International Journal of Advanced Engineering and Management Research

Vol. 9, No. 03; 2024

ISSN: 2456-3676

Ergonomic Design Using Anthropometric Methods to Reduce Electrical Power Use: Save Energy When Using Electrical Power

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doi.org/10.51505/ijaemr.2024.9309 URL: http://dx.doi.org/10.51505/ijaemr.2024.9309

Received: May 22, 2024 Accepted: May 29, 2024 Online Published: Jun 08, 2024

Abstract

Electric power is the dominant means needed by the entire community with all its risks. Electrical power is a basic thing in people's lives to carry out their daily activities. Moreover, people's lives are lives and with development to achieve better conditions, electricity is very necessary to support progress. To achieve this progress cannot be separated from electricity to support its achievement.

The longer the electricity condition, the more expensive it will be to use and this requires wise usage procedures. The current condition of electric power means that entrepreneurs who use electric power must be very careful in their use. For this reason, efforts are needed to reduce the use of electricity so that the business can run well. All kinds of efforts have been made to reduce electricity use which cannot be achieved properly.

The use of electric power is a condition related to life, its use must be planned and a design created that can be used in its use.

Keywords: Electrical Power, Business, Ergonomic Design, Anthropometric Methods

1. Introduction

Electricity usage is increasing, which means paying the electricity bill every month is increasing. Electricity makes us comfortable and using more electricity will increase enthusiasm for work and also make us safe. Using electricity will make work easier and more comfortable in life.

Electricity is considered a measure of life because the more electricity used, the more life increases. However, for most people, electricity is still considered expensive and they use as little as possible so that the remaining money can be used for other purposes. The simplest method used is to use an automatic device to illuminate the page (photocell) or by lowering the light according to the height of the person standing with their arms raised. If it's a hotel, you need to use a card key so that if the occupants of the room leave, all electricity usage stops (turns off). This situation must be done so that the lights save electricity and monthly bill payments are reduced. The use of electricity should be as simple as possible and the use of

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lights is increasing over time. Managing electricity usage is very difficult, but you have to use the right methods so that electricity can be used safely and comfortably. Comfort and safety in using electricity are the main goals, but energy savings must also be prioritized.

The design must be prioritized using ergonomics as a whole and installation must coincide with the construction of the house where the equipment will be installed.

2. Materials And Methods

a. Material

The material in this writing is about lights that are installed in a house, business inside or outside to provide light around the place or environment. Lamps provide light to both the yard and room for beauty as well as comfort. The lamp will be used to provide monotonous lighting to always illuminate the area with the same conditions and time in a device installed on the lamp to provide the same on and off time interval.

b. Method

The method will provide a way to solve existing problems based on how the problem is modeled.

Table 1. Lamp lights based on on time and off time using a photo cell.

o.	Afternoon Live Lights			Afternoon Live Lights		
	Light 1	Light 2	Light 3	Light 1	Light 2	Light 3
1	17.52	18.08	18.08	6.00	6.10	6.43
2	18.01	17.08	18.07	6.01	6.41	6.44
3	18.03	17.56	18.07	6.10	6.08	6.12
4	18.07	18.00	18.02	6.02	6.09	6.04
5	18.06	18.05	18.09	5.59	5.59	6.01
6	18.27	17.51	17.55	5.58	5.57	5.55
7	18.04	18.11	18.11	6.31	6.32	6.29
8	18.17	18.10	18.12	6.39	6.42	6.42
9	18.15	18.16	18.19	6.39	6.42	6.42
10	18.20	18.21	18.22	6.38	6.41	6.42
11	18.19	18.20	18.20	6.35	6.36	6.33
12	18.21	18.23	18.23	6.03	6.12	6.10
13	18.06	18.05	18.06	6.05	6.04	6.04
14	18.27	17.51	17.55	6.10	6.09	6.07
15	18.12	18.12	18.24	6.12	6.11	6.12
16	18.17	18.10	18.12	6.13	6.12	6.13

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17	18.15	18.16	18.19	6.27	6.26	6.30
18	18.20	18.21	18.22	6.27	6.29	6.34
19	18.19	18.20	18.28	6.32	6.33	6.34
20	18.21	18.23	18.23	6.27	6.29	6.29
21	18.31	18.33	18.34	6.25	6.27	6.28
22	18.35	18.37	18.37	6.36	6.37	6.38
23	18.33	18.34	18.35	6.31	6.35	6.35
24	18.26	18.27	18.27	6.21	6.25	6.27
25	18.25	18.26	18.27	6.30	6.26	6.31
26	18.27	18.30	18.29	6.27	6.26	6.31
27	18.23	18.26	18.27	6.24	6.23	6.20
28	18.19	18.18	18.19	6.18	6.17	6.15
29	18.19	18.18	18.19	6.15	6.16	6.17
30	18.14	18.18	18.18	6.15	6.17	6.18
31	18.07	18.09	18.11	6.15	6.16	6.16
32	18.13	18.14	18.15	6.20	6.22	6.22
33	18.20	18.02	18.02	6.30	6.30	6.32
34	18.04	18.08	18.09	6.30	6.31	6.32
Average	18,15	18,08	18,15	6,18	6,20	6,23

Table 2. Lights on based on on time and off time without using a photo cell (with switch)

No.	Lights on in the evening			Lights off in the morning		
	Light 1	Light 2	Light 3	Light 1	Light 2	Light 3
1	18.20	18.20	18.20	7.00	7.00	7.00
2	18.50	18.50	18.50	6.30	6.30	6.30
3	18.20	18.20	18.20	7.00	7.00	7.00
4	18.50	18.50	18.50	7.30	7.30	7.30
5	18.20	18.20	18.20	7.00	7.00	7.00
6	18.50	18.50	18.50	7.30	7.30	7.30
7	18.20	18.20	18.20	8.00	8.00	8.00
8	18.50	18.50	18.50	7.40	7.40	7.40
9	18.20	18.20	18.20	7.00	7.00	7.00
10	18.50	18.50	18.50	7.05	7.05	7.05
11	18.20	18.20	18.20	7.30	7.30	7.30

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12	18.50	18.50	18.50	7.00	7.00	7.00
13	18.20	18.20	18.20	7.30	7.30	7.30
14	18.50	18.50	18.50	8.00	8.00	8.00
15	18.20	18.20	18.20	7.40	7.40	7.40
16	18.50	18.50	18.50	7.00	7.00	7.00
17	18.20	18.20	18.20	8.05	8.05	8.05
18	18.50	18.50	18.50	7.40	7.40	7.40
19	18.20	18.20	18.20	8.15	8.15	8.15
20	18.50	18.50	18.50	8.00	8.00	8.00
21	18.20	18.20	18.20	7.15	7.15	7.15
22	18.50	18.50	18.50	7.30	7.30	7.30
23	18.20	18.20	18.20	8.00	8.00	8.00
24	18.50	18.50	18.50	7.40	7.40	7.40
25	18.20	18.20	18.20	7.00	7.00	7.00
26	18.50	18.50	18.50	7.05	7.05	7.05
27	18.20	18.20	18.20	7.30	7.30	7.30
28	18.50	18.50	18.50	7.00	7.00	7.00
29	18.20	18.20	18.20	7.30	7.30	7.30
30	18.50	18.50	18.50	8.00	8.00	8.00
31	18.20	18.20	18.20	7.40	7.40	7.40
32	18.50	18.50	18.50	7.00	7.00	7.00
33	18.20	18.20	18.20	8.05	8.05	8.05
34	18.50	18.50	18.50	7.40	7.40	7.40
Average	18,35	18,35	18,35	7,36	7,36	7,36

Table 3. Differences in light flame before and after using photo cells

Average with cell photos	18,15	18,08	18,15	6,18	6,2	6,23
Average without cell photos	18,35	18,35	18,35	7,36	7,36	7,36
Difference	0,2	0,27	0,2	1,18	1,16	1,13
Final Difference				0,98	0,89	0,93

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Table 4. Lights turn on and off using a timer

No.	The lights come on in the afternoon			The lights go out in the morning		
	Light 1	Light 2	Light 3	Light 1	Light 2	Light 3
1	18,00	18,00	18,00	6,00	6,00	6,00
2	18,00	18,00	18,00	6,00	6,00	6,00
3	18,00	18,00	18,00	6,00	6,00	6,00
4	18,00	18,00	18,00	6,00	6,00	6,00
5	18,00	18,00	18,00	6,00	6,00	6,00
6	18,00	18,00	18,00	6,00	6,00	6,00
7	18,00	18,00	18,00	6,00	6,00	6,00
8	18,00	18,00	18,00	6,00	6,00	6,00
9	18,00	18,00	18,00	6,00	6,00	6,00
10	18,00	18,00	18,00	6,00	6,00	6,00
11	18,00	18,00	18,00	6,00	6,00	6,00
12	18,00	18,00	18,00	6,00	6,00	6,00
13	18,00	18,00	18,00	6,00	6,00	6,00
14	18,00	18,00	18,00	6,00	6,00	6,00
15	18,00	18,00	18,00	6,00	6,00	6,00
16	18,00	18,00	18,00	6,00	6,00	6,00
17	18,00	18,00	18,00	6,00	6,00	6,00
18	18,00	18,00	18,00	6,00	6,00	6,00
19	18,00	18,00	18,00	6,00	6,00	6,00
20	18,00	18,00	18,00	6,00	6,00	6,00
21	18,00	18,00	18,00	6,00	6,00	6,00
22	18,00	18,00	18,00	6,00	6,00	6,00
23	18,00	18,00	18,00	6,00	6,00	6,00
24	18,00	18,00	18,00	6,00	6,00	6,00
25	18,00	18,00	18,00	6,00	6,00	6,00
26	18,00	18,00	18,00	6,00	6,00	6,00
27	18,00	18,00	18,00	6,00	6,00	6,00
28	18,00	18,00	18,00	6,00	6,00	6,00
29	18,00	18,00	18,00	6,00	6,00	6,00
30	18,00	18,00	18,00	6,00	6,00	6,00
31	18,00	18,00	18,00	6,00	6,00	6,00

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32	18,00	18,00	18,00	6,00	6,00	6,00
33	18,00	18,00	18,00	6,00	6,00	6,00
34	18,00	18,00	18,00	6,00	6,00	6,00
Average	**18,00**	**18,00**	**18,00**	**6,00**	**6,00**	**6,00**

Table 5. Lights turn on and off using without a timer

No.	Lights on in the evening			Lights off in the morning		
	Light 1	Light 2	Light 3	Light 1	Light 2	Light 3
1	17,00	17,00	17,00	7,00	7,00	7,00
2	17,00	17,00	17,00	6,30	6,30	6,30
3	18,30	18,30	18,30	7,00	7,00	7,00
4	17,35	17,35	17,35	7,30	7,30	7,30
5	18,20	18,20	18,20	7,00	7,00	7,00
6	18,50	18,50	18,50	7,30	7,30	7,30
7	18,20	18,20	18,20	8,00	8,00	8,00
8	17,00	17,00	17,00	7,40	7,40	7,40
9	18,30	18,30	18,30	7,00	7,00	7,00
10	17,35	17,35	17,35	7,15	7,15	7,15
11	18,20	18,20	18,20	7,30	7,30	7,30
12	18,50	18,50	18,50	7,00	7,00	7,00
13	18,20	18,20	18,20	7,30	7,30	7,30
14	18,20	18,20	18,20	8,00	8,00	8,00
15	18,50	18,50	18,50	7,40	7,40	7,40
16	18,20	18,20	18,20	7,00	7,00	7,00
17	17,00	17,00	17,00	8,05	8,05	8,05
18	18,30	18,30	18,30	7,40	7,40	7,40
19	17,35	17,35	17,35	8,15	8,15	8,15
20	18,30	18,30	18,30	8,00	8,00	8,00
21	18,30	18,30	18,30	7,30	7,30	7,30
22	18,21	18,21	18,21	8,00	8,00	8,00
23	18,30	18,30	18,30	7,40	7,40	7,40
24	18,20	18,20	18,20	7,00	7,00	7,00
25	17,00	17,00	17,00	8,05	8,05	8,05
26	18,30	18,30	18,30	7,40	7,40	7,40

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27	17,35	17,35	17,35	8,15	8,15	8,15
28	18,30	18,30	18,30	8,00	8,00	8,00
29	18,30	18,30	18,30	7,30	7,30	7,30
30	18,21	18,21	18,21	8,00	8,00	8,00
31	18,30	18,30	18,30	7,00	7,00	7,00
32	17,35	17,35	17,35	8,05	8,05	8,05
33	18,30	18,30	18,30	7,40	7,40	7,40
34	18,30	18,30	18,30	8,15	8,15	8,15
Average	**17,96**	**17,96**	**17,96**	**7,48**	**7,48**	**7,48**

Table 6. Difference between using a timer and not using a timer

With Timer	**18**	**18**	**18**	**6**	**6**	**6**
No Timer	**17,96**	**17,96**	**17,96**	**7,48**	**7,48**	**7,48**
Difference	0,04	0,04	0,04	-1,48	-1,48	-1,48
Final Difference				-1,52	-1,52	-1,52

Table 7. Save electricity by using a Card Key

No.	Entry Hours Before Using Card Key			Clock out Using Card Key		
	1	**2**	**3**	**1**	**2**	**3**
1	13	14	13	6,30	6	6
2	13	13	13	6	6	6
3	14	13	13	6	6	6
4	15	14	14	6	7	7
5	14	13	14	7	7	7
6	14	14	15	7	6,30	6,30
7	13	15	13	6,30	6,30	6,30
8	14	15	13	6,30	6	6
9	15	14	14	6	6	6
10	13	14	13	6	6	6
11	14	13	14	6	7	7
12	15	14	15	7	7	7
13	14	15	15	7	6,30	6,30
14	14	13	14	6,30	6	6
15	13	14	14	6	7	7

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16	14	15	13	7	7	7
17	15	14	14	7	7	6,30
18	14	14	15	6,30	6,30	6
19	14	13	13	6	6,30	7
20	13	13	14	6	6	7
21	14	14	15	7	6	7
22	15	15	14	7	6	6,30
23	15	14	13	6,30	7	6,30
24	14	14	13	6,30	7	6
25	14	13	14	6	6,30	6
26	13	14	15	6	6	6
27	14	15	14	6	5	7
28	15	14	14	7	5,3	6
29	13	15	13	7	5	6
30	14	14	13	6	6	6
Average	**17,96**	13,97	13,80	6,40	6,27	6,39

Table 8. Electrical data with and without card keys in the room

No.	Before Using Card Key			After Using Card Key		
	Room 1 (jam)	Room 2 (jam)	Room 3 (jam)	Room 1 (jam)	Room 2 (jam)	Room 3 (jam)
1	12	12	12	7	7	8
2	12	10	12	6	7	9
3	11	12	10	8	8	10
4	12	12	12	7	7	8
5	12	10	12	7	7	9
6	11	12	10	7	7	10
7	12	12	12	7	7	8
8	10	12	12	6	8	9
9	12	9	9	8	7	7
10	12	12	12	7	7	8
11	12	12	12	7	7	7
12	12	9	12	7	7	8
13	12	12	9	7	7	9
14	12	12	12	7	7	10
15	12	12	12	8	8	8

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16	12	10	12	7	7	9
17	12	12	10	7	7	10
18	11	12	12	7	7	8
19	12	12	12	8	7	9
20	12	12	12	7	8	7
21	12	12	9	7	7	9
22	12	12	12	8	7	10
23	12	9	12	7	10	8
24	12	12	8	7	10	9
25	10	12	12	8	9	10
26	12	12	11	7	8	8
27	12	10	12	7	10	9
28	10	12	9	8	9	10
29	12	12	10	7	8	6
30	12	12	12	6	9	7
Average	11,70	11,43	11,17	7,13	7,70	8,57

Table9. Use of Card Keys

No.	Before Using Card Key			After Using Card Key		
	Room 1 (jam)	Room 2 (jam)	Room 3 (jam)	Room 1 (jam)	Room 2 (jam)	Room 3 (jam)
Average	11,70	11,43	11,17	7,13	7,70	8,57
Final Difference				4,57	3,73	2,60

3. Discussion

3.1 Yard lights use SELCON

3.1.1 Installation of SELCON in yard lights.

SELCON functions to ensure that the lights turn on and off at specified times so that they can turn on properly at night. The SELCON function can be ensured to reduce excessive use of lamps. SELCON is a tool that can be used as a tool that will be attached to a lamp so that the lamp can turn on and off automatically. SELCON works automatically based on the strength of sunlight that shines throughout the day. Sunlight is needed to make the pieces of the two metals in the SELCON which have different densities become exposed to heat so that they stretch and do not connect the two types of metal so that electric current does not flow through the metal and the electric current is not distributed and the light goes out.

In the afternoon towards evening the sunlight began to weaken so that the two metals began to approach each other until they finally touched and the lights began to come on. In the morning

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the sun's rays began to appear and shine so that the two metals began to stretch and the lights went out. This process always repeats itself in the morning and evening so that SELCON can function according to its design and benefits.
Using a SELCON can be seen to save close to 1 hour per day per lamp so it can be said that this tool is suitable for use as a tool to save energy. From the research used, three lamps in saving one lamp can save almost 1 hour as seen in Table 3. With the composition of lamps 1, 2, 3, the time obtained in lighting for one day is 0.98, 0.89, 0, 93 hours. Thus, it is very feasible to use SELCON because it is proven that the results obtained are shown in Table 3 and it is feasible to use it.

3.1.2 Page lighting without using SELCON

If the lights do not use SELCON, the owner must be careful and skillful in turning the light switch on and off so that the lights don't stay on all day. The main function of a light switch is to turn on and turn off the electric current source. If the source of electric current is cut off with a device called a switch, the electric current cannot be cut off automatically. The power of the switch also has certain limitations, for this reason the switch must be adjusted to the size of the lamp installed. The switch must not be installed with lights that exceed the power of the switch. If it is installed with excessive power, it can cause a short circuit and cause heat to occur in the switch and cause the tire to burn.

3.2 Terrace lights use DIMER

DIMER is a tool used as a time limiter in order to limit the desired time. The dimer functions automatically. A time limiter is needed to reduce the time used by a working tool so that it does not exceed the specified working capacity. The lights on the terrace use a time limiter (DIMER) to limit the operation of the lights so that they do not exceed the working time. Time limiters are installed on terrace lights as a control in the use of electric current which is increasingly expensive.

By using DIMER, this tool means it is very useful because the results of its use are very successful in producing values that are suitable for use, such as: 1 hour 52 minutes for DIMER 1, 1 hour 52 minutes for DIMER 2 and 1 hour 52 minutes for DIMER 3. Installation of the DIMER tool will make humans forget the disease humans have, namely forgetfulness.

3.3 Terrace lights do not use DIMER

Electricity can be used in good condition and is very easy to use, but it will be dangerous if you use it incorrectly. Cables are a means of channeling electric current so that electricity can be utilized properly. The cable must be of good quality with standards that meet the size or diameter appropriate to the equipment to be installed. DIMER must also be in accordance with the capability requirements of the DIMER itself with the limitations of the DIMER's capabilities. So DIMER must be used within limits and to limit the running time of the lamp. For this reason, the timer is used as a means to limit the running time of the lights and if you

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don't use a timer, you can be sure that the lights will stay on longer and make electricity use longer and make you pay more electricity bills at the end of the month.

3.4 Rooms use electric card locks

The function of the card door lock is to regulate the on and off power and cut off electricity for the entire room. Cutting off the electric current must be done and disconnection is carried out on all electric currents in the room. If a guest leaves the room for certain purposes, the card will be removed from where it was placed. After the card is removed from the key very slowly, the electric current will be cut off and the disconnection of the electric current will be done automatically.

The use of card keys can be used to save energy in hotels or other businesses because there is evidence that the use of card keys can indeed be relied on to save energy in a business or other use. very good energy. Energy savings reach 4 hours 57 minutes in room 1, for room 2 the savings reach 3 hours 73 minutes (4 hours 13 minutes) and for room 3 the savings reach 2 hours 60 minutes) or 3 hours.

3.5 The room does not use an electric card lock

The electric card lock actually has a working principle that is almost the same as the working principle of other safety devices used for other automatic electrical breakers. Other disconnecting devices are also expected to work according to expectations so that they can work to cut off electrical currents according to the limits of the device itself. Humans have abilities and limitations and often forget things that must be done, such as the daily work of turning off the electric circuit breaker to reduce the burden of electricity payments. To not forget to turn off, especially turning off the electric current, use a power breaker with automatic capabilities. For example, in rooms that are rented, automatic devices such as electric card locks are used so that those who occupy them leave, automatically all facilities that use electricity are turned off.

Conclusion

The conclusions that can be drawn are:
The use of the three circuit breakers is so that in use they can function to save electricity as desired and can help in turning on and off the electric current by itself and can reduce electricity usage. Circuit breaker operation. This is almost the same as other circuit breakers, only the way it works is automatically.

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