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Development and Testing of Arduino-Based Virus Spread Prevention Tools

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Abstract−The process of online buying and selling transactions which are global in nature by involving many people actually facilitates the process of spreading viruses, one of which is the Covid-19 virus, which spreads mostly through splashes of liquid expelled from the nose and mouth, such as sneezing, coughing and yawning. Viruses that stick to the surface of goods also have the potential to infect humans who come in direct contact. The incubation period for the virus until the disease appears is between 3 (three) to 7 (seven) days. the covid-19 virus is sensitive to heat with a temperature of 56 ℃ for 30 minutes. Based on the root of the problem, this research was conducted as an effort to prevent the chain of distribution of Covid-19 by building a heating box with a width of 50 cm and a length of 65 cm using fiber glass material with a thickness of 3mm. By using Arduino Uno as a tool to control the MLX temperature sensor, the temperature sensor works by emitting infrared light towards the surface of the goods wall, then reflected and received by the receiver. This heat will be converted by the temperature sensor module into a voltage between 0 to 5 Volts.This voltage is used as an arduino input to get the surface temperature of goods, the results of temperature readings are displayed on the 16 x 2 LCD. Based on the validation results of the electronic circuit design and heating box, validation results obtained were 89.26% for usability, 86.96% for information quality and 92.2% for service interaction quality with an average percentage of 89.47%, which means the tool is running well. The test results using an initial temperature of 30ºC and the desired temperature of 56ºC takes 1 minute 13 seconds, the temperature displayed on the LCD has reached 56ºC. . This heater is also operated through an android application that communicates with the Arduino microcontroller via the HC-05 bluetooth moduleAbstract is a brief summary of the manuscript to help readers quickly determine the main research problem, the method used as a solution to solving the problems encountered, research objectives and temporary research results which can be in the form of numbers/percentages according to research needs. The abstract should be clear and informative, providing a statement for the problem under study. Abstract length between 200 to 230 words. The abstract has no citations/references. Avoid unusual abbreviations and define all symbols used in the abstract. Using keywords related to the research topic is recommended.

Keywords: Heater Box; Virus; Arduino; Microcontroller

1. INTRODUCTION

Buying and selling through market places is a trend for urban communities to people who live in villages. 88.1% of internet users in Indonesia have used e-commerce services to buy products. More than 74 percent of consumers in Indonesia choose to shop online. This causes e-commerce trade transactions in 2021 to reach IDR 401 trillion[1]. Currently, Indonesia has more than 2,300 startups with 11 startup companies that have unicorn status. So it is not surprising that currently Indonesia is a country with a large digital economy in Southeast Asia. The transaction process which is global in nature by involving many elements from various circles has facilitated the process of spreading the Covid-19 virus[2]. Many people have handled groceries received by buyers, from packaging officers, delivery couriers, expeditors, receiving couriers, consignees. and finally the buyer. On March 2, 2020, for the first time the government announced two positive cases of Covid-19 in Indonesia. Epidemiologist at the University of Indonesia (UI), Pandu Riono, said that the Covid-19 virus had entered Indonesia since early January. but the identification of the first case was in early March, and it was already a local transmission and not imported case transmission. The entry of the virus is very likely to occur through groceries purchased online which are global in nature by involving many parties in the transaction process[3][4].

The Centers for Disease Control and Prevention (CDC) explained that the COVID-19 virus spreads most widely through splashes of fluids expelled from the nose and mouth, such as sneezing, coughing and yawning. Viruses that stick to a surface also have the potential to infect humans who come in direct contact [5][4]. The incubation period for the virus until the disease appears is between 3 (three) to 7 (seven) days. Corona virus is sensitive to heat with a temperature of 56 ℃ for 30 minutes [6][7]. The COVID-19 virus can live up to 3 hours in air, 4 hours on copper and 24 hours on cardboard and two to three days on plastic and stainless steel [8][9][10].

The first stage in this research was to determine the potential and root causes of the problem by conducting audiences and Focus Group Discussions (FGD) with several people who often buy goods online, courier services and sellers of goods in Lombok Tengah Regency, related to patterns of receipt and delivery groceries purchased online, from the results of the audience and FGD it was found that 87% of the people of Lombok Tengah Regency did not know how to spread the virus and prevent the covid-19 virus. Furthermore, an initial survey was carried out by distributing questionnaires (question forms) via social media, from the results of the questionnaire, 167 people filled out the questionnaire, of the 167 people who responded to the survey, it was determined that 4.2% sprayed with disinfectant, 96.8% did not spray items received with disinfectant and 3.1% drying groceries upon receipt, 97.9% not drying groceries upon receipt. Based on data obtained from one of the Indonesian Post Offices located in Praya City, Lombok Tengah Regency, there are approximately 350 packages per day that will be delivered to each buyer by courier. From the resulting

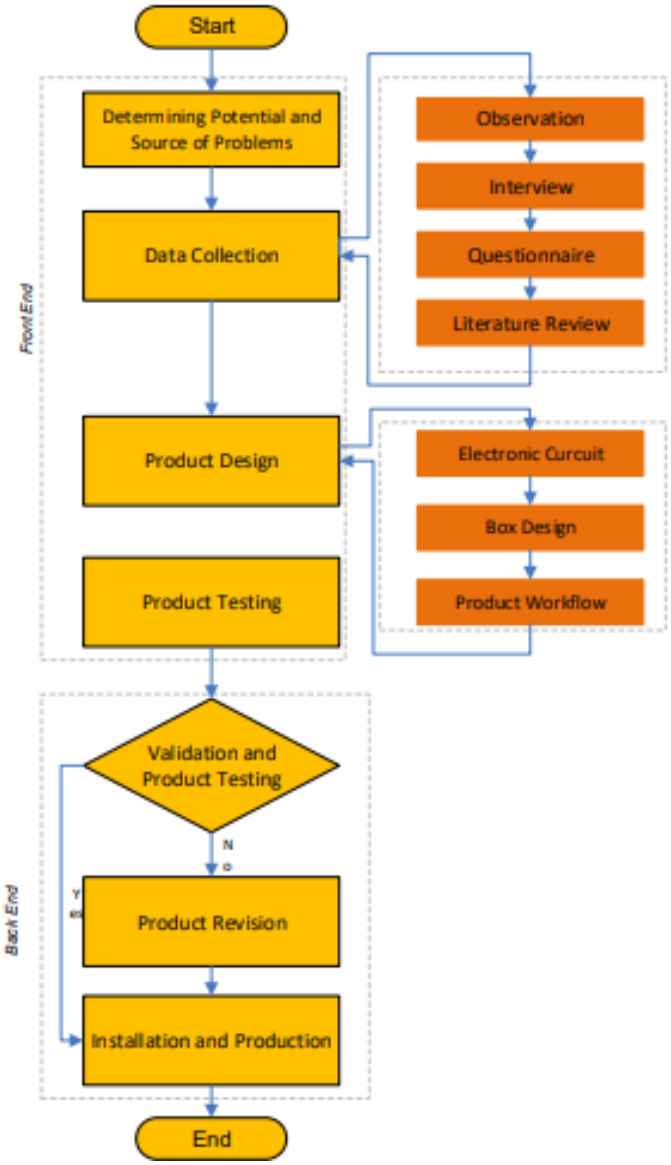
survey results, it was concluded that there are still many people who are not aware of the importance of preventing the Covid-19 virus by drying or placing items that have just been received in a place that has a hot temperature of approximately 56ºC within 30 minutes, which aims to dry items that have been accidentally splashed with liquid splashed through the nose or mouth.

The importance of handling the virus, the researchers conducted research as an effort to prevent the spread of the virus by building a Grocery Heater Box tool that can provide a hot temperature of 56º Celsius and dry liquid that is accidentally splashed on newly received groceries, a tool that can help the community in preventing the spread of the virus through goods [11].

2. RESEARCH METHODOLOGY

2.1 Research Stages

The research method used in this research is Research and Development (R&D)[12][13]. This method describes the flow of developing and testing a product with systematic and measurable steps [14][15].



Figiru 1. Research and Development (R&D) Research Stages [16][17][18]

2.2 Determining Potential and Source of Problems

The first stage in this research is to determine the potential and sources of problems by conducting audiences and Focus Group Discussions (FGD) with several people who often buy goods online, courier services and sellers of goods in Central Lombok Regency, related to patterns of receipt and delivery groceries purchased online, from the results of the audience and FGD it was found that 87% of the people of Lombok Tengah Regency did not know how to spread the virus and prevent viruses, especially the covid-19 virus.

2.3 Data Collection

The method of data collection was observation and interview techniques by visiting several post offices and shipping expeditions in Lombok Tengah Regency. From the observations and interviews, an average of 350 packages were sent per day to the owner/buyer. Furthermore, a survey was carried out by distributing questionnaires (question forms) through social media, From the results of the questionnaire, it was found that 167 people filled out the questionnaire, out of the 167 people who responded to the survey, 4.2% sprayed with disinfectant, 96.8% did not spray items received with disinfectant and 3.1% dried groceries on when received, 97.9 who did not dry groceries when received. From the resulting survey results, it was concluded that there are still many people who are not aware of the importance of preventing the Covid-19 virus by drying or placing items that have just been received in a place that has a hot temperature of approximately 56ºC within 30 minutes.

2.4Heating Box Design Scheme

The design of a heating box with a width of 50 cm and a length of 65 cm uses fiber glass with a thickness of 3mm [19][20][21].

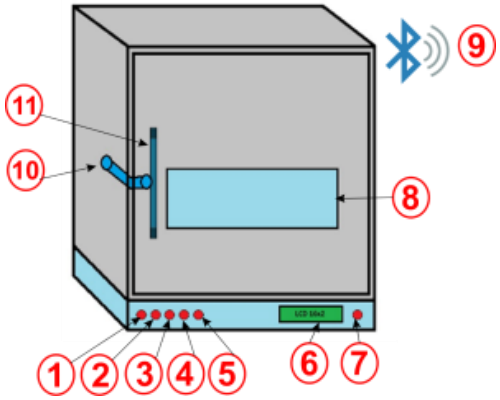


Figure 2. *Front View Heater Box*

Image Description:

1. Start Button :used to start the work of the appliance heating goods. This button is used after setting the maximum temperature of the tool.
2. Stop Button : used to end the tool to warm up shopping goods
3. Menu Button : The menu button is used to select the settings that have been made
4. Suhu + Button : used to increase the temperature setting value
5. Suhu – Button : used to lower the temperature setting value
6. LCD Display :to display settings when settings are made and displays the temperature of the item being heated when heating is carried out.
7. Power Switch : to turn the appliance on and off completely
8. Window to observe the condition of goods from the outside
9. Intermediary bluetooth module between arduino uno and android cellphone.
10. Door lock
11. Appliance door handle

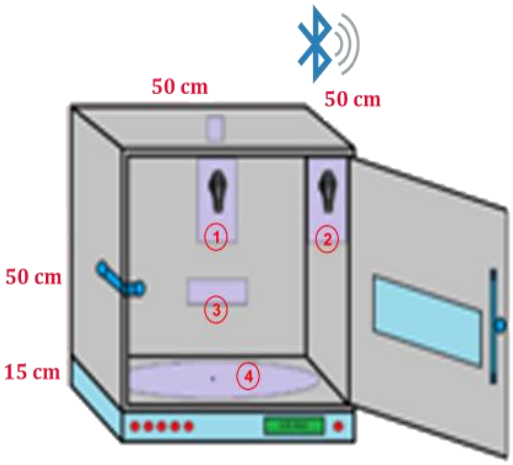


Figure 3. *Inner Heating Box*

Image Description:

1. Hair Dryer 1 : Top goods heater
2. Hair Dryer 2 : Left side heater
3. Proximity Sensor : to detect whether there are goods or not in the tool
4. Stand Rotari : To rotate the item so that it gets evenly heated on each side

2.5 Electronic Circuit Schematic Design

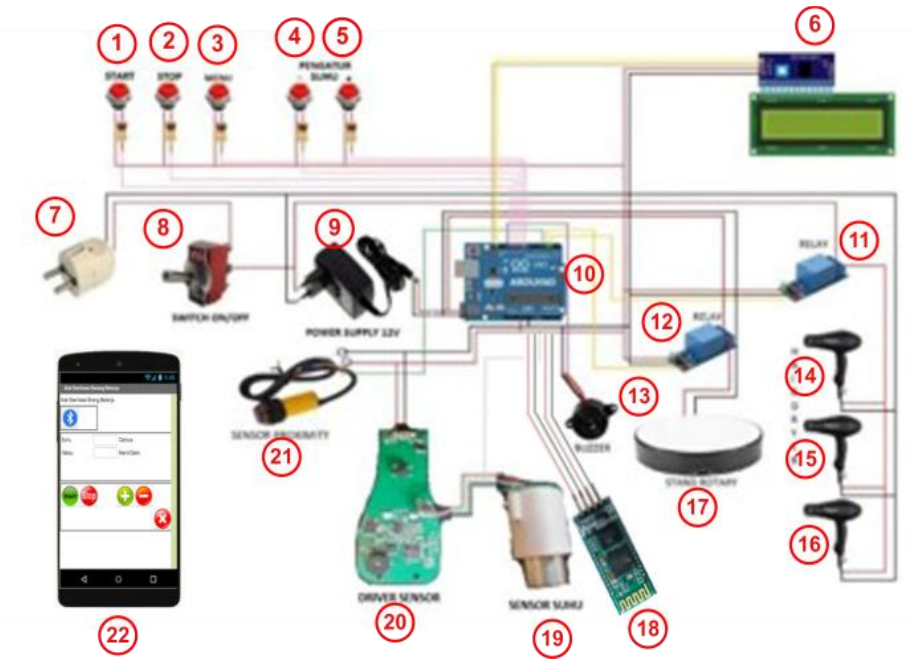


Figure 4. Electronic Schematic Design

Image Description :

1. Start Button : used to start the work of the tool to heat the goods. This button is used after setting the maximum temperature of the tool.
2. Stop Button : used to end the tool to warm up shopping goods
3. Menu Button : The menu button is used to select the settings that have been made
4. Suhu + Button : used to increase the temperature setting value
5. Suhu – Button : used to lower the temperature setting value
6. LCD Display :to display settings when settings are made and displays the temperature of the item being heated when heating is carried out.
7. Contact : electricity contact 220 Volt PLN
8. Power Switch : to turn the appliance on and off completely
9. Power Supply : lowering the voltage from 220 Volts AC to 12 Volts DC
10. Arduino Uno : As the main controller, save the program and settings
11. Relay 1 Module : Electronic switch to turn on and off the hair dryer
12. Relay 2 Module : Electronic switch to turn on and off the Rotary stand
13. Buzzer : as an indicator for pressing buttons 1 to 5 and when the tool has reached the set temperature
14. Hair Dryer 1 : Top goods heater
15. Hair Dryer 2: Left side heater
16. Hair Dryer 3: Right Side heater
17. Stand Rotari : To rotate the item so that it gets evenly heated on each side
18. Bluetooth Module :An intermediary between Arduino Uno and an Android cellphone.
19. Temperature Sensor : Read the temperature on the wall of the goods
20. Temperature Sensor Module : translate the temperature sensor readings into an electric voltage
21. Proximity Sensor: to detect whether there are goods or not in the tool
22. Android : as an optional control to make settings avoiding the use of buttons

2.6 How the Tool Works

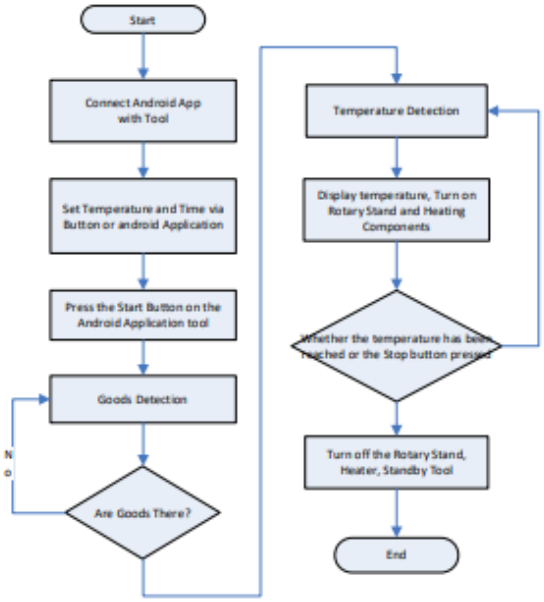


Figure 5. How the Tool Works

a. Connect the android app with the tool
b. Set the temperature and time by pressing the menu button to select the temperature menu and time menu, then press the (-) button to decrease or press the (+) button to increase the temperature.
c. After setting the temperature and time as needed, then press the start button to start the item detection process and the heating process.
d. The process of detecting goods that aim as a condition for starting the entire heating process.
e. If the item is not detected, the step is repeated from the item detection, but if the item is detected, the Arduino controller will detect the temperature.Temperature detection to get temperature information inside the heating box
f. The Arduino controller detects the temperature and displays the temperature, then the rotary stand is turned on, and the heating component is turned on.
g. If the temperature has been reached and or the start button is pressed then the heating process is stopped. If not then repeated from temperature detection.

3. RESULT AND DISCUSSION

3.1 Product Trials

a. Temperature Test

In testing the temperature measurement on the surface of the goods, the researchers raised the temperature constantly, the temperature rising each time the test was 10ºC, with the aim of knowing how long it would take to reach a maximum temperature of 56ºC on the surface of the goods.

Table 1. Temperature Test

No	Initial Temperature - Reach Temperature (C)	Time (Minute/Second)	Temperature on the Surface of Goods (C)
1	30º - 39º	01 : 00	39.5º
2	39º - 48º	01 : 01	45.2º
3	48º - 56º	01 : 13	55.7º

The test results using an initial temperature of 30ºC and the desired temperature of 56ºC takes 1 minute 13 seconds, the temperature displayed on the LCD has reached 56ºC. When the surface temperature of the goods is measured using a thermo gun, the result is 55.7ºC. The trial results show that the resulting temperature is close to 56ºC.

2.Tool Performance

Table 2. Tool Performance Trial

No	Volume And Weight Of Goods	Initial Temperature	Goods Surface Temperature	Box Temperature Sensor	Time
1	1.470m**3** 1Kg	30º	55.7º	56º	01:13.6
2	2.100m**3** 2Kg	35º	54.2 º	56º	01:36.8
3	4.875m**3** 3Kg	40º	53.7 º	56º	01:38.8

4	3.300m**3** 4Kg	48º	54.3 º	56º	01:44.7
5	7.200m**3** 5Kg	50º	53.2 º	56º	01:44.3

Table 3. Testing the Use of the Tool With the Addition of Aluminum Foil on the Wall of the Tool

No	Volume and Weight of Goods	Initial Temperature	Goods Surface Temperature	Box Temperature Sensor	Time
1	1.470m**3** 1Kg	27º	43.7º	56º	01:41.2
2	1.470m**3** 1Kg	46º	44.3º	56º	00:38.0
3	1.470m**3** 1Kg	49º	44.8º	56º	00:23.4
4	1.470m**3** 1Kg	50º	46.4º	56º	00:20.4
5	1.470m**3** 1Kg	51º	44.8º	56º	00:26.9
6	2.100m**3** 2Kg	39º	46.3º	56º	00:49.6
7	2.100m**3** 2Kg	40º	46.4º	56º	00:23.6
8	2.100m**3** 2Kg	50º	46.3º	56º	00:25.6
9	2.100m**3** 2Kg	49º	48.2º	56º	00:30.2
10	2.100m**3** 2Kg	47º	47.0º	56º	00:31.2
11	4.875m**3** 3Kg	43º	42.0º	56º	00:36.5
12	4.875m**3** 3Kg	49º	49.3º	56º	00:24.0
13	4.875m**3** 3Kg	48º	50.0º	56º	00:26.8
14	4.875m**3** 3Kg	48º	49.6º	56º	00:26.8
15	4.875m**3** 3Kg	50º	50.9º	56º	00:22.0
16	3.300m**3** 4Kg	38º	51.0º	56º	00:46.4
17	3.300m**3** 4Kg	27º	50.9º	56º	01:56.0
18	3.300m**3** 4Kg	43º	52.1º	56º	00:49.2
19	3.300m**3** 4Kg	41º	48.1º	56º	00:50.5
20	3.300m**3** 4Kg	46º	53.1º	56º	00:35.7
21	7.200m**3** 5Kg	39º	53.5º	56º	00:55.7
22	7.200m**3** 5Kg	48º	46.5º	56º	00:25.7
23	7.200m**3** 5Kg	48º	51.8º	56º	00:29.5
24	7.200m**3** 5Kg	45º	52.0º	56º	00:36.5
25	7.200m**3** 5Kg	47º	54.1	56º	00:29.1

The results of the performance testing of the tool are, the increase in heat temperature given by the heating box has been maximized to get a temperature of 56 ºC, takes 1 minute 13.6 seconds, the DS18B20 temperature sensor can measure temperature accurately. Based on the trials conducted, the first trial used a volume of 1,470m3 and a weight of 1Kg and an initial temperature of 30ºC and the desired temperature was 56ºC where the temperature was displayed on the LCD, the time needed to reach the desired temperature was 01:13.6, the temperature on the surface of the goods reached 55.7º which was measured using a thermo gun.

The second trial uses a volume of 2.100m3 and a weight of 2 kg and an initial temperature of 35ºC, the desired temperature is 56ºC where the temperature is displayed on the LCD, the time needed to reach the desired temperature is 01:36.8, while the temperature on the surface of the goods reaches 54.2ºC which means measured using a thermo gun.

The third trial uses a volume of 4.875m3 and a weight of 3 kg and an initial temperature of 40ºC, the desired temperature is 56ºC where the temperature is displayed on the LCD, the time needed to reach the desired temperature is 01:38.8, while the temperature on the surface of the goods reaches 53.7ºC which means measured using a thermo gun.

The fourth test uses a volume of 3.300m3 and a weight of 4 kg and an initial temperature of 48ºC, the desired temperature is 56ºC where the temperature is displayed on the LCD, the time needed to reach the desired temperature is 01:44.7, while the temperature on the surface of the goods reaches 54.3ºC which means measured using a thermo gun.

The fifth trial uses a volume of 7,200m3 and a weight of 5 kg and an initial temperature of 50ºC, the desired temperature is 56ºC where the temperature is displayed on the LCD, the time needed to reach the desired temperature is 01:44.3, while the temperature on the surface of the goods reaches 53.2ºC which means measured using a thermo gun.

3.2 Installation and Production

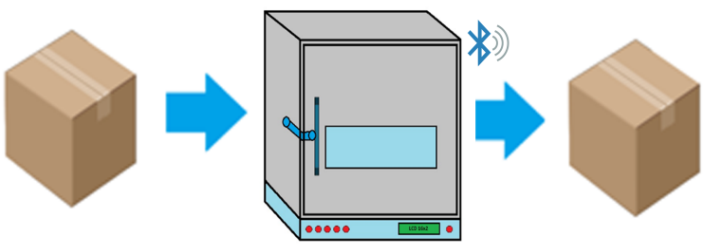


Figure. 6. Simulation of how the tool works

First enter the items to be sterilized, then connect the android application with the device, set the temperature and time by pressing the menu button to select the temperature menu and time menu, then press the (-) button to decrease or press the (+) button to increase the temperature , after setting the temperature and time as needed, then press the start button to start the item detection process and the heating process. The process of detecting goods is intended as a condition for starting the entire heating process. If the item is not detected, the step is repeated from the item detection, but if the item is detected, the Arduino controller will detect the temperature. The temperature sensor works by emitting infrared light by the sender towards the surface of the wall of the goods, which is then reflected and received by the receiving part. This heat will be converted by the temperature sensor module into a voltage between 0 to 5 Volts.

This voltage is used as arduino input to get the surface temperature of the goods. The temperature reading results are displayed on the 16 x 2 LCD. The heater and rotary stand will turn on after the start button is pressed, if the proximity sensor detects items, and the temperature is below the maximum temperature set. The heater and rotary stand will be turned off when the surface temperature reaches the set temperature or the stop button is turned off. This heater can also be operated through an android application that communicates with the Arduino microcontroller via the HC-05 bluetooth module.

4. CONCLUSION

Based on the results of research that has been carried out that Arduino-based virus prevention tools can be used as a solution to stop the circulation of viruses, based on the results of testing the surface temperature of goods using an initial temperature of 30ºC and the desired temperature of 56ºC takes 1 minute 13 seconds, the temperature displayed on the LCD has reached 56ºC and measurements using a thermogun get results of 55.7ºC from the trial results showing the resulting temperature is close to 56ºC. While testing the performance of the tool, the increase in heat temperature given by the heating box has been maximized to get a temperature of 56 ℃, takes 1 minute 13.6 seconds, the DS18B20 temperature sensor can measure temperature accurately. Based on the validation results for the design of the electronic circuit and heating box, the validation results were 89.26% for usability, 86.96% for information quality and 92.2% for service interaction quality with an average percentage of 89.47%, which means that the tool is running properly.

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