
Thesis Project Portfolio

Development of a Multi-purpose Lamp that Adjust Brightness Automatically
(Technical Report)

How companies fight back against challenges introduced by Smart Home Technology
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

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Spring, 2021

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Sociotechnical Synthesis

The widespread of smartphones and high-speed internet gives rise to the enormous market of smart home technology products. A well-designed smart home provides residents with the ability to control their houses' maintenance in an optimized way. This project analyzed the potential challenges smart home technologies brought up and various ways the current companies tried to solve them and designed a smart lamp that prioritizes user experience by adapting to and improve the techniques companies are using.

The technical portion utilized a Light Dependent Resistor (LDR), which changes its resistivity according to the light intensity. A series of amplification circuits are used to transfer this change in resistance into a change in voltage in the range 0V - 3V. This voltage signal is then sent to MSP430, a microcontroller that controls all functionalities of the lamp. The controller then sends out a signal that links to the led driver. The driver then adjusts the light intensity according to the signal preprocessed by the controller. The controller can also work as a central hub that allows connection from Wi-Fi units, Bluetooth units, motion sensors, etc. These units can function as another input besides the LDR to control the light.

The STS portion explored the current challenges in smart home technologies and categorized them as two major issues: security issues and cost issues. Then the existing solutions on how companies overcoming these two issues are explored and examined. To deal with security issues, companies build their products by both applying physical isolation and software encryption techniques. These solutions do help solve the problem in some ways and still have space for improvements. For money and time cost issues, companies mainly try to reduce the monetary cost by allowing the product to save money in the long run and reduce the time cost by minimizing the installation process and designing user-friendly control logic.

The technical portion of this project can still be improved through time: new functionalities can be added to the system to help improving user experience. A mobile app could be developed to control the lamp through the Internet and Bluetooth; A lift to light up mode can also be implemented to add night light functions into the lamp. The STS portion of this project can also be expanded. With technological improvements, companies will release new solutions to overcome the challenges of smart home technologies. Keep tracking the changes could improve the research result and gain new insights. I want to thank Professor Ferguson for his guidance and help during the STS portion of my thesis. In addition, I would like to acknowledge Professor Powell and Barnes, who guided us through the capstone project.