

Anti-Burglar Security Alarm System

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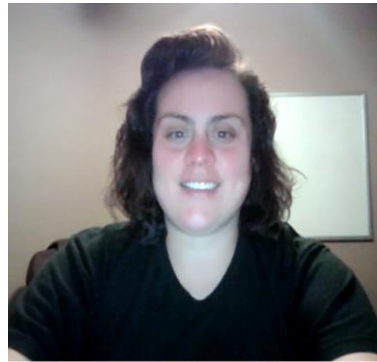
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PROBLEM STATEMENT:

Many customers often pay a high cost when investing in alarm systems as a form of protection. More than often, older alarm components cannot be reused. In addition, many alarm systems cannot function during power outages.

OBJECTIVE:

The goal is to design a low-cost alarm system that provides the comfort of a secure home or office. Home Assistant and The Zigbee Alliance will allow our alarm system to seamlessly unify brands we all love. The alarm system will also monitor and communicate during extended power outages.



MARKETING REQUIREMENTS	ENGINEERING REQUIREMENTS	JUSTIFICATIONS
Integrated communication solution	• ESP32 microcontroller • REYAX Lora module • Texas Instrument Sonoff Zigbee analyzer	• Low energy system • Sends data and live feed for up to 12 kilometers. • Embedded Wi-Fi, Bluetooth, and Zigbee capabilities.
Remote monitoring	• Self-monitoring through application • Optional 24/7 emergency and monitoring services	• 24/7 monitoring of property will reassure a customer of investment.
Multi detection sensors	• Reed switch sensor • Passive infrared (PIR) sensor camera • Temperature and Humidity sensor	• Multiple sensors collect readings to alert the customer of a hazard or a security breach.
Off-grid power source	• Solar power • Rechargeable battery source	• Additional marketing tool for sales. • Provides protection during extended power outages. • Customer safety increased.

Product Comparison

PRODUCT	IMAGE	PROS	CONS	COST	REFERENCE	DECISION
Smart Security System		• Works off-grid • Integrate multiple brands • Serves as a smart home control panel.	• Vulnerable to burglars due to jamming devices	\$600	N/A	
Wired ADT Security system		• Extremely reliable • Access to wide range of smart home devices	• Expensive installation • Minimum 36-month contract required	\$600 to \$2500	https://www.thisoldhouse.com/home-safety/21355319/adt-home-security	
Wireless Simpli Safe alarm system		• Easy to setup and install • Systems available in DIY kits	• Possible connection errors • High up-front cost	\$200 to \$1000	2021 Home Security System Cost Monthly Alarm System Prices (homeguide.com)	

Proposed Deliverables

- Security alarm system that primarily utilizes Wi-Fi and Zigbee capabilities.
- Security alarm system with home or office monitoring via a Samsung Tablet and a portable device (phone application).
- System will have multi-detection sensors that will provide the user with sensory data.
- System will notify user when alarm is triggered.
- System will be powered via rechargeable battery and solar.

Software Development



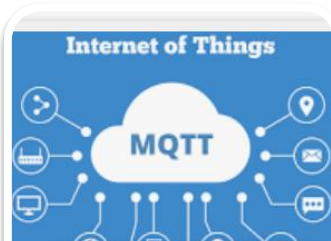
Home Assistant

- Open-source software
- Dashboard development
- Platform for automation services



ESPHome

- Programming of microcontrollers
- Optimized network protocol
- User defined services



Cloud

- Message Queue Telemetry Transport.
- Encrypted domain name system (DNS).
- 509 certificates for Transport Layer Security encryption



User Interface

- Service message blocking (SMB) protocol provides an authenticated inter-process communication.
- NabuCasa for remote user interface.
- Mobile app for real-time monitoring.

Final Design



Solar Panel

Power
Supply

Tablet

Transmitter
and Receiver

Reed Switch
and Sensors

Camera

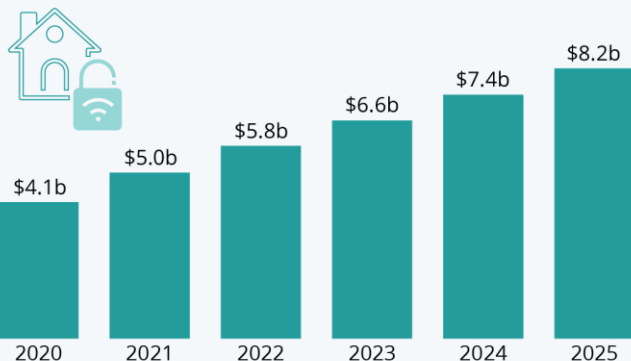
Project Impact Summary

<u>Categories</u>	<u>Applicability</u>
Economic Impact	●
Technological Impact	●
Safety and Welfare Impact	●
Social & Global Impact	
Environmental Impact	●

Economic Impact

Demand Growing For Smart Home Security Systems

Forecast revenue growth of the U.S. smart home security sector*



* Includes smart locks, cameras, hazard notifications, emergency calls, etc.

Source: Statista Digital Market Outlook



statista

- Home providers give discounts on insurance premiums if a home has an installed security system.
- Home security systems tend to increase the value of the home.
- Design utilizes less expensive parts than most security systems, which results in a less expensive product to purchase.

Our project will provide an alarm system that is affordable, reduces expenses for homeowners, and raises the property value of homes for homeowners.

Technological Impact



- 38% of Americans own a home security product
- 18% report owning a video camera, doorbell, or both
- 16% have a professionally monitored home security system
- 8% own a self-monitored system

Our goal is to design an alarm system with a remote user interface that enables us to monitor and control the system from anywhere around the world.

Safety and Welfare Impact

Engineering Protection Systems

Home Burglary Statistics



- 1.4 million home burglaries occur per year.
- 65% occur in the day.
- 57% of burglaries require forcible entry
- 33% gain access through unlocked windows or doors.

The goal of this project is to create an alarm system that is unique, reliable and affordable, to assure peace of mind of property owners while they are on or off their property.

Environmental Impact

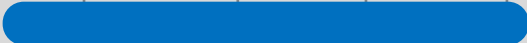
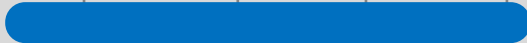


- Estimate of annual E-waste will exceed 82 million tons in 2030
- \$ 54.2 million worth of raw materials was lost in 2021.
- \$ 8.5 million worth of raw materials were recovered

When electronics are improperly disposed toxic chemicals are released, impacting the earth's air, soil, water and ultimately, human health.

Our design will implement alternative energy as the main power supply. The design also serves as a smart home platform that can revamp outdated tech into smart technology.

Project Schedule

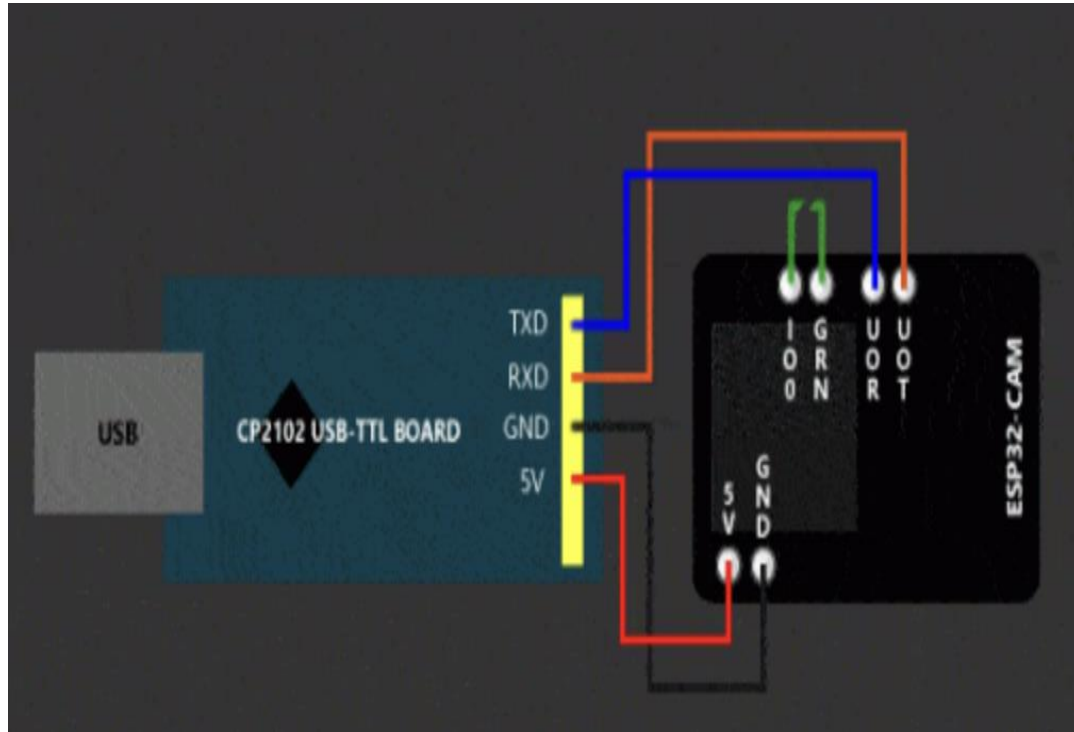
Tasks	First Semester					Second Semester				
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Project Selection										
Project Research										
Parts and Software Research										
Developing the Design										
Order of Parts										
Build Design										
Test Design										
Final Design										
Troubleshooting										
Final Build										

Codes and Standards

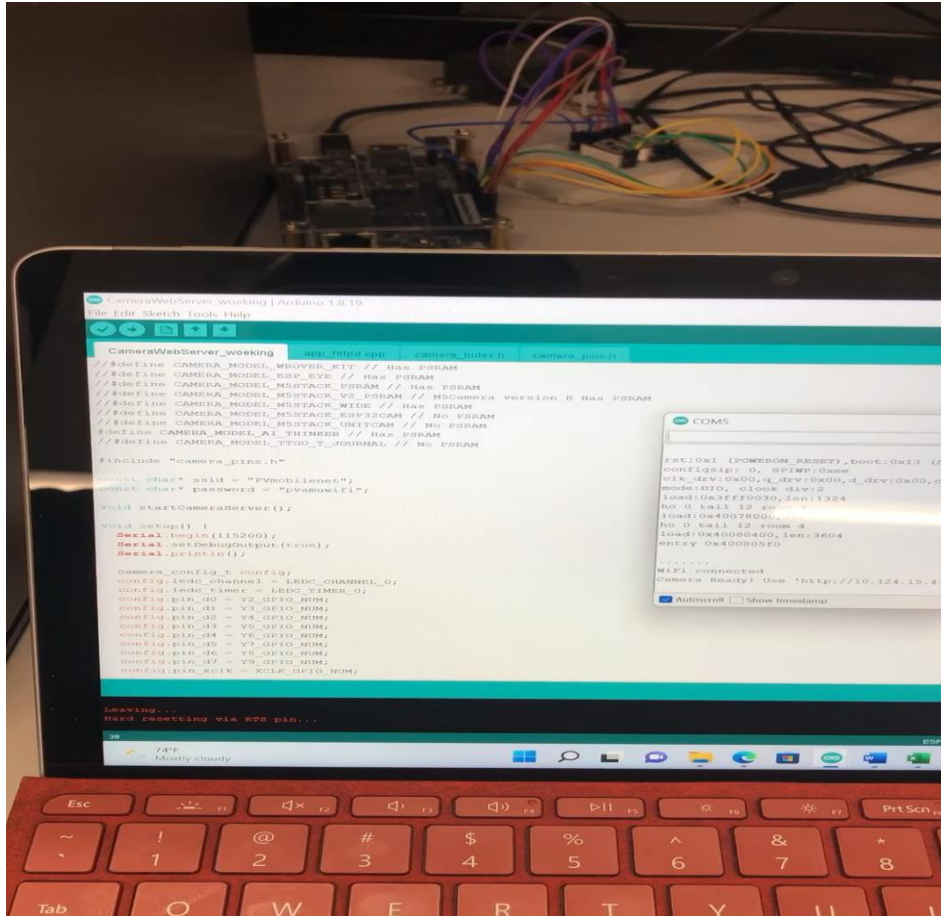
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- NESC: National Electrical Safety Code - Electrical safety precautions are specific control measures implemented to remove electrical hazards and mitigate the risks of electrical accidents and injuries.
- IEEE 7.1: U.S. Engineer Registration - The IEEE recognizes that licensure and registration contributed to the professions' efforts to protect the health, safety, and welfare of the public by ensuring that practitioners meet minimum recognized levels of education, experience, and competence.
- IEEE 7.6: Protection of the Public - The IEEE recognizes the obligation of the profession to protect the health, welfare and safety of the public.
- IEEE 7.8: Code of Ethics
 - ▣ 1) To hold paramount the safety, health, and welfare of the public, to strive to comply with ethical design and sustainable development practices.
 - ▣ 5) To seek, accept, and offer honest criticism of technical work.
- IEEE Std 1547-2020: IEEE Conformance Test Procedures for Equipment Interconnecting Energy Resources with Electric Power Systems and Associated Interfaces – This standard is recognized that a distributed energy resource can be a single device providing all required functions or an assembly of components, each having limited functions and capabilities.
- IEEE/ASHRAE Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications - Ventilation of stationary lithium-ion battery installations is critical to improving battery life.

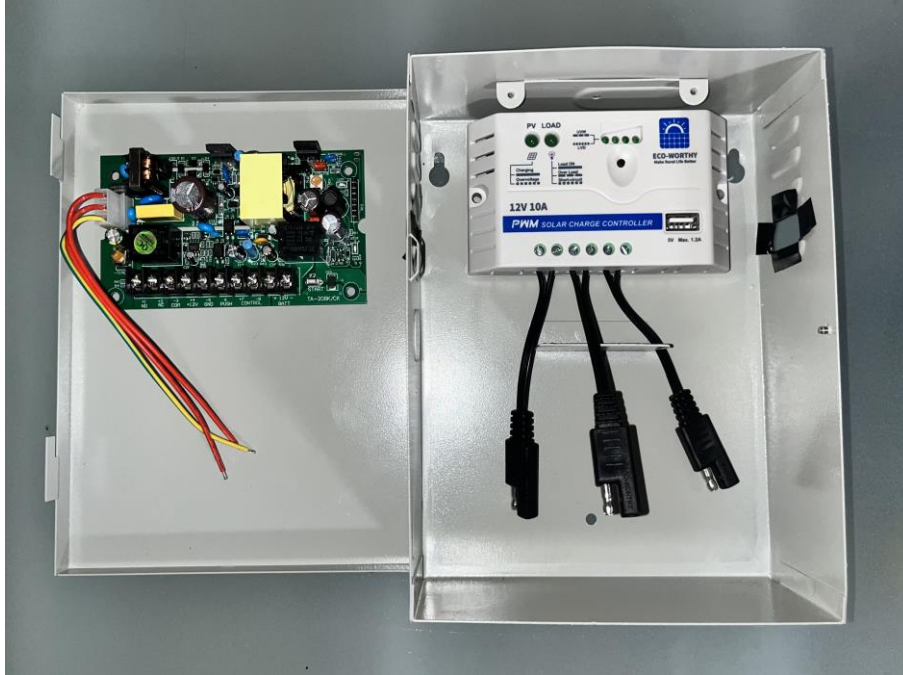
Camera Build Schematic



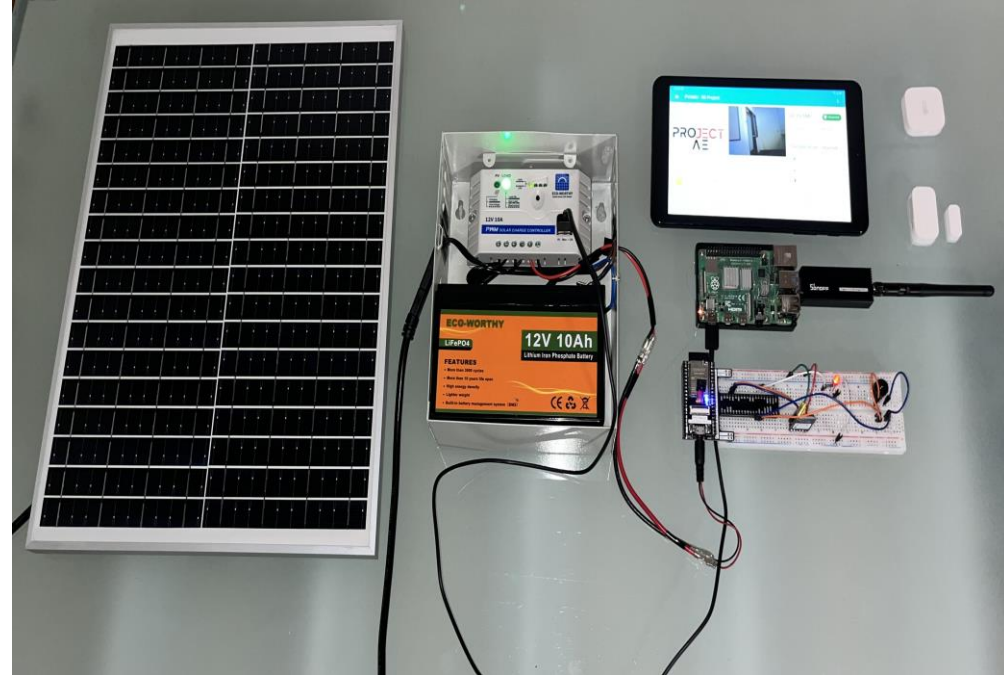
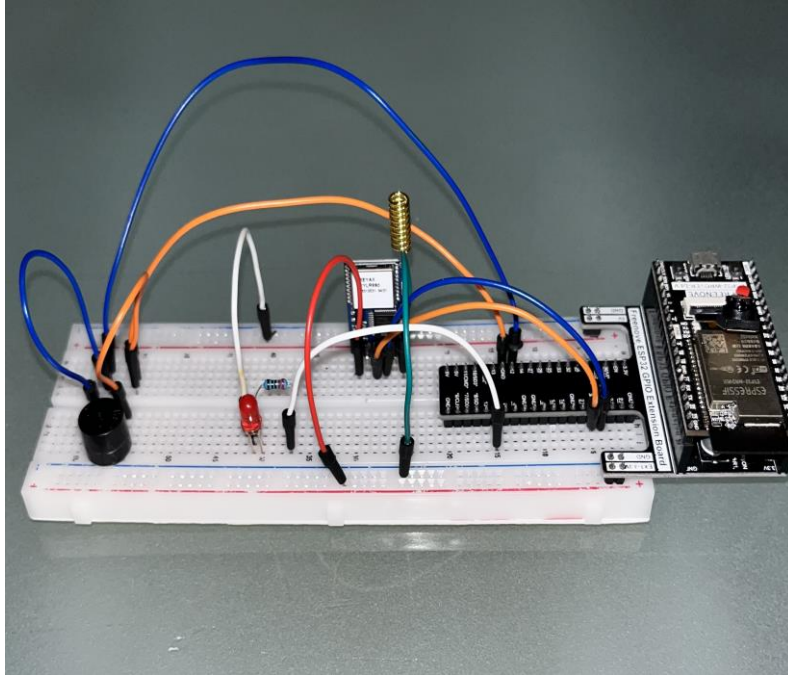
Camera Build Video



Power Supply Build



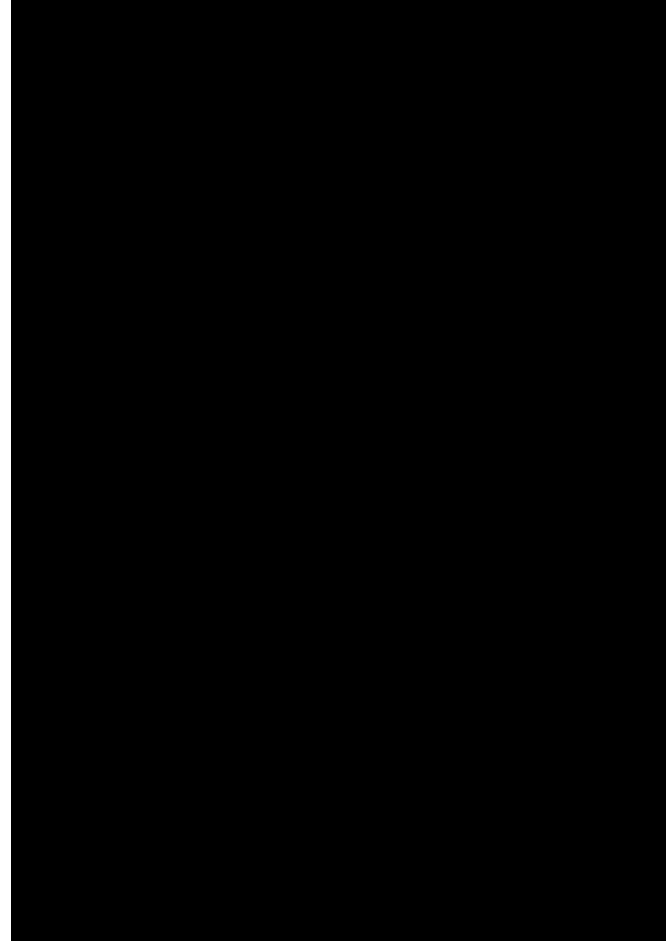
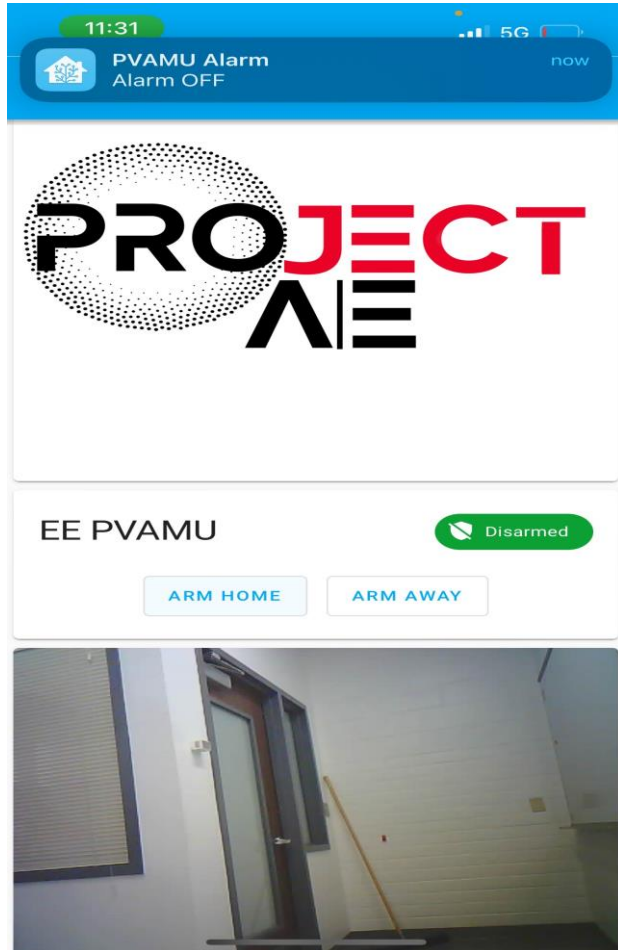
Security Alarm System Build



Triggering of Alarm Demo



Screen Setup & Screen Notification



QUESTIONS?



Back Up Slides

Literature References

- **YouTube.com**

- McAfee, B. (2017, July 3). *How to keep your home safe during a power outage: Crime prevention*. CPSS. Retrieved October 5, 2021, from <https://www.cpss.net/about/blog/2015/08/how-to-keep-your-home-safe-during-a-power-outage/>
- Lauren, A. (2021, August 11). *How a power outage puts your home security at risk*. Reader's Digest. Retrieved October 5, 2021, from <https://www.rd.com/article/power-outage-home-security/>.
- *Home & Business Security Systems in Jacksonville, FL*. SafeTouch. (n.d.). Retrieved October 5, 2021, from <https://safetouch.com/security-during-a-power-outage/>.
- Carmen. (2019, October 24). *Security system creativity for remote off-the-grid living*. Off The Grid News. Retrieved October 5, 2021, from <https://www.offthegridnews.com/home-defense/off-grid-security-system/>.
- Tatro, Kaitlyn. "Light Energy: Our Wasted Resource." *Consilience*, no. 22, Columbia University, 2020, pp. 65–72, <https://www.jstor.org/stable/26924963>.
- Newmeyer, N. "Changing the Future of Cyber-Situational Awareness." *Journal of Information Warfare*, vol. 14, no. 2, Peregrine Technical Solutions, 2015, pp. 31–40, <https://www.jstor.org/stable/26487492>.
- *An Investigative Study for Smart Home Security ... - Scirp.org*. https://file.scirp.org/pdf/WSN_2016042516164326.pdf.
- Dutta, Pallavi, et al. "5 Major Reasons for 'Why Is Cyber Security Important?'" *Security Boulevard*, 13 Apr. 2021, <https://securityboulevard.com/2021/04/5-major-reasons-for-why-is-cyber-security-important/>.
- by, Written, and Katherine Torres. "8 Benefits to Owning a Home Security System." *SafeWise*, 22 Apr. 2021, <https://www.safewise.com/blog/top-8-reasons-get-home-security-system/>.
- "Cybersecurity for Physical Security Systems." *UL*, <https://www.ul.com/services/cybersecurity-physical-security-systems>
- Do I Really Need a Security System? By Celeste Tholen, Managing Editor from (May 27, 2021) <https://www.safewise.com/home-security-faq/do-i-need-a-security-system/>
- [9 important home burglary statistics - EPS Security](#)

Advantages and Disadvantages

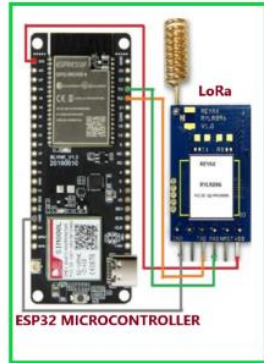
Advantages	Disadvantages
• Our system will promote safer and more vigilant neighborhoods and other residentials. • It will provide two power sources, a solar source and a power supply source which will elongate the battery life. • The addition of our system in a household increases will the value of the home, by enforcing greater security measures.	• Vulnerable to EMP jammers. • Compatibility issues due to need of specialized drivers to run open-source programs.

Preliminary Engineering Design

POWER SUPPLY



TRANSMITTER SIDE

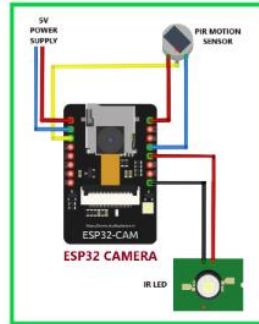


COMMUNICATION DEVICES

USER INTERACTION APPLICATION



IoT APPLIANCES



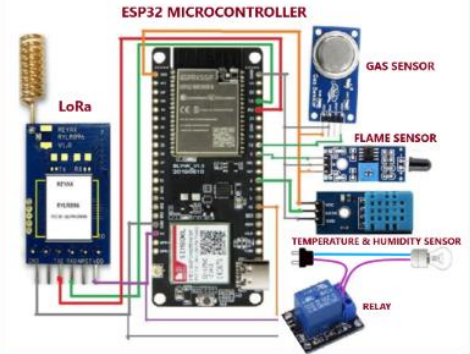
RECEIVING SIDE



RASBERRY PI 4
LCD SCREEN



WIFI REED SWITCH



Assumptions and Constraints

Assumptions

- Alarm system will sound and send an emergency notification to the owner when system is triggered by a “burglar” setting off a sensor.
- The camera sensor will detect an intrusion and the camera will provide live feed of the area and.
- Power sources will last long in providing power to the system. Back-up power source will
- The user can interact with the system’s control panel via a mobile app or directly through LCD panel.

Constraints

- The project has a \$600 budget.
- Lack of experience in application development.
- Electromagnetic jammers could disrupt the system.

Executive Summary

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Problem Statement – Most security alarm systems lack the necessary features to function during a power outage.

Objective - To design a security alarm system that continues to function during power outages with the use of a versatile power-supply and a system that easily integrates with a variety of monitoring and Internet of Things (IoT) devices.

Prospective Plan

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Target Audience

- Homeowners
- Retailers
- Business owners

Proposed Deliverables:

- Remote monitoring
- Multi-detection sensors
- Alternative energy source

Budget & Spending

- Project Budget: \$600
- Amount Spent: \$560

