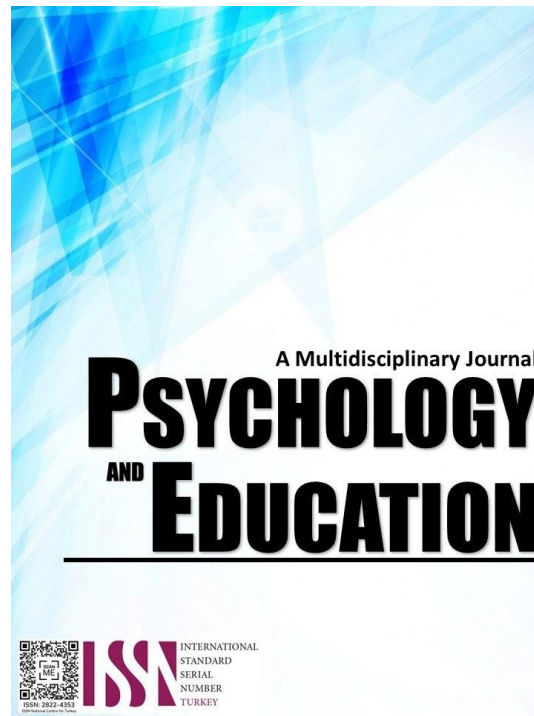


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PSYCHOLOGY AND EDUCATION: A MULTIDISCIPLINARY JOURNAL

2023

Volume: 13

Pages: 1002-1005

Document ID: 2023PEMJ1228

DOI: 10.5281/zenodo.8380119

Manuscript Accepted: 2023-24-9

2-In-1 Motion and Sound Powered Desk Lamp

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Abstract

For elders and PWDs, it is sometimes arduous for them to reach the switch of the light and turn it on. Hence, innovating new and unique light bulbs might help them and it can be favorable for students, children, and the elderly. This study aimed to create a 2-in-1 motion and sound-powered desk lamp in terms of detecting different hand motions and sound sources. The device was assembled by programming the code of the Arduino. Different wires served their purpose and were then connected to the Arduino. Quantitative observation was utilized in this study in which a series of testing was conducted to determine the sound and motion sensitivity of the 2-in-1 motion and sound-powered desk lamp. The results showed that the motion and sound sensitivity were both rated excellent in turning the device on by 5 different hand motions (back and forth vertical and horizontal handwave motion, raising the front and back parts of the hand, pushing the palm towards the sensor, and peace sign hand gesture) and 3 specified sound sources (handclap, knocking, and tapping an object) The study concluded that the 2-in-1 motion and sound Powered desk lamp has a high sound and motion sensitivity which enables it to emit light automatically.

Keywords: *arduino, hand motion, powered desk lamp, sound, sensor, sensitivity*

Introduction

People are living in a century where various inventions have been made. As mankind continues to evolve, technology also improves. Way back before, the first way of turning a light bulb on was by heating the metal filament until it glows. And then a lot of inventors made their contribution by improving the way the light bulb turns on. Experiments have been conducted and plugged-on and switched-on light bulbs came to life. Light bulbs can now be turned on through sensors such as motion and sound. Life is made easier through technology. With that, the researchers developed an invention connecting a motion sensor with a sound sensor to produce light.

Motion and sound-powered desk lamp is a quality lighting design that produces light innovatively. The motion and sound sensors in the bulb automate the light switch. So, the motion sensor turns itself on and off after detecting a gesture, whereas the sound sensor is turned on and off by detecting sounds. In conclusion, this device may be helpful in terms of saving electricity and reducing the bills of homeowners. Sometimes, it is arduous for elders and PWDs to reach the switch of the light and turn it on. With this, the researchers came up with the idea of making a motion and sound-powered device. Additionally, this device might also be helpful to students when they are studying. Through this device, the lives of many people might be easier. Moreover, the sound and motion-powered device is user convenient as well as it is beneficial for students, children, and the elderly. Further, this study aimed to

design and develop an improved version of a smart desk lamp that is activated by motion and sound in terms of its motion and sound sensitivity.

Literature Review

The lighting based on motion sensing of people, animals, and objects is known as motion sensor lighting. Motion sensor lights do not require touch to turn on or off the lights. The system is very useful for children, the elderly, and disabled people. The trigger is an electronic signal that is also a response generated by the sensor. Every sensor has a normal state, and the motion sensor is triggered when it is disturbed. Some sensors report not only the disturbance but also when the sensor returns to its normal state (Tuteja, Jain, Singla, & Sharma, 2014).

There are mainly two classes categorized for motion detection, i.e. pixel-based motion detection and region-based motion-based algorithm. The pixel-based motion detection is based on binary difference by employing the local model of intensity used in real-time applications. The latter is based on the spatial dependencies of neighboring pixel colors to provide a result that is more robust to false alarms. The region-based motion detection algorithm includes special point detection and block matching algorithm. (Charadva, Sejpal, & Sarwade, 2014).

There are numerous benefits or advantages of motion sensor LED bulbs such as It consumes very low power, it eliminating manual switching of the device i.e. Bulb, motion activation saves thousands of hours



of run time and hence prolongs the life of the LED bulb, it saves energy i.e. electricity. When a person forgets to turn off the switch, the light bulb automatically gets OFF after a few seconds (~20) of idle condition., it uses a B22 cap which offers a direct replacement for an incandescent bulb, it also offers a sturdy structure, durability and corrosion resistance, it operates with wider voltage range from 120V to 320V, it works with low light ambiance conditions, and the radar motion sensor based lighting does not use UV and IR rays (RF Wireless World, 2012).

More so, loudspeakers function much like bulbs, enabling you to hear by turning the to-and-fro movements of electrical currents, which encode the sound, into the to-and-fro movements of air. Hearing a sound is a process. So, it cannot be sensibly thought of as an energy in a store, which is as a result something that has happened: sound is happening, or it is not sound. Making connections between sound and energy descriptions is best done through power. The sounding is a pathway that empties or fills stores of energy. Sound is not a store of energy. Yet, the power of a sound we hear is tiny, but it is best thought of as filling or emptying stores through the mechanical working pathway (Institute of Physics, 2023).

Moreover, a sound sensor is used to detect sound in the desk lamp. It is also known as an acoustic sensor, which refers to a module that detects sound waves through their intensity and proceeds to convert them into electrical signals. It consists of a diaphragm, a magnet, a coil, and some wires. The human body process that involves our ears and signal transmission to the brain works similarly to the stimulus-to-response pathways seen in electronic sound sensor operation. However, what's different is that a sound sensor consists of an in-built capacitive microphone, a peak detector, and an amplifier that's highly sensitive to sounds (Shawn, 2020).

Sound sensors, when attached to a microcontroller like Arduino, the electrical signals can be read. The microcontroller can then code to respond to the signal and do things like turn lights on and off in response to sounds (Koche, 2021). Microphones are the sound sensors used in phones, computers, baby monitors, and music systems like karaoke machines. The use of sensors has exploded into the design of uncountable everyday tools, equipment, appliances, and devices (Teach Engineering, 2021).

Methodology

The device was assembled by programming the code of the Arduino. Different wires served their purpose and were then connected to the Arduino. The prototype design was then assembled with the use of recyclable materials like plastic spoons, shredded strand sack, tubes, and plastic containers. Quantitative observation was utilized in this study in which a series of testing was conducted to determine the sound and motion sensitivity of the 2-in-1 motion and sound-powered desk lamp. When the device was activated, five different body motions were tested. First, the vertical handwave motion was tested back and forth in front of the motion sensor. Second, the horizontal handwave motion was tested back and forth in front of the motion sensor. Third, the front part of the hand was raised by the researcher in front of the motion sensor. Fourth, the back part of the hand was raised by the researcher in front of the motion sensor. After this, a peace sign hand gesture was raised by the researcher. These hand signs' efficiency in turning the light bulb on was tested. A constructed scaling was made to identify the performance of the device using the said hand gestures.

The sound sensor was tested right after. Four different sounds were tested. First, the handclap was tested on the sound sensor. Second, snapping was tested by the researchers on the sensor. Third, a knocking was tested on the sound sensor. After these, tapping an object was tested by the researchers. These four different sounds' efficiency in turning the light bulb on was tested. A constructed scaling was made to identify the performance of the device using the said sounds. The device was analyzed through descriptive analysis. This analysis helps to describe or summarize the characteristics of the data.

Results and Discussion

Table 1. *Sensitivity of the 2-in-1 Motion and Sound Powered Desk Lamp through hand movements.*

<i>Hand Movements</i>	<i>1st Trial</i>	<i>2nd Trial</i>	<i>3rd Trial</i>	<i>Mean</i>	<i>Description</i>
Back and Forth Vertical Handwave Motion	3	3	3	3	Excellent
Back and Forth Horizontal Handwave Motion	3	3	3	3	Excellent
Raising the front part of the hand	3	3	3	3	Excellent
Raising the back part of the hand	3	3	3	3	Excellent
Pushing the palm towards the sensor	3	3	3	3	Excellent
Peace sign hand gesture	3	3	3	3	Excellent



Table 2. Sensitivity of the 2-in-1 Motion and Sound Powered Desk Lamp through sound detection.

Sound Sources	1 st Trial	2 nd Trial	3 rd Trial	Mean	Description
Handclap	3	3	3	3	Excellent
Snapping	1	1	1	1	Poor
Knocking	3	3	3	3	Excellent
Tapping an object	3	3	3	3	Excellent

A series of testing was conducted to determine the sound and motion sensitivity of the 2-in-1 motion and sound-powered desk lamp. The result shows that the sensitivity of the device in 5 different hand movements in 3 trials, all of the body movements employed are rated 3 which denotes *Excellent* in turning the desk lamp on. This is probably due to the movement that these actions produce. These five different body motions produce accurate motions which make it easier for the sensor to detect. Supporting this data, Tuteja and her group (2014) stated that every sensor has a normal state, and the motion sensor is triggered when it is disturbed. This implies that the 2-in-1 Motion and Sound Powered Light Bulb has high sensitivity in detecting different hand movements to emit light.

Moreover, 4 different sound sources were tested in 3 trials in the sound sensitivity of the device. As shown, handclap, knocking, and tapping an object are rated 3 which denotes *Excellent* while snapping is rated 1 means *Poor* in turning the desk lamp on. Koche (2021) stated that sound sensors, when attached to a microcontroller like Arduino, the electrical signals can be read. The microcontroller can then code to respond to the signal and do things like turn lights on and off in response to sounds. This implies that the 2-in-1 motion and sound Powered desk lamp has high sound detection sensitivity only in handclap, knocking, and tapping on an object in which that sound is audible.

Overall, the motion and sound sensitivity were both rated excellent in turning the device on by 5 different hand motions and 3 specified sound sources. Furthermore, the study recommends that future researchers develop a device that is activated by speech recognition.

Conclusion

The study concludes that the 2-in-1 motion and sound-

powered desk lamp has a high sound and motion sensitivity which enables it to emit light automatically.

References

- CHARADVA, M.J., Dr. N.P. SARWADE, and R.V. SEJPAL. 2014. A Study of Motion Detection Method for Smart Home System. *International Journal of Innovative Research in Advanced Engineering (IJIRAE)*. 1:149. Retrieved on January 27, 2022 from [http://www.ijirae.com/images/downloads/vol1issue5/JNEE10086\(29\).pdf](http://www.ijirae.com/images/downloads/vol1issue5/JNEE10086(29).pdf).
- DIMACULANGAN, J., R.W. CANTA, L.J. COSICO, and J.K. VITERBO. 2015. Design and Development of a Solar-powered Lighting System Using Motion Sensing Detection. *Journal of Engineering and Computer Studies*. 3:114. Retrieved on February 21, 2022 from https://www.researchgate.net/publication/310798444_Student_Active_Participation_in_the_Study_of_the_Light_Bulbs.
- INTERNATIONAL DARK SKY ASSOCIATION (IDA). 2019. Light Pollution Wastes Energy and Money. Retrieved on January 27, 2022 from <https://www.darksky.org/light-pollution/energy-waste/>
- Institute of Physics. 2023. Light and sound as pathways. Retrieved on July 29, 2023 from <https://spark.iop.org/light-and-sound-pathways>.
- KOCHE V. 2021. Sound sensor. Retrieved on January 15, 2023 from <https://www.semiconductorforu.com/sound-sensor/>
- LATEST OPEN TECH FROM SEED. 2020. What is a sound sensor? – Uses, Arduino Guide, Projects. Retrieved on January 15, 2023 from <https://www.seeedstudio.com/blog/2020/01/03/what-is-a-sound-sensor-uses-arduino-guide-projects/>.
- OGRUTAN P., L.E ACIU, C. GERIGAN, and F. SANDU. 2016. Student Active Participation in the Study of the Light Bulbs. *TEM Journal*. 5:425. Retrieved on January 27, 2022 from https://www.researchgate.net/publication/310798444_Student_Active_Participation_in_the_Study_of_the_Light_Bulbs.
- RF Wireless World. 2012. LED bulb for motion sensor lighting. Retrieved on July 29, 2023 from <https://www.rfwireless-world.com/Terminology/Advantages-and-Disadvantages-of-Motion-Sensor-Lighting.html>.
- TEACH ENGINEERING. 2021. How Does a Sound Sensor Work? Retrieved on January 15, 2023 from https://www.teachengineering.org/lessons/view/umo_sensorswork_lesson04.
- TUTEJA, D., D. JAIN, H. SINGLA, and D. SHARMA. 2014. Detailed Survey on Motion Sensing. *Journal of Basic and Applied Engineering Research*. 1:27. Retrieved on January 27, 2022 from https://www.krishiansanskriti.org/vol_image/03Jul20150907539.pdf.

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