University of Asia Pacific

Project Report

CSE 306: System Analysis and Design Lab

Residential Security Monitoring System

Protecting every home, every moment.

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9th May, 2024

INTRODUCTION

Residential Security Monitoring System ensures the safety and security of the residents of the residential areas. Advanced technology and vigilant monitoring provide round-the-clock surveillance, granting confidence to live life without worry. Discover a new level of safety with an option of reliable and efficient residential security solutions. From discouraging intruders to offering a quick response in emergencies, residential security monitoring system protects residences and families at all times. Customizable features tailored to the desires provide the convenience of remote monitoring and the guarantee of professional oversight. Trust in the dedication to delivering peace of mind, one home at a time.

MOTIVATION

The motivations behind the 'Residential Security Monitoring System' are as follows:

Rising Security Concerns in Residential Areas :

The motivation behind implementing a Residential Security Monitoring System stems from the increasing need for heightened security in residential areas. With a rise in criminal activities, trespassing, and potential threats to residents, there's a growing demand for sophisticated security measures. Traditional security methods may fall short in addressing modern challenges, emphasizing the necessity for an advanced monitoring system.

Protecting Residents and Assets:

A Residential Security Monitoring System acts as a proactive deterrent to unauthorized access, offering real-time monitoring and fast response capabilities. By using advanced technologies like smart sensors and automated alerts, these systems keep a constant watch over residents and their property, ensuring they stay safe and protected all day, every day.

Customized Security Solutions:
Motivation also arises from the need for customized security solutions tailored to the unique requirements of residential areas. A one-size-fits-all approach is inadequate, and thus, the system is designed to be adaptable, addressing specific challenges faced by each residential community.

SIMILAR PROJECTS

Here are some similar projects to the residential security monitoring system:

1. **SimpliSafe:** Both SimpliSafe and Residential Security Monitoring System have the goal of boosting the safety and security of homes. They both offer options for monitoring and safeguarding homes against intruders and emergencies. Additionally both systems allow for access and control enabling homeowners to keep an eye on their properties from using mobile devices or computers. While SimpliSafe provides a user approach with its made security packages, a personalized custom solution like Residential Security Monitoring System offers a higher level of customization and integration. Despite its convenience SimpliSafe falls short in terms of personalization, cutting edge features and seamless device integration – aspects that distinguish top notch security solutions. Moreover the cost of subscription fees along with limitations in scalability could impact its long term sustainability. Relying solely on SimpliSafe ecosystem also exposes homeowners to risks, in case of disruptions or company changes. For individuals looking for tailored security options opting for a designed system is definitely the preferred choice.
   SimpliSafe Home Security Systems | Wireless Home Security Alarms

2. **Ring:** Ring and Residential Security Monitoring System are based on keeping residence safe. They both offer ways to watch over the houses using cameras and sensors. Also, both systems can send alerts to the user's phone if something unusual happens at home. Additionally, both Ring and a residential

security monitoring system can be connected to other devices in the home, like lights or locks, to make home even safer. While Ring and Residential Security Monitoring System have similarities in enhancing home security, they differ in many aspects. Ring basically focuses on video doorbell and cameras for surveillance, whereas a Residential Security Monitoring System environ a specific range of security features beyond just video monitoring, such as sensors for detecting motion, smoke, or carbon monoxide. Moreover, Ring often relies on homeowners to manage and respond to alerts, while in our system, trained professionals can respond to alerts and dispatch emergency services if needed alongside the residents. Additionally, Ring allow homeowners to install and manage the system themselves, whereas our system requires professional installation and ongoing maintenance.
Home Security Systems | Cameras, Alarms, Doorbells | Ring

OBJECTIVES

The objectives for the "Residential Security Monitoring System" project may include:

- The system will be able to detect intruders, and protect residents and their property by preventing unauthorized access.
- Developing a system which is capable of continuous real-time monitoring of the residential environment, allowing homeowners to receive quick alerts on security status if something unusual happens.
- Integrating a centralized resident information database into the system, which leads to managing resident details efficiently and aiding in personalized security monitoring.
- Enhancing security measures by implementing cargo inspection for vehicles entering the residential area, this helps to reduce the chance of unauthorized things causing problems.
- Customizing security solutions to address the unique requirements of each residential community, providing tailored protection and peace of mind for residents.

PROJECT OUTPUT

- ***Installed Security Infrastructure:*** Implementing installation of monitors, sensors, and cameras throughout the area, placing them strategically to offer most adequate coverage.
- ***Functional Software Interface:*** A development of a user-friendly mobile app or web platform allowing homeowners to receive warnings easily, change security options, and watch real-time monitoring screens.
- ***Resident Information Database:*** The development of a secure, centralized database housing resident details, gadget adjustments, and safety choices.
- ***Alert System:*** Deployment of an auto alarm scheme that signals occupants and security staff about suspicious conduct or security infringements via text or notice system.
- ***Comprehensive Documentation:*** For ensured efficient system operation and future expandability, a thorough documentation set up comprising user guides, setup instructions, problem-solving assistance, a couple FAQs, and system upkeep protocols.

SYSTEM REQUIREMENT SPECIFICATION

The system requirements specification provides a comprehensive framework for designing, developing and implementing the system. Here's the system requirements specification for our project:

Functional Requirements:

1. ***Sensor Integration:***
    - The system shall work with various types of sensors like motion sensors, door/window sensors, smoke detectors, and glass break detectors.
    - Sensors will be in good spots in the residential area to watch over perfectly.
    - System will always keep an eye on the data from the sensors for any strange activity.

2. ***Camera Surveillance:***
    - The system shall need to have cameras to see what's going on around the house.
    - Cameras will be placed in places like the front door, driveway and outside areas.
    - And users will be able to watch the camera videos on their computer or phone anytime.
3. ***Alarm System:***
    - The system will have alarm system to notify if something is wrong.
    - The alarms shall include making noise, showing flashing lights, or sending messages to the user's phone.
    - Alarm will act based on sensor data or any suspicious activity detected by the system.
4. ***User Interface:***
    - The system will feature a user-friendly interface such as a website or phone application.
    - The interface will allow homeowners to check data, watch camera video, and change alarm settings.
    - Homeowners will receive real-time notifications or messages if any problem occurs.
5. ***System Administration:***
    - The users will be able to change settings for sensor, camera, and user account.
    - Only allowed people will be able to make this change and for this user shall need to have special permission.

To specify more what our system will do, here are some user and admin features and functionalities below:

User Features

- Device information
- Analytical report
- Timer settings
- Report system
- Security alert
- Emergency services
- Monitoring

Admin Features

- User Role Management
- Real-time Monitoring
- Alert and Notification
- Analytics and reporting
- Security and compliance
- Device info and update
- Record footage

Non-Functional Requirements:

1. ***Performance:***
    - The system will work properly without taking longer time to do any functionalities.
    - System shall have the ability to handle lots of user using it at the same time without slowing down.
2. ***Security:***
    - The system shall keep the information such as passwords, locks and personal information safe.
    - Only allowed people will be able to see the sensitive information or change the settings.
3. ***Usability:***
    - The website or application will be easy for the user to understand and use.
4. ***Reliability:***
    - The system will work all the time, even if things go wrong or in any kind of adverse situation.
    - It will have backup options so that users don't lose anything if there's a problem.
5. ***Scalability:***
    - The system shall be able to grow and manage more things without breaking.
    - Most importantly, the system will work as well for a small house as it does for a big one.
6. ***Regulatory Compliance:***
    - The system will definitely follow the rules and regulations about privacy and safety.
    - It will have certificates to show that it's safe and follow the rules.

PROPOSED METHODOLOGY

This method is flexible and adaptive, which makes it perfect for projects where security concerns and stakeholder needs may change over time. The following is a thorough, agile project methodology :

1. Project Planning and Initialization:

Under the direction of improving safety and offering cutting-edge security solutions, the team establishes precise goals and scope during the project's planning phase. Installing monitoring and surveillance cameras throughout the residential area is one of the first jobs. In this stage, the developers, security specialists, and stakeholders form a cross-functional team.

2. Planning:

The project is divided into smaller, more manageable sprints lasting two to five weeks each. At each sprint planning session, tasks are scheduled and prioritized based on the project's outputs, such as the development of an intuitive mobile application and web platform. With the use of these technologies, residents will be able to effectively manage their security settings and access real-time monitoring feeds.

3. Development And Testing:

During every sprint, the team concentrates on creating features that tackle project goals such as creating an automatic alert system and merging a centralized resident information database. Continuous testing makes sure every feature complies with specifications and is in line with the project's intended goals.

4. Review and Feedback:

The team shows finished work to stakeholders at the conclusion of each sprint for approval and comments. This stage makes certain that the functional software interface and installed security infrastructure satisfy residents' needs and take care of any modifications that may be required. The stakeholders are kept informed of how their input has been applied and of any resulting adjustments that will follow.

5. Continuous Integration and Deployment:

With every sprint, the team works to integrate new features into the current systems. Improvements like real-time monitoring feeds and alarms are made available to

residents through incremental implementation. This phased approach will ensure that the system is always enhanced.

6. Documentation and Knowledge Sharing:

Throughout the project, thorough documentation is produced, including installation instructions, user manuals, troubleshooting guides, some FAQs and system maintenance protocols. This guarantees system scalability and future maintenance while also assisting residents and security staff in using it successfully.

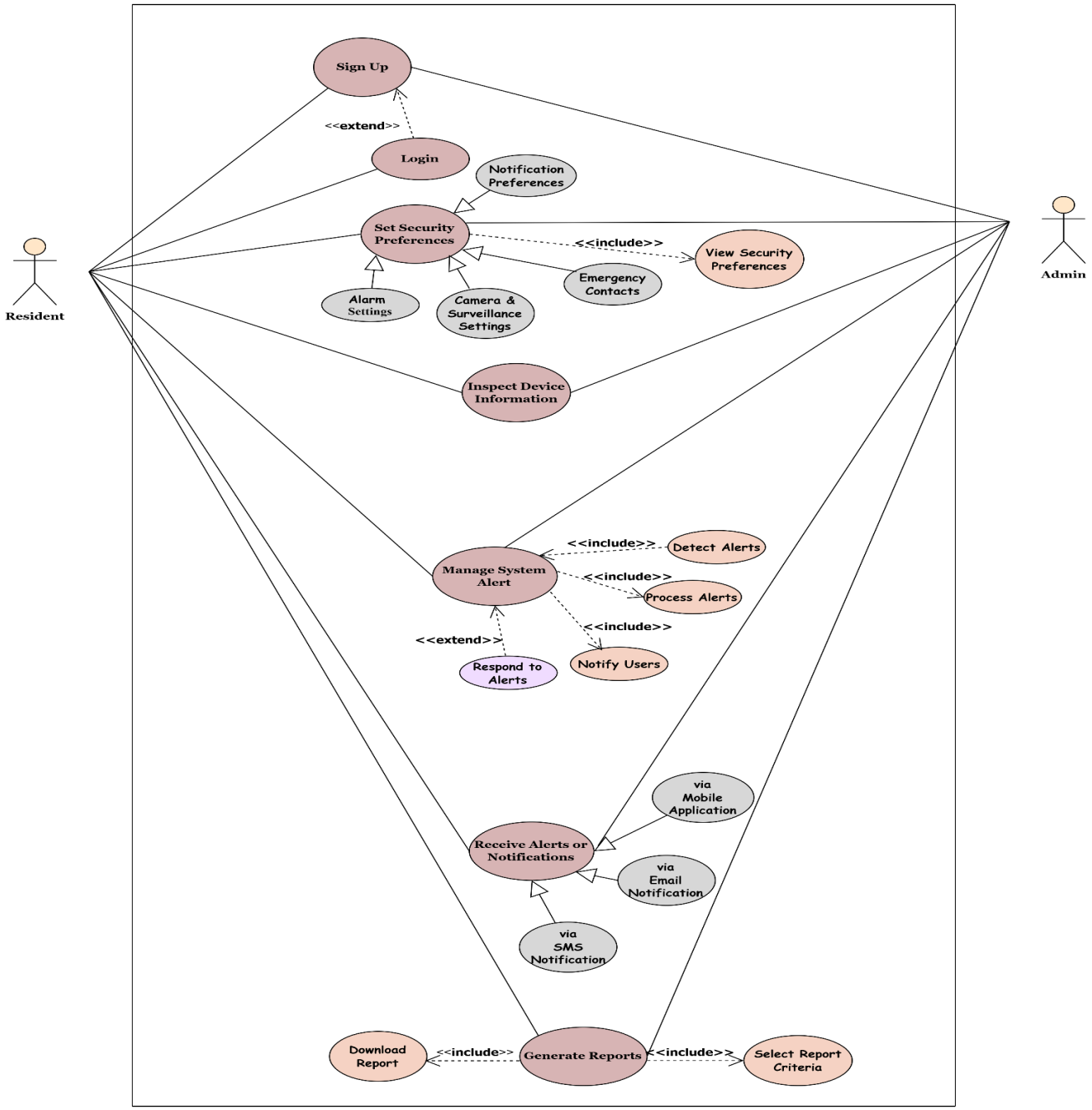
7. Retrospective and Continuous Improvement:

The team meets for a retrospective at the conclusion of every sprint to discuss challenges, accomplishments, and performance. Future sprints are guided by the lessons acquired from these evaluations, which also aid in continual improvement and guarantee that the project's goals and deliverables are met.

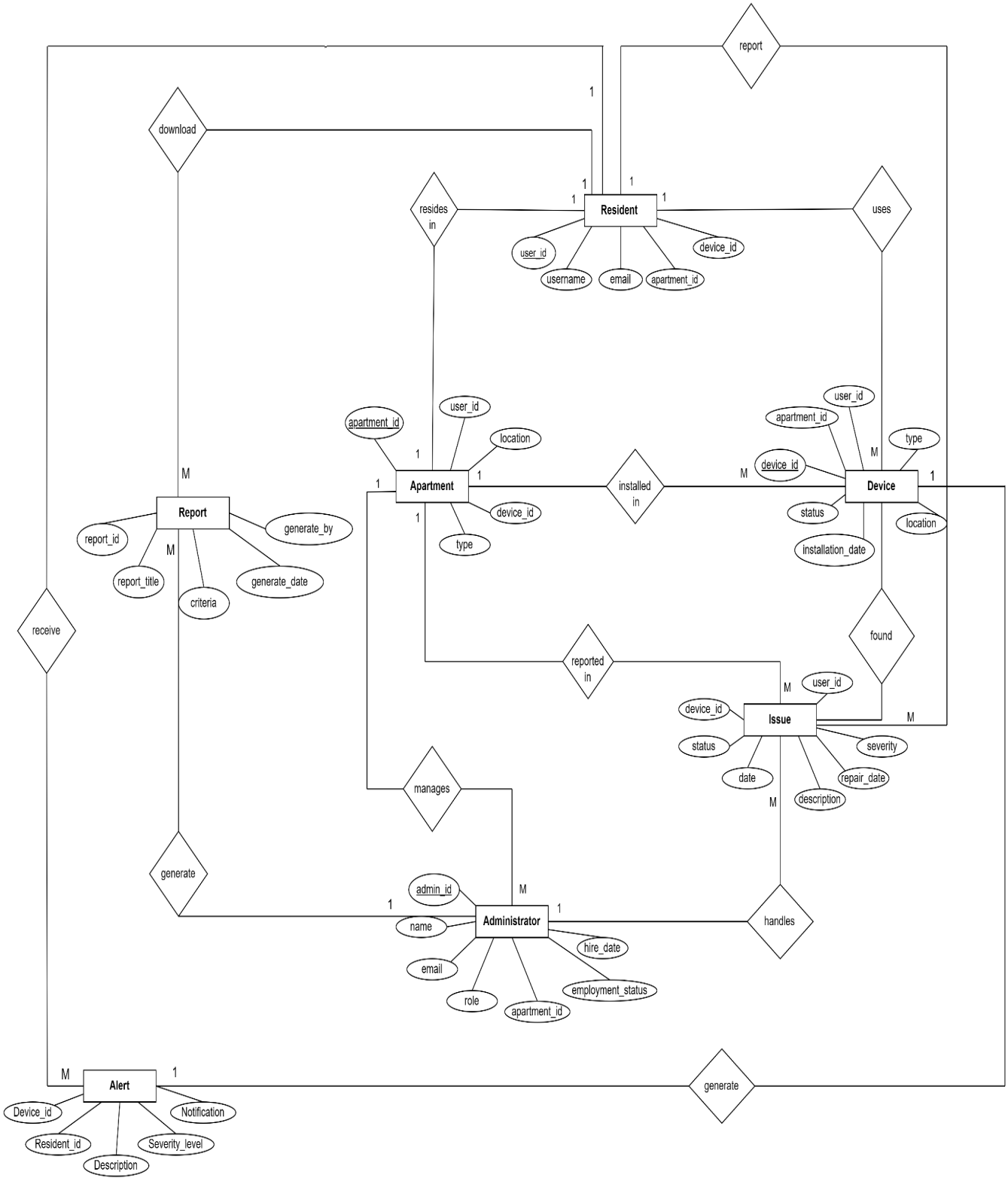
SYSTEM DESIGN

System design involves planning out how the system will look and work, using different diagrams to show its structure and functions. Here're some diagrams below:

1. *Use Case Diagram:*

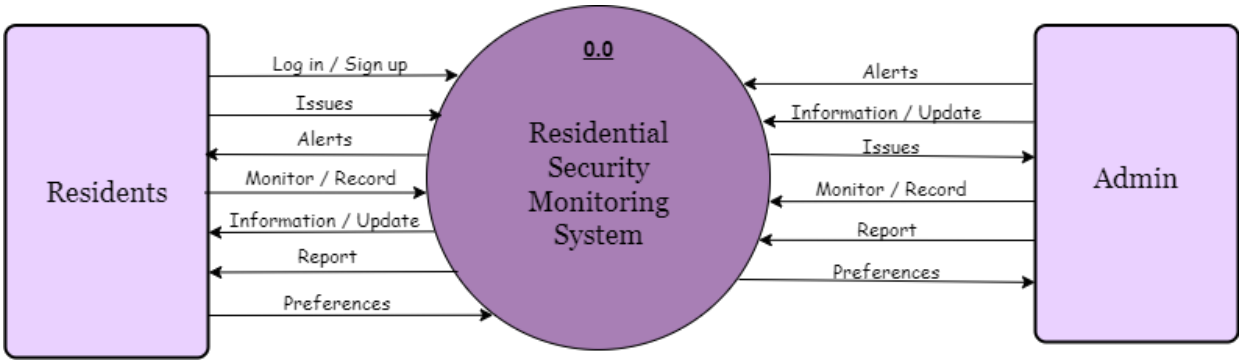


2. *Entity Relationship Diagram*

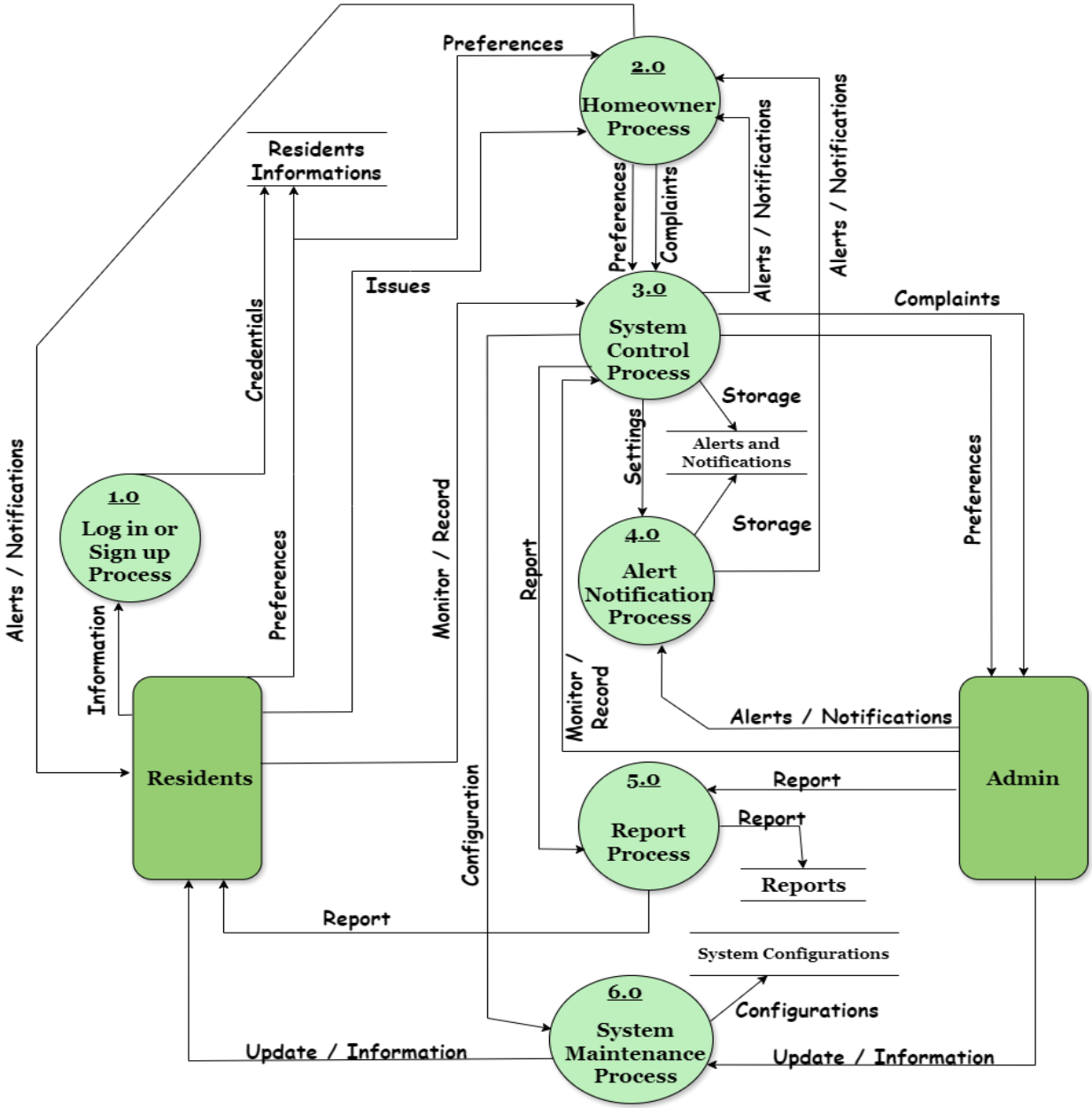


3. Data Flow Diagram

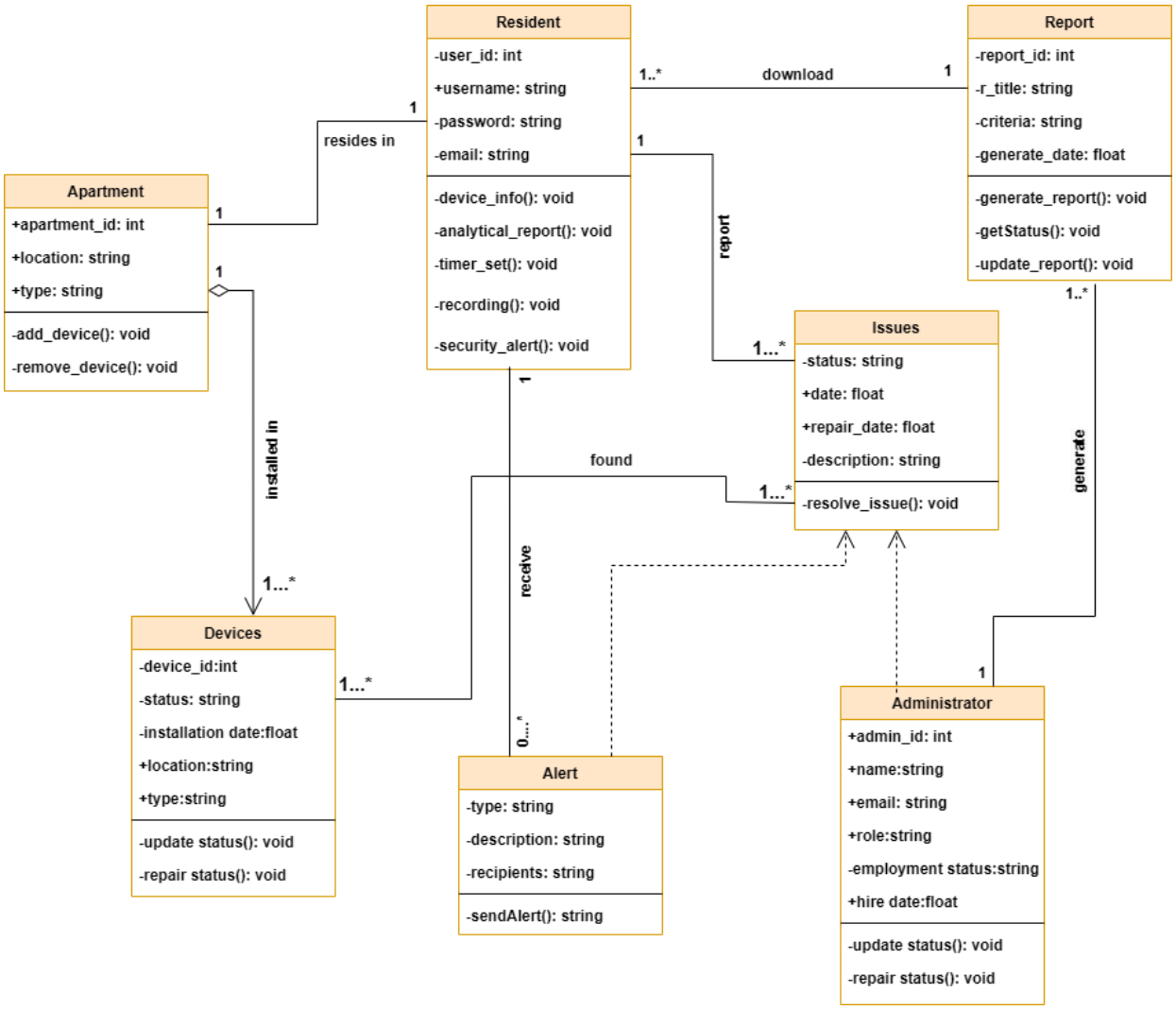
Level 0



Level 1


Preferences
2.0
Homeowner Process
Residents Informations
Preferences
Complaints
Alerts / Notifications
Alerts / Notifications
Credentials
Issues
3.0
System Control Process
Complaints
Storage
Alerts and Notifications
Settings
Storage
4.0
Alert Notification Process
Alerts / Notifications
1.0
Log in or Sign up Process
Information
Preferences
Monitor / Record
Report
Preferences
Monitor / Record
Alerts / Notifications
Residents
Admin
Configuration
5.0
Report Process
Report
Report
Reports
Report
System Configurations
6.0
System Maintenance Process
Configurations
Update / Information
Update / Information

4. Class Diagram



FEASIBILITY ANALYSIS (ECONOMIC)

The Residential Security Monitoring System project's financial aspects are assessed by the economic feasibility analysis to ascertain its viability and return on investment. The following crucial areas are covered by the analysis:

1) **Cost Analysis:**

Development Costs:

The project's upfront expenses include the procurement and setup of hardware, including monitoring systems, security cameras, and other essential equipment for the residential area. Developing the web application and mobile application that let residents control security settings and view live feeds is another expense associated with software development. These upfront costs are essential for setting up the resident digital interfaces and security infrastructure.

Operational Costs:

The project will need continuing operating expenses to sustain and maintain the infrastructure after the system is operational. These consist of server hosting and data storage costs to manage the constant stream of monitoring data. The durability and efficacy of the system are guaranteed by routine maintenance, and technical support offers assistance to security guards and residents as needed. The security system's continued dependability and functionality depend on these operating expenses.

Types of costs		YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	TOTAL
Development Cost	System and Hardware	70000	0	0	0	0	115000
	Labor	25000	0	0	0	0	
	Miscellaneous	20000	0	0	0	0	
	Total development cost	115000	0	0	0	0	
Operational Cost	Operational Labor	0	90000	95000	100000	105000	588500
	System and Hardware	0	40000	45000	45000	55000	
	Maintenance and Technical Support	0	2000	3000	3500	5000	
	Total Operational cost	0	132000	143000	148500	165000	

2) Benefit Analysis:

<u>Direct Financial Benefits:</u>

Through a decrease in theft, vandalism, and damage, the system lowers costs. Household insurance premiums may also decrease as a result of these reductions, which also lessen replacement and repair costs. Also financial benefit including initial revenue, subscription fee, additional services, customer referrals, and advertisement.

Indirect Benefits:

Since safer residential areas are in higher demand, increased security can raise property values. A higher quality of life and potential improvement in community cohesion are two benefits of increased resident satisfaction. Rising property values benefit us as the system developer. Firstly, homes equipped with our system increase in value, demonstrating the effectiveness of our product, and boosting our reputation which can lead to increased demand for our services. Additionally, as property value increases, homeowners may be more willing to invest in premium features and upgrades offered by our project Residential Security Monitoring System, creating opportunities for expansions of our services. In the long run, this can contribute to the growth and profitability of our business.

BENEFITS	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	TOTAL
Initial Revenue	200000	0	0	0	0	1900000
Subscription fees	0	150000	200000	350000	600000	
Additional Services	0	30000	35000	40000	50000	
Customer Referrals	0	10000	15000	20000	25000	
Advertisement	0	10000	15000	25000	45000	
Rising Property Value	0	20000	25000	35000	60000	
Total Benefit	200000	220000	290000	470000	720000	

NET CALCULATIONS	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	TOTAL
Net Benefit	200000	220000	290000	470000	720000	1900000
Cumulative Benefit	200000	420000	710000	1180000	1900000	1900000

3) **Return On Investment (ROI):**

By comparing the net benefits of a project—that is, all benefits less all costs—to the initial investment, return on investment (ROI) calculates the project's profitability. ROI, or return on investment, is a metric that shows how much money is made back on a project in comparison to how much was initially invested. One of the most important metrics for assessing the project's financial performance is ROI, since a greater ROI indicates a more successful investment.

ROI = ((Total Benefit - Total Cost) / Total Cost) x 100%

= ((1900000-703500)/703500) x 100 %

= 170%

4) **Break-Even Point:**

After all costs are paid, break-even point (BEP) determines when it begins to turn a profit. It indicates the turning point in the project's cumulative cash flow from negative to positive. BEP is crucial for determining when the project will turn a profit and cease to lose money. An early BEP indicates that the project will start turning a profit sooner, which is a positive indication of its financial sustainability.In the years that follow a potential negative cash flow, BEP determines how much extra benefit we receive using this methodology:

BEP = Number of Years with Negative Cash Flow + (Yearly Net Cash Flow - Cumulative Cash Flow in That Year) / Yearly Net Cash Flow

BEP can only be obtained by computing the remaining part of the formula for each year. Knowing the number of years with negative cash flow is necessary for this.

For Year 0: BEP = (200000-200000/200000) = 0

For Year 1: BEP = (220000-420000/220000) = -0.91

For Year 2: BEP = (290000-710000/290000) = -1.45

For Year 3: BEP = (470000-1180000/470000) = -1.51

For Year 4: BEP = (720000-1900000/720000) = -1.64

A project is profitable if the cumulative cash flow is positive, as indicated by a negative sign in the break-even point (BEP) calculation.

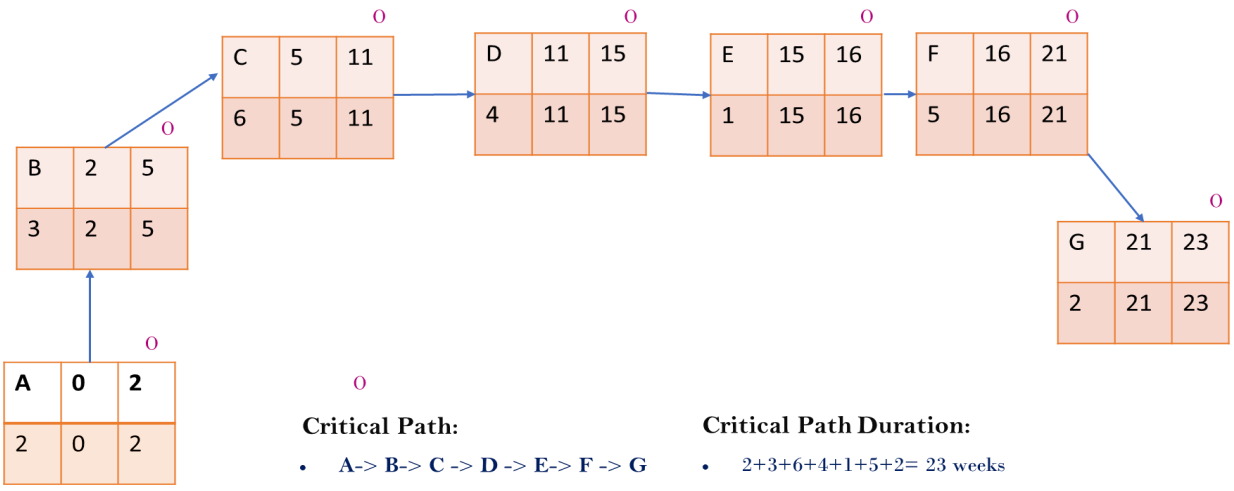
Therefore to conclude, the break-even point is not a worry for our project because we have never had a year of negative cash flow and have always turned a profit. Throughout the project's duration, we never experienced a year with negative cash flow, meaning that we always turn a profit. With all things considered, the initiative is profitable and successful.

PROJECT SCHEDULING (CPM)

Project Data

Activity serial	Activity	Preceding Activity	Duration
A	Requirements Gathering	-	2 weeks
B	Planning	A	3 weeks
C	Development And Testing	B	6 weeks
D	Review and Feedback	C	4 weeks
E	Continuous Integration and Deployment	D	1 week
F	Documentation and Knowledge Sharing	E	5 weeks
G	Retrospective and Continuous Improvement	F	2 weeks

Critical Path (CPM):



Critical Path:

- **A-> B-> C -> D -> E-> F -> G**

Critical Path Duration:

- 2+3+6+4+1+5+2= 23 weeks

CEP MAPPING

How **Knowledge Profile (K's)** are addressed through our project and mapping among K's, COs, POs:

K's	Attribute	How K's are addressed through our project	CO	PO
K2	Mathematics	Mathematics, Statistics are vital for analyzing the data collected by the monitoring system	CO2	PO2
K3	Engineering Fundamentals	Software Engineering, Database, Computer Networking, Electrical Engineering Fundamental knowledges are needed for our project	CO1, CO4	PO1, PO3, PO5
K4	Specialist Knowledge	Applying specialized knowledge such as ML and AI are crucial for recognition and analyzing data	CO4	PO5
K5	Engineering Design	We used use case diagram, ERD, DFD, class diagram to design our project	CO3	PO2, PO3
K6	Engineering Practice	Hardware based knowledge and components are essential, also we used django, python and SQL in implementation of user interface and database	CO3	PO3
K7	Comprehension	Addressing ethical, social, and environmental implications, as well as balancing conflicting requirements, ensures that our project not only provides effective security measures but also aligns with broader societal values and sustainability principles.	CO5, CO6, CO7	PO6, PO8, PO9

How **Complex Engineering Problem (P's)** are addressed through our project and mapping among P's, COs, POs:

P's	Attribute	How P's are addressed through our project	CO	PO
P1	Depth of knowledge required	Requires depth engineering knowledge at the level of ML & AI (K4), Database & Computer Networking (K3), class diagram design (K5), django & SQL (K6) to design and implement a comprehensive predictive modeling system	CO1, CO2, CO3, CO4	PO1, PO2, PO3, PO5
P3	Depth of analysis required	Analysis our project involves examining various aspects such as developing algorithms for anomaly detection to spot unusual patterns, designing smart sensor placement strategies based on environmental factors, conducting in-depth risk and scenario analysis to predict and prevent problems early	CO2, CO4, CO8	PO2, PO5, PO10
P7	Interdependence	Within our project, we encounter high-level problems such as designing effective surveillance systems, real-time monitoring and response comprising multiple interconnected components and sub-problems. These components include sensor networks, data processing and analysis, user interface and many more. These interconnected components and sub-problems highlight the complexity of our project, emphasizing the need for comprehensive solutions that address various aspects of residential security monitoring.	CO3, CO4, CO7	PO3, PO5, PO9

How **Complex Engineering Activities (A's)** are addressed through our project and mapping among A's, COs, POs:

A's	Attribute	How A's are addressed through our project	CO	PO
A1	Range of resources	Our project involves using various resources including professionals, allocating budget, hardware, advance technologies such as surveillance cameras, motion sensors, DBMS, user interface and so on	CO1, CO4	PO1, PO5
A2	Level of interaction	The project involves addressing significant challenges that arise from the interaction such as balancing security needs with user privacy, integrating smart home devices. And fixing issues by using algorithms, robust encryption protocols, sensor placement strategies.	CO2, CO3, CO4	PO2, PO3, PO5
A4	Consequences for society and the environment	The system enhances security, fostering a greater sense of well-being and potentially reducing crime rates. However, it also raises concerns about environmental impact, energy consumption, electronic waste, and privacy issues.	CO5	PO6
A5	Familiarity	We explore innovative techniques grounded in fundamental principles of engineering, security and data analysis. This approach enables us to develop strategies for anomaly detection, risk assessment, and system optimization. We can adapt to evolving threats, incorporate emerging technologies.	CO1, CO2, CO3	PO1, PO2, PO3, PO5

CONCLUSION

Residential Security Monitoring System represents a significant progression in securing homes and providing homeowners with greater control. By utilizing the power of Artificial Intelligence (AI), our system will work on real-time monitoring functions which are effective in threat detection and will enhance safety for residents.

Through primarily testing, the capabilities of our system to deliver real-time monitoring is confirmed. The integration of customizable security features or settings and a user-friendly interface uplifts the usability and acceptance of the system.

While the journey to developing Residential Security Monitoring System faced challenges, particularly related to overcoming the hardware components, the system is robust, cost-effective, scalable and adaptable to various residential environments.

Anticipating future developments, the Residential Security Monitoring System is flexible for continuous improvement and advancement, by taking cues from feedback provided by homeowners and stakeholders. The system will keep getting updated by adjusting with the new ideas and being adaptable. This way, it stays effective and relevant in keeping residential areas or communities safe, no matter how security features need change.

Furthermore, the development and implementation of Residential Security Monitoring System helped to gain learning experience, not only in technology and problem-solving but also in collaboration and innovation. These experiences serve as a solid foundation for the future, as we continue to push the boundaries of security technology and make meaningful contributions to enhancing residential safety and security.