Design an automatic clothes dryer in a cabinet with wi-fi transmission

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Abstract. Indonesia is a tropical country that has two seasons, dry and rainy seasons. Now this season in Indonesia is difficult to predict because of the effects of global warming. The effect of global warming is quite disturbing activities of human life, one of which is in the case of drying clothes. Then an automatic clothes dryer cabinet was made with Wi-Fi transmission media making it easier for humans to find out information in the cabinet remotely using a smartphone. The system starts when the voltage supply is turned on and the fan turns on and the other system is standby. When the clothes are in the cabinet, the heater will turn on and the microcontroller will send information about the situation in the cabinet. The heater will turn off when it has reached the set temperature to prevent excess heat in the cabinet. Clothing weight information will appear on the smartphone through the application, if the weight of the clothes has reached <190 grams, then the clothes notification will appear dry and turn off the system on the application. The weight sensor has a role to activate the digital thermostat which has a temperature sensor to disconnect and connect the power to the heater.

1. Introduction

Indonesia is a tropical country that has two seasons, dry and rainy seasons [1]. Global warming is a condition where the temperature on the surface of the earth becomes hotter than normal temperatures and occurs due to the greenhouse effect [2]. The temperature of the sun during the day ranges between 33°C - 39°C in Jakarta (according to research by the Meteorological Agency and Geophysics in 2010) [3]. Clothing is one of the 3 primary human needs. Clothing serves as a body protector from outside weather threats, such as heat, wind and rain. Clothing can also be the identity of togetherness of an agency / company If you see the effects of global warming that is happening right now it's difficult to take advantage of the way to dry clothes in a conventional manner [4]. The solution to deal with these threats is to use express laundry services. However, express laundry services cost more than ordinary laundry services and can even be twice the normal price. So we need a tool that can dry automatic clothes that do not cost big on a regular basis, no need to have to leave the house again and relatively relatively time short too. The dryer is equipped with a microcontroller. In this modern era microcontroller / automation technology is increasingly developing in all fields, ranging from industry, education, health, security and others [4]. This microcontroller-based clothes dryer has been widely researched and designed such as the Design of the Atmega8535 Microcontroller-Based Wardrobe Control Clothes Drying System [5]. Advances in industrial technology have now entered the industrial revolution 4.0 in which all tools or jobs use the internet, or commonly known as the Internet of Things (IoT) [6]. Referring to the problems and advances in industrial technology today, a clothes dryer will be designed which
utilizes IoT. You do this by inserting clothes into this tool then the clothes will be detected by temperature sensors and weight sensors to determine the condition of the clothes inside. This tool uses Wi-Fi as a transmission medium to smartphones in sending information.

2. Literature review

2.1. Load cell
Load cell is a sensor that produces an output in the form of an electrical signal that changes when force or weight is applied. A load cell sensor is composed of several conductors, a strain gauge, and a wheatstone bridge [7] [8].

![Load Cell](image1)

**Figure 1.** Load Cell

2.2. Temperature sensor
Temperature sensor is a measurement parameter that is often used in the data acquisition process. Sensors have an important role in changing the quantity obtained from nature (analogous) into a quantity that can be processed by a computer (digital) [9]

2.3. Microcontroller
Microcontroller is one of the basic parts of a computer system. Microcontrollers are formed or composed of the same basic elements and have a smaller form than personal computers and mainframe computers [10]. Microcontroller is a chip in the form of an IC (Integrated Circuit) that can receive input signals, process them and provide output signals in accordance with the program that is loaded into them.

![Microcontroller](image2)

**Figure 2.** Microcontroller

2.4. Android Application
Android is an operating system used for Linux-based mobile devices. Android creates a platform that is open source for developers to be given the freedom to be able to create their own applications for various purposes.

2.5. Relay
Relay is an electronic component in the form of an electronic switch that can open or close a circuit using an electric current. The relay can also function as a safety. There are 2 principles of how it works,
1. Normally open (NO): the switch is connected to this contact when the relay is inactive or the switch can be said to be in an open condition.

2. Normally closed (NC): the switch is connected to this contact when the relay is active or it can be said the switch is closed. [12].

In a relay there is the term Pole and Throw, Pole is the number of contacts that a relay has, while Throw is the number of conditions that a contact has. Based on the classification of the number of Pole and Throw, relays are classified into 4 groups including Single Pole Single Throw (SPST), Single Pole Double Throw (SPDT), Double Pole Single Throw (DPST), and Double Pole Double Throw (DPDT).

**Figure 3. Relay**

### 2.6 Wi-fi

Wifi is a wireless network technology that uses high frequency. Wi = Fi technology uses frequencies that are in the 2.4 Ghz to 5 GHz spectrum. WLAN is a technology used to transfer data from one device to another without using a cable as a transmission medium by using radio waves to provide a network connection to all users in the surrounding area [13]. The specifications used in WLAN are 802.11 from IEEE. 802.11 is often called the Wi-Fi standard that deals with data access speeds. There are several types of specifications from 802.11, namely 802.11b, 802.11g, 802.11a, and 802.11n.

### 3. System procedure

When the clothes are in the cupboard and detected by a weight sensor, the heater system will turn on and the microcontroller will send information about the situation in the cabinet in the form of heavy clothing which then utilizes the heater will die when it reaches a predetermined temperature to prevent excess heat inside cupboard. The DC motor fan will also turn off to save power used. Microcontroller and weight sensor will still function. If when the clothes reach their dry limit, the smartphone owner will get a notification in the application that the clothes are dry. When the smartphone owner turns off the supply voltage, the process of drying clothes is finished.

**Figure 4. Block diagram**
4. Results and discussion

Testing the whole system is done by connecting all the modules that are there. The power supply module is used as a voltage source to power the entire module in the system and DC motor fan. NodeMCU as a processor is connected to the relay module and the weight sensor module. The temperature sensor is connected to the heater via a digital thermostat that has been connected to the relay module as a trigger. Digital thermostats use 220VAC voltage.

The first test is done by turning on the whole system without putting clothes on the loadcell. The fan will automatically turn on and the heavy sensor module can detect the presence or absence of load on the loadcell. The weight sensor module will send data to nodeMCU. NodeMCU will process information obtained through an internet connection to the owner's smartphone application.

| No. | Test                                           | Result   |
|-----|-----------------------------------------------|----------|
| 1   | The Power Supply Module Is Able to Turn On The Whole System | 12.12 V |
| 2   | Load cell Module Detects Weight               | 0 gr     |
| 3   | Relay Module for Turning on Digital Thermostats | Does not work |
| 4   | The NodeMCU Module Sends Severe Information Through the Internet | Sent |
| 5   | Informasi yang Ditampilkan pada Aplikasi Smartphone | 0       |

The next test is to put 1 shirt on loadcell. Information will be sent to the owner's smartphone application. In addition to sending information, NodeMCU also activates a relay whose purpose is to turn on the heater and temperature sensor.

| No. | Test                                           | Result   |
|-----|-----------------------------------------------|----------|
| 1   | The Power Supply Module Is Able to Turn On The Whole System | 12.12 V |
| 2   | Load cell Module Detects Weight               | 183 gr   |
| 3   | Relay Module for Turning on Digital Thermostats | Work     |
| 4   | The NodeMCU Module Sends Severe Information Through the Internet | Sent |
| 5   | Informasi yang Ditampilkkan pada Aplikasi Smartphone | 183     |
Figure 5. Results

5. Conclusion
Load cell module successfully performs its function in detecting loads or clothing. Load cell module has an important role to activate the digital thermostat, if there are no clothes then the temperature sensor and heating element do not light up, if there are clothes both components are active and start working. The temperature sensor along with a digital thermostat is able to work to disconnect and connect power to the heater. Applications that have been designed can work well, which displays information on the burden of clothes being dried. The information displayed when the clothes are dry is already in accordance with what has been planned that is <190 grams.

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