THE DEVELOPMENT OF AUTOMATIC CIGARETTE SMOKE DETECTION SYSTEM USING TA12-100 AND MQ-135 SENSORS

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Abstract— *Indonesia is ranked 3rd with the highest number of active smokers in the world after India and China. Cigarettes contain more than 4000 chemical compounds that are harmful to active smokers and passive smokers. The large number of active smokers in Indonesia also has an impact on passive smokers where passive smokers also inhale cigarette smoke. The purpose of this research is to build an automatic cigarette smoke detector to support air hygiene control, protect passive smokers, and save electricity used. The stages in designing this research include analysis of product specifications, assembly, programming, and trials. This study was designed using Arduino UNO as the microcontroller, the MQ-135 sensor as a tool to detect cigarette smoke, the TA12-100 sensor to calculate electrical power consumption, the relay as an automatic switch, and the exhaust fan as a smoke neutralizer. The results of this study are that the MQ-135 sensor can detect cigarette smoke properly with the Relay as an automatic switch that functions to turn on the exhaust fan automatically. Based on the test results on the TA12-100 sensor, the consumption of electrical energy with an automatic mechanism is more efficient than the consumption of electrical energy in a manual way, with a difference of 0.0000385 kWH and Rp. 0.05205. Future research could focus on developing a more complex system for overall air cleanliness control, rather than just focusing on cigarette smoke detection.*

Keywords: *Arduino Microcontroller, MQ-135 Censors, Smoke Detection, TA12-100 Censors,*

Intisari— *Indonesia menduduki peringkat ke 3 dengan jumlah perokok aktif terbanyak di dunia setelah India dan China. Rokok mengandung lebih dari 4000 senyawa kimia yang berbahaya bagi perokok aktif maupun perokok pasif. Banyaknya para perokok aktif di Indonesia berdampak pula pada perokok pasif dimana perokok pasif ikut menghirup asap rokok. Tujuan penelitian ini adalah membangun sebuah alat pendeteksi asap rokok otomatis guna mendukung pengendalian kebersihan udara, melindungi para perokok pasif, serta menghemat daya listrik yang digunakan. Tahapan dalam perancangan penelitian ini mencakup analisa spesifikasi produk, perakitan, pemrograman, dan uji coba. Penelitian ini dirancang dengan menggunakan Arduino UNO sebagai mikrokontrolernya, sensor MQ135 sebagai alat untuk mendeteksi asap rokok, sensor TA12-100 untuk menghitung konsumsi daya listrik, Relay sebagai saklar otomatis, dan Exhaust fan berfungsi sebagai penetralisir asap rokok. Hasil dari penelitian ini adalah sensor MQ135 dapat mendeteksi asap rokok dengan baik dengan Relay sebagai saklar otomatis berfungsi untuk menghidupkan exhaust fan secara otomatis. Berdasarkan hasil uji pada sensor TA12-100 konsumsi energi listrik dengan mekanisme otomatis lebih hemat dibandingkan dengan konsumsi energi listrik dengan cara manual dengan selisih 0.0000385 kWH dan Rp. 0,05205. Penelitian selanjutnya dapat berfokus kepada Pengembangan sistem yang lebih kompleks untuk pengendalian kebersihan udara secara keseluruhan, bukan hanya terfokus pada deteksi asap rokok.*

Kata Kunci: *Arduino Uno, Sensor MQ 135, Deteksi Asap Rokok, , Sensor TA 12-100.*

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INTRODUCTION

Smoke is a suspension of small particles in the air (aerosols) that come from incomplete fuel combustion. Smoke is generally an uncooled byproduct of fire. One example of smoke is cigarette smoke. Cigarette smoke is smoke that arises from smoking activities. Cigarette smoke has a negative impact on body health, not only for smokers (active smokers) but also for inhalers other than passive smokers (Rahmad, Ekadiansyah, Triandi, Puspasari, & Ardiyanti, 2021). The Ministry of Health released the results of a global survey on tobacco use in adults (Global Adult Tobacco Survey – GATS) which was carried out in 2011 and repeated in 2021 involving 9,156 respondents. In his findings, over the last 10 years, there has been a significant increase in the number of adult smokers by 8.8 million people, namely from 60.3 million in 2011 to 69.1 million smokers in 2021 (Widyawati, 2022). Cigarette consumption by the public is increasing rapidly, and almost everywhere we meet people who consume cigarettes. Based on data from the Central Bureau of Statistics, it is noted that the number of active smokers aged over 15 years has increased from 28.89% in 2020 to 29.33% in 2021, and East Java Province is ranked 18th in Indonesia as a region with a smoking rate quite a young age. (BPS, 2021).

Besides harming the health of active smokers, cigarette smoke is also detrimental to passive smokers. The air pollution it causes is environmental cigarette smoke or Environment Tobacco Smoke (ETS). Those who smoke ETS as passive smokers or Secondhand Smoke (SHS), passive smokers do not smoke but are forced to inhale cigarette smoke from their environment. The smoke from burning cigarettes doesn't just evaporate into the air, however, there is nicotine residue that sticks to the dust or things around us, such as clothes, carpets, walls, furniture, or chairs. This nicotine dust will not disappear in a short time so it will be inhaled by other people even though the smoker has left the place (Siregar, Simamora, & Daulay, 2021). People who do not smoke (passive smokers) will inhale twice as much poison contained in cigarette smoke. A cigarette contains harmful substances, such as nicotine, tar, arsenic, cadmium, cyanide, nitrosamines, and many other compounds that can cause various diseases such as chronic cough, lung cancer, and other health problems, approximately 4000 compounds. and 250 of them are the most dangerous and deadly (Tantri, 2021).

Considering the many harmful compounds or substances posed by cigarette smoke for passive smokers, this has an impact on passive smokers or non-smokers exposed to direct exposure to cigarette smoke which can cause various diseases such as cardiovascular, lung cancer, atherosclerosis, heart attacks, strokes, and other diseases that can be bad for passive smokers in the future (Ningrum & Indrayani, 2019). Until now the solution that has been implemented so that passive smokers avoid exposure to cigarette smoke is by installing an alarm that functions as a warning for smokers not to smoke anywhere (Umar, K., Halide, Rusjdi, & Ijsam, 2023), but the existing solution so far has not taken direct action to prevent smoking. Passive smokers avoid exposure to cigarette smoke.

In addition to written warnings regarding the prohibition of smoking in certain places, it is necessary to create a good, fast, and economical system to be able to monitor and give warnings to violators who often smoke out of place. With the existence of an automated system, it is expected to facilitate human work. Several literature reviews have been conducted to support this research. The first is research entitled Monitoring System for Cigarette Smoke Detection Equipment in Microcontroller-Based Rooms Using Mq-135 and Telegram where this research aims to create a monitoring system for cigarette smoke detectors by connecting the microcontroller with telegrams on smartphones, laptops, and computers so that monitoring range becomes wider (Sambani, Rohpandi, & Fauzi, 2021).

Furthermore, there is research entitled Making Cigarette Smoke Detectors in the Labor Environment of the Faculty of Engineering with Arduino-Based Alarms. This study aims to make a cigarette smoke detector with an Arduino-based alarm and an MQ 2 sensor as an interface for Buzzer instructions as output. The results of this study are that the system built can work properly, the MQ-2 sensor functions properly and the Buzzer can work according to orders so that with this warning alarm the room is smoke-free (Harja, 2020). The next piece of literature is research entitled Design and Build of Cigarette Smoke and Flame Detectors for Health and Fire Management Based on Arduino Uno and GSM SIM900.

This study discusses the manufacture of cigarette smoke and flame detectors which aim to send SMS messages to users when there is smoke and flames to turn on the fan immediately. The result of this research is a tool that functions to detect smoke and flames which then sends an SMS message to the user, which later the user can turn on the dc voltage fan by replying to the message (Hamdani & Handayani, 2019). Then the next literature review is research with the title Design and Build Simulation Model of Arduino-Based Automatic Cigarette Smoke Detection and Disposal Systems. This study discusses the manufacture of cigarette smoke detectors that aim to detect

cigarette smoke and neutralize it automatically using a 12V fan. The results of this study are cigarette smoke detectors that are placed in a room, then if there are people smoking the sensor will detect cigarette smoke and display cigarette smoke levels on the LCD so that it will turn on the buzzer alarm and turn on the exhaust fan as a smoke neutralizer.

Based on the test results, the system is able to work properly and optimally, the detection process has a short delay time so that the exhaust functions of the system can run synchronously in neutralizing potential hazards in the environment (Ramady, Yusuf, Mahardika, & Lestari, 2020). Last but not least, research conducted by (Suherman, Nataraj, Pratama, & Kahfi, 2023) shows that the use Internet of Things (IoT) for electricity management system has made a significant contribution to more efficient and controller electrical energy. It can be monitored directly via web or smartphone.

The purpose of this research is to build an Automatic Cigarette Smoke Detection System Using TA12-100 and MQ-135 Sensors. The MQ-135 sensor is used to detect cigarette smoke levels in the room, while the TA12-100 sensor is used to measure electricity consumption. This system is expected to provide general knowledge for the general public regarding the dangers of smoking and can help to neutralize air automatically so as to save on electricity costs.

In this research, the TA12-100 sensor is used to calculate electrical power consumption because this sensor is a current sensor that can measure the current flowing through a circuit. By measuring the current passing through the circuit, these sensors can provide data that allows power consumption calculations. In the context of research into the development of an automatic cigarette smoke detection system, the TA12-100 sensor is used to automatically monitor system power consumption. This information is important for assessing the energy efficiency of the system and comparing power consumption between automatic and manual operating modes (Antara, Suteja, Putra, & Widja, 2022).

Meanwhile, the MQ-135 sensor was used in this research to detect cigarette smoke because this sensor is a gas sensor that is sensitive to various gases, including smoke particles and various dangerous gases contained in cigarette smoke such as ammonia, benzene and carbon monoxide. The MQ-135 sensor is an economical sensor, easy to use, and provides reliable gas detection, making it suitable for detecting cigarette smoke in automatic cigarette smoke detection systems (Oktavianto & Yunanda, 2022).

MATERIALS AND METHODS

The Arduino platform, which operates on accessible hardware and software, is an open-source electronics system. With Arduino boards, various inputs can be detected, such as light on a sensor, a button being pressed, or even a message received on Twitter. These inputs can then be transformed into outputs, such as activating a motor, illuminating an LED, or publishing content online. (Arduino, 2023). For physical computing, there is a wide range of microcontrollers and platforms to choose from. Options such as Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many more provide comparable functionality. These tools package the intricate aspects of microcontroller programming into a user-friendly format. Arduino, like these options, streamlines the microcontroller experience, but it offers unique benefits for educators, learners, and enthusiasts.

A. Inexpensive
Arduino sheets are moderately reasonable compared to other microcontroller stages. The slightest costly adaptation of the Arduino module can be collected by hand, and indeed the pre-assembled Arduino modules fetched less than $50

B. Cross-Platform
The Arduino Software (IDE) is compatible with various operating systems, including Windows, Macintosh OSX, and Linux. Unlike most microcontroller systems, which are primarily designed for Windows, the Arduino Software (IDE) offers a wider range of options for users.

C. Open Source
The Arduino software is released as an open-source platform, allowing skilled programmers to enhance its capabilities. By utilizing C++ libraries, the language can be expanded, enabling individuals to delve into the intricacies of the underlying AVR C programming language from which Arduino derives.

D. Simple
The Arduino Software (IDE) provides a user-friendly interface that is accessible to beginners and also offers advanced users the flexibility they need. It is designed with teachers in mind, as it is based on the familiar Processing programming environment. This means that students who are already learning to program in Processing will find it easy to navigate and utilize the Arduino IDE.

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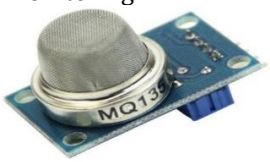
Source: (Arduino Documentation, 2022)
Figure 1. Arduino Uno

The MQ-135 sensor is a gas sensor that can detect ammonia (NH3), benzene (C6H6), carbon dioxide (CO2), sodium dioxide (NOx), sulfur hydroxide (H2S), other harmful gases and smoke. Like other gas sensors in the MQ series, this sensor has digital and analog outputs. When the gas level in the air exceeds a threshold, the digital pin goes HIGH because the analog output pin provides an analog voltage that can be used to estimate the gas level in the air. (Rombang, Setyawan, & Dewantoro, 2022). Inside the MQ-135 sensor, there is a tin dioxide (SnO2) sensing element. When the sensor comes into contact with gases, certain gas molecules are adsorbed onto the surface of the sensing element, leading to changes in its electrical resistance. These changes are then measured and analyzed to determine the presence and concentration of specific gases.

Regarding cigarette smoke detection, cigarette smoke contains various gases and particles, including carbon monoxide, volatile organic compounds (VOCs), and particulate matter. When cigarette smoke interacts with the MQ-135 sensor, it can trigger changes in the conductivity of the sensing element, allowing the sensor to detect the presence of cigarette smoke. The MQ-135 sensor's ability to detect various gases, including cigarette smoke, lies in its sensitivity to changes in the chemical composition of the surrounding environment. By calibrating the sensor and analyzing its response patterns to different gases, it can reliably identify and quantify the presence of specific gases, making it suitable for applications such as air quality monitoring, industrial safety, and environmental monitoring.



Source: (Rombang, Setyawan, & Dewantoro, 2022)
Figure 2. MQ-135 Censors

In an electronic circuit, there are voltage, current, and resistance that are interconnected. An ampere meter is a tool for measuring the current flowing in an electronic circuit. An electric current flowing in a conductor creates a magnetic field. Therefore, electric current can be measured by the magnitude of the magnetic field.

The magnetic field is influenced by several factors, including the amount of electric current, the distance of the magnetic field to a point of measurement, the direction of the magnetic field that is formed (Ardiliansyah, Puspitasari, & Arifianto, 2021). A magnetic field is a field created by moving electric charges (electric currents) which cause a force to appear on other moving electric charges. The quantum mechanical spin of a single particle forms a magnetic field and the spin is affected by itself like an electric current A magnetic field is a vector field, i.e., associated with every point in vector space which can change with time.

Current strength can be measured by connecting the device in series to the circuit conventionally. This method has a weakness because it interferes with the flow of current to be measured (Antara, Suteja, Putra, & Widja, 2022).

Source: (Antara, Suteja, Putra, & Widja, 2022)
Figure 3. TA12-100 Censors

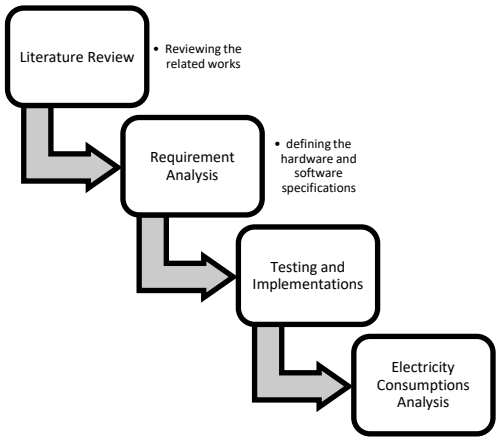
Current sensor A wire carrying an electric current to the load is passed between the toroid ring and a number of email wires are wound on the toroid ring, the wire coil on the ring will induce an electric current from the current wire. By processing the induction signal on the toroid coil wire, the value of the current that is passed to supply the load at the end of the current wire will be obtained. With this method, the current that is passed will be read on the voltage magnitude function in the form of a sinusoidal wave.

Table 1. TA12-100 Sensors Data Sheets

Items	Min	Typical	Max	Unit
Transformation Coefficient	-	1000:1	-	-
Input Current	0	-	5	A
Output Current	0	-	5	mA
Sampling Resistor	-	200	-	Ω
Sampling Voltage	0	-	1	v
Working Frequency	20	-	20000	HZ
Non-Linear Scale	-	-	0,2%	-
Phase Shift	-	-	5’	-
Operating temperature	-55	-	85	~
Dielectric Strength	-	6	-	KVAC/1min

Source: (Antara, Suteja, Putra, & Widja, 2022)

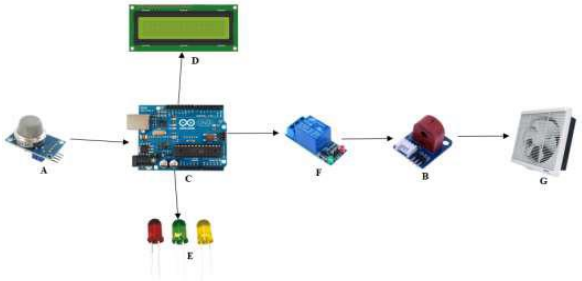
Referring to the research flow in Figure 1, this research starts from a literature review related to the cigarette smoke detection system using Arduino. Next is a needs analysis and preparation of what hardware and software is needed. The tools that have been arranged will then be implemented in a 3x3 meter room. Then the TA 12-100 sensor is used to measure the power consumption required to turn on the exhaust fan.



Source: (Aditya, Lotussa, & Putri, 2021)
Figure 4. Research Flow

After conducting a review of previous work, the next step is to analyze the requirements and define the hardware used. Referring to Figure 5, the following is a description of a series of tools for detecting cigarette smoke:

A. MQ-135 Sensors
The MQ-135 sensor functions to read the PPM (Parts Per Million) in cigarette smoke
B. TA 12-100 Sensors
Sensor TA12-100 serves to measure the voltage and use of AC power
C. Arduino Uno
Arduino Uno is a microcontroller that functions to make it easier to control electronic components with programs
D. LCD
The LCD is a tool that functions to display text from what has been read by the MQ135 sensor
E. LED
LED is an electronic component that converts electrical energy into light
F. Relay
A Relay is an automatic switch that functions to break and connect electricity
G. Exhaust Fan
The exhaust fan functions as an air neutralizer, if the sensor detects cigarette smoke, the relay will automatically turn on and turn on the exhaust fan for 5 minutes



Source: (Research Method Construction, 2024)
Figure 5. Overall System Prototype Design

The following is the specification of the hardware used in the study. Arduino Uno Atmega 328 is a basic type of microcontroller with an operating voltage of 5 V. Table 2 shows the specifications of Arduino Uno.

Table 2. Arduino Uni Atmega 328 Specifications

Components	Description
Microcontroller	Atmega328
Operating Voltage	5V
Recommended Voltage	7V - 12V
Limitation	6V – 20V
Pin Input/Output Digital	14
Analog Pin Input	6
Flow on Pin Digital	40 mA
Flow on Pin	3,3 50 mA
Flash Memory	32 KB (0,5 for bootloader)
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Length	68,6 mm
Width	53,4 mm
Weight	25 g

Source: (Harja, 2020)

Next are the basic specifications of the MQ-135 sensor where the sensor has a better concentration of detecting cigarette smoke than other sensors. This sensor has an accuracy of 10 – 1000 PPM (Parts Per Million). Table 3 shows the specifications of the MQ-135 Sensor.

Table 3. MQ-135 Sensors Specifications

Components	Description
Detectable Substance	Ammonia, CO2, NH4, CO, Smoke
Accuracy	10 – 1000 PPM
Voltage	5V
Preheat Time	24 hours
Energy Consumption	150 mA
Length	36 mm
Width	24 mm
Height	25 mm

Source: (Rombang, Setyawan, & Dewantoro, 2022)

Furthermore, the basic specifications of the TA12-100 sensor where this sensor has a Brick-type Current Transformer TA12-100 which has better

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and more accurate measurements compared to other current sensors. This sensor has a current measurement range of 0-5 Amperes. Table 4 shows the specifications of the TA 12-100 sensor.

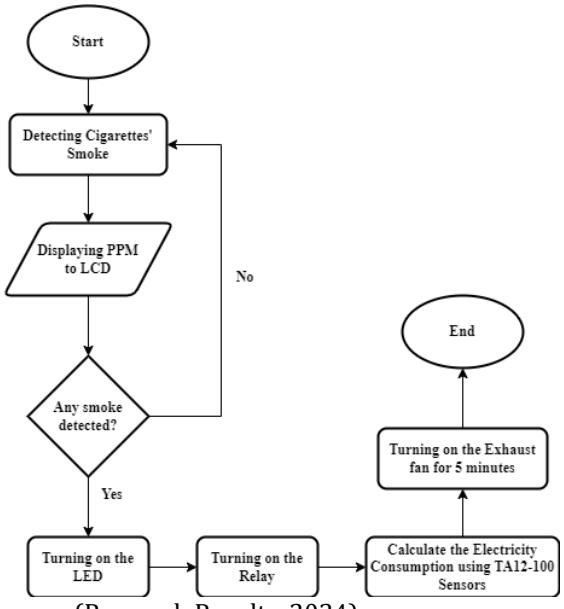
Table 4. TA12-100 Sensors Specifications

Components	Description
Type of Sensors	Brick TA12-100 Current Transformer
Current Measuring Range	0 – 5 Ampere
Voltage	5V
Frequencies	20-20000Hz
Temperature	55℃ ~+ 85℃
Modul Length	30 mm
Modul Width	24 mm
Modul Height	1,5 mm

Source: (Antara, Suteja, Putra, & Widja, 2022)

RESULTS AND DISCUSSION

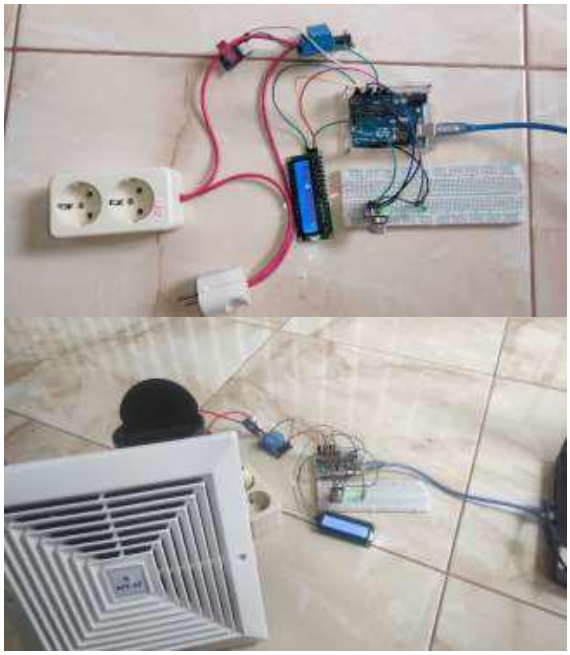
The design of a cigarette smoke detection system can be seen in Figure 6. This detector will be tested in a 3x3 room. Referring to the flow of testing the tool as shown in Figure 5, the tool will be placed in the corner of the room with an exhaust fan installed. Cigarette smoke will be detected by the sensor which will then be displayed on the LCD. If cigarette smoke is detected, the LED light will turn on and then proceed with turning on the relay, then the exhaust fan will turn on for approximately 5 minutes. The fan will automatically turn off when no smoke is detected.



Source: (Research Results, 2024)

Figure 6. Flowchart of Cigarette Smoke Detection and Calculating Automatic Electrical Energy Consumption using Arduino Uno

Figure 7 is the result of the sensor assembly with the exhaust fan. The tool will be placed in a corner of the room and connected to a laptop/pc so that the configuration can be arranged in such a way. Tool testing is carried out with the range limit of the MQ135 sensor as far as 1 meter and set at 150 ppm and the TA12-100 sensor will later calculate the electricity used to turn on the exhaust fan for 5 minutes and later it can also be converted into rupiah. The MQ135 sensor reads the ppm level in the room, the room conditions are set in such a way that even if the room uses an AC (Air Conditioner) or fan, it does not affect the air quality. Furthermore, the ppm (air quality value) level is displayed on the LCD and serial monitor, if the higher the level ppm the worse the air quality in a room, so if the sensor detects more than 150 ppm it is expected that Arduino will give a signal to the relay to conduct electricity to turn on the exhaust fan which is given a tolerance of 5 minutes.



Source: (Research Results, 2024)

Figure 7. Installing Device

At this stage there are 3 tests presented, the first is testing the detection distance of the tool and the second is electricity consumption automatically and the third is testing electricity consumption manually. The first testing phase is testing to find out how far the MQ135 sensor can detect smoke. In this test, obtained data at a distance of 20-140 cm the MQ135 sensor can detect smoke well, at a distance of 160-200 cm the sensor cannot detect smoke because the smoke distance is too far so that it cannot be detected by the MQ135 sensor. Table 5 shows the results of cigarette smoke sensor testing.

Table 5. Cigarette Smoke Sensor Testing

No	Distance (Cm)	Status
1	20	Detected
2	40	Detected
3	60	Detected

No	Distance (Cm)	Status
4	80	Detected
5	100	Detected
6	120	Detected
7	140	Detected
8	160	Not Detected
9	180	Not Detected

Source: (Research Results, 2024)

The next test calculates the electricity costs incurred to manually turn on the exhaust fan. This test is to reveal how much the cost of electricity consumption is used when the exhaust fan is turned on manually without going through sensor detection. The results of this calculation will be compared with the use of the TA 12-100 sensor to turn on the exhaust fan automatically. Table 6 shows the Electric Power Consumption Using an Exhaust Fan Manually accompanied by a conversion to the IDR value.

Table 6. Consumption of Electric Power Using Exhaust Fan Manually

Time	Watt	kWH	Price (IDR)
16:13:00	33,4	0,0000278	0,03758
16:13:03	32,1	0,0005360	0,72467
16:14:00	32,1	0,0010710	1,44799
16:15:00	32,1	0,0016060	2,17131
16:16:00	32,1	0,0021410	2,89463
16:17:00	32,1	0,0026760	3,61785
16:18:00	32,1	0,0032110	4,34127
16:19:00	32,1	0,0037460	5,06459
16:20:00	32,1	0,0042810	5,78791
16:21:00	32,1	0,0048160	6,51123
16:22:00	32,1	0,0053510	7,23455
16:23:00	32,1	0,0058860	7,95787

Source: (Research Results, 2024)

The last test is measuring the electricity costs incurred to turn on the exhaust fan automatically. This test uses the TA 12-100 sensor where this sensor functions to turn on and turn off the exhaust fan based on cigarette smoke detection carried out by the MQ135 sensor. Table 7 shows the power consumption expended to turn on the exhaust fan automatically.

Table 7. Electric Power Consumption Using Exhaust Fan Automatically

Time	Power (Watt)	Power in kWH	Price (IDR)
15:41:00	34,332	0,0000281	0,03799
15:41:03	31,880	0,0005328	0,72034
15:42:00	31,880	0,0010641	1,43866
15:43:00	31,880	0,0015954	2,15698
15:44:00	31,880	0,0021267	2,87529
15:45:00	31,880	0,0026580	3,59361
15:46:00	31,880	0,0031894	4,31206
15:46:03	34,332	0,0032175	4,35006
15:47:00	31,880	0,0037222	5,03241
15:48:00	31,880	0,0042535	5,75073
15:49:00	31,880	0,0047848	6,46904
15:50:00	31,880	0,0053161	7,18736
15:51:00	31,880	0,0058475	7,90582

Source: (Research Results, 2024)

The research abstract highlights the significant issue of smoking in Indonesia, where it is ranked 3rd globally in terms of active smokers. The harmful effects of cigarette smoke, containing over 4000 chemical compounds, not only impact active smokers but also pose risks to passive smokers. The development of an automatic cigarette smoke detector aims to address air hygiene control, protect passive smokers, and promote energy efficiency.

The utilization of Arduino UNO as the microcontroller, MQ-135 sensor for smoke detection, TA12-100 sensor for power consumption calculation, relay for automatic switching, and exhaust fan for smoke neutralization showcases a comprehensive approach to designing the system. The successful detection of cigarette smoke by the MQ-135 sensor and the efficient energy consumption demonstrated by the TA12-100 sensor validate the effectiveness of the developed system.

CONCLUSION

Based on the results of the design and testing of the tool, it can be concluded that the MQ135 sensor can effectively detect cigarette smoke, which can later be used to detect cigarette smoke and neutralize the air in a room. Furthermore, the TA12-100 sensor, which functions as a counter to electrical energy consumption, can also properly calculate and compare electricity consumption when using automatic and manual methods. The test results show that the consumption of electrical energy using the TA 12-100 sensor which automates the use of exhaust fans, is more power- and cost-efficient than the manual method, with a difference of 0.0000385 kWH and Rp. 0.05205. Further research is still needed regarding the reading of the MQ135 sensor, which can be used in various rooms; therefore, there is no need to set the program code when you want to move it. Therefore, it is necessary to consider adding other components such as a DHT11 sensor so that it can detect hot air in a room.

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