Value of Smart Home Devices and Cost of Implementation

Danny Liu
California Polytechnic State University, San Luis
Obispo
San Luis Obispo, CA

A home to many is a comfortable and safe place to enjoy their leisure, a getaway from the world around them, and something they truly appreciate acquiring. A smart home can contribute to the comfort, efficiency, and value of a home to certain individuals. Upgrading a home from a traditional aspect to a smart home can be done as an easy do-it-yourself project on a weekend or several, depending on the number of upgrades desired. Major brands have and continue to release new products for smart homes that are simple and easy to use. The estimate sheet provided gives homeowners a rough cost to transform a typical 2,400 square foot home in Alameda, CA to a smart one. This paper provides survey responses of individuals that own smart home devices and how these devices add value to their life. Additionally, the participants that use smart home products would recommend them to their friends and family. The survey also suggests that most people that do not already own smart home products would want to add them in the future. Smart homes provide a more comfortable, efficient, and valuable home.

Key Words: Smart Home Technology, Smart Home Security, Smart Lighting, Google Home, Amazon Echo

Introduction

Technology is something that everyone uses every day in our lives. Through the wide range of functions a cell phone has, benefiting the daily life of a human being, it proves there is no reason to think that technology is useless. Moreover, smart home technology has rapidly evolved over the past decades and can help homeowners or renters ease their day-to-day activities with a push of a button or with a few spoken words. Smart homes would also enhance comfort, convenience, security, and leisure through the automation of manual processes. Bringing a current home and advancing it into a smart home should not be rocket science, and I am glad to say it is not. Simple research should be done based on the user's end goals, and the intended purpose of the smart home in order to choose a product that best fits those needs. Smart home technology has been made simple enough for a do it yourself based project and can be easily implemented into a home. There are however, some considerations or other costs that might need to be calculated before diving deep down the smart home path.

The Industrial Revolution changed our lives in major ways that people rarely ever think of. The advancement to machinery, electronics, and the railroad changed society permanently (History, 2009). The first ever binary programmable computer was created in 1936 and after that, many more technological advancements have been made (Computer Hope, 2021). Home technology can date as far back as the 1900's when home appliances came out such as the vacuum cleaner, and later on irons, refrigerators, and many other components were invented. (Hendricks, D. 2014). Smart home technology can be attributed to 1966 where the ECHO IV was the first automated home device created, this was the first device that could control temperature and appliances in homes (Smart Home Design, 2019). Years later in the 2000's, smart home innovation increased and "smart devices and systems have been evolving at a rapid pace. It was estimated that by 2012, there were already 1.5 million automated home systems in place" (Smart Home Design, 2019). It is safe to say that with technology advancing more each day, the results of this advancement will be more integrated smart home devices.

Selection of Smart Home Products

Since smart home technology has been advancing and getting increasingly more popular, more people are getting ready to purchase this technology. Up to fifty seven percent of households in the United States are expected to own smart home devices by 2025 (Vigderman, A. 2020). When first researching the process to convert a traditional home into an integrated smart home, a vast amount of information and data can be found, overwhelming the homeowner. On the contrary, creating a smart home is not as hard as some of the information and data can portray it to be. Major brands such as Google, Amazon, Apple, Philips, Belkin, Eufy, Lutron, Ecobee, Ring and others offer products that are quite simple to install for a weekend project. In the beginning stage of this process, it is highly recommended to choose an ecosystem that can do all the functions you want your smart home to be equipped with (Looper, C. 2020). A coherent smart home installation is something that is important, as a homeowner you would not want to be in a position where your smart home components are not able to integrate with each other. Ensuring that the products selected are able to connect to one another is crucial. Conversely, anyone with a smartphone that has access to the internet, and an application could also control the items through their own branded application.

Smart Speakers

Convenience and time savings are invaluable to many people. Smart speakers can improve efficiency and increase the productivity of people's daily lives from dawn to dusk. Smart speakers are most likely "the starting point for building a do-it-yourself smart home" (Brown, R. & Priest, D. & Crist, R. & Price, M. 2021). Bringing out your phone to have an alarm or checking the weather is convenient but talking to a speaker and doing the same functions could be invaluable when your hands are full or you are in a hurry with other tasks.

Smart speakers such as the Google Home are compatible with up to 161 devices that are shown on the website, more items can be found through other retailers as well. Most items that are compatible with Google Home will state "works with the Google Assistant" on them. These items range from "lighting, security & awareness, comfort & control, and connectivity & entertainment" (Google, 2021). The Google Home can be used to control those devices compatible with the smart speaker such as listening to music, setting alarms, control home lighting, control home temperature, and other functions depending on the Google smart speaker that is chosen. Google's voice controlled "personal

assistant" is called the Google Assistant. Google Home is one of the few options that combines many different functions, giving the home occupants a central system to have control over all the functions.

Figure 1: Google Home Smart Speakers (Amadeo, 2020)

Another big company that features one of their top tier smart speakers is Amazon. Their form of the "personal assistant" is called Alexa. Amazon's Echo "holds the lion's share of the dedicated voice speaker market and has a more diverse lineup of gadgets" (Linder, C. 2021). Amazon's Echo, like the Google Home, can help automate daily tasks of turning on and off lights, setting alarms, controlling home temperature, and much more. With Amazon Echo there are thousands of products that could be used in conjunction with the smart speaker listed on the Amazon website.

Figure 2: Amazon Echo Smart Speakers (Patterson, 2019)

Everyone has heard of Apple's Siri and Apples' ecosystem of smart speakers, which are the HomePod and the HomePod mini. The HomePod can do all the things that a Google Home and Amazon Alexa can do. Apple's smart home platform is based on their HomeKit application. This allows users to control their internet connected devices such as thermostats, lightbulbs and more (Clover, J. 2020). Apple's line up of products that could connect to the Apple App Store could download their HomeKit

application and control their home devices from anywhere in the world with an internet connection. With the HomePod there are a total of 48 devices listed that are compatible.

Figure 3: Apple HomePod Smart Speakers (Apple, 2021)

Price can be a big factor when choosing a smart speaker. To start off down the smart speaker path without spending a lot of money, most will opt for an Echo Dot or a Google Home Mini. These are the least expensive options when it comes to getting an affordable smart speaker (Leger, H. & Pino, N. & Porter, J. 2020). Typical prices of smart speakers range from $40 for the entry level to $400 for the top-of-the-line products that the companies offer.

There are many other brands that utilize Google Home and Amazon Echo. These brands include Sonos, Bose, Lenovo, and more. These devices utilize Google Assistant, Amazon Alexa, or a combination of both. The added convenience of daily tasks that could be completed through a smart speaker could positively impact one's life.

Smart Lighting

Traditional CFL and incandescent lights draw on a lot of energy. Higher lumen lights would take up to 150W with traditional incandescent lights while for the same number of lumens, light emitting diodes (LED) would only take about 28W (McBride, B. 2021). This is a massive difference in the amount of energy consumed by a home, the energy costs are a reflection of the energy consumption difference of the transition from incandescent to LED. Philips LEDs take 90% less energy than traditional lights (Philips, 2021). Smart home technology has introduced us to many smart light bulbs on the market. Light bulbs can now be replaced with current lights in your home and controlled with a smartphone or a virtual assistant, such as a smart speaker (Moscaritolo, A. & Colon, A. 2021).

Being such a simple upgrade to start a smart home, there are now numerous options on the market to create a smart home, satisfying the owners and tenants needs. Prices can differ by a large margin ranging anywhere from the sub $10 to $50 (Moscaritolo, A. & Colon, A. 2021). Philips with their

HUE line of products offer numerous ways to control the lights and colors through the Philips HUE application, wireless motion sensors and switches, and voice assistants (Philips Hue, 2021). Users could "use light to easily change the atmosphere of any room. Whether you want to accent an interior space, set the optimal light for functional tasks, throw an outdoor party, or create a romantic dinner, you can personalize your Philips Hue lights to create the perfect ambience. Choose from any shade of white or from a spectrum of 16 million colors to find the one that matches your mood" (Philips Hue, 2021). Additionally, being able to set schedules, or being able to have lights turned on pulling into a home could be beneficial for many people that either have their hands full or are walking up a dimly lit porch. The convenience of adding smart lights could simplify and illuminate the lives of many people.

Several other brands on the market have their own light bulbs that could be used to replace current light bulbs in homes. Depending on the needs of the individual, they could decide which light bulb would best fit their needs. Prices of smart bulbs can vary greatly depending on their functionality. Essentially, smart light bulbs use a hint more energy than a regular LED bulb. When comparing a Philips HUE smart bulb to a standard Philips LED bulb, the wattages are seven watts and five watts, respectively. In a 2020 study done by the owner of the LED Lighting Info, bulbs were running two hours a day, the smart bulb cost $0.15 and the regular LED cost $0.11, in the end the difference is insignificant (Eugen, 2020). In any event, changing lights from traditional CFL and incandescent bulbs to LEDs would be beneficial.

Figure 4: Smart Light Bulbs (Crist, 2020)

Smart Outlets & Switches

Smart light switches and outlets provide even more convenience. Smart outlets are one of the cheapest and easiest components to do so. Using a smart outlet is as simple as plugging it into a wall, then

plugging in a light, fan, or any other on/off device and setting it up with an application (Cericola, R. 2021). Most smart plugs on the market are compatible with a Google Home or Amazon Echo. They could also be set up to turn on and off on a timer schedule. The timer has the capability to be programmed to turn on the coffee maker before waking up, having hot coffee ready in the morning, would cut down time and add convenience to people's mornings.

Wyze, TP-Link, Philips, and Wemo are just a few brands that have a smart outlet. Almost all of these outlets are controllable via Google Home and Amazon Echo. Wyze has one of the best smart outlets on the market at an affordable price (Cericola, R. 2021). When it comes to buying smart outlets, having one with scheduling abilities and control functions from remote locations is key to convenience. Wyze provides both of those options and more. Allowing users to turn off appliances and any other component connected to a smart plug gives a sense of safety by eliminating worries of possible electrical fire hazards. Outlets could also tell users about energy usage of a certain appliance in real time, to help save and cut down costs on their utility bills. Furthermore, there are outlets that are hardwired, using pre-existing wiring in a home. Hardwired outlets tend to be pricier, yet they do not add the bulk of an external outlet.

Recessed lighting is a popular lighting option controlled with a central lighting switch. Replacing each of those lights with smart light bulbs is a huge cost and the smart light bulb is only good if the light switch is on (Brown, M. 2021). They could also be used with any type of light socket compared to light bulbs. Smart light switches being hardwired into a home are the solution to this. After the installation of a smart light switch, it allows you turn your lights on and off manually and automatically, based on a schedule, with voice commands, motion, and even location (Brown, M. 2021). Major electrical brands like Lutron, Leviton, GE and other brands have been creating and releasing new smart light switches. Compared to traditional light switches, smart light switches have a higher initial cost, most likely being a one-time cost, the value and convenience that a smart light switch adds is significant compared to costs.
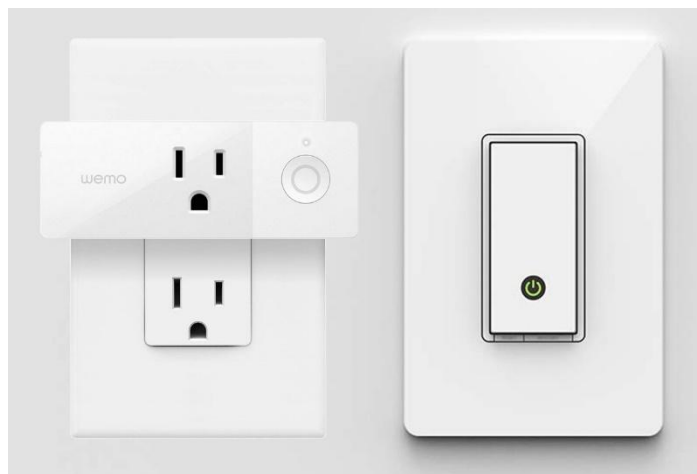

Figure 5: Smart Home Outlets and Switches (Haslam, 2018)

Smart Home Security

Home burglaries are bound to occur, and the next victim could be any individual or the next-door neighbors. Research shows that out of 127.59 million households, only nearly 30% of those have security systems, and determined that even if only one household in a neighborhood had a security system, the area was less enticing to criminals (Vigderman, A & Turner, G. 2021). Smart home technology has made it extremely simple to boost a home's security and monitoring system.

Smart cameras, doorbell cameras, and smart locks have made it simple to arm a home with security measures. Smart cameras utilize the traditional security camera system and take the guesswork out of it. Smart cameras can upload footage to a cloud-based server eliminating a viewing station and a bulky hard drive storage at home, allowing it to be viewed remotely, and controlled by an application on a smartphone (SafeWise, 2021). For a small fee, homes could be professionally monitored 24/7, however there are also products that do not have professional monitoring and the homeowner or renter would be responsible for monitoring their household.

Smart locks have made it extremely convenient for people to enter their homes and see when the door was locked or unlocked, and allow users to forgo keys entirely (SafeWise, 2021). With smart locks, there is no more wondering if the door was locked before leaving the premises, the user could simply look at their phone application and lock it remotely if they wanted to. With an added doorbell camera, homeowners would be able to view who is at the front door if the doorbell is rung. These smart devices have made it extremely simple to add a little security to their home if they decide to not fully commit to an outdoor smart camera system quite yet or deem it not necessary.

Figure 6: Eufy Security EcoSystem (Eufy, 2021)

Considerations

Wi-Fi connectivity is a major concern upgrading a traditional home to a smart home. While it would be just fine to connect a few extra devices to the current Wi-Fi router, a smart home with multiple added extra devices, the router may not be able to handle the added load. It is imperative that the homeowner knows that the router would be able to handle the added load, if not then they may need to upgrade their WiFi router to a mesh system. By the year 2023, the Internet of Things (IoT) will account for half of the global device market, connected home devices will be the largest category (NETWORKWORLD, 2021). Having large and steady Wi-Fi coverage will ensure that there are no faults in the system, keeping those smart home devices always connected (NETWORKWORLD, 2021).

Smart home bridges can be something that smart home device users do not realize they need. Bridges act as the "central brain of the smart home, managing communications and commands between connected bulbs, blinds, thermostats and the like" (Tofel, K. 2020). Many products that are out in shelves now are switching away from needing bridges and will have their own Wi-Fi chips installed eliminating the need for a bridge. It is up to the due diligence of the owner to research if they would require a bridge or not.

Methodology

The methodology chosen for this study was a qualitative study. The purpose of this survey consisted of posting the survey on a website called NextDoor. Like social media, NextDoor connects people together on updates and news, but on a smaller scale within their own community. While the researcher did not know how many people would answer the questions, it proved to be beneficial to use social media to conduct his research. To find out how people utilized their smart home devices, and if it added value or convenience to their life? Additionally, if they did not have any smart home devices, were they interested in adding some to their homes. The research conducted was to find results of seven questions listed below:

- If users were owners or renters of their homes.
- Which major smart home brand smart speaker users were using.
- What smart home users did with the devices that they owned.
- If the smart home product added value in their life.
- In which ways the product added value to their life.
- If smart home device owners would recommend family members and friends to adopt this technology.
- Lastly, if people were interested in adding some smart home devices into their homes.

Results

The first objective of this survey was to evaluate if members completing the survey were owners or renters of their residence. Utilizing smart home devices in rental properties could mean changing out light switches and light bulbs to properties. This could potentially sway renters from making any changes to the residences. In the survey, there were a total of seventy-eight respondents. Out of those seventy-eight, forty-three were homeowners and thirty-five were renters of their properties.

| ● Own | 43 |
| ● Rent | 35 |

Figure 7: Responses to question 1: Do you own or rent your current residence?

The second question asked the respondents if they used Amazon Alexa, Google Home, or Apple HomeKit. The results varied greatly between each respondent with Amazon Alexa holding the largest category of users, and Google Home coming in second. Other users used Apple HomeKit, other devices, or were not users of smart home devices. Thirty-Two respondents said they used Amazon Alexa, nineteen of them used Google Home, six used Apple HomeKit, four used other devices, and seventeen said they did not use any of these devices.

● Amazon Alexa	32
● Google Home	19
● Apple Homekit	6
● Other	4
● None	17

Figure 8: Responses to question 2: Do you use Amazon Alexa, Google Home, or Apple Homekit?

The third question on the survey asked homeowners and renters what they did with the smart home devices. Answers from seventy-eight respondents ranged from users saying they used the devices to "turn on and off lights, nest for heat control, smart lock to be able to open doors, check statuses" to "Turn on light, tell stories, play music, answer questions, translate". Other respondents used these devices to "Automating lights to turn on and off at certain times. Scheduling robot vacuums. Checking garage door status. Monitoring front doors, doorbell and lock". Most users mainly utilized

their equipment to turn on and off lights and listen to music as well as check the weather.

The fourth and fifth question asked if the devices added value in their life and how it did so. Value is different for everyone, and if it saves people some time or gives them convenience, this product essentially adds value to the user's life. Out of the seventy-eight respondents, fifty-seven users confirmed that the devices added value. Conversely, three respondents said that these devices do not add value and eight-teen people said they were not users. Respondents added that it helped them by "Saving electricity when you forget to turn off lights. Not having to get up to turn on/off lights, Keeps house cleaner. Allows you to check on your door locks so you don't have to be worried and try and remember if your door is closed/locked" and "convenience, don't have to worry about turning on, off lights, access to do things remotely". Most users mention that these devices added a lot of convenience and time saving.

● Yes	57	
● No	3	
● Not a user	18	

Figure 9: Response to question 4: Does this smart home product add value to your life?

In a world where everyone had a smart device, households would have more time and convenience when doing daily tasks. The question asked was if participants would recommend a smart home product for friends and family. Fifty-two users replied that they would recommend a smart home device to others and four replied that they would not. Eight of them said maybe and fourteen of them said they were not users.

● Yes	52	
● No	4	
● Maybe	8	
● Not a user	14	

Figure 10: Response to question 6: Would you recommend your family members or friends to get a smart home product?

The last question of the survey was to find data regarding people's interests in smart home devices. Only thirty-eight people replied to this question and twenty-three of those would be interested in adding a product into their home. However, fifteen of those responses said that they were not interested.

● Yes	23	
● No	15	

Figure 11: Response to question 7: If you do not own a smart home device are you interested in adding some to your residence?

Lessons Learned

With smart home technology, the conclusion can be made that the largest portion of users appreciate their products and usage in the sector. There are multiple use cases in which users utilize this technology. With most users using their technology to turn on and off lights, listen to music, and check statuses of other in-home products, the added convenience is a comfort feature for many. Interested users could spend a small amount of money to be able to start changing their traditional home into a smart home and start enjoying these comforts in their own home. Users could also start wherever they want and add more products in the future if desired.

Smart home technology is evolving every day with new products on the market regularly. Deciding what users want to do with their smart home and achieving that goal is relatively simple with little research. Smart home products have been made so that a weekend DIYer can easily transform a boring home into a smart one. Prices can vary drastically depending on the amount of "smartness" one wants in their home. Additionally, a considerable number of devices are renter friendly and do not involve extensive changes to current design.

Many major brands have been focusing on traditional home appliances and developing them into smart products. Customer demand is always high and with more improved technology, this demand will only grow. As people learn more about smart home technology and what it can do for homeowners, more companies will start putting research and development costs into these products for many families to come.

Conclusion

Creating a smart home is not a task that homeowners should be afraid of. A smart home takes advantage of automated tasks and makes it so that homeowners have a new level of control while providing convenience, security, accessibility, efficiency, and higher resale value (Hartman, D.). Smart home technology makes life easier and more enjoyable, while automating daily tasks efficiently. Users and interested users can start at any level and expand further into products when they want. A simple home can be transformed into a relatively smart home with the devices included in this estimate (Appendix A) based on a 2400 SqFt. single family home. Users can pick which products they would want to utilize in their home, while not having hidden costs. As companies grow and give users what they want, smart home technology is bound to take off due to manufacturers putting their research and development and marketing budgets into home monitoring and security as well as other IoT devices (TIME, 2019).

In the future, further research could be to utilize this estimate (Appendix A) and change a traditional home into a smart home. The other goal of the project was to change a traditional home in Alameda, CA into a smart home that could be utilized for years and give feedback on which products tested were the best value for the features and how those features would create a more efficient and convenient home for the owners. Other conclusions could have been made about costs associated with this topic and the installation processes as well. However, Cal Poly decided that this project was not sufficient and did not end up getting funded. In the future, suggestions for students are to push harder for funding to complete their projects.

References

5-Piece Home Alarm Kit. eufy. (n.d.). https://us.eufylife.com/products/t8990.

A&E Television Networks. (2009, October 29). *Industrial Revolution*. History.com.
    https://www.history.com/topics/industrial-revolution/industrial-revolution.

A Brief History of Smart Home Automation. (2019, August 21). https://zeusintegrated.com/blog/item/a-brief-
    history-of-smart-home-automation.

Amadeo, R. (2020, June 24). *With YouTube Music, Google is holding my speakers for ransom*. Ars Technica.
    https://arstechnica.com/gadgets/2020/06/youtube-music-library-transfers-your-purchased-music-is-
    not-welcome-here/.

Brown, M. (2021, April 20). *The best smart light switches and dimmers: Lighting is the foundation of the
    smart home*. TechHive. https://www.techhive.com/article/3570222/best-smart-switches-and-
    dimmers.html

Brown, R., Priest, D., Crist, R., & Price, M. (2021, March 30). *Best smart home devices for 2021*. CNET.
    https://www.cnet.com/home/smart-home/best-smart-home-devices/.

Cericola, R. (2021, May 13). *The Best Plug-In Smart Outlet*. The New York Times.
    https://www.nytimes.com/wirecutter/reviews/best-smart-switch/.

Clover, J. (2020, August 7). *HomeKit: Everything You Need to Know*. MacRumors.
    https://www.macrumors.com/guide/homekit/.

Colon, A., & Moscaritolo, A. (2021, March 15). *The Best Smart Light Bulbs for 2021*. PCMAG.
    https://www.pcmag.com/picks/the-best-smart-light-bulbs.

Crist, R. (2020, December 3). *The best smart bulb bargains of 2020: Philips, Lifx, GE, Wyze and more*. CNET.
    https://www.cnet.com/home/energy-and-utilities/best-led-smart-bulbs/.

Eugen. (2021, April 2). *Does Smart Lighting Use More Electricity? - LED & Lighting Info*. LED & Lighting
    Info - Useful Tips To Improve Design. https://ledlightinginfo.com/does-smart-lighting-use-more-
    electricity.

The Future of Connectivity: Wi-Fi 6 and Smart Homes Explained. Network World. (2021, April 15).
    https://www.networkworld.com/article/3615312/the-future-of-connectivity-wi-fi-6-and-smart-homes-
    explained.html.

Google. (n.d.). *Google Assistant Compatible Smart Plugs & Devices*. Google Store.
    https://store.google.com/us/magazine/helpful_home_energy.

Hartman, D. (n.d.). *The Advantages of a Smart House*. Home Guides | SF Gate.
    https://homeguides.sfgate.com/advantages-smart-house-8670.html.

Haslam, A. (2018, November 19). *Turn your dumb devices into smart ones with all-time low Amazon prices on Wemo accessories*. TechHive. https://www.techhive.com/article/3321750/turn-your-dumb-devices-into-smart-ones-with-all-time-low-amazon-prices-on-wemo-accessories.html.

Hendricks, D. (2014, April 22). *The History of Smart Homes*. IoT Evolution World. https://www.iotevolutionworld.com/m2m/articles/376816-history-smart-homes.htm.

HomeKit - All Accessories. Apple. (n.d.). https://www.apple.com/shop/accessories/all/homekit?page=1.

HomePod User Guide. Apple Support. (n.d.). https://support.apple.com/guide/homepod/welcome/homepod.

Linder, C. (2021, April 30). *Amazon Echo vs. Google Nest: Which Is Better?* Popular Mechanics. https://www.popularmechanics.com/technology/gear/a28929913/google-home-vs-alexa/#:~:text=Google%20Assistant%20is%20technically%20more,more%20diverse%20lineup%20of%20gadgets.

Looper, C. de. (2020, March 3). *We compared Google Assistant, Amazon Alexa, and HomeKit to see which smart home platform is the best - and Alexa wins when it comes to device support*. Business Insider. https://www.businessinsider.com/homekit-vs-google-assistant-vs-amazon-alexa.

McBride, B. (2021, April 29). *Comparing LED vs CFL vs Incandescent Light Bulbs*. Viribright® LED Lights. https://www.viribright.com/lumen-output-comparing-led-vs-cfl-vs-incandescent-wattage/.

Patterson, B. (2019, November 29). *Which Echo should I get? A buyer's guide for Amazon's dizzying array of Echo devices*. TechHive. https://www.techhive.com/article/3453834/amazon-echo-buyers-guide.html.

Philips Hue Smart lighting. Philips Hue. (n.d.). https://www.philips-hue.com/en-us/explore-hue/philips-hue-benefits.

Porter, J., Pino, N., & Leger, H. S. (2020, October 1). *Amazon Echo vs Apple HomePod vs Google Home: the battle of the smart speakers*. TechRadar. https://www.techradar.com/news/amazon-echo-vs-homepod-vs-google-home-the-battle-of-the-smart-speakers.

Save money and energy with LED bulbs. LED energy savings | Philips lighting. (n.d.). https://www.usa.lighting.philips.com/consumer/led-lights/eco-friendly-led-light.

Tofel, K. C. (2020, October 21). *It's almost 2021: Do you want or need hubs in your smart home?* Stacey on IoT | Internet of Things news and analysis. https://staceyoniot.com/what-is-a-smart-home-hub-and-do-you-need-one/.

Vigderman, A. (2020, September 15). *Smart Home Technology Usage, Satisfaction and Purchase Intent: 2020*. Security.org. https://www.security.org/smart-home/consumer-adoption-2020/.

Vigderman, A., & Turner, G. (2021, May 4). *Do I Need A Home Security System?* Security.org. https://www.security.org/home-security-systems/do-i-need-one/.

What are the Home Automation Features of Security Systems? SafeWise. (2021, April 22). https://www.safewise.com/home-security-faq/home-automation-

features/#:~:text=Many%20smart%20home%20security%20systems,associated%20app%20on%20your%20smartphone.

When was the first computer invented? Computer Hope's Free Computer Help. (2021, March 13). https://www.computerhope.com/issues/ch000984.htm.

Appendix

Appendix A: Cost estimate for 2400 Sq. Ft. Home.

Home Improvement Items

	Item	Quantity	Price	Install Time (Hrs)	Total		Link
1	eufy Security, Video Doorbell	1	$ 99.99	1	$	99.99	https://amzn.to/3wUt3ch
2	eufy Security Smart Lock Touch	2	$ 186.99	1	$	373.98	https://amzn.to/2TqGIsW
3	Kasa Smart Dimmer Switch 3 Pack	1	$ 54.99	0.5	$	54.99	https://amzn.to/2SOVoli
4	Kasa Smart Light Switch 3 pack	16	$ 36.98	2	$	591.68	https://amzn.to/2SOVjOw
5	Kasa Smart 3 Way Switch	2	$ 32.99	1	$	65.98	https://amzn.to/34GPTYN
6	Google Nest Thermostat	1	$ 129.99	1	$	129.99	https://amzn.to/3uHSs7w
7	Smart Outlet W/ Usb Port	1	$ 89.99	0.5	$	89.99	https://amzn.to/3uFQ9Sj
8	Philips Hue Starter Kit	2	$ 199.99	1	$	399.98	https://thd.co/2TqGW3g
9	Philips Hue Play	2	$ 59.99	1	$	119.98	https://amzn.to/3c6NOta
10	eero Pro 6 tri-band mesh Wi-Fi 6	1	$ 399.00	0.5	$	399.00	https://amzn.to/3g4Cv5N
11	eufy 2 pro Wireless Home Security Camera System	1	$ 349.00	3	$	349.00	https://amzn.to/3yWN43K
12	Moen Smart Faucet	1	$ 399.00	1	$	399.00	https://thd.co/3g0sXJk

Smart Speakers

	Item	Quantity	Price	Install Time (Hrs)	Total		Link
1	Echo Dot	3	$ 29.99	0.3	$	89.97	https://amzn.to/2SObVpl
2	Echo Show 8	1	$ 104.00	0.3	$	104.00	https://amzn.to/3uFolbq
3	Echo Studio	1	$ 199.99	0.3	$	199.99	https://amzn.to/3yNWnCS
					$	3,467.52	Total Cost
				14.4		Total installation time	