made is good, In the second experiment, the author uses paper that is burned at a distance of 1m then the value issued by the tool is 1530 with medium information, and if the sensor reads the value greater than 1530, then the description is bad.

3.3 Sending Data To Arduino *Cloud* IoT

In this research, the method for sending data from the ESP-32 to the Arduino cloud IoT is done using the MQTT protocol, which is required to use the internet network [14]. The device will try to connect to the Arduino Cloud IoT MQTT server; after connecting, the data from the sensor will be visible using the Arduino IoT remote application [15].

3.4 IoT Remote View

3.4.1 Login View

This view is used to access the remote IoT dashboard page. Users can log in using the user and password that has been created [16].

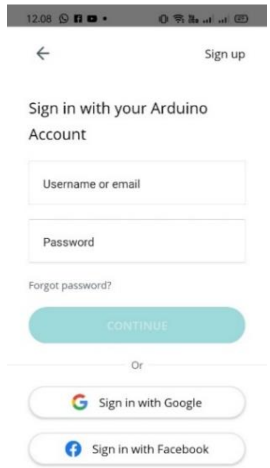

Figure 6. Login Page
Source from research's results

3.4.2 Dashboard

This view presents control and monitoring widgets; the values in the widgets will change according to the data released from the tool; these values will be displayed on the widgets such as gauge, percentage, and tool control using widgets such as buttons and switches from the web or application [17], [18].

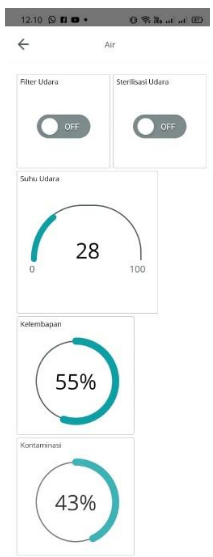

Figure 7. Dashboard IoT Remote
Source from research's result

4. CONCLUSION

The design of an air filter prototype using water decompression can add the latest innovations in carrying out the filtration process on the air purifier. With IoT, we can also directly monitor air conditions with devices via smartphones and can control directly; the use of this filtration is expected to reduce the costs incurred when using an air purifier that uses a HEPA filter; the authors hope for further development to use a more advanced form, portable and more efficient performance.

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