Automatic Lamp and Fan Control Based on Microcontroller

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Abstract. In general, automation can be described as a process following pre-determined sequential steps with a little or without any human exertion. Automation is provided with the use of various sensors suitable to observe the production processes, actuators and different techniques and devices. In this research, the automation system developed is an automatic lamp and an automatic fan on the smart home. Both of these systems will be processed using an Arduino Mega 2560 microcontroller. A microcontroller is used to obtain values of physical conditions through sensors connected to it. In the automatic lamp system required sensors to detect the light of the LDR (Light Dependent Resistor) sensor. While the automatic fan system required sensors to detect the temperature of the DHT11 sensor. In tests that have been done lamps and fans can work properly. The lamp can turn on automatically when the light begins to darken, and the lamp can also turn off automatically when the light begins to bright again. In addition, it can concluded also that the readings of LDR sensors are placed outside the room is different from the readings of LDR sensors placed in the room. This is because the light intensity received by the existing LDR sensor in the room is blocked by the wall of the house or by other objects. Then for the fan, it can also turn on automatically when the temperature is greater than 25°C, and the fan speed can also be adjusted. The fan may also turn off automatically when the temperature is less than equal to 25°C.

1. Introduction

Automation systems at home today has been developed. Automation can be generally described as a process following pre-determined sequential steps with a little or without any human exertion. Automation is provided with the use of various sensors suitable to observe the production processes, actuators and different techniques and devices [1]. Smart home automations gives the owner of a home an ultimate control over his or her home by automated lighting system, dimming, and electrical appliances. This advanced technology is used to do automation of a house activities, so it is also can be called as home automation [2].

One of the home automation systems developed is an automatic lamp system. In an era like this now has a lot of people who wander out of town. So that when there is time off work or school holiday, many of these people back to hometown and will leave their home sometimes for long periods of time. To avoid the house in the dark usually some lights will keep it turned on until be person returns home. This can certainly lead to wasteful consumption of electricity and disadvantageous the government. Lighting can account for 10–38% of the total energy bill in typical cities worldwide [6]. Therefore, the researcher is interested to develop the automatic lamp system that
the house lamp will turn on automatically if the light intensity has dimmed and will turn off automatically if the light density is bright again. This will definitely save electricity.

Then the home automation system developed also is an automatic fan system. Country of Indonesia including tropical country which has two seasons namely dry season and rainy season. However, in recent times the dry season occurs longer so that sun exposure occurs continuously and can cause temperature rise. At this time most of the existing fan in Indonesia is still manual that is necessary for the operator. In previous research by following technological developments, mechanical switch system is no longer the only way to control speed of the fan. Speed control of a fan can be controlled by the electronic circuit system [3-5]. Therefore, researchers also want to develop an automatic fan system as a room temperature controller. In this case the fan can turn on, off and adjust its speed according to room temperature.

2. Methodology

2.1. System Description

Smart home products made in the form of prototype which includes automatic lamp and automatic fan. Both systems will be processed using an Arduino Mega 2560 microcontroller. A microcontroller is used to obtain values of physical conditions through sensors connected to it [7]. In the automatic lamp system required sensors to detect the light of the LDR (Light Dependent Resistor) sensor. Some previous studies have also used LDR sensors for light detection in automatic lighting [8-11]. While the automatic fan system required sensors to detect the temperature of the DHT11 sensor. The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor [12]. The block diagram of this home automation system can be seen in Figure 1.

![Figure 1. The block diagram of making smart home products](image)

2.2. Automatic Lamp Design

In this automatic lamp system, the input is obtained from the LDR sensor. The LDR sensor serves to provide information about the intensity of light around. This information will be used by the microcontroller to make a decisions whether or not the light is turned on. In this process the lamp will light up when the light is dark (the light intensity is less than equal to 700) and the lamp will off again when the light is bright (the light intensity is greater than 700). For more details about this automatic lamp process can be seen in Figure 2.
2.3. **Automatic Fan Design**

In this automatic fan system, the input is obtained from DHT11 sensor. The DHT11 is a dual temperature and humidity sensor, meaning that it can read both temperature and humidity [13]. Microcontroller will receive input data from the sensor and will process it into output on the fan. The input of this sensor is the amount of temperature in the room, then we have to set program on the desired temperature and output fan speed limits. If the sensor’s read temperature is less than 25°C then the fan will off or will not rotate. If the temperature reads the sensor between 26 – 29°C then the fan will spin slowly. If the temperature reads the sensor between 30 – 34°C then the fan will spin at medium speed. Then if it exceeds 35 °C then the fan will spin rapidly. For more details about the process of this automatic fan detection can be seen in Figure 3.

![Flowchart automatic lamp system](image)

**Figure 2.** Flowchart automatic lamp system
3. Results And Discussion

3.1. Automatic Lamp Testing

Automatic lamp system testing is done at different times, with the aim of knowing how different LDR sensor readings at different light intensities. In previous research the LDR sensor was able to work well which has been proven from the reading result done in the morning and evening [14]. In this research the lamp used is a 1 watt HPL lamp that is placed outside the room (home page) and placed in the room (living room). This is done to determine the difference in function of the LDR if it is outdoors or indoors, because the intensity of light received will be different. Automatic lamp testing is done in the afternoon and morning, the test results can be seen in Table 1. In Table 1 it can be seen that the reading results of LDR sensors placed inside and outside the room are different. This is because the light intensity received by the LDR sensor in the room is blocked by the wall of the house or by other objects so the result is darker.

![Figure 3: Flowchart System Automatic Fan](image-url)
Table 1. The result of automatic lamp test

| Test Hours | LDR Sensor Readings | Lamp Condition |
|------------|---------------------|----------------|
|            | Indoors  | Outdoors | Indoors | Outdoors |
| 17:00      | 473      | 707      | On      | Off      |
| 17:15      | 461      | 724      | On      | Off      |
| 17:30      | 454      | 694      | On      | On       |
| 17:45      | 451      | 689      | On      | On       |
| 18:00      | 445      | 688      | On      | On       |
| 05:30      | 456      | 671      | On      | On       |
| 05:45      | 467      | 689      | On      | On       |
| 06:00      | 488      | 693      | On      | On       |
| 06:15      | 493      | 713      | On      | Off      |
| 06:30      | 505      | 719      | On      | Off      |

3.2. Automatic Fan Testing

Automatic fan system testing is performed within a full day, with the aim of knowing how much
temperature the DHT11 sensor reads at those times. The results of automatic fan testing can be seen in
Table 2. In Table 2 the temperature read by the DHT11 sensor provides action according to the
ambient temperature.

Table 2. The result of automatic fan test

| Test Hours | DHT11 Sensor Readings | Fan Condition | Fan Speed |
|------------|-----------------------|---------------|-----------|
|            | Indoors  | Outdoors | Indoors | Outdoors |
| 05:00      | 29       |          | On      | Slow     |
| 06:00      | 25       |          | Off     | -        |
| 07:00      | 27       |          | On      | Slow     |
| 13:00      | 33       |          | On      | Medium   |
| 14:00      | 33       |          | On      | Medium   |
| 15:00      | 35       |          | On      | Fast     |
| 18:00      | 32       |          | On      | Medium   |
| 23:00      | 32       |          | Off     | Medium   |
| 00:00      | 30       |          | Off     | Medium   |
| 01:00      | 30       |          | Off     | Medium   |

4. Conclusion

From the results of tests that have been done, it can be concluded that the lamps and fans can
work properly. The lamps can turn on automatically when the light begins to darken and the lamp can
also turn off automatically when the light begins to bright again. In addition, it can be concluded also
that the readings of LDR sensors are placed outside the room is different from the readings of LDR
sensors placed in the room. This is because the light intensity received by the existing LDR sensor in
the room is blocked by the wall of the house or by other objects. Then for the fan it can also turn on
automatically when the temperature is greater than 25°C and the fan speed can also be adjusted. Fan
rotation speed is divided into three namely slow, medium, and fast. Furthermore, the fan will
automatically shut off when the temperature is less than equal to 25°C.

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