

STRAP: Specialized TRacker for Pets

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EXECUTIVE SUMMARY

This paper is a documentation of the development plan for the Specialized TRAcker for Pets or STRAP. The goal of this project is to create a system that is specialized for the improvement of pet ownership and care while also providing a solution to the stray pet population problem in the Philippines. STRAP will contain features such as a GPS tracking system for the collar that will show the real time GPS location for pets, it will also contain pet information such as the medical history, a notification or alarm that will notify the user if the collar is moving away by a specified range, and a Quick Response (QR) code in which users can scan and view the identification of the pet with the scanned STRAP QR with authorization of the owner.

The STRAP collar will involve the development of two systems, the tracker collar and the web application. The tracker collar will relay the GPS location of the pet that wears the collar as well as contain the QR code for the pet's identification. The web application will have login functionalities and will be the main application where users will be able to add or edit their pet's information, view the live GPS feed and view other pet's identification after the QR code has been scanned.

Future researchers can use this reference for the development of more Arduino projects based on smart pet and animal devices and further improve the studies involving the field of Animal Computer Interaction (ACI).

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
CHAPTER 1: INTRODUCTION	15
1.1 Project Context	15
1.2 Purpose and Description	17
1.3 Objectives	18
1.3.1 General Objective	18
1.3.2 Specific Objectives	18
1.4 Assumptions, Scope, and Limitations	19
1.4.1 Assumptions	19
1.4.2 Scope	19
1.4.3 Limitations	19
CHAPTER 2: REVIEW OF RELATED LITERATURE, STUDIES, AND SYSTEMS	21
2.1 About Pets & People	21
2.1.1 Responsibilities of a Pet Owner	21
2.2 Protocols for Helping Stray Animals	22
2.3. Animal Computer Interaction	22
2.3.1 Ethical Principles of Animal Computer Interaction	23
2.4. Dog Collar Styles	24
2.4.1 The Pros and Cons of a Harness or Collar	25
2.4.1 Why Should A Pet Use a Collar	26

2.4.1 Protect Pets from Getting Lost	26
2.4. Global Positioning System	27
2.4.1 Advantages of Global Positioning System	28
2.4.2 Disadvantages of Global Positioning System	29
2.4.3 NMEA Data String	30
2.4.4 National Marine Electronics Association	31
2.5 Arduino	31
2.5.1 Arduino Software	31
2.5.2 Arduino IDE	32
2.5.3 Arduino and C++	32
2.5.4 Vehicle Tracking System using GPS and Arduino	33
2.5.5 Arduino UNO	33
2.5.6 Why is Arduino UNO Used?	34
2.5.7 GPS Module?	34
2.5.8 GSM Module?	35
2.5.9 LiPo Battery?	36
2.5.10 Advantages of Using LiPo Batteries?	37
2.6 What's the Internet of Things(IoT)?	37
2.6.1 The Internet of Things: The Basics Explained	38
2.6.2 History of Internet of Things	39
2.6.3 Guidelines for Internet of Things Deployment	40

2.6.4 What is an IoT Device?	40
2.6.5 Building Blocks of IoT Device	43
2.6.6 IoT Device Life-Cycle Management	44
2.7 Republic Act 10173 – Data Privacy Act of 2012	46
2.8 Republic Act (RA) 9482 - Anti-Rabies Act of 2007	48
2.9 Web Application Security	49
2.9.1 The Definition of Hashing	50
2.9.2 Hash Algorithms	51
2.9.2.1 MD5	51
2.9.2.2 Secure Hash Algorithm	51
2.9.2.3 CRC32	52
2.9.3 Encryption	52
2.10 Cross-Site Scripting	52
2.10.1 Types of Cross-Site Scripting Attacks	53
2.10.2 How to Prevent Cross-Site Scripting Attacks	53
2.11 SQL Injection	54
2.11.1 Types of SQL Injection	54
2.12 What is SCRUM?	55
2.13 PHP	56
2.13.1 Advantages of PHP	57
2.13.2 Disadvantages of PHP	57

2.14 Bootstrap	57
2.14.1 Why Use Bootstrap?	58
2.14.2 The Disadvantages of Using Bootstrap	59
2.15 The Apache Web Server	60
2.16 ReactJS	60
2.17.1 Advantages of ReactJS	61
2.17.2 Disadvantages of ReactJS	62
2.17 JavaScript	62
2.17.1 Advantages of JavaScript	62
2.17.2 Disadvantages of JavaScript	63
2.18 Node.js	63
2.17.1 Advantages of Node.js	64
2.17.2 Disadvantages of Node.js	64
2.19 JavaScript Object Notation (JSON)	64
2.19.1 Why Use JSON?	65
2.20 Importance of Privacy and Policy	65
Review of Related Systems	67
Related System: My Family - Family Locator	67
Related System: Pawfit GPS Pet Tracker	68
Related System: 11pets: Pet Care	69
Related System: Smart QR Code Scanner	70

Related System: mSpy	71
Related System: Map My Run by Under Armour	72
Related System: Google Maps	73
Related System: FamiSafe	74
Related System: Life360	75
Related System: TrackView	76
Related System: Glympse	77
Related System: FollowMee	78
2.21 Synthesis: Pet Related Articles	79
2.22 Synthesis: GPS Related Articles	84
2.23 Synthesis: Arduino Related Articles	86
2.24 Synthesis: Internet of Things Related Articles	91
2.25 Synthesis: Republic Act Related Articles	95
2.26 Synthesis: Security Related Articles	96
2.27 Synthesis: Web Development Related Articles	103
2.28 Synthesis: Framework Related Articles	107
2.29 Synthesis: Related Systems	108
CHAPTER 3: TECHNICAL BACKGROUND	113
3.1 Requirement Analysis	113
3.1.1 Functional Requirements	113
3.1.2 Non-Functional Requirements	113

3.1.2.1 Availability	113
3.1.2.2 Privacy and Confidentiality	114
3.1.2.3 Performance and Reliability	114
3.1.2.4 Security	114
3.2 Design Methodology	115
3.2.1 Research Methodology	115
3.2.2 SDLC Methodology	116
3.3 System Design	118
3.4 Development Plan	133
3.5 Test Plan	147
3.6 Implementation Plan	155
3.6.1 Hardware Specifications	155
3.6.2 Software Specifications	164
3.6.3 Work Breakdown	171
CHAPTER 4: IMPLEMENTATION, RESULTS AND DISCUSSION	177
4.1 Requirements Documentation	177
4.1.2 System Requirements	191
4.1.2.1 Hardware Requirements	191
4.1.2.2 Software Requirements	199
4.2 Design of Software, Systems, Product, and/or Processes	207
4.2.1 System Sequence Diagrams	207

4.2.2 Network Design	214
4.2.3 Database Design	215
4.2.4 Circuit Diagram	216
4.2.5 Data Dictionary	217
4.3 Testing and Results	220
CHAPTER 5: CONCLUSION & RECOMMENDATIONS	245
5.1 Conclusion	245
5.2 Recommendations	246
PRIVACY POLICY	247
BIBLIOGRAPHY	262
APPENDICES	270

LIST OF FIGURES

Figure 1.1 Schematic Design	16
Figure 1.2 Input-Process-Output System Model	17
Figure 3.2 The SCRUM Cycle	116
Figure 3.3.1 Strap System Activity Diagram	118
Figure 3.3.2 Use Case Diagram	120
Figure 3.3.4 STRAP Database Schema	127
Figure 3.4.1 Color Palette for Website	133
Figure 3.4.2 Main Page	135
Figure 3.4.3 Log-in Page	135
Figure 3.4.4 Pet's Information Page	136
Figure 3.4.5 Pet's Geo Location Page	137
Figure 3.4.6 Missing Notification Page	138
Figure 3.4.7 Last Location Page	139
Figure 3.4.8 Log-out Page	139
Figure 3.4.9 Forgot Password Page	140
Figure 3.4.10 Sign-up Page	141
Figure 3.4.11 Data Privacy Page	141
Figure 3.4.12 Medical Records Page	142
Figure 3.4.13 Diets Page	142
Figure 3.4.14 General Settings Page	143

Figure 3.4.15 Tracker Settings Page	144
Figure 3.4.15 Owner Trackers Logs Dashboard	145
Figure 3.4.15 Owner Trackers Approval Dashboard Page	145
Figure 3.4.15 Scanned QR Code Owners Page	146
Figure 4.2.1.1 System Sequence Diagram - Guest Management Module	207
Figure 4.2.1.2 System Sequence Diagram - Profile Management Module	208
Figure 4.2.1.3 System Sequence Diagram - User Management Module	209
Figure 4.2.1.4 System Sequence Diagram - Pet Management Module	210
Figure 4.2.1.5 System Sequence Diagram - Tracker Management Module	211
Figure 4.2.1.6 System Sequence Diagram - Admin Management Module	212
Figure 4.2.1.7 System Sequence Diagram - Super Admin Management Module	213
Figure 4.2.2 STRAP Network Diagram	214
Figure 4.2.3 STRAP Entity Relationship Diagram	215
Figure 4.2.4 Circuit Diagram - STRAP GPS Device	216
Figure 5.1 STRAP Evaluation Form	245

LIST OF TABLES

Table 2.20 Pet Related Articles	79
Table 2.21 GPS Related Articles	84
Table 2.22 Arduino Related Articles	86
Table 2.23 IoT Related Articles	91
Table 2.24 Republic Related Articles	95
Table 2.25 Security Related Articles	96
Table 2.27 Web Development Related Articles	103
Table 2.26 Framework Related Articles	107
Table 2.28 Related Systems	108
Table 3.3.3.1 Create Administrator Account Use Case Narrative	121
Table 3.3.3.2 User Support Use Case Narrative	122
Table 3.3.3.3 Edit Pet Details Use Case Narrative	123
Table 3.3.3.4 Activate Tracker Use Case Narrative	124
Table 3.3.3.5 View Map Use Case Narrative	126
Table 3.3.5 Specialized TRacker for Pets: Users Data Dictionary	128
Table 3.3.6 Specialized TRacker for Pets: Report Data Dictionary	129
Table 3.3.7 Specialized TRacker for Pets: Address Data Dictionary	130
Table 3.3.8 Specialized TRacker for Pets: Roles Data Dictionary	131
Table 3.3.9 Specialized TRacker for Pets: Pet Data Dictionary	131
Table 3.3.10 Specialized TRacker for Tracker: Tracker Data Dictionary	132

Table 3.5.1 Test Case:Check if User is Able to Activate a New Tracker	147
Table 3.5.2 Test Case:Check if User Can Connect Web Application to STRAP	148
Table 3.5.3 Test Case:Check if STRAP Web Application Can Scan QRCode View Pet Profile	149
Table 3.5.4 Test Case:Check if STRAP Will Notify User if Pet Exceeds a 200 Meter Distance	149
Table 3.5.5 Test Case:Check if User Can View GPS Location of STRAP Using Application	150
Table 3.5.6 Test Case:Check if User Can View Pet's Profile on the Web Application	151
Table 3.5.7 Test Case:Check if User Can Edit Pet's Profile on the Web Application	152
Table 3.5.8 Test Case:Check if User Can Add Pet Profile for Newly Activated STRAP Collar	153
Table 3.6.1 Arduino UNO Technical Specifications	155
Table 3.6.2 Arduino Shield GSM SIM900 Technical Specifications	157
Table 3.6.3 NEO-6M GPS Module Pin Configuration and Technical Specifications	159
Table 3.6.4 LiPo Battery 3.7V 4000mAh Technical Specifications	162
Table 3.6.5 Microsoft Visual Studio Specifications	164
Table 3.7.1 Work Breakdown	171
Table 4.1.1 Use Case Diagram - STRAP	177
Table 4.1.2 Use Case Narrative - User Login	178
Table 4.1.3 Use Case Narrative - User Registration	179
Table 4.1.4 Use Case Narrative - User Add Tracker to Website	180
Table 4.1.5 Use Case Narrative - User Deactivate Tracker from Website	181
Table 4.1.6 Use Case Narrative - User Add Pet Details	183

Table 4.1.7 Use Case Narrative - User Edit Existing Pet Details	184
Table 4.1.8 Use Case Narrative - Administrator Edit Existing Pet Details	185
Table 4.1.9 Use Case Narrative - Administrator Manage User Requests	187
Table 4.1.10 Use Case Narrative - Super Administrator Add Administrator	188
Table 4.1.11 Use Case Narrative - User Search For Owner using QR Code	189
Table 4.1.2.1 Arduino UNO Technical Specifications	191
Table 4.1.2.2 Arduino Shield GSM SIM900 Technical Specifications	193
Table 4.1.2.3 NEO-6M GPS Module Technical Specifications	195
Table 4.1.2.4 LiPo Battery 3.7V 4000mAh Technical Specifications	198
Table 4.1.2.5 Microsoft Visual Studio Specifications	200
Table 4.2.5.1 STRAP Data Dictionary - User Registration	217
Table 4.2.5.2 STRAP Data Dictionary - User Login	217
Table 4.2.5.3 STRAP Data Dictionary - Search Pet	218
Table 4.2.5.4 STRAP Data Dictionary - Add Pet	218
Table 4.2.5.5 STRAP Data Dictionary - Add Tracker	219
Table 4.3.1 Test Cases - Navigation Bar	220
Table 4.3.2 Test Cases - Login Page	221
Table 4.3.3 Test Cases - Register Page	223
Table 4.3.4 Test Cases - Pet Registration Page	231
Table 4.3.5 Test Cases - View Pets Page	234

Table 4.3.6 Test Cases - Pet Update Page	235
Table 4.3.7 Test Cases - Add Tracker Page	237
Table 4.3.8 Test Cases - Search Pets Page	239
Table 4.3.9 Test Cases - Dashboard Page	240
Table 4.3.10 Test Cases - Edit Profile Page	240

CHAPTER 1: INTRODUCTION

1. 1 Project Context

The Philippines is ranked fifth in the world when it comes to dog population coming in at eleven million dogs (PetSecure, 2017). This, in correlation with the ever-growing number of stray animals in the Philippines, one can assume that a great number of these animals are formerly owned by a family but were lost or abandoned during their lifetime. WorldAtlas states that the Philippines ranks fourth in the world in the incidence of human deaths from rabies. This turns the stray animal population in the Philippines into a serious problem (Nag, 2017).

The overpopulation of stray animals also leads to a decision by some local governments to resort to mass culling of these animals and are reported to be in manners that are deemed cruel by animal welfare organizations (Nag, 2017). There exists a number of solutions conducted by the government such as free anti-rabies programs and other vaccines to help mitigate the spread of diseases of rabies on household pets, but due to the growing population of stray animals, these solutions can only do so much.

With all this in mind, pets that get lost and owners having trouble trying to find them across a span of multiple days and in the end will only stay missing, will contribute to the problem of stray animal overpopulation in The Philippines. Studies show that only 15 percent of pet guardians reported a lost dog or cat within the past five years. Moreover, 93 percent of dogs and 75 percent of cats lost were never returned to their owner (Moore, 2012). In order to offer a solution to this problem that contributes to the growing stray animal population, the researchers developed a Specialized TRAcker for Pets or STRAP to provide a solution to this growing problem. This tracker is a collar fitted with a Global Positioning System (GPS) and connects to the user's device. This in turn will let the user know where their pets are in real-time, and be

alerted if their pet is further increasing its proximity with the owner's device. The user will also be able to create a profile for their pet along with its personal information so that way if a person happens to find this missing dog fitted with the STRAP collar, they can simply scan the collar using a Quick Response Code (QR) and be able to see the personal information of the animal. This will let pet owners in the Philippines be more responsible and caring for their pets and could help mitigate the prevalent problem of the stray pet population.

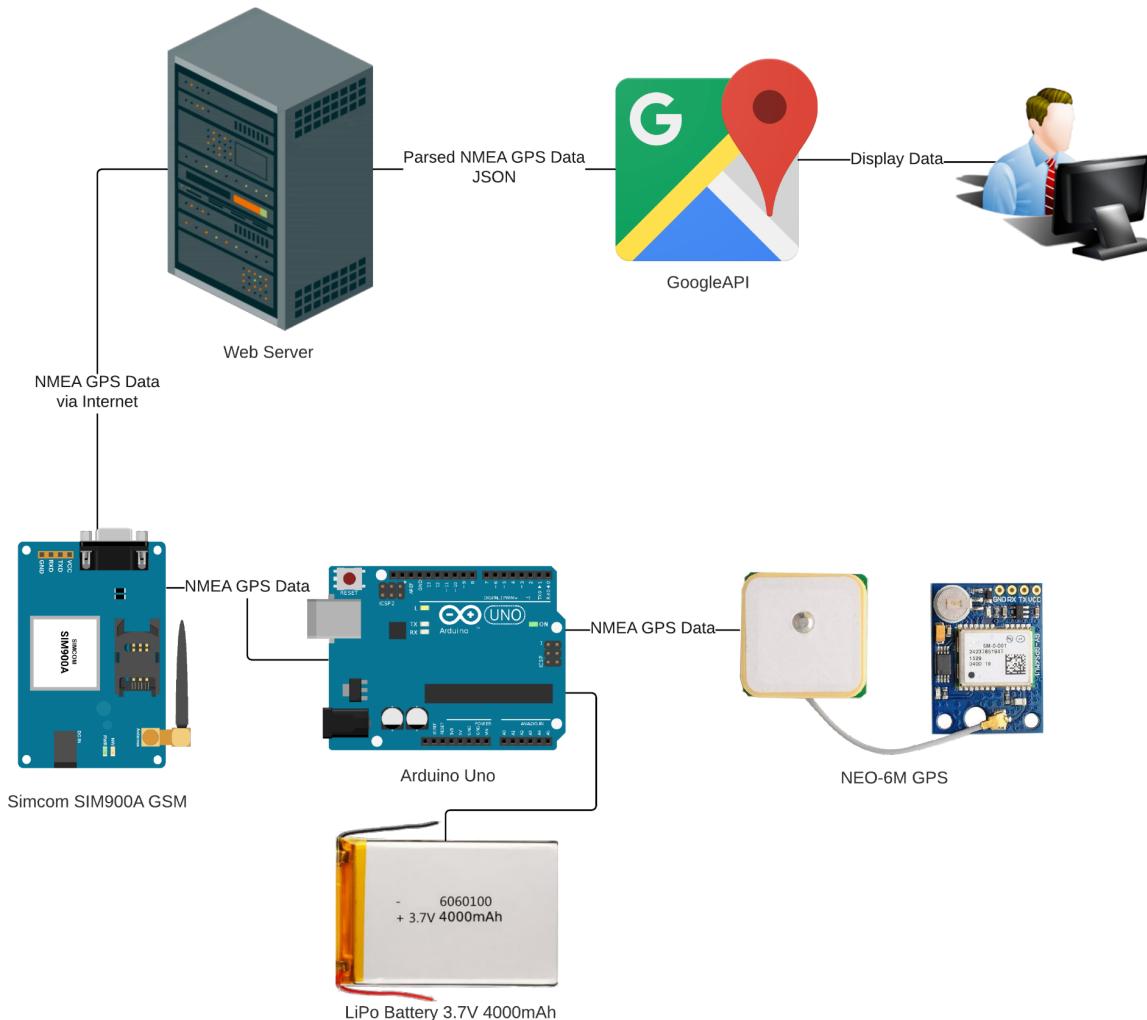


Figure 1.1 Schematic Design

1.2 Purpose and Description

The purpose of this project is to develop an application that will help track and monitor pets, including the ability to see the basic information of other pets through the use of QR scanning on the collar. Instead of posting banners and social media posts when the user's pet is lost. The user can now refer to the web application where he can track the current location via GPS. When a pet is lost, a bystander can scan the QR code to see the pet's details and also the owner's details like name and contact number to help with its return.

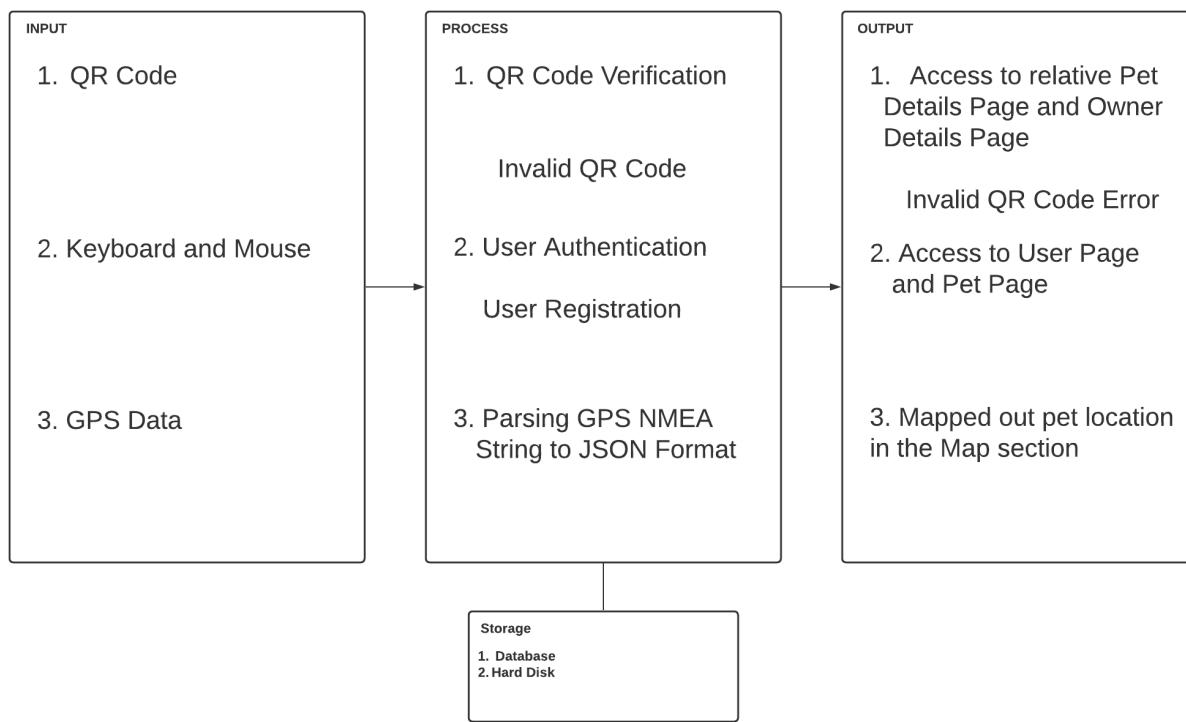


Figure 1.2 Input-Process-Output System Model

The IPOS Model displays the flow of data through the system coming from the input diagram to the output diagram while showing the process in between. The diagrams are linked via numbers where input one in the Input diagram is linear to both input ones of process and output diagrams.

1.3 Objectives

1.3.1 General Objective

- The Specialized TRAcker for Pets (STRAP) aims to provide important information real-time data location to the pets of the owner by using a Global Positioning System (GPS) collars.

1.3.2 Specific Objectives

- To build a GPS collar using Arduino for real-time data location of the pets.
- To create a web application that stores the pet's identification information.
- To allow users to register into the web application.
- To allow users to login into the web application.
- To allow users to log out of the web application.
- To allow owners to enter their pet's personal information into the web application.
- To allow users to access the pet's personal information using a Quick Response (QR) code from the specialized collar.
- To allow users to view the pet's information page.
- To allow users to change their password if forgotten.
- To allow users to generate a report.
- To be able to authorize who can and cannot access the pet's identification information by the pet's owner.

1.4 Assumptions, Scope, and Limitations

1.4.1 Assumptions

- Utilizes both hardware and software.
- The target market is mainly for pets, especially cats and dogs.
- Accessing the pet's information website is internet-dependent.

1.4.2 Scope

- Allows the owner to enter their pet's personal information.
- Allows the owner to view his/her pet's information.
- Permits other users to check the pet's personal information by utilizing the Quick Response (QR) code.
- It provides the pet an identification number.
- It shows the pet's current medical records, diet, and its owner's information .
- The QR code has the ability to authenticate who can access the pet's information.
- Lets owners see the real-time location of their pets through a GPS tracker.
- Allows the users to scan the QR code and view the pet's basic information with or without internet access.
- Allows the users to see other pets who use the application.

1.4.3 Limitations

- Tools/programming languages used are only restricted to HTML, CSS, C++(Arduino), JavaScript, Arduino UNO, SIM800L, and PHP.
- It has no influence over GPS signals, especially in poor weather conditions.
- It has no control over who can scan the QR code.
- The battery consumption is dependent on GPS usage.

- Due to monetary constraints, the developers are limited to recruiting only five volunteers. After finishing the prototype, these volunteers are contacted to do a dry run.
- The dry run period will last a maximum of 1 week.
- Each volunteer to the dry run will be asked to complete a short questionnaire in order to evaluate the STRAP's functionalities.

CHAPTER 2: REVIEW OF RELATED LITERATURE, STUDIES, AND SYSTEMS

2.1 About Pets & People

Owning a pet has its health benefits and according to the Centers for Disease Control and Prevention(2019), owning a pet can increase the opportunity for owners to get outside, exercise, and socialize. Regular walking or playing with pets can decrease blood pressure, cholesterol levels, and triglyceride levels. Also, owning a pet can help manage loneliness and depression by giving us companionship and most households in the United States have at least one pet. Studies have shown that having a pet and bonding with them can increase fitness, lower stress, and can even bring happiness. However, pets can carry harmful germs that may affect you or other members of your family. Whether you are bonding, playing, feeding, or cleaning up your pet, it is important to wash your hands, running water and soap are best for hand washing, to help reduce the risk of getting sick from the germs that your pets are exposed to.

2.1.1 Responsibilities of a Pet Owner

The government has mandated a policy known as the Republic Act 9482 or The Anti Rabies Act and Responsibilities of a Pet Owner. This act aims to lawfully guide citizens on the proper care and protection of their pets and also the environment that they live in. In this policy, it is stated that owners are required to have their pets regularly vaccinated, along with maintaining a registration card containing the characteristics of their pets. All information of the pet shall be included in the registration card, this includes the pet's health history. The policy also states that owners shall maintain control over their pets and are not allowed to let their pets roam the streets of any public place

without a leash. This policy provides people a clear and concise guide on how to take care of their pets legally, and with approval from the government (PAWS, n.d.).

2.2 Protocols for Helping Stray Animals

According to the Philippine Animal Welfare Society (PAWS), when a person finds themselves in a situation where they encounter an animal presumed to be lost and could be injured, it is imperative that the person do not simply take pictures and post them onto a social media site. The person present is considered the best option for the animal to survive (PAWS, 2020). It is also stated by PAWS that the person in concern must then gather as much information as they can by asking the barangay, asking the area if said animal has an owner, and if injured, getting the animal out of harm's way. According to PAWS, it is important to consider the time it takes before the animal rescue organization and should decide if the situation calls for any immediate action. If no owners are found, the person must be ready to foster or temporarily keep the animal up until a sufficient amount of veterinary care has been provided to the animal.

2.3. Animal Computer Interaction

Animal Computer Interaction (ACI) according to Mancini (2011), aims to understand the interaction between animals and computing technology within the context of the animal's environment, lifestyle, and socialization with the same species or other species, including humans. ACI aims to influence the development of interactive technology to improve animal life, not only in terms of their life expectancy but also the quality. This is achieved by facilitating the fulfillment of their physiological and

psychological needs. ACI technology encourages healthy habits for domestic animals and fosters the relationship between humans and their companion animals. ACI aims to develop a user-centered approach, informed by the best available knowledge of animals' needs and preferences, to the design of technology that is meant for animal use.

2.3.1 Ethical Principles of Animal Computer Interaction

In an article written by Mancini (2011), ACI takes into consideration a non-speciesist approach to research that involves animals. It is stated that the researchers must acknowledge the characteristics of all species participating in the research without discriminating against any of them. Researchers must treat both human and nonhuman participants as individuals equally deserving of consideration, respect, and care according to their needs. The researchers must also choose to work with a species only if the intent is to advance knowledge and develop technology that is beneficial or otherwise relevant to that particular species. Researchers must protect human and nonhuman participants from physiological and psychological harm at all times by employing research methods that are noninvasive, non-oppressive, and non-depriving. The choice for the participants to freely withdraw from the interaction and research whether that be temporary or permanent must be allowed. Finally, researchers must obtain informed consent to the involvement of both human and animal participants either from the participants themselves or from those who are legally responsible for the animal participants, particularly their owners (Mancini, 2011).

2.4 Dog Collar Styles

Collars are worn by pets, mostly seen for dogs, for training, walking, fashion, and identification. (Stregowski, 2019) stated in her article that there are 8 different types of dog collars. First on the list is called Everyday Collars, it is a more personalized style of collar. Owners can either choose a collar with metal buckles or with a quick release clasps. Second on the list is called Chain Slip Collars, these collars are also known as choke chains, and it is intended for training purposes only since it could damage the dog's neck. Third on the list is Metal Prong Collars, it is usually used by owners for their stubborn dogs and same as the Chain Slip Collars, it should be used with caution. Fourth on the list is an advanced type of collar called Smart Collars, it is an IoT device that can be connected to a mobile device to monitor the dog's location and the ability to monitor the changes in the dog's behavior. Fifth on the list is Martingale Collars or also known as Greyhound Collars. Martingale collars are worn by dogs to prevent them from slipping out of the collar while walking on a leash. The collars tighten with a tug of leash but the difference compared to Metal Prong Collars is that there is a stopping mechanism to prevent choking the dogs. Sixth on the list is called Head Collars, it resembles a muzzle but has a different purpose, head collars are used to help train a dog to walk on a leash and heel. Seventh on the list is a Harness Collar, it is designed to be placed around a dog's chest, abdomen, and strap around the back. These collars are a friendly type of collar since it does not put pressure on the neck of the dog. Eight and last on the list is called Dog Show Collars, it is typically made out of braided materials, nylon, or metal.

2.4.1 The Pros and Cons of a Harness or Collar

A lot of our pet parents are choosing between a Harness or a Collar for their four-legged friend. Collars have been around for decades, but in recent years, harnesses have become popular due to their safety net around the neck of a dog.

According to Puisis (2021), a dog collar is a common item used by owners for their four-legged friend and that is for a good reason. A dog collar is the simplest way to identify that a dog has an owner. Also, it allows for easy attachment of identification tags that can be used for identification in case the dog escaped from your home. A dog collar is good for identification of your four-legged friend but there is a downside to using it. A dog collar may not always be the right choice for training your dog and a collar can place significant stress on the dog's trachea, esophagus, thyroid gland, cervical vertebrae, and more. Since training a dog includes pulling the leash, a dog collar may not be the right tool for your dog.

For the harnesses, Puisis (2021) stated that harnesses for dogs come in many different styles, and the main reason owners use harnesses is to distribute any force given to the dog on a larger area of the dog's body instead of just in the neck area. The biggest benefit of a harness is the distribution of stress placed on the dog but poor-fitting of the harness can be as detrimental as a collar. Also, it is important to take note that different breeds may or may not have the same benefits of using a harness since the dog's natural range of motion should be taken into consideration.

2.4.2 Why Should a Pet Use a Collar

Buying or adopting a dog isn't just about buying/adopting a dog itself. When a person decides to buy/adopt, it also includes the food, hygiene kit, and a collar. In today's time, there are different sizes, shapes, and designs of a collar that a person can choose from. According to Wettergren (2019), There are many reasons why a person should give their dog a collar. Wettergren(2019) stated that a dog collar provides identification and allows other people to know who they are and to indicate that they have an owner. Having a collar also prevents your pet from being abducted by the authorities thinking it's a stray animal.

2.4.3 Protect Pets From Getting Lost

Every pet owner hates the thought of having their pets lost. There are tendencies wherein dogs or cats will sprint outside as soon as a door is opened. Outdoor pets are at a greater risk of wandering outside and getting lost rather than indoor pets, but indoor pets can get lost too if the owners are not careful. According to Hastings(2020), there are 5 ways on how to protect pets from getting lost, and first on the list is to always hold on to the record of ownership in case your pets are found by someone. The record of ownership should include an up-to-date phone number and address. Second, make sure that your pets have a collar with an id tag even though some pets hate it. Third, an owner can invest in a microchip or tattoo since collars are not failproof and some pets don't like wearing a collar. Fourth, always keep your pet on a leash when walking outside and there are external factors such as traffic or unfamiliar animals that may trigger your pets to run suddenly. By practicing safe outdoor activities, pet owners can bond with their

four-legged friends but also ensure safety and health. Lastly, pet owners can consider having their pet spaying or neutering their pet. When a dog or cat is in a high sexual drive, they might roam outside to find a temporary mating partner.

2.4 Global Positioning System

According to Dierck, Rogier, and Declercq (2012) they declared that wearable multi-band circularly polarized active antennas are presented for use in Global Positioning System and Iridium satellite phone applications. The square patch antenna is constructed using flexible foam and fabric substrates and conductors etched on thin copper-on-polyimide films. The feed substrate integrates a compact low-noise amplifier chip directly underneath the antenna patch. The antenna performance is studied under bending conditions and in the presence of a human body. The active antenna exhibits a gain higher than 25 dBi and a 3 dB axial ratio bandwidth exceeding 183 MHz in free-space conditions and is robust to bending and on-body placement.

Last 2010 a group called Spacecraft formation Flying put together a study about the Global Positioning System. They stated in the study that it is a satellite-based navigation system made up of a network of satellites placed into orbit by the US Department of Defence. GPS was originally intended for military applications, but in the 1980s the system was made available for civilian use.

The study also states that GPS satellites circle the earth twice a day in an MEO orbit, at ~14 000 km/h, while transmitting information signals. In Figure 4.43, a constellation of 24 satellites is shown. By March 2008 the number of active satellites was brought to 32. The additional satellites improve the precision of GPS receiver

calculations by providing redundant measurements. With 32 satellites, the constellation was changed to a nonuniform arrangement, improving reliability and availability of the system when multiple satellites fail.

Also, a study called (*Global Positioning System, 2014*) states that GPS satellites consist of three different parts which are the Space, Control, and the User segment. The Space Segment is A constellation of at least 24 US government satellites distributed in six orbital planes inclined 55° from the equator in a Medium Earth Orbit (MEO) at about 20,200 kilometers. While the control segment Stations are assigned on Earth monitoring and maintaining the GPS satellites. Lastly, the User Segment are the ones who are responsible for processing the navigation signals from the GPS satellites and calculating position and time.

2.4.1 Advantages of Global Positioning System

Based on a study about the advantages and disadvantages of GPS by Bonheur (2018), he cited that there are pros and cons to using GPS technology. One of the benefits and pros is that the Global Positioning System technology does not require a user to transmit data from his or her device. He also stated that a GPS device generally works independently from telecommunication infrastructures or in other words, it does not consume wireless communication data. However, telecommunication systems can enhance GPS positioning and geolocation, and time information. Bonheur also notes that a key benefit of GPS is that it is free. Aside from the fact that an enabled device does not consume wireless communication data from telecommunication service providers, the entire technology is free of charge without any subscription or license.

Bonheur (2018) also declared that one of the benefits of using GPS technology is Global Accessibility. He stated that 24 to 32 satellites in medium Earth orbit are tasked to provide GPS services across the globe. These satellites orbit the globe to ensure full coverage of different areas. Furthermore, having different satellites orbiting at different tracks and at different times improves further the precision of geolocation information.

Also, Bonheur (2018) explicitly said that one of the benefits of using GPS technology is the use of science applications. In science, technology has been used to meet specific goals and objectives. He clear-cut defined that GPS technology has been used for weather surveillance because an enabled device can also come equipped with different features such as barometric altimeters. It has also been used in traffic monitoring, geological surveillance or tectonics, and in disaster and emergency response.

2.4.2 Disadvantages of Global Positioning System

Bonheur (2018) said one disadvantage of GPS is accuracy. Although several satellites are orbiting the Earth to ensure precision through full global coverage, interference can cause significant problems. Note that the ionosphere and the troposphere can slow down the rate of signal propagation. Weather conditions and electromagnetic interference can also affect data transmission.

Certain geological features can also obstruct the communication between GPS satellites and receivers or enabled devices. Cities with high-rise buildings or confined locations such as mountains, caves, and forests can hamper communication because signals do not pierce through solid objects. Obstructions can lead to misleading coordinates or geolocation information.

Also, he stated that a device equipped with GPS capabilities consumes battery power. The specific GPS chips are power-hungry. It is also worth mentioning that a key limitation of GPS is that once battery power runs out, an enabled device is virtually useless. These devices are only as useful as their battery capacities. Such is the reason why these devices need to come with power management features and better battery capacities.

Lastly, Bonheur (2018) raises concerns about privacy. When used alongside Internet applications, such as mobile apps or social media, GPS can effectively track and record the location of a user, thus allowing companies to exploit geolocation data and information for commercial purposes such as geo-targeted advertising.

2.4.3 NMEA Data String

NMEA is an acronym for the National Marine Electronics Association. NMEA existed well before GPS was invented. According to the NMEA website, the association was formed in 1957 by a group of electronic dealers to create better communications with manufacturers. Today in the world of GPS, NMEA is a standard data format supported by all GPS manufacturers, much like ASCII is the standard for digital computer characters in the computer world. The purpose of NMEA is to give equipment users the ability to mix and match hardware and software. NMEA-formatted GPS data also makes life easier for software developers to write software for a wide variety of GPS receivers instead of having to write a custom interface for each GPS receiver. Without a standard such as NMEA, it would be time-consuming and expensive to write and maintain such software. (Gakstatter, 2015)

2.4.4 National Marine Electronics Association

The NMEA, which stands for National Marine Electronics Association, is committed to enhancing the technology and safety of marine electronics through installer training and interface standards. NMEA members promote professionalism within the marine electronics industry.

2.5. Arduino

According to SparkFun Electronics, Arduino is used for building electronics projects since it is an open-source platform. Arduino is made up of both a physical programmable circuit board oftentimes called a microcontroller and a piece of software that runs in your computer system. The software is an Integrated Development Environment (IDE) that is used to write and implement code to the physical board. For people who are just starting out with electronics, the Arduino platform is a popular choice for a number of reasons. The Arduino platform does not need any additional hardware in order to load a new code onto the physical board, it only needs to use a Universal Serial Bus (USB). Also, the Arduino IDE uses a simplified version of C++.

2.5.1 Arduino Software

The Arduino software is really a collection of many different open source and free software packages. The Arduino software is licensed under the GPL version 2, although the component packages are licensed under a veritable rainbow of different ideas. Wheat D. (2011)

2.5.2 Arduino IDE

IDE's are usually used by programmers to speed up the process of creating a program. Common features of an IDE include automatic line numbering, syntax highlighting, and integrated compiling. Technically, it is possible to write software using a simple text editor, but the process is much faster and easier when writing code in an IDE. According to Kalu, the Arduino Integrated Environment(IDE), also known as Arduino Development Environment is a programming environment which is designed to make writing software easier. The Arduino platform is commonly used for robotics since it is a popular electronics platform to help programmers simplify the process of designing an electronic device.

2.5.3 Arduino and C++

Arduino code is written in C++ which also includes some additional special methods or functions made specifically for Arduino. According to Circuito, C++ is a human readable programming language which means that every code that runs gets processed and compiled into machine language for the Arduino board to read. Arduino has its own Integrated Development Environment (IDE) called Arduino IDE. It is the main text editing program used in Arduino and it is where developers will first write their code for the Arduino board that the developers want to program. Arduino code is referred to as sketches (Circuito, 2018). The Arduino IDE also includes a function called the Serial Monitor and Serial Plotter which is used to interact with the Arduino board using the computer and is also used for real-time monitoring and debugging.

2.5.4 Vehicle Tracking System using GPS and Arduino

According to Saddam (2016), vehicle tracking systems are widely used in fleet management and asset tracking systems. Not only can it track the location of a vehicle, it can also control and report the speed of the vehicle. It is in the form of Latitude and Longitude (GPS coordinates) in which we can track the location of the vehicle. This kind of tracking system is widely efficient for outdoor applications purposes such as the use of cabs/taxis, stolen vehicles, school buses, etc. The vehicle tracking system can track a vehicle using GPS and Global System for Mobile Telecommunication (GSM). The components needed for the tracking system are Arduino UNO, GSM module, GPS module, 16x2 LCD, power supply, connecting wires, and a 10 K POT. The GPS module is the main component of the system and the said device receives coordinates from the satellite that gives the real-time location of the vehicle.

2.5.5 Arduino UNO

Based on the article of Gupta, P., the Arduino UNO is classified as a microcontroller and as for the controller, the said microcontroller uses an ATmega328. The Arduino UNO is a type of Arduino board that is used as an open-source board for electronic projects and used to design the circuitry of a product. The Arduino UNO board contains 14 input/output (IO) pins and from those 14 IO pins, there are 6 analog input pins, one power jack, Universal Serial Bus (USB) connector, one reset button, In Circuit Serial Programming (ICSP) header, and other components. The Arduino UNO board can be charged using a USB port or a Direct Current(DC) supply to the board.

2.5.6 Why Arduino UNO is Used?

According to Gupta, the Arduino UNO board is mostly used by beginners wanting to create an electronic project with programming included. There are several reasons why the Arduino UNO board is primarily used than other Arduino boards. The Arduino UNO board can be easily connected to other computer systems using a USB port. The USB port of the Arduino UNO board can be used to connect the board to a power supply and to connect to other computer systems. If an USB connector is unavailable to connect to a power supply, the Arduino UNO board can be charged from an external power supply using a DC adaptor with a voltage of 12V. The microcontroller of the Arduino UNO board, ATmega328, can be replaced if damaged or improper functioning which is not possible with other Arduino boards. The digital and analog pins of the Arduino UNO board are used to adjust the voltage supply in the board to have a constant power supply of 5V. The Arduino UNO board design is simple which can be used by multiple users. The Arduino UNO board also has several hardware components including a bluetooth module, internet connection, motor control, and many more. Lastly, the price of the Arduino UNO board is lower compared to other Arduino boards which is one of the main reasons why beginners prefer using this board amongst other Arduino boards.

2.5.7 GPS Module

According to Techplayon (2017), a GPS is a worldwide radio-navigation system formed from satellites and their ground stations. These “man made stars” are used by the GPS system to use as a reference point to calculate the position of a device/vehicle using

meters as its measurement. These days, GPS is now found inside our mobile phones, vehicles, and computer systems since GPS receivers have been miniaturized. The GPS receivers get an exact time and location that the satellites transmit. Also, the GPS receiver can determine the position of the device/vehicle in three dimensions -- east, north, and altitude. A GPS module doesn't need any external component for its GPS reception unlike a GPS chipset which needs external components such as an external power supply, clock, antenna, low noise amplifier, etc. Additionally, according to ElectronicWings, a GPS receiver module gives a data output using the standard (National Marine Electronics Association) NMEA string format. The NMEA string format that the GPS receiver module provides different parameters that are separated by commas like longitude, latitude, altitude, time, etc. Lastly, the NMEA string format starts with a ‘\$’ symbol and ends with a carriage return/line feed sequence.

2.5.8 GSM Module

As time continues to move forward, so does our technology. Today, we are living in the world of Internet of Things (IOT) wherein controlling an object is within the palm of our hands. So, what's a Global System for Mobile Communication (GSM) module that is a small part of this huge IOT? According to Robu.in (2020, January 09), a GSM module is a small chip that uses serial communication to communicate with any microcontroller. Just like our phone devices, it has an in-built onboard antenna and a Subscriber Identification Module (SIM) for SIM insertion purposes. The SIM800L GSM module has 12 total pins that are used to set up a connection to a microcontroller and each pin has a different purpose. A Ring pin is used for indication and this pin sends

an interrupt signal when we receive a Short Message Service(SMS) or a phone call. Next pin is called DTR or an enable pin, the pin plays a major role when it comes to saving electricity consumption. If the pin is high, the GSM module is in sleep mode and the serial communication is disabled and if the pin is low, the GSM module is turned on. For the connection of microphone and speaker, the pins are Mic+, Mic-, SPK+, and SPK-. A NET pin is used to attach the helical shape antenna of the module. An RST pin is used to reset the SIM800L module if the module is not working properly and by making the pin as high as 100ms, the module can be reset. For the connection of power supply, the pins are called VCC and GND but using these pins should not have more than 3.3V and for its current, it should not be less than 1A. The last 2 pins are called RX and TX, and the RX pin is used for receiving commands from the controller while the TX pin is used for sending out the data.

2.5.9 LiPo Battery

During the past several years, usage of IoT Devices like Arduino has increased. These devices are widely portable and wireless. Rechargeable Batteries are one of many power sources they regularly use. A lot of these devices use LiPo Batteries or lithium polymer batteries or correctly known as lithium-ion polymer batteries. Lithium is the lightest of all metals, has the greatest electrochemical potential, and provides the largest energy density for weight. Making it a good selection for portable devices (Moore, 2008).

So a lithium polymer battery is a rechargeable battery that consists of three pieces viz. positive electrode, a negative electrode, and electrolyte or liquid chemical compound between these electrodes. Li-Ion battery uses liquid as the chemical electrolyte between

+ve and -ve electrodes whereas the LiPo battery uses one of the three forms viz. dry solid, porous chemical compound, or gel-like an electrolyte.

2.5.10 Advantages of Using LiPo Batteries?

There are a wide variety of batteries with different designs and purposes across the market. While mostly lithium based batteries a good share are LiPo Batteries. People use them for the following advantages. The main advantages of LiPo battery cells are that they have about four times the energy density of nickel cadmium or nickel metal hydride batteries. LiPo batteries are very lightweight and pliable, and can be made to almost any size or shape. They can be banged around, punctured, dropped or run over with a car and still not explode, making them more resistant to physical trauma than most batteries according to (cedtechnologies, n.d.) Since the prototype is designed to fit along with the collar it is highly advised to be durable hence why LiPo Batteries are used.

2.6 What's the Internet of Things(IoT)

The world is now in the age of technology wherein everything can be done within the palm of our hands due to this so called Internet of Things(IoT). According to Kenton W. (2021), excluding traditional computers like laptops and servers, IoT is a name for the aggregation of network-enabled devices. “Smart” appliances such as refrigerators and thermostat; home security systems; computer peripherals, like webcams and printers; wearable technology, such as Apple watches and Fitbits; routers; smart speaker devices, like Amazon Echo and Google Home are all part of what we call Internet of Things. These IOT devices use Internet Protocol (IP) which is the same protocol that recognizes

computers that allows them to communicate with one another all over the world wide web. The objective of these IoT devices is to have it self-report to improve and efficiently bring important information to the surface faster than a system that relies on human intervention.

Also stated by Kenton (2021), due to these IoT, in medicine, medical professionals can monitor their patients either inside or outside of a hospital setting. Additionally, medical practitioners can adjust the treatments and improve patients outcome due to the evaluation of the IoT devices. Also, the use of these IoT devices can become advantageous for businesses since by tracking the data about the energy and use of inventory levels, these businesses can lessen its overall costs. Lastly, when it comes to urban planning, it will be a great help for the drivers and city officials since sensors that have an IP address are placed in different parts of the city so that city officials can alert drivers about possible delays or accidents.

2.6.1 The Internet of Things: The Basics Explained

Ranger (2020) stated in his article that Internet of Things (IoT), refers to billions of physical devices that are connected to the internet which collects and shares data all around the world. Due to the advancement of technology, it's possible to turn something as small as a pill to as big as an aeroplane, due to the materialization of super cheap computer chips and the appearance of wireless networks, into an IoT device. These devices are “dumb” but adding sensors and connecting up all these different objects adds a level of intelligence to it thus enabling these devices to communicate real-time data

without human intervention. As time continues forward, the world around us becomes more smarter and responsive due to the implementation of these IoT devices.

Also, according to Ranger(2020), any physical objects can become a subject of an IoT device as long as it can be connected to the internet to be controlled or to be able to communicate information. As simple as a lightbulb can be turned into an IoT device by having its switch controlled by a smartphone or a smart thermostat that can change the temperature to the right amount by sensing its environment. Additionally, Ranger(2020) stated that the term IoT is mainly used for devices that can communicate with the network independently of human action. For this reason, a personal computer(PC) isn't considered an IoT device and the same goes for a smartphone -- even though a smartphone is crammed with sensors, it cannot operate without human interaction.

2.6.2 History of Internet of Things

The Internet of Things (IoT) has not been around for a long time but there are already machines that communicate with one another since the early 1800s. The telegraph, the first landline, according to Foote (2016), was developed in the 1830s and 1840s, was a machine that provided direct communication. The first radio voice transmission described as “wireless telegraphy” took place on June 3, 1900 which became a component for the development of Internet of Things. The Internet itself is a significant component of the IoT. It started out as a part of Defense Advanced Research Projects Agency(DARPA) in 1962, which later became Advanced Research Projects Agency Network(ARPANET) in 1969. Commercial service providers, in the 1980s, began supporting ARPANET for public use, allowing it to become what our internet is

today. Foote (2016) also mentioned that the Department of Defense provided a stable, highly functional system of 24 satellites in 1933 thus Global Positioning Satellites(GPS) became a reality. Due to these advancements, IoT has been continuing to move forward and satellites/landlines provide basic communications for much of the IoT. Additionally, one important aspect to the development of IoT is the Internet Protocol Version 6(IPV6) address. Steve Leibson, of the Computer History Museum, stated that “*The address space expansion means that we could assign an IPV6 address to every atom on the surface of the earth, and still have enough addresses left to do another 100+ earths.*”. Simply put, internet addresses would keep on increasing and it wouldn’t run out anytime soon.

2.6.3 Guidelines for Internet of Things Deployment

Oriwoh (2013) introduces in his paper, The Guidelines for Internet of Things Deployment, a set of guiding principles referred to in his paper as commandments, that can be applied by all stakeholders involved in the Internet of Things (IoT) during its introduction, deployment and thereafter. Stated in the paper by Oriwoh are 8 commandments which he considers essential to acknowledge by the developers. “Thing” in the context of his paper according to Oriwoh (2013), refers to the range of traditional computing devices like personal computers (PC) to the general household objects embedded with capabilities for sensing or communicating through the use of technologies such as Radio Frequency Identification (RFID).

First in the list of commandments by Oriwoh (2013) is entitled “Your Thing is *your Thing*”. Oriwoh (2013) states that the IoT device belongs to, and is the responsibility of their owners and, by inference, so are the actions of the IoT device. The

owner must not expect that any negative action of the IoT device carried out will be excused without expecting any form of reproach to himself as the owner. In this way the owner bears some responsibility for the actions of the IoT device.

Secondly, “Illegal Access” states that if any person should access or control the IoT device without the permission of the owner is regarded as illegal. Objects that are permanently embedded with transponders such as the RFID technology are at risk as owners have little or no control over who can access the device (Oriwoh, 2013). This resulted in the introduction of laws such as The UK Computer Misuse Act (CMA) 1990, or in the case of The Philippines, Republic Act No. 10175. Also known as the Cybercrime Prevention Act of 2012.

Third in the list of commandments by Oriwoh (2013) is “Your Thing *should* have a relationship with all your other Things”. In this commandment, it is stated that all IoT devices that are connected to each other must be easily and be uniquely identifiable to each other and by each other. This ensures that no rogue IoT device that could be a risk to every other device connected to each other is able to have access. Oriwoh (2013) states that a rogue IoT device attempting to connect itself to another device that is properly secured due to its authentication is met by a requirement to fulfill a certain criteria. The criteria can be based on a system of Authentication, Authorization, and Accountability (AAA) (Oriwoh 2013).

Next in the list of commandments is “Your *Things* should be able to identify communication between each other by the use of an established method”. Oriwoh (2013) states that all communication by IoT devices must only be through a trusted network.

This ensures security and any rogue IoT device that tries to communicate with the trusted network is easily detected and rejected.

Fifth in the list of commandments is the “Usability and Ease of Use”. According to Oriwoh (2013), All IoT devices must be easy for users to configure. This includes adding new IoT devices or removing IoT devices. Vendors of IoT devices should prioritize their devices to be plug and play. This ensures that users do not get bogged down by instructions and complications due to having a complicated installation of the IoT device.

Next Oriwoh (2013) states that “All *Things* Should be Controllable by their Owners”. It is important for developers of IoT devices to acknowledge that the user must have complete or at least partial or shared control over the IoT devices. It is imperative that vigorous tests and surveys are conducted in order to make sure that the IoT device is ensured to be easy to use and easily accessible and understandable. Similar to this is the next commandment in the list by Oriwoh (2013) is “Every *Thing* Must Have an Owner”. This basically means that every IoT device must have a clearly identifiable owner. This commandment according to Oriwoh (2013) would prove useful when it comes to locating the IoT device in an occasion of it being lost.

Finally, Oriwoh (2013) states that “all IoT devices must be non-permanent and easily disposable according to an owner’s choice”. This means that all owners have the freedom to easily dispose of their IoT devices which means that vendors and developers must take into consideration this freedom of the owner and make sure that these devices are easily disabled at any time and at any place.

2.6.4 What is an IoT Device?

An IoT device, according to Mishra (2020), also known as Node Device in IoT application can be any object that has its own unique modifier which can send/receive data over a network. An example of an IoT device are smart phones, tv, computer, or a modern car. These IoT devices are connected to the internet and can send data about itself or about its surroundings over a network or allow actuation by human intervention or by its environment. For example, an IoT device can be a sensor that is connected to a device that sends information on a smartphone or a wearable device that can monitor the health of a human and send the data to a cloud server. Also stated by Mishra(2020), IoT devices include sensors, software, actuators, computer devices and these are usually attached to a particular device that operates through the internet, making the transmission of data among devices with or without human intervention possible. In simple terms, with the help of the internet, anything that has a sensor attached to it and can transmit data from one object to another.

2.6.5 Building Blocks of IoT Device

In order to have a proper IoT device, Anand (2014) states that there are four basic building blocks an IoT device should have. First is the End Node, it is the front-most node of any IoT system. It's main job is to send or receive data or it can do both. These nodes have a unique identifier in order to communicate with other IoT applications or systems. Second building block is called a processing node and can be considered as the heart of IoT. Its main function is to process the data and information received from end nodes and send the information to an application or cloud based service. Third building

block is the connectivity, without it, it would not be possible to send/receive data. Connectivity is an essential part in any networked system and it may be wired or wireless. Its main job is to transfer data that was gathered by the end nodes and processed by the processing node to the device or in any cloud-based service. Bluetooth or WiFi are the commonly used local connectivity while GSM, RS485, and RF are usually used for long distance communication. Fourth and last building block is the application, it can either be a cloud-based service or an end-application which is the place the data is being sent to.

2.6.6 IoT Device Life-Cycle Management

According to Watson (2020), the Internet of Things(IoT) has the potential to create completely new business models and increase the efficiency of businesses in numerous domains. Through real-time bilateral communication with these IoT devices, not only can a user receive valuable information by these devices, it also needs maintenance and management automatically and remotely. As stated in the article, it is important to know the foundation of any IoT solution in order to successfully deploy it. IoT systems usually last for many years and it is important to design a plan for the whole life cycle of an IoT device and applications. The life cycle of an IoT device consists of security, pre-commissioning, commissioning, operations, and decommissioning.

The first part of the IoT device life cycle, according to Watson(2020), is security since device authentication is crucial when establishing secure communication links. Before accessing data in an IoT system, it is necessary to check whether the device is a threat or not. If it's identified as a threat, the operations team can make an action to block

or disconnect devices. Supplying a device-specific private keys and the device's corresponding digital signature during production is one of the ways to authenticate a device.

For pre-commissioning, it requires an agent, this agent is a software that works autonomously to monitor the devices, to be deployed on connected devices. Also, the device management software communicates with the device to be able to send commands and receive responses when needed. In order to automatically connect to the remote device management, the agent needs to be configured with valid credentials for authentication.

Commissioning has 3 parts, first is Device Registration, Initial Provisioning, and Dynamic Configuration. For device registration, an IoT device, before being connected and authenticated for the first time, must be registered in the system. These devices are usually identified based on its serial numbers, preshared keys, or unique device certificates issued by its trusted manufacturers. Initial provisioning is the step wherein IoT devices are delivered to the customers with factory settings, in short, it's the default system for every device without any customer-specific software configurations. For dynamic configuration, IoT applications can start very simple and over time, it will become more complex. This may require dynamic software updates and configuration changes without disrupting the use of the device for the customer. Dynamic configuration may apply to only one specific IoT device, a group of IoT devices, or all the registered IoT devices.

For operations, due to the complexity of these IoT devices, it is necessary to have a central dashboard that shows the overview of the devices. For the device itself, it is

important to have a backup to ensure that, in the event of malfunction, it can automatically troubleshoot the problem or reboot itself. Lastly, there is a possibility that decommissioning will affect the whole IoT solution, for example, changing or decommissioning a device. The device certificates should be revoked and other confidential information should also be deleted securely in this stage.

2.7 Republic Act 10173 – Data Privacy Act of 2012

In 2012 the Philippines passed the Data Privacy Act 2012, comprehensive and strict privacy legislation “to protect the fundamental human right of privacy, of communication while ensuring free flow of information to promote innovation and growth.” (Republic Act. No. 10173, Ch. 1, Sec. 2).

In terms of scope and application, it applies to all the Philippines citizens regardless of where they reside. The law’s approach is “The processing of personal data shall be allowed subject to adherence to the principles of transparency, legitimate purpose, and proportionality.”

The law states that it has extraterritorial application meaning it not only applies to businesses with offices in the Philippines, but when equipment based in the Philippines is used for processing. The act further applies to the processing of the personal information of Philippines citizens regardless of where they reside.

The law also states that there’s an exception in the act that provides that the law does not apply to the processing of personal information in the Philippines that was

lawfully collected from residents of foreign jurisdictions — an exception helpful for Philippines companies that offer cloud services.

Regarding collection, processing and consent The act states that the collection of personal data “must be a declared, specified, and legitimate purpose” and further provides that consent is required prior to the collection of *all* personal data. It requires that when obtaining consent, the data subject be informed about the extent and purpose of processing, and it specifically mentions the “automated processing of his or her personal data for profiling, or processing for direct marketing, and data sharing.” Consent is further required for sharing information with affiliates or even mother companies.

The law also states that the consent must be “freely given, specific, informed,” and the definition further requires that consent to collection and processing be evidenced by recorded means. However, processing does not always require consent. Consent is not required for processing where the data subject is party to a contractual agreement, for purposes of fulfilling that contract. The exceptions of compliance with a legal obligation upon the data controller, protection of the vital interests of the data subject, and response to a national emergency are also available. An exception to consent is allowed where processing is necessary to pursue the legitimate interests of the data controller, except where overridden by the fundamental rights and freedoms of the data subject.

The law defines sensitive personal information as being: About an individual’s race, ethnic origin, marital status, age, color, and religious, philosophical or political affiliations; About an individual’s health, education, genetic or sexual life of a person, or to any proceeding or any offense committed or alleged to have committed; Issued by

government agencies “peculiar” (unique) to an individual, such as social security number; Marked as classified by executive order or act of Congress. All processing of sensitive and personal information is prohibited except in certain circumstances. The exceptions are: Consent of the data subject; Pursuant to law that does not require consent; Necessity to protect life and health of a person; Necessity for medical treatment; Necessity to protect the lawful rights of data subjects in court proceedings, legal proceedings, or regulation.

The law also states that it requires that any entity involved in data processing and subject to the act must develop, implement and review procedures for the collection of personal data, obtaining consent, limiting processing to defined purposes, access management, providing recourse to data subjects, and appropriate data retention policies. These requirements necessitate the creation of a privacy program. Requirements for technical security safeguards in the act also mandate that an entity have a security program.

2.8 Republic Act (RA) 9482 - Anti-Rabies Act of 2007

RA 9482 Anti-Rabies Act of 2007 Section 5: Responsibility of Pet Owners. All Pet Owners specifically for C and D it requires to:

- (c) Maintain control over their Dog and not allow it to roam the streets or any Public Place without a leash.

- Rule 5(c)1. The length of the leash shall not be more than 1.5 meters (5 feet) and the required dog tag shall be attached to the dog collar/harness. Aggressive dogs shall be muzzled in public places.
 - Rule 5(c).2. The Committee shall issue guidelines on the handling of dogs in designated dog activity areas.
 - Rule 5(c).3. The owner shall be responsible for the proper collection and disposal of excreta/feces.
- (d) Be a responsible Owner by providing their Dog with proper grooming, adequate food and clean shelter.

- Rule 5(d).1. Pet owners shall maintain good human-animal relationships and provide good health management programs for their dogs.

2.9 Web Application Security

Web applications are always threatened by security risks that if developers are not able to prioritize are easily taken advantage of by hackers or attackers. In an article written by Ballal (2020), he states the best practices that developers must and should keep in mind when developing a web application.

The security of a website according to Ballal (2020) should be prioritized as early as the design phase. The design phase is the time wherein developers decide and discuss the technical requirements of the project they are going to work on, the capabilities of the team, and the best design approaches for the product (Ghahrai, 2018). Ballal recommends that developers discuss any risks and take them into account. Every security feature that is deemed necessary for the project must be taken into consideration.

Ballal (2020) also recommends that developers should do Secure Coding. A practice in which the team must follow the best practices to avoid any potential weaknesses in the code.

Input checks or data validation must be done in order to cement the integrity of the code. Developers should prevent users from entering any invalid input onto the input fields. Ballal (2020) states that instead of blacklisting, whitelisting must be used in order to prevent users from ever being able to enter invalid characters in the first place by only allowing the whitelisted characters.

Encryption according to Ballal (2020) is one of the most important parts of any web application security. It is important to use well known and updated encrypting techniques as this will prevent the encryption itself from becoming a liability to the entire website. Developers should avoid known weak algorithms and encrypt all sensitive data.

2.9.1 The Definition of Hashing

According to Frankenfield (2020), hash functions are mathematical functions used in cryptography. These functions take inputs of different lengths and characters and return outputs of a fixed length. Chung (2019) describes hashing as an algorithm that transforms data into a far shorter fixed-length value or key which represents the original string. Hash functions are used mostly in website security with the usage mainly on password verification.

Chung (2019) also states the benefits of using hashing in that hash functions can be used for comparisons and checking specific files for equality. Another usage of hash functions according to Chung (2019) is the use of it in verification of the integrity of files

to ensure the file is not corrupted. By comparing the hash of two files, a user can then tell that the file on hand is an identical copy.

2.9.2 Hash Algorithms

According to Rountree (2011), hashing algorithms are abundant but there are some that are used much more frequently as compared to other algorithms. These algorithms are commonly used in web applications and come with their own positives and negatives. Chung (2019) states that good hash algorithms must be complex enough that they do not produce the same hash value from two different inputs. When a hash algorithm produces the same hash for two different inputs, this is defined as a hash collision. A good hash algorithm according to Chung (2019) is one that has a very low chance of collision.

2.9.2.1 MD5

The MD5 hash function or the Message-Digest Algorithm is a hash function whose main purpose is to verify if a file has been altered in any way (Fisher, 2020). The MD5 algorithm is a relatively old hash algorithm and has been seen to have multiple weaknesses and vulnerabilities (Conrad et al., 2014).

2.9.2.2 Secure Hash Algorithm

The Secure Hash Algorithm (SHA) is a series of algorithms of various bit lengths. The most popular SHA algorithm is the SHA-256 and is used to hash a string of fixed size to 256 bit. SHA-256 is considered one of the most secure hash algorithms and

sensitive information relating to SHA-256 is protected as required by the United States government (N-able, 2019).

2.9.2.3 CRC32

The Cyclic Redundancy Check (CRC) is an error-detection code used for detection of changes to data. The CRC32 hash algorithm is used mainly for file integrity checks and is rarely used outside of Zip files (Conrad et al., 2014).

2.9.3 Encryption

According to Loshin & Cobb (2020), encryption is defined as the method in which information is converted from plaintext into a code that hides the original text's true meaning. An effective cipher according to Loshin P. & Cobb M. (2020) is one that includes a variable also known as a key. This key is what makes the cipher's output unique and helps in securing information that was encrypted through the use of the cipher.

2.10 Cross-Site Scripting

According to Cloudflare(n.d), cross-site scripting(XSS) is a malicious act wherein attackers attempt to put a malicious program onto a legitimate website that will execute when the victim user loads the website. Most popular way of doing xss is through the url or the malicious program is posted directly to the page. In technical terms, it is a client-side code injection attack.

2.10.1 Types of Cross-Site Scripting Attacks

According to Sucuri Guides (2019), there are five types of cross-site scripting attacks, first on the list is called Stored Cross-Site Scripting, this attack occurs when attackers store their malicious program on a compromised server wherein it can affect other visitors. Second is Reflected Cross-Site Scripting, it is the opposite of the Store Cross-Site Scripting wherein attackers load their malicious program in the data sent from the browser to the server side. Third on the list is Self-Cross-Site Scripting, the only victim in these is the user itself since this type of XSS occurs when things like cookie values or setting your own information to payload are changed. Fourth on the list is Blind Cross-Site Scripting, it occurs when attackers can't see the result of the attack. Commonly lies on a website wherein only authorized users have access. Last on the list is DOM-Based Cross-Site Scripting, this occurs when the attacks are focused on the JavaScript of the page rather than the server itself.

2.10.2 How to Prevent Cross Site Scripting Attacks

According to SiteLock (2019), there are four ways to prevent cross-site scripting attacks, first is to always keep your software updated since outdated versions of a software are vulnerable to attacks. It's advisable to review your systems and web applications regularly to check if it is updated or not. Second is to sanitize the input fields since input fields are a common gateway for cross-site scripting attacks. Checking if the data is in the proper input fields ensures that only expected information is submitted to the server. Predefining what a user can input helps prevent cross-site scripting attacks. Third is to use client-and server-side form validation and validating all forms submission

allows the user to check the data on the form before it's accepted by the server. Before the server accepts the data from the client-side, only deemed as “acceptable” must be on the client-side form. Last on the list is to use a web application firewall, and firewalls can prevent cross-site scripting before it occurs.

2.11 SQL Injection

SQL Injection (SQLi) is a type of an injection attack that makes it possible to execute malicious SQL statements. These statements control a database server behind a web application. Attackers can use SQL Injection vulnerabilities to bypass application security measures. They can go around authentication and authorization of a web page or web application and retrieve the content of the entire SQL database. They can also use SQL Injection to add, modify, and delete records in the database.

2.11.1 Types of SQL Injection

SQL injection can be used in many ways to cause serious problems to a website. An attacker could easily bypass authentication, access, alter, and delete data in a database. Acunetix (n.d) identifies different types of sql injection and first is called In-Band SQLi and it occurs when an attacker is able to use the same communication channel to launch the attack and retrieve the results. Next is the Error-Based SQLi is an In-Band SQLi technique that relies on error messages given by the database server to obtain information about the formation of the database. Third on the list is a Union-Based SQLi wherein attackers leverage the UNION SQL operator to combine the result of two or more SELECT statements into a single result as part of an HTTP response. Fourth on

the list Inferential SQLi, no data is actually transmitted in the web application but the attacker can reconstruct the database structure. Fifth is the Boolean-Based SQLi, it relies on sending SQL statements to the database which forces the web application to return a different result depending if its True or False result. Sixth on the list is the Time-Based SQLi, it relies by sending an SQL statement to the database which forces the database to wait for a specific amount of time before responding. The response time will indicate if the result is True or False. Last on the list is the Out-of-band SQLi, which occurs when the attacker is unable to use the same channel to launch the attack and gather results.

2.12 What is SCRUM?

Cohn (2014) states that SCRUM is a type of agile framework that focuses on a cycle that makes sure features are developed fast and efficiently and with proper coordination and participation within members of the team. SCRUM members are separated into roles namely the product owner and the Scrum master. The product owner, according to Cohn (2014), has the responsibility of accepting or rejecting work results, adjusting priority for every sprint, and defining the features of the product. The product owner prioritizes the backlog or the list of features to be added onto the project, and makes sure that the team members have clear goals in mind when it comes to the construction of the requirements. The Scrum Master is the one responsible for enacting the Scrum and coaches the team members to be at their best possible performance. The Scrum master also makes sure that close cooperation of all roles in the SCRUM is possible. Furthermore, Cohn (2014) explains that SCRUM is separated into different parts or “Ceremonies” as he calls it in his article. These parts start with the sprint

planning. The sprint planning phase makes sure that the team knows what their agendas are for the current sprint cycle and why. This allows the team to have a clear goal in mind when working. The daily scrum is the part where the team participates and communicates on the current progress of the chosen spring backlogs they are currently working on. These meetings are informal, and only take a few minutes to finish. Furthermore, the sprint review is accomplished during the sprint. This is the time wherein new features are presented. Lastly the sprint retrospective is done after every sprint. This part is where the team discusses what they would like to do regarding the current backlog of the project. Some other parts of the framework include the product backlog, where according to Cohn (2014), uses the full list of requirements for the project and is always reprioritized by the end of every sprint.

2.13 PHP

PHP is one of the most popular server side languages. Many popular open-source software such as WordPress, Joomla, ZenCart, and many others are written in PHP. PHP works well with MySQL database, which is one of the most popular open-source databases. The PHP software works with the web server, which is the software that delivers web pages to the world. When you type a URL into your web browser's address bar, you're sending a message to the web server at that URL, asking it to send you an HTML file. The web server responds by sending the requested file. Your browser reads the HTML file and displays the web page. (Suehring, 2018)

2.13.1 Advantages of PHP

According to (Garwal, 2020), Most important advantage of PHP is that it's open source and free from cost. It is often downloaded anywhere and readily available to use for web applications. It is platform independent. PHP based applications can run on any OS like UNIX, Linux and windows, etc. Applications can easily be loaded which are based on PHP and connected to the database. it's mainly used due to its faster rate of loading over slow internet and speed than another programming language. It has less learning curve, because it is straightforward and straightforward to use. If a private knows C programming can easily work on PHP. It is more stable from a few years with assistance of providing continuous support to various versions. It helps in reusing an equivalent code and not having to write lengthy code and sophisticated structure for the event of web applications.

2.13.2 Disadvantages of PHP

According to (Garwal, 2020), It is not that secure due to its open-source, because the ASCII text files are often easily available. It is not suitable for giant content-based web applications. It has a weak type, which can cause incorrect data and knowledge to the user. PHP frameworks have to learn to use PHP built-in functionalities to avoid writing additional code. Using more features of PHP framework and tools cause poor performance of online applications.

2.14 Bootstrap

Bootstrap is defined as a framework for designing web pages in an easier, faster, and more readable way (Segal, 2016). Furthermore, Bootstrap helps web developers build responsive websites that fit with today's standards of websites. Bootstrap also supports

mobile first styles as part of its overall framework which means that the Bootstrap framework is not only compatible with all major browsers be it Chrome, Firefox, Internet Explorer, or Safari, but also supports all sizes of screens depending on the user's device.

2.14.1 Why Use Bootstrap

Prabhu (2020) states 8 reasons why developers should use Bootstrap to create websites that are responsive and easy to navigate. With Bootstrap being one of, if not, the most popular web design framework available today, it is important for developers to be knowledgeable of the reasons as to why Bootstrap is important to the development of websites.

First reason according to Prabhu (2020) is that Bootstrap is time-saving. Prabhu (2020) states that developers must take advantage of the ready-made blocks built in Bootstrap in order to effortlessly finish a front-end project when a developer has found themselves bound to a confined timeline to build a website.

Second reason is that Bootstrap is easy to use. According to Prabhu (2020) Bootstrap is safe and easy to use no matter what the skill level of a developer is. He mentions that whether a developer be a beginner or an expert, Bootstrap will always have something for all.

Another important reason why Bootstrap should be used according to Prabhu (2020) is the responsive grid system that has been made readily available to the Bootstrap framework. Prabhu (2020) states that Bootstrap is made under the idea of a "Mobile-First" idea in which the grid system available to Bootstrap can easily be modified and changed to fit any number of users screens, even phones.

Prabhu (2020) also states that Bootstrap is very customizable in which developers can easily use the Bootstrap framework to give a website a distinctive look with certain adjustments and tweaks to the code. Developers can modify the code of Bootstrap's design template in order to make the website they are designing to be truly their own design.

Websites that are designed with the Bootstrap framework need not to worry about compatibility issues, because Bootstrap is compatible with all browsers. Prabhu (2020) states that Bootstrap supports compatibility with all modern browsers versions.

Prabhu (2020) also states that Bootstrap allows developers of both the front-end and back-end to have a consistent library that means no matter who handles the project, the framework makes sure that consistency is maintained throughout the project.

Finally, Bootstrap is fully open source. According to Prabhu (2020) modification of the code can be according to your projects demands without having to spend any amount of money on licenses. This also means that Bootstrap has a huge number of resources available and with a large community of developers, the front-end development process is made easier and more efficient.

2.14.2 The Disadvantages of Using Bootstrap

Although one of the most widely used web design frameworks, there will always be some form of disadvantage from using Bootstrap to develop websites. Gupta (2017) states that Bootstrap has a disadvantage when making a website look unique because a developer must go the extra mile to create a design that avoids falling into a group of websites that look very much the same. Gupta (2017) also states that styles in Bootstrap

are verbose meaning these styles can lead to Hypertext Markup Language (HTML) output that the developer does not need. According to SkatDesign (2017) Bootstrap can also have a steep learning curve when it comes to fully learning and mastering bootstrap. Although the basics can be easily learned, more advanced techniques need an ample amount of time before mastery (SkatDesign, 2017).

2.15 The Apache Web Server

Apache, an open-source Web server created by American software developer Robert McCool. Apache was released in 1995 and quickly gained a majority hold on the Web server market according to (Hosch, 2008). Apache provides servers for Internet giants such as Google and Wikimedia projects such as Wikipedia. In the early 21st century, Apache servers deployed more than 50 percent of the Internet's content.

As a Web server, Apache is responsible for accepting directory (HTTP) requests from Internet users and sending them their desired information in the form of files and Web pages. Much of the Web's software and code is designed to work along with Apache's features. (Hosch, 2008)

2.16 ReactJS

According to (Sufiyan, 2021) , React is a JavaScript library created for building fast and interactive user interfaces for web and mobile applications. It is an open-source, component-based, front-end library responsible only for the application's view layer. In

Model View Controller (MVC) architecture, the view layer is responsible for how the app looks and feels. React was created by Jordan Walke, a software engineer at Facebook.

React's popularity today has eclipsed that of all other front-end development frameworks. Here is why: Easy creation of dynamic applications: React makes it easier to create dynamic web applications because it requires less coding and offers more functionality, as opposed to JavaScript, where coding often gets complex very quickly.

Improved performance: React uses Virtual DOM, thereby creating web applications faster. Virtual DOM compares the components' previous states and updates only the items in the Real DOM that were changed, instead of updating all of the components again, as conventional web applications do. Reusable components: Components are the building blocks of any React application, and a single app usually consists of multiple components. These components have their logic and controls, and they can be reused throughout the application, which in turn dramatically reduces the application's development time.

2.16.1 Advantages of React.js

According to (DDI Development, 2017), the Updates process is optimised and accelerated. JSX makes components/blocks code readable. It displays how components are plugged or combined with. React's data binding establishes conditions for creating dynamic applications. Prompt rendering. Using comprises methods to minimise the number of DOM operations helps to optimise updating process and accelerate it. Testable. React's native tools are offered for testing, debugging code.

2.16.2 Disadvantages of React.js

According to (DDI Development, 2017), The Learning curve. Being not a full-featured framework it is required in-depth knowledge for integration of user interface free libraries into MVC framework. View-orientedness is one of the cons of ReactJS. It should be found 'Model' and 'Controller' to resolve the 'View' problem. Not using an isomorphic approach to exploit applications leads to search engines indexing problems.

2.17 Javascript

As its name implies, JavaScript is a scripting language. Traditional languages such as C++ are compiled before they're run into executable binary form, with the compiler checking for any errors in the entire program before the process is complete. Scripting languages, by contrast, are executed one line at a time by another program called an interpreter. Scripting languages got their start as simple series of shell commands used to execute other programs, but their flexibility and ease of use made them a popular type of programming language in their own right, and they particularly became important with the rise of the Web. (Fruhlinger, 2019)

2.17.1 Advantages of JavaScript

According to (Gupta, 2019), Speed. Client-side JavaScript is very fast because it can be run immediately within the client-side browser. Unless outside resources are required, JavaScript is unhindered by network calls to a backend server. Simplicity. JavaScript is relatively simple to learn and implement. Popularity. JavaScript is used everywhere on the web. Interoperability. JavaScript plays nicely with other languages and

can be used in a huge variety of applications. Server Load. Being client-side reduces the demand on the website server. Gives the ability to create rich interfaces.

2.17.2 Disadvantages of JavaScript

According to (Gupta, 2019), Client-Side Security. Because the code executes on the users' computer, in some cases it can be exploited for malicious purposes. This is one reason some people choose to disable Javascript. Browser Support. JavaScript is sometimes interpreted differently by different browsers. This makes it somewhat difficult to write cross-browser code.

2.18 Node.js

According to (Patel, 2018), The Node.js run-time environment includes everything you need to execute a program written in JavaScript. If you know Java, here's a little analogy. Node.js came into existence when the original developers of JavaScript extended it from something you could only run in the browser to something you could run on your machine as a standalone application. Now you can do much more with JavaScript than just making websites interactive. JavaScript now has the capability to do things that other scripting languages like Python can do. Both your browser JavaScript and Node.js run on the V8 JavaScript runtime engine. This engine takes your JavaScript code and converts it into a faster machine code. Machine code is low-level code which the computer can run without needing to first interpret it.

2.18.1 Advantages of Node.js

When it comes to understanding node.js advantages & disadvantages for your web app, there are multiple factors a CTO or a tech expert has to consider. For instance, tech scalability, speed, performance, application limitations, and much more. Decisions made at this stage determine how fast your application will reach the market according to (Kaneriya, 2020). Web applications powered by Node.js benefit massively from its ability to multitask. Unlike other platforms, its single-threaded, event-driven architecture processes multiple concurrent requests efficiently without clogging the RAM. Moreover, its event-loop and non-blocking I/O operations allow code execution at a pace which significantly impacts the application's overall performance.

2.18.2 Disadvantages of Node.js

Despite its advantages of being single-threaded and event-driven, Node.js falls short at executing heavy CPU-based computing for the exact same reason. When Node.js receives a sizable CPU-driven task in its event loop, it utilizes all of its available CPU strength to accomplish the undertaking. This leads to the deceleration of the overall event loop, further hindering your application's interface. To solve this, in 2018, Node.js introduced the “worker threads” module that allowed developers to execute multiple threads simultaneously. However, this solution does not entirely equip you to deal with CPU-bound computation challenges.

2.19 Javascript Object Notation (JSON)

According to Kumar (2020) JSON is an acronym for the JavaScript Object Notation. The use of this notation is to make it easy for developers to transfer data from one system to another without having to worry about the requirements that are needed to

be met by the hardware or software. According to an article written by PCMag (2018), JSON is a text based data format used in web development in order for developers to be able to perform data interchange. Kumar (2020) states that JSON is much easier to read by humans in comparison to Extensible Markup Language (XML). Furthermore Kumar (2020) states that JSON is lightweight, and follows an Open Standard Format to transmit data objects with the use of a Key-Value Pair. JSON files have a “.json” extension that can be read by any programming language.

2.19.1 Why Use JSON?

Freeman (2019) states that JSON was the answer to a problem in developing websites back in the early 2000s. According to Freeman (2019) these websites were sluggish as all the work was relied upon the servers that would result in a request response that was slow and sluggish and was deemed inefficient. When the capability of loading data in the background was developed and introduced in Internet Explorer 5, the approach was seen as more viable and efficient as compared to the current one being used. This means that the delay of page rendering is practically eliminated, and data is now loaded quickly and asynchronously. (Freeman, 2019)

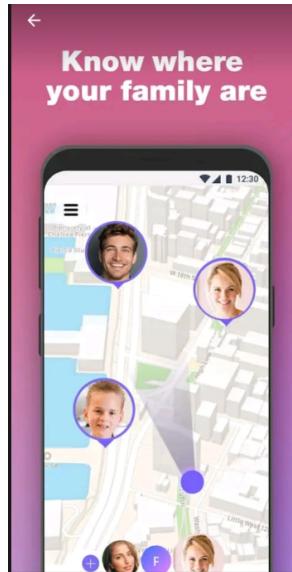
2.20 Importance of a Privacy and Policy

According to an article by PrivacyTrust (2018), one of the most important documents on any website is the Privacy and Policy document. The privacy and policy documents contain the views of the developers or company, the procedures on information collection of the users and guests of the website, and overall ensures the

users that the data gathered from them by the website is safe and protected by whatever security measures the developers have implemented into the website. According to Huberty (2018) privacy rights help build trust, and ensures that the users have control over the data they want to share, and also privacy rights that if there was a situation that data is stolen or misused, the person responsible will be held accountable. Huberty (2018) states that privacy laws are important as they are a necessity in the protection of privacy rights.

Review of Related Systems

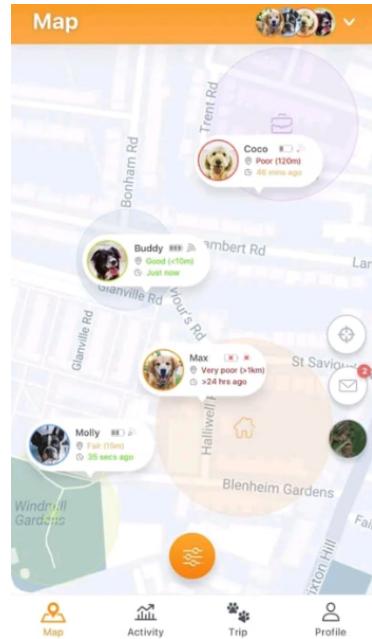
Related System: My Family - Family Locator



MyFamily is designed for family safety and parental control. My Family locator is the most accurate and easy to use service which can help your family stay connected all over the world. It provides a real time location finder service allowing relatives to privately share their location.

Comparable to STRAP's main functionality it would track the pet's real-time location. Also, on MyFamily - Family Locator App it receives notifications when a family is nearby. For STRAP it alerts the user if the pet exceeds a 20-meter radius from the owner's phone.

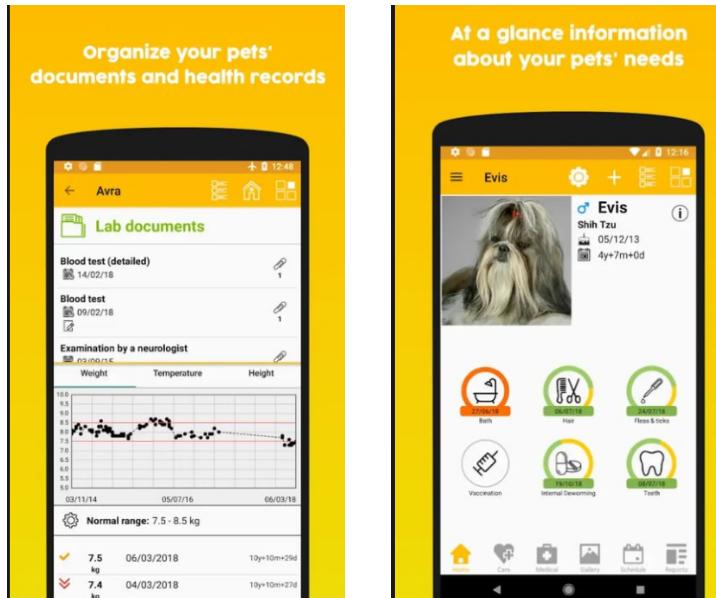
Related System: Pawfit GPS Pet Tracker



Pawfit is a GPS Pet Tracker app that combines digital activity monitoring, live location tracking and securing features making sure your pets are healthy, safe and happy.

Likewise, STRAP has its digital activity monitoring and live location tracking. Similar to Pawfit, it also shows nearby pets that have an account on the STRAP's website.

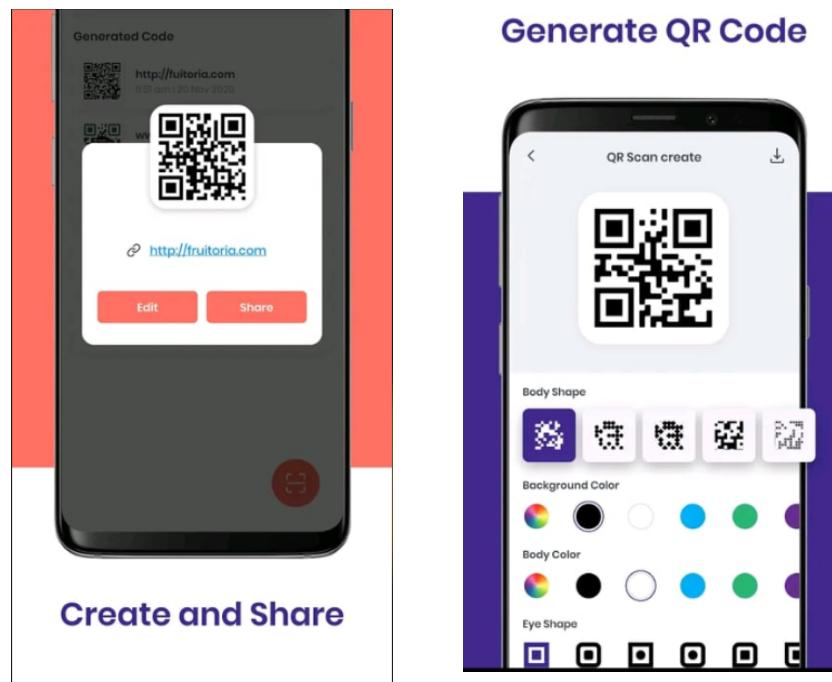
Related System: 11pets: Pet Care



11pets: Pet Care is an app that is specifically designed to help pet owners with everything from vaccination and deworming reminders, complete medical history, reminders for medications and food.

Specifically, the pertinent information on one pet is the owner's contact information, medical history, dietary plan, etc. Pertinent information is that even if the pet is lost once strangers scan the QR code it could give the pet's best care possible.

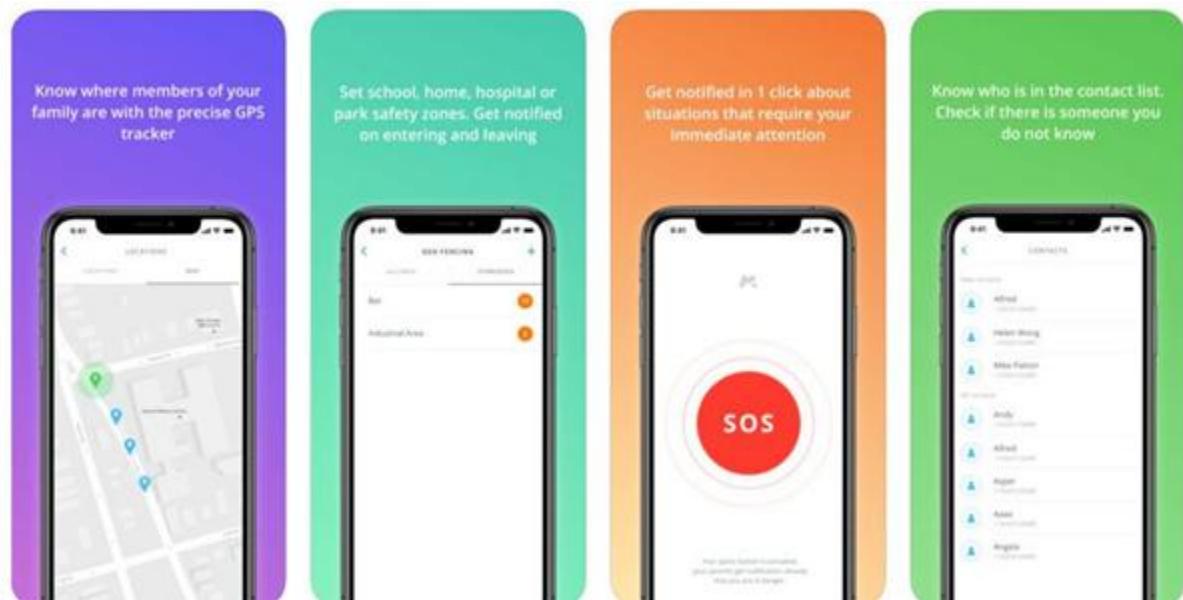
Related System: Smart QR Code Scanner



Smart QR Code Scanner is an app that gives a user a modern and all-customizable QR Code Generator. It's a platform for users to scan their QR codes using their own smartphone devices, which are natively developed to scan/detect QR codes. These codes are generated using this app itself that displays an online information to the scanner when scanned.

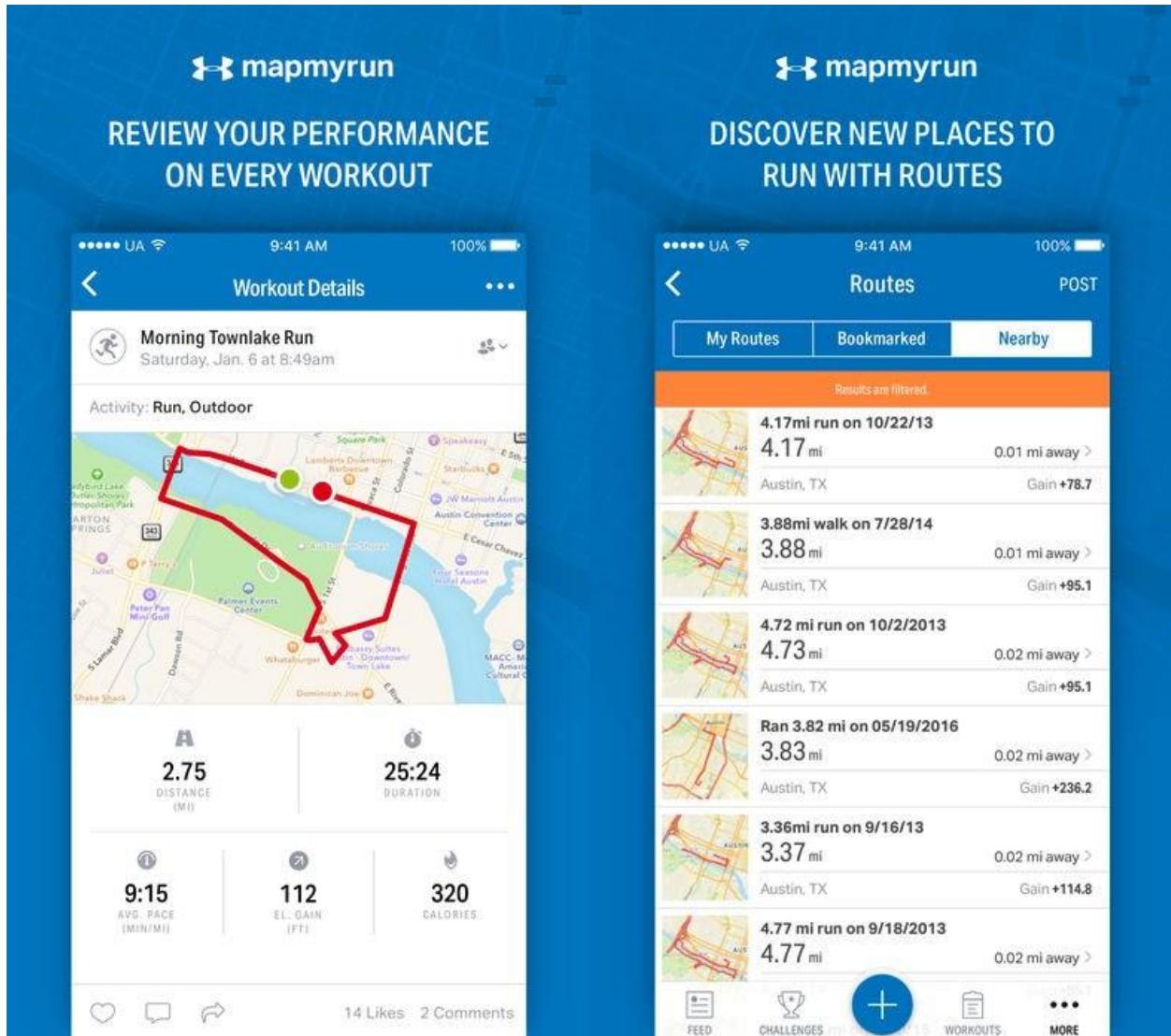
Likewise for the STRAP, it utilizes the QR Code Scanner that'll be put to the collar of the pet. When a user scans the QR code of that pet, the user will be redirected to the pet's information page.

Related System: mySpy



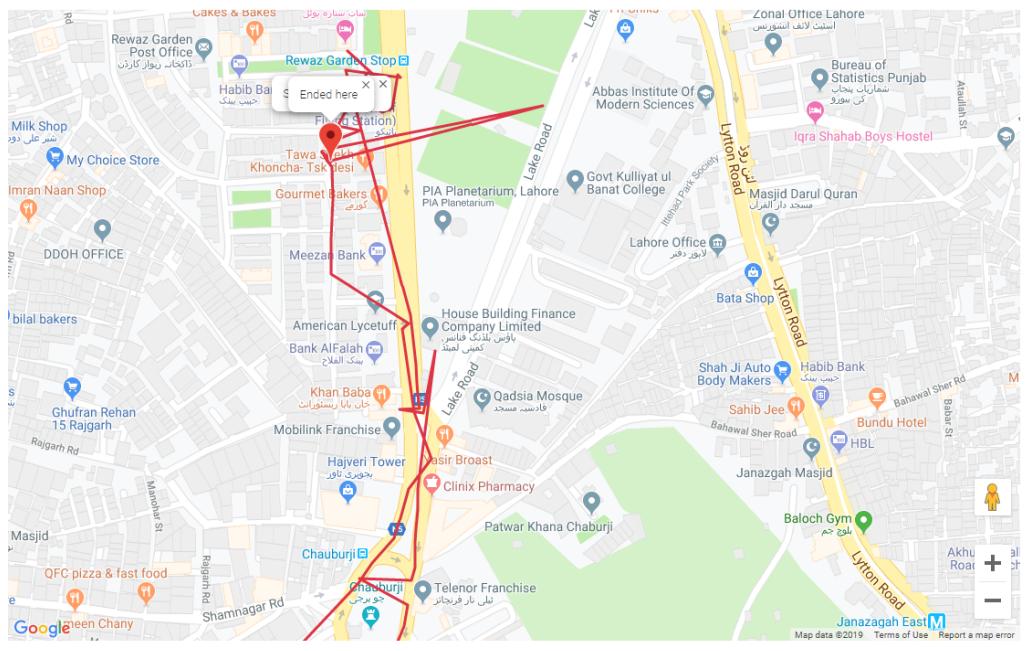
mSpy is a phone tracker app that lets you track your child's smartphone activities. mSpy records your child's GPS location but also sends it to you so that you can keep track of his/her real-time location throughout the day.

Related System: Map My Run by Under Armour



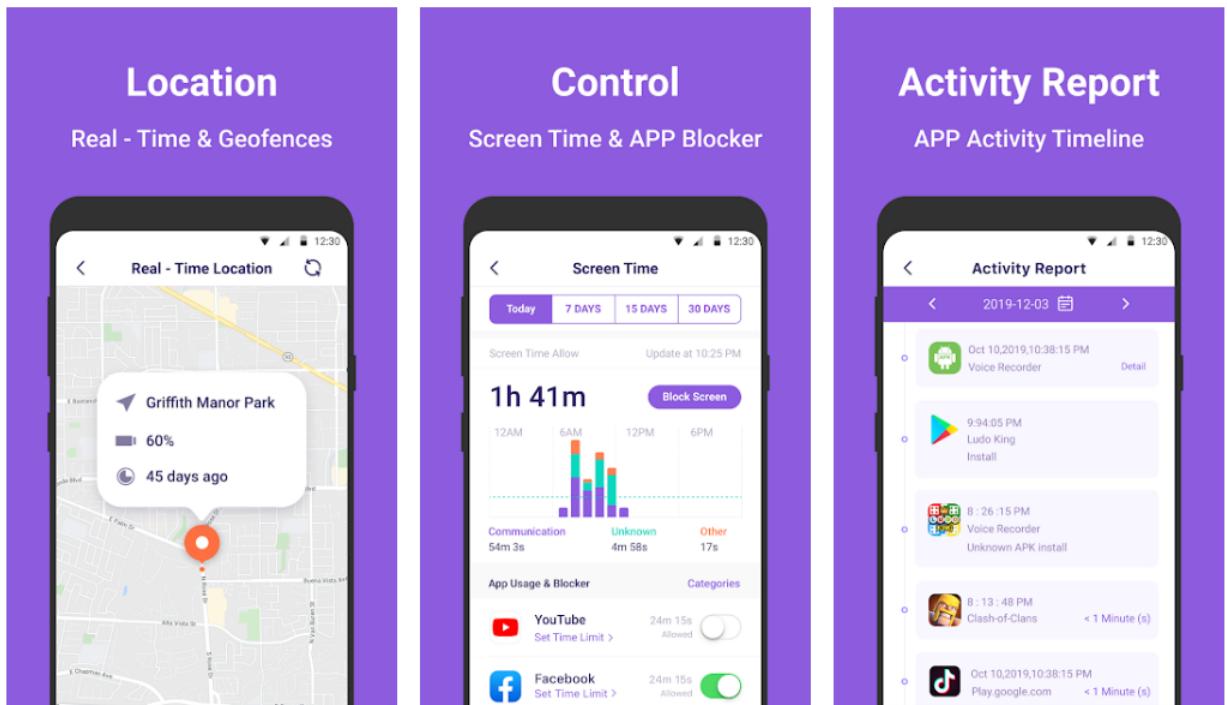
Map My Run is a tracking app that can also be highly integrable and can be synced with most wearables like Google Fit, Android Wear, Garmin, Fitbit, Suunto, etc.

Related System: Google Maps Tracking



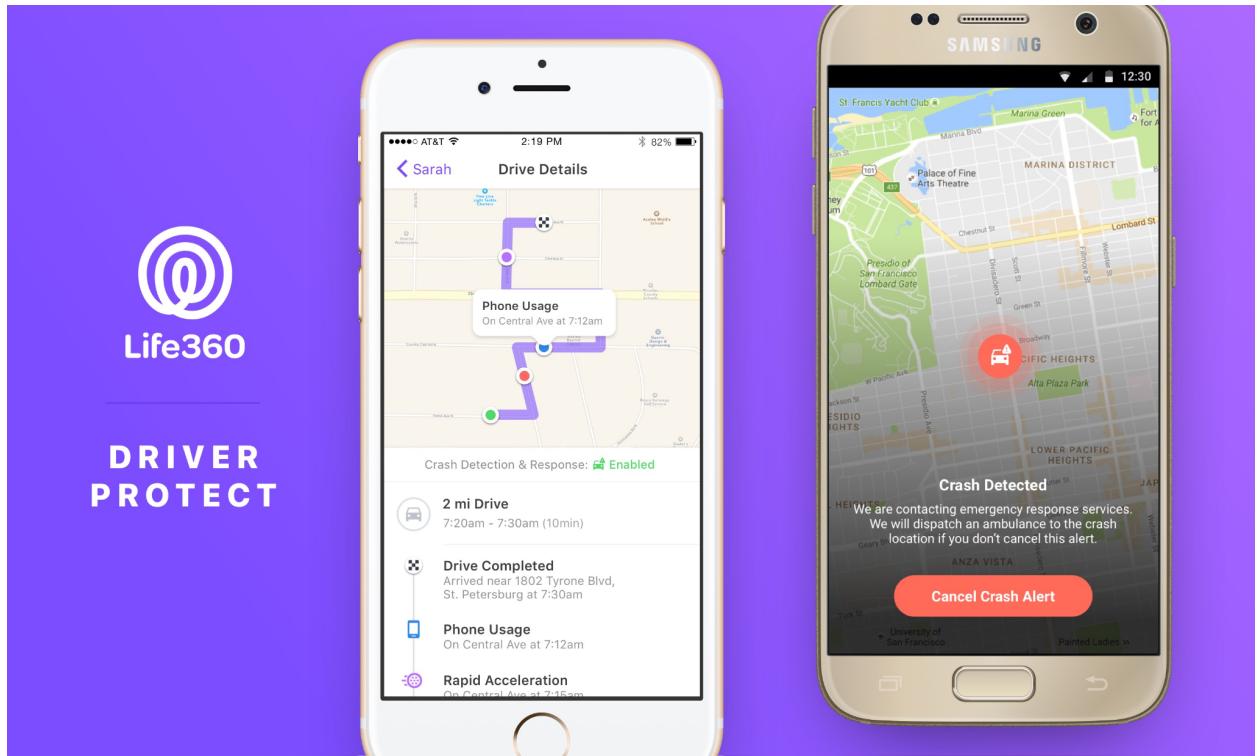
Google Maps is surely one of the best and most popular family phone tracker apps for both iPhone and Android mobiles. With a recent ‘share location’ feature added, it has become even more accurate and reliable as a tracking application. It has a user-friendly interface and plenty of options to customize the real-time location tracking requirements.

Related System: FamiSafe



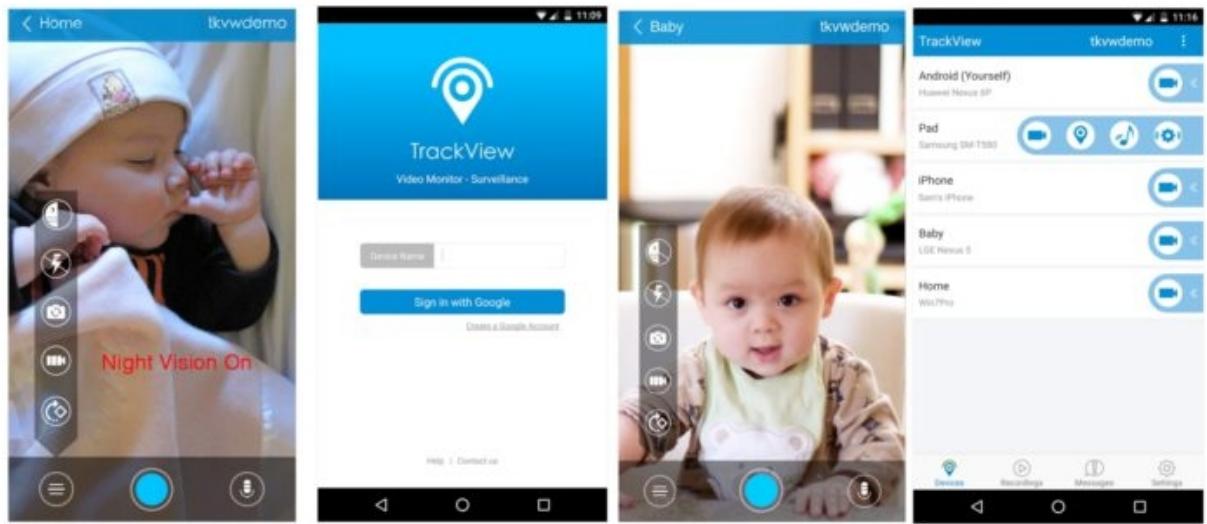
If you want to know how to track a phone without them knowing, especially if they are your kids or old family members with memory loss issues, FamiSafe is the app you need. With Famisafe, you can benefit from geo-fencing, smart parental control setting, app blocker & web filtering, location tracking, web filtering, screen time control, and emergency alerts. Using geofencing, you can create your own customized virtual safety zones like your kid's school or your grandparent's clinic on their cell phones. You'll get alerts when your kid or grandparent enters or leaves the zone. It's a great location tracker that updates you about the loved one's whereabouts without any stress.

Related System: Life360



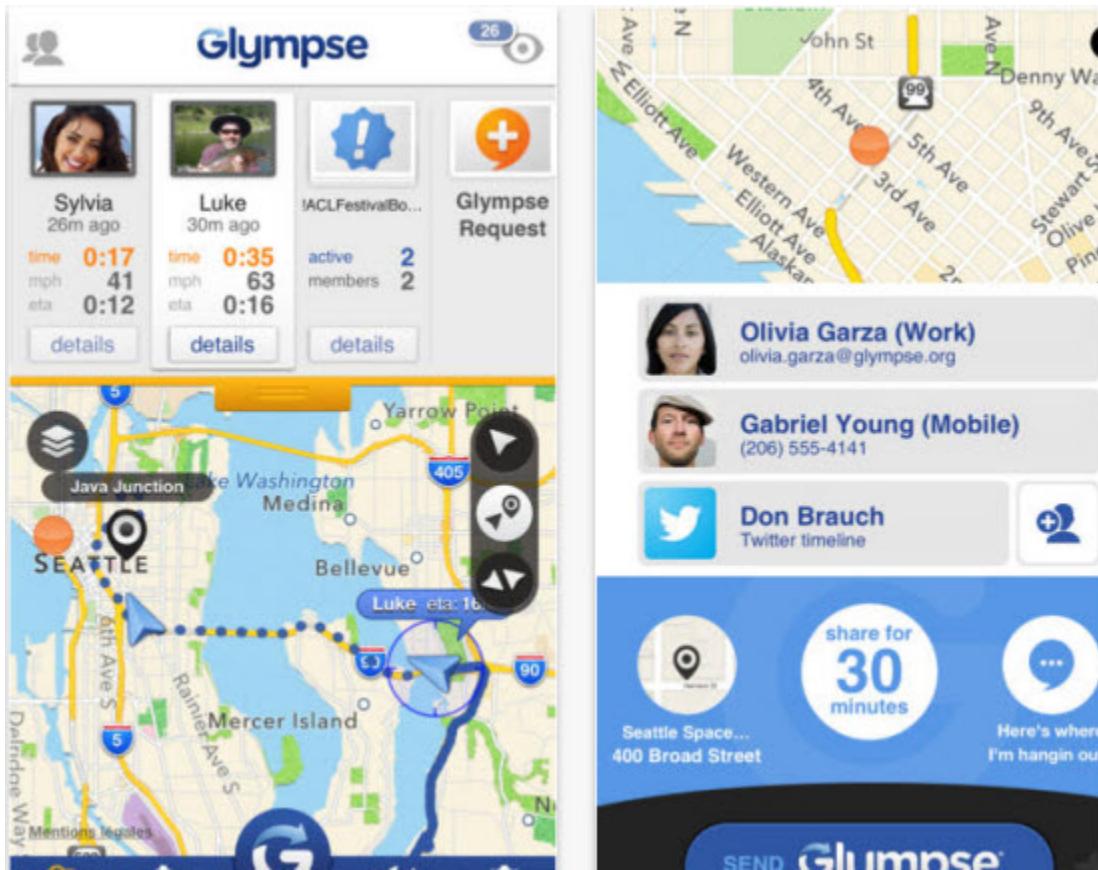
One of the best location tracker app that is reliable and user-friendly. The free phone tracker app without permission provides you with a smart and easy way to monitor your kid's location or keep a check on your friend's whereabouts in real-time. The Life360 mobile locator also includes cross-platform location sharing and in-app messaging. This best family locator app allows you to turn off the sharing feature in case you do not want your current location to be disclosed.

Related System: TrackView



If you are looking for a free phone tracker app without permission for the safety and security of your family which you can carry everywhere with you, look no further, TrackView is the answer for you. TrackView cell phone location tracker app not only allows you to monitor the location of your loved ones but also turn their PCs, Tablets, or Smartphones into a connected IP camera with a GPS locator. It offers a wide range of features such as geo-fencing, real-time location tracking of target devices, a web-based interface that you can remotely access, stealth mode, and access to your social media feeds, etc. This is an exceptional location tracker that can give you information about the target device's past locations, and also allows you to operate remote audio and video recording.

Related System: Glympse



Glympse is the answer to the question of what is the best app to track someone's location. This one of the most popular location sharing and tracking apps has been exclusively designed to offer real-time tracking. Although it does not include stealth mode, it features a range of other functionalities such as location sharing without any downloads, instant alerts, navigation options, geo-fencing, and in-app messaging.

Related System: FollowMee

The screenshot shows a web interface for 'FollowMee'. At the top, there's a navigation bar with links for Home, Map, App, Service, How-To, Support, Account, and Search. A user session is indicated by 'Hi, demo99 | Logout'. Below the navigation, the title 'Download Report for Device 3' is centered. Underneath it, a section titled 'Select Your Tracks' includes a date picker set to '2019-02-27' and a checked checkbox for 'Show Only GPS Location'. The next section, 'Select A Format', contains several options: 'HTML - Shown on screen, with mileage option' (selected), 'CSV File - Import to Excel, with mileage option', 'KML File - Use in Google Map or Google Earth', 'GPX File - GPS Exchange Format used in other applications', 'Include Mileage' (unchecked), 'Include Address' (checked), 'Include Tracker Status' (checked), and 'Include Visit/Stop' (unchecked). The 'Include Tracker Status' checkbox is circled in red. At the bottom of this section are 'Download' and 'Cancel' buttons.

FollowMee is a location tracking app that comes with various business features which allow you to integrate multiple devices with one account and let the user track the location of those devices at any given time. FollowMee app works fine with weaker connection as well. It stores the data even when offline and updates the maps immediately on the receiving network.

2.21 Synthesis: Pet Related Articles

Table 2.20 Related Literature Synthesis: Pet

<i>Literature</i>	<i>Details and Summary</i>	<i>Relation</i>
<p>Title: About Pets & People</p> <p>Author/s: Centers for Disease Control and Prevention(2019)</p> <p>Link: https://www.cdc.gov/healthypeople/health-benefits/index.html</p>	<p>Centers for Disease Control and Prevention discusses the benefits and risks of having a pet.</p>	<p>This article enumerates the benefits of having a pet and since STRAP, in order for it to work, needs a pet for data collection.</p>
<p>Title: Responsibilities of a Pet Owner</p> <p>Author/s: N.A</p>	<p>The article discusses the Republic Act of 9482 or the Anti-Rabies Act and Responsibilities of a Pet Owner. The article provides people with a clear and concise guide on how to take</p>	<p>The article gives a guide on how to be a responsible pet owner and during the testing phase, a pet will be a part of it for data collection.</p>

<p>Link:</p> <p>http://pawsphilippines.weebly.com/responsibilities-of-a-pet-owner-ra9482-the-anti-rabies-act.html</p>	<p>care of their pets legally.</p>	
<p>Title:</p> <p>Protocols for Helping Stray Animals</p> <p>Author/s:</p> <p>Philippine Animal Welfare Society (PAWS)</p> <p>Link:</p> <p>http://pawsphilippines.weebly.com/stray-rescue-what-to-do-with-rescues-and-stray-emergencies.html</p>	<p>PAWS discusses the proper steps to take when a person finds themselves in a situation where they require helping a stray animal and the authorities they must contact.</p>	<p>This article written by PAWS enumerates steps concerning helping a stray animal. It implies that the person must ask around the area for any information about the owner. This information can be used on pets who have STRAP and can be a powerful solution to finding lost pets.</p>
<p>Title:</p> <p>Animal Computer Interaction</p>	<p>The article discusses the definition of Animal Computer Interaction and its</p>	<p>The researchers can use Animal Computer Interaction as a guide in writing this</p>

<p>Author/s: Mancini (2011)</p> <p>Link: https://interactions.acm.org/archive/view/july-august-2011/animal-computer-interaction1</p>	<p>goals in developing technology for the benefit of an animal's lifestyle or socialization and to improve the relationship between humans and their companion animals.</p>	<p>paper and take into account the proper goal of Animal Computer Interaction to help in the development.</p>
<p>Title: Ethical Principles of Animal Computer Interaction</p> <p>Author/s: Mancini (2011)</p> <p>Link: https://interactions.acm.org/archive/view/july-august-2011/animal-computer-interaction1</p>	<p>This article aims to let readers be aware of the proper testing for the understanding of the interaction between animals and computing technology. It is important to take into consideration the physiological and psychological needs of the respondents.</p>	<p>The information in the article is important to the researchers and can be used for maintaining a healthy testing phase during the development.</p>
<p>Title: Dog Collar Styles</p>	<p>The article discusses different types of dog collars and its</p>	<p>The information given by the article will be an important</p>

<p>Author/s: Stregowski, J. (2019, July 1)</p> <p>Link: https://www.thesprucepets.com/different-types-of-dog-collars-1118613</p>	<p>uses including the benefits and risks of using these collars.</p>	<p>factor to the development phase on what type of collar that the researchers will be using.</p>
<p>Title: The Pros and Cons of a Harness or Collar</p> <p>Author/s: Puisis, E. (2021, April 29)</p> <p>Link: https://www.thesprucepets.com/pros-and-cons-of-a-dog-harness-or-collar-5114538</p>	<p>Puisis (2021) discusses the pros and cons of using a harness or a collar.</p>	<p>The article gives info about what kind of tool that the researchers will be needing in the development phase.</p>
<p>Title: Why Should My Dog Wear a Collar?</p>	<p>The article gives a straight point of idea on why a dog should wear a collar.</p>	<p>The information given by Wettergren(2019) is inline with the project since STRAP</p>

<p>Author/s:</p> <p>Wettergren, M. (2019, July 11)</p> <p>Link:</p> <p>https://drfoxvet.net/why-should-my-dog-wear-a-collar/</p>		<p>gives identification to a pet.</p>
<p>Title:</p> <p>How to Protect Pets from Getting Lost</p> <p>Author/s:</p> <p>Hastings Staff (2020, September 02)</p> <p>Link:</p> <p>https://hastingsvet.com/how-to-protect-pets-from-getting-lost/</p>	<p>The article enumerates 5 ways on how to protect pets from getting lost.</p>	<p>The article also stated about using a collar and STRAPs main tool that the researchers will be using during the development phase is a collar.</p>

2.22 Synthesis: GPS Related Articles

Table 2.21 Related Literature Synthesis: GPS

<i>Literature</i>	<i>Details and Summary</i>	<i>Relation</i>
<p>Title: Global Positioning System Author/s: A. Dierck, H. Rogier and F. Declercq(2013) Link:https://ieeexplore.ieee.org/abstract/document/6327601</p>	<p>This article aims to give an overview on what a global positioning system is and how it works. .</p>	<p>These articles help the developers to have a fully and deeper understanding of a GPS.</p>
<p>Title: Advantages of Global Positioning System Author/s: Bonheur, K. (2018, October 23) Link:</p>	<p>The article emphasizes the points to which makes the usage of the GPS great and its benefits. It also shows why the GPS is an effective tool in today's technology.</p>	<p>The developers use the information given by the article to fully understand the benefits of implementing a GPS feature onto STRAP.</p>

https://www.profolus.com/topics/advantages-and-disadvantages-of-gps/		
<p>Title: Disadvantages of Global Positioning System</p> <p>Author/s: Bonheur, K. (2018, October 23)</p> <p>Link:</p> https://www.profolus.com/topics/advantages-and-disadvantages-of-gps/	<p>The article states the limitations of GPS and the reasonings for such.</p>	<p>The limitations stated by the article can be used by the researchers to see the actual limitations of the GPS feature of STRAP such as the weather.</p>

2.23 Synthesis: Arduino Related Articles

Table 2.22 Related Literature Synthesis: Arduino

<i>Literature</i>	<i>Details and Summary</i>	<i>Relation</i>
<p>Title: Arduino</p> <p>Author/s: SparkFun Electronics (n.d)</p> <p>Link: https://learn.sparkfun.com/tutorials/what-is-an-arduino/all</p>	<p>The article discusses the general idea of what Arduino is.</p>	<p>In relation to the project of the researchers, STRAPs main component is an Arduino device.</p>
<p>Title: What is an Arduino IDE?</p> <p>Author/s: Kalu, N. (n.d)</p> <p>Link: https://www.easytechjunkie.com/what-is-an-arduino-ide.htm</p>	<p>Kalu discusses the general idea of what Arduino IDE is and why it is better than a simple text editor.</p>	<p>In order for the STRAP to work, it needs an IDE for the programming part of the device for faster and easier writing of code.</p>

<p>Title: Arduino and C++</p> <p>Author/s: Circuito (2018)</p> <p>Link: https://www.circuito.io/blog/arduino-code/</p>	<p>Circuito states the basic information regarding the relationship between Arduino and C++. This includes the IDE, how C++ is coded and some jargon related to Arduino and C++.</p>	<p>The researchers use the information in the article to understand the basics of the usage of Arduino and C++ for the development of STRAP.</p>
<p>Title: Vehicle Tracking System Using GPS and Arduino</p> <p>Author/s: Saddam (2016, March 03)</p> <p>Link: https://circuitdigest.com/microcontroller-projects/vehicle-tracking-system-using-arduino-gps-and-gsm</p>	<p>The article gives an example of a real life application of Arduino and GPS. The article includes some information of the hardware required, and how the GPS module can transmit the location data onto the Arduino.</p>	<p>The information provided by this article is used by the researchers to further understand and to learn on how a real life application can be used with the combination of Arduino and GPS.</p>

<p>Title: What is Arduino UNO?</p> <p>Author: Gupta, P (n.d)</p> <p>Link: https://www.educba.com/what-is-arduino-uno</p>	<p>The article gives a basic description on the use and components of Arduino UNO.</p>	<p>The researchers use this information to gain a basic understanding on the basic uses and components of the Arduino UNO.</p>
<p>Title: Why is Arduino UNO Used?</p> <p>Author/s: Gupta, P (n.d)</p> <p>Link: https://www.educba.com/why-is-arduino-uno</p>	<p>This article discusses the main reasons why the Arduino UNO is used as opposed to other Arduino boards. It also discusses the Arduino UNO's hardware.</p>	<p>The Arduino UNO is the main board used by the researchers and this article explains as to why it is chosen as the preferred board for this project.</p>
<p>Title: What's a GPS Module?</p>	<p>The article explains the difference between the GPS</p>	<p>The information in the article is used by the researchers to</p>

<p>Author/s: Techplayon (2017)</p> <p>Link: https://www.techplayon.com/gps-gps-module-used-base-station-applications-choose-gps-module/</p>	<p>Module and the GPS chipset. Included in the article are some information as to how a GPS module transmits geopositional data.</p>	<p>learn more information about the usage of the GPS module as opposed to the GPS chipset.</p>
<p>Title: What's a GSM Module?</p> <p>Author/s: Robu.in (2020, January 9)</p> <p>Link: https://robu.in/sim800l-interfacing-with-arduino/</p>	<p>The article discusses a brief description of the GSM Module which also includes an in depth explanation of its hardware and how the GSM Module functions.</p>	<p>The article is used by the researchers to further advance their knowledge on the GSM Module that is to be implemented onto STRAP.</p>
<p>Title: What's a LiPo Battery</p>	<p>The article explains what is a Lithium Polymer Battery, what does it consist of and</p>	<p>The article is important for the research as it serves as the reasoning on using LiPo</p>

<p>Author/s: Moore, A. (2008, November 14)</p> <p>Link:</p> <p>https://revotacs.com/articles/lithium_polymer_lipo_battery_guide?v=a284e24d5f46</p>	<p>advantages of using it.</p>	<p>batteries as the devices main power supply unit.</p>
<p>Title:</p> <p>Advantages of Using LiPo Batteries</p> <p>Author/s:</p> <p>Link:</p>		

2.24 Synthesis: Internet of Things Related Articles

Table 2.23 Related Literature Synthesis: Internet of Things

<i>Literature</i>	<i>Details and Summary</i>	<i>Relation</i>
<p>Title: What's Internet of Things? (IoT)</p> <p>Author/s: Kenton, W (2021, May 28)</p> <p>Link: https://www.investopedia.com/terms/i/internet-things.asp</p>	<p>The article stated by Kenton explains what the Internet of Things(IoT) is and how it has affected different kinds of fields.</p>	<p>The article explains what IoT means and it is important for the research since it gives a general explanation about IoT and STRAP is an IoT device.</p>
<p>Title: The Internet of Things: The Basics Explained</p> <p>Author/s: Ranger, S (2020, February 03)</p> <p>Link:</p>	<p>The article stated by Ranger gives an in-depth idea on what Internet of Things and how small or big an IoT device can be.</p>	<p>The article explains what IoT can be made of and STRAP is an IoT device.</p>

https://www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot-right-now/		
<p>Title: History of Internet of Things</p> <p>Author/s: Foote, K.D (2016, August 16)</p> <p>Link: https://www.dataversity.net/brief-history-internet-things/#</p>	<p>The article written by Foote discusses the history of the Internet of Things and how “internet” started including the development of Internet Protocol Version address.</p>	<p>Every IoT device will have an IP address in the internet and STRAP is an IoT device that will have an IP address during the connection of the STRAP to the internet.</p>
<p>Title: Guidelines for Internet of Things Deployment</p> <p>Author/s: Oriwoh (2013)</p> <p>Link: https://www.researchgate.net/</p>	<p>Oriwoh enumerates a set of guidelines or as he states in his article as “commandments that developers must follow in order to properly deploy an Internet of Thing project.</p>	<p>The guidelines stated by Oriwoh are very important for use as a guideline for the proper development and deployment of STRAP.</p>

<u>publication/259539252_Guidelines_for_Internet_of_Things_Deployment_Approaches_-The_Thing_Commandments</u>		
<p>Title: What is an IoT Device?</p> <p>Author/s: Mishra, H. (2020, April 10)</p> <p>Link: https://iotbyhvm.ooo/iot-device-what-is-an-iot-device/</p>	<p>The article by Mishra discusses how an IoT device can send/receive data over a network with or without human intervention or by its environment.</p>	<p>In order for STRAP to work, it needs to send/receive information regarding the pet's location on the map and will be sent to the web application.</p>
<p>Title: Building Blocks of IoT Device</p> <p>Author/s: Anand, D. (2014, December 17)</p>	<p>Anand discusses the four building blocks an IoT device goes through.</p>	<p>In order for STRAP to be an IoT device, it needs to go through the four basic building blocks that Anand discusses in his article.</p>

<p>Link:</p> <p>https://iot.electronicsforu.com/expert-opinion/building-blocks-iot-getting-started/</p>		
<p>Title:</p> <p>IoT Device Life-Cycle Management</p> <p>Author/s:</p> <p>Watson, E. (2020, December 02)</p>	<p>Watson discusses in his article the life cycle of an IoT device. The life-cycle has five parts and Watson explains each part that makes up for the life-cycle of an IoT device.</p>	<p>Every IoT device will have a life-cycle and STRAP is an IoT device.</p>
<p>Link:</p> <p>https://pupuweb.com/iot-device-life-cycle-management/#:~:text=IoT%20device%20life-cycle%20management%20As%20enterprise%20IoT%20systems,cycle%20includes%20security%2C%20pre-commissioning%2C%20commissioning%2C%20operations%2C%20operations</p>		

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2.25 Synthesis: Republic Act Related Articles

Table 2.24 Related Literature Synthesis: Republic Act

<i>Literature</i>	<i>Details and Summary</i>	<i>Relation</i>
<p>Title: Republic Act 10173 - Data Privacy Act of 2012 Author/s: N.A Link: https://www.privacy.gov.ph/data-privacy-act/</p>	<p>The article gives an overview of the Data Privacy Act of 2012 that states the applicability of individuals and legal entities that process personal information.</p>	<p>The law explains whenever the developers get the pet owner's personal information.</p>
<p>Title: Republic Act (RA) 9482 - Anti-Rabies Act of 2007 Author/s: N.A Link:</p>	<p>The law specifically Section 5 C and D enumerates the responsibilities of a pet owner.</p>	<p>The law establishes the owner's pet responsibilities. As developers of the app itself, the app should give importance to it.</p>

https://paws.org.ph/downloads/ra9482_anti_rabies_act_of_2007.pdf		
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2.26 Synthesis: Security Related Articles

Table 2.25 Related Literature Synthesis: Security

<i>Literature</i>	<i>Details and Summary</i>	<i>Relation</i>
Title: Web Application Security Best Practices: A Developer's Guide Author/s: Ballal (2020), Link: https://securityintelligence.com/posts/web-application-security-best-practices-developers-guide/	Ballal describes the best practices and recommendations when it comes to developing secure web applications.	The researchers use Ballal's recommendations when building the web application for STRAP in order to make sure security is prioritized.
Title:	A quick and informative	This article helps the

<p>What is Hashing?</p> <p>Author/s</p> <p>Frankenfield (2020),</p> <p>Link:</p> <p>https://www.investopedia.com/news/cryptographic-hash-functions/</p>	<p>definition of hash functions is discussed by Frankenfield and along with its benefits.</p>	<p>developers to prioritize the best type of hash functions available and to be knowledgeable of the capabilities of hash functions outside of security.</p>
<p>Title:</p> <p>Introduction to Hashing and its uses</p> <p>Author/s</p> <p>Chung (2019),</p> <p>Link:</p> <p>https://www.2brightsparks.com/resources/articles/introduction-to-hashing-and-its-uses.html</p>	<p>Chung discusses the benefits of using has functions on web applications, and also when it comes to verification for file equality and integrity.</p>	<p>This article supports Frankenfield (2020) in the usage of hash algorithms and security and verification.</p>
<p>Title:</p> <p>Cryptography</p>	<p>Rountree further supports the usage of hashing algorithms</p>	<p>The article helps the developers when it comes to</p>

<p>Author/s Rountree (2011)</p> <p>Link: https://www.sciencedirect.com/topics/computer-science/hashing-algorithm</p>	<p>and describes the abundance of different types of these hash functions.</p>	<p>knowing a more in depth definition of hash algorithms and their uses.</p>
<p>Title: Eleventh Hour CISSP (Second Edition)</p> <p>Author/s (Conrad et al., 2014)</p> <p>Link: https://www.sciencedirect.com/topics/computer-science/hashing-algorithm</p>	<p>This article describes in depth the usage and definition of the Message-Digest or MD5 hash function and the Cyclic Redundancy Check or CRC32.</p>	<p>The developers will use the knowledge in this article to take into consideration what hash algorithm is best used for the STRAP web application.</p>
<p>Title: SHA-256 Algorithm Overview</p>	<p>N-able (2019) explains the definition of the Secure Hash Algorithm (SHA) most</p>	<p>The information in this article is integral to the development of STRAP's web security and</p>

<p>Author/s N-able (2019)</p> <p>Link: https://www.n-able.com/blog/sha-256-encryption</p>	<p>specifically the SHA-256 algorithm.</p>	<p>privacy as it describes the importance and reliability of the SHA-256 hash function.</p>
<p>Title: Data Security Guide: Everything You Need To Know</p> <p>Author/s: Loshin, P. & Cobb, M. (2020)</p> <p>Link: https://searchsecurity.techtarget.com/definition/encryption?fbclid=IwAR3jwj8ePV4PYSNv0_uqSDFFKyA88AFSEn0W1gLuv5p-Lb7LaClEsjrtqqw</p>	<p>Loshin and Cobb discuss the importance and the basic usage of encryption and how a cipher works.</p>	<p>The information present in the article will help the developers with the further improvement and development of online security for STRAP.</p>
<p>Title:</p>	<p>The article gives an</p>	<p>The article will be used to</p>

<p>What is Cross-Site Scripting?</p> <p>Author/s:</p> <p>Cloudflare (n.d)</p> <p>Link:</p> <p>https://www.cloudflare.com/learning/security/threats/cross-site-scripting/</p>	<p>explanation on cross-site scripting.</p>	<p>understand cross-site scripting during the developmental phase and testing phase of the project.</p>
<p>Title:</p> <p>What Are Types of Cross-Site Scripting?</p> <p>Author/s:</p> <p>Sucuri Guides(2019, November 07)</p> <p>Link:</p> <p>https://sucuri.net/guides/what-is-cross-site-scripting/#:~:text=Examples%20of%20reflected%20cross-site%20scripting</p>	<p>The article gives an idea about different types of cross-site scripting attacks and how it is usually done.</p>	<p>The article gives insight on different types of cross-site scripting attacks which give insight to the researchers during the security testing phase of the web application.</p>

%20attacks%20include%20when, the%20server%2C%20and%20only%20they%20see%20the%20result.		
<p>Title: How to Prevent Cross-Site Scripting Attacks</p> <p>Author/s: SiteLock (2019, November 21)</p> <p>Link: https://www.sitelock.com/blog/prevent-cross-site-scripting-attacks/#:~:text=How%20to%20Prevent%20Cross-Site%20Scripting%20Attacks%20Keep,can%20filter%20bad%20bots%20and%20other%20malicious%20</p>	<p>This article gives an in-depth guide on how to prevent cross-site scripting attacks. It has 4 ways on how to prevent xss attacks.</p>	<p>The developers will use the idea presented in the article during the testing phase of the web application to ensure the prevention of cross-site scripting attacks.</p>
Title:	The article gives an	The developers will try to do

<p>What is SQL Injection?</p> <p>Author/s:</p> <p>Cloudflare (n.d)</p> <p>Link:</p> <p>https://www.cloudflare.com/learning/security/threats/sql-injection/</p>	<p>explanation on what SQL Injection is and how it works.</p>	<p>an sql injection during testing phase to ensure security in the final stage of development.</p>
<p>Title:</p> <p>Types of SQL Injection</p> <p>Author/s:</p> <p>Acunetix (n.d)</p> <p>Link:</p> <p>https://www.acunetix.com/websitesecurity/sql-injection2/</p>	<p>This article explains the different types of sql injection and how it works.</p>	<p>The developers will use the article during the testing phase to see if the web application prevents sql injection attacks.</p>

2.27 Synthesis: Web Development Related Articles

Table 2.26 Related Literature Synthesis: Web Development

<i>Literature</i>	<i>Details and Summary</i>	<i>Relation</i>
<p>Title: How PHP Works Author/s (Suehring, 2018) Link: https://www.dummies.com/programming/php/how-php-works/</p>	<p>This article describes in depth the usage and definition of the language PHP</p>	<p>The developers will use the knowledge in this article to develop the backend web server</p>
<p>Title: Apache Author/s (Hosch, 2008) Link: https://www.britannica.com/technology/Apache-Web-server</p>	<p>This article describes in depth the usage and definition of the Apache web server</p>	<p>The developers will use the knowledge in this article to develop the backend web server</p>

<p>Title: 10 Common Uses of Bootstrap</p> <p>Author/s (Segal, 2016)</p> <p>Link: https://www.htmlgoodies.com/html5/10-common-uses-of-bootstrap/</p>	<p>Segal discusses in depth the basics of the Bootstrap Framework and its uses in the modern day development of websites.</p>	<p>The developers can use the information in this article to gain more knowledge on how Bootstrap can be used onto STRAP.</p>
<p>Title: 8 Reasons Why You Should Use Bootstrap</p> <p>Author/s (Prabhu, 2020)</p> <p>Link: https://techaffinity.com/blog/why-use-bootstrap-for-front-end-design/</p>	<p>Prabhu discusses 8 specific reasons why developers should use Bootstrap in developing websites.</p>	<p>The developers can use the information to justify the usage of Bootstrap on STRAP.</p>
<p>Title: Pros and Cons of Bootstrap &</p>	<p>Gupta (2017) states some disadvantages of Bootstrap</p>	<p>This article lets users become aware of the disadvantages of</p>

<p>Foundation – Know what you need!</p> <p>Author/s (Gupta, 2017)</p> <p>Link: https://www.uplers.com/blog/wha at-are-the-pros-cons-of-foundati on-and-bootstrap/</p>	<p>and how it can affect web development.</p>	<p>using Bootstrap, and adjust accordingly if STRAP requires.</p>
<p>Title: Introduction To JavaScript Object Notation (JSON)</p> <p>Author/s (Kumar, 2020)</p> <p>Link: https://www.c-sharpcorner.co m/article/introduction-to-java script-object-notation-json/</p>	<p>Kumar describes the definition and technical functionalities of the usage of JSON in the development of websites.</p>	<p>The usage of JSON is important for STRAP as is with most other websites, this article helps the developers be more knowledgeable of its usage in the development of websites.</p>
<p>Title: Introduction To JavaScript Object Notation (JSON)</p>		

<p>Author/s (Kumar, 2020)</p> <p>Link: https://www.c-sharpcorner.com/article/introduction-to-javascript-object-notation-json/</p>		
<p>Title: What is JSON? A better format for data exchange</p> <p>Author/s (Freeman, 2019)</p> <p>Link: https://www.infoworld.com/article/3222851/what-is-json-a-better-format-for-data-exchange.html</p>	<p>Freeman (2019) discusses the importance of JSON in the history of web development and its impact on modern websites.</p>	<p>This article is used by the developers to add more knowledge and information in order to fully build the STRAP web application properly and efficiently.</p>

2.28 Synthesis: Framework Related Articles

Table 2.27 Related Literature Synthesis: Framework

Literature	Details and Summary	Relation
<p>Title: What is SCRUM?</p> <p>Author/s: Cohn (2014)</p> <p>Link:</p>	<p>Cohn discusses in his article an in depth explanation of the SCRUM and how it works and how it is implemented onto projects and development.</p>	<p>The article explains in depth the pros of utilizing SCRUM onto the development of projects such as STRAP. This information is used as a main basis for the usage of SCRUM by the developers.</p>
<p>Title: Software Development Life Cycle - SDLC</p> <p>Author/s: Ghahrai (2020)</p> <p>Link:</p>	<p>Gharai explains the parts of the SDLC and what developers must do in each specific part. Most specifically the Design Phase.</p>	<p>This supports Ballal's (2020) article of which developers must start prioritizing security as early as the development phase. Ghahrai (2020) explains what goes on in the Design Phase, and what must be prioritized.</p>

2.29 Synthesis: Related Systems

Table 2.28 Related Literature Synthesis: Related Systems

Literature	Details and Summary	Relation
Title My Family -Family Locator Link: https://play.google.com/store/apps/details?id=family.tracker.my	The app is designed for family safety and parental control. It provides a real time location finder service allowing relatives to privately share their location.	It gives STRAP a reference to its main functionality which is it could track the pet's real-time location.
Title: Pawfit GPS Pet Tracker Link: https://play.google.com/store/apps/details?id=com.latsen.pawfit	The app is designed for digital activity monitoring, live location tracking for your pets	It gives STRAP a reference on its digital activity monitoring and live location tracking. Also, it gives a reference on how to navigate nearby pets that have an account on the STRAP's website.

<p>Title: 11pets: Pet Care</p> <p>Link: https://play.google.com/store/apps/details?id=com.m11pets.elevenpets</p>	<p>The app is specifically designed to help pet owners with everything from vaccination and deworming reminders, complete medical history, reminders for medications and food.</p>	<p>It gives STRAP a reference on how to present pertinent information on an app or website.</p>
<p>Title: Smart QR Code Scanner</p> <p>Link: https://play.google.com/store/apps/details?id=com.mactech.qrsapp</p>	<p>The app is designed to scan/detect QR codes</p>	<p>It gives a reference to STRAP on how to utilize a QR Code Scanner that'll be put on the collar of the pet itself.</p>
<p>Title: mySpy</p> <p>Link: https://play.google.com/store/apps/details?id=com.mspy.lite</p>	<p>One of the functionalities of mySpy is it is designed to: Track real-time location with GPS tracking;</p>	<p>It gives a reference to STRAP on tracking or locating someone</p>

Title: Google Maps Link: https://play.google.com/store/apps/details?id=com.google.android.apps.maps&hl=en_US	The Google location tracking app also keeps a record of the past locations and displays them on the timeline. The free app enables you to manage the sharing options, as well.	It gives a reference to STRAP on tracking or locating someone
Title: Map My Run by Under Armour Link: https://play.google.com/store/apps/details?id=com.mapmyrun.android2&hl=en&gl=US	A tracking app that can also be highly integrable and can be synced with most wearables like Google Fit, Android Wear, Garmin, Fitbit, Suunto, etc.	It gives a reference to STRAP on how to integrate it on a hardware
Title: FamiSafe Link:	Using geofencing, you can create your own customized virtual safety zones like your kid's school	It gives a reference to STRAP on tracking or locating someone

<p>https://apps.apple.com/us/app/famisafe-parental-control/id1385417904</p>	<p>or your grandparent's clinic on their cell phones;</p>	
<p>Title: Life360 Link: https://apps.apple.com/us/app/life360-family-locator/id384830320</p>	<p>It offers a wide range of features such as geo-fencing, real-time location tracking of target devices, a web-based interface that you can remotely access, stealth mode, and access to your social media feeds, etc.</p>	<p>It gives a reference to STRAP on tracking or locating someone</p>
<p>Title: FollowMee Link:https://play.google.com/store/apps/details?id=com.fmeeservf&hl=en&gl=US</p>	<p>FollowMee is a location tracking app that allows you to integrate multiple devices with one account and let the user track the location of those devices</p>	<p>It gives a reference to STRAP on tracking or locating someone</p>

	at any given time. It also stores the data even when offline and updates the maps immediately on the receiving network.	
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CHAPTER 3: TECHNICAL BACKGROUND

3.1 Requirement Analysis

3.1.1 Functional Requirements

- Pet owners should be able to input his/her pet's personal information.
- Pet owners should be able to view his/her pet's personal information.
- The specialized collar should be able to permit other users to check the pet's personal information by using a QR code.
- The QR code on the specialized collar should be able to authenticate on who can access the pet's personal information.
- Once authenticated, users can view the pet's identification number.
- Once authenticated, users can view the pet's current medical record, diet, and its owner's information.
- The system should be able to let the owners see the real-time location of their pet through a GPS module built within the collar.
- Pet owners should be able to scan the QR code and view the pet's basic information with or without internet access.
- The system should be able to see other pets who use the application.

3.1.2 Non-Functional Requirements

3.1.2.1 Availability

- The specialized collar would have a battery lifespan of around 2-3 years and may also vary depending on the usage of the battery.

- The specialized collar can be charged using a USB port or through a direct current supply.
- The specialized collar with a GPS module can be seen on the map using internet connection.

3.1.2.2 Privacy and Confidentiality

- The specialized collar will not show any personal information regarding the pet and its owner.
- Pet's personal information can only be accessed through the use of QR code.
- The QR code has the ability to authenticate the user who has scanned the code.

3.1.2.3 Performance and Reliability

- The specialized collar would notify the owner if their pet is moving away from the application with an expected range of 200 M.
- The specialized collar would be able to see nearby pets who use the application.
- The Arduino with its modules will be put inside a specialized collar to protect it from external risk factors.

3.1.2.4 Security

- Only the pet owner can input his/her pet's personal information.
- Only the owner and the user who have scanned the QR code from the specialized collar can view the pet's personal information.

- The user who has scanned the QR code from the specialized collar can only view the pet's personal information once authenticated.

3.2 Design Methodology

3.2.1 Research Methodology

- Data Gathering
 - The developers utilized data gathering as their research methodology by observing the overwhelming statistics on lost and stray pets in the Philippines. By knowing the aforementioned information, the developers noticed that there's no platform nor device locally for pet owners to keep track of their pets in real-time.
- Questionnaire
 - The developers implemented the questionnaire as a research methodology for them to gather information on whether non-pet owners and pet owners necessitate a device that could locate your/friends/relatives' pets in real-time.
- Survey
 - The developers enforced the survey as a research methodology. The developers gather information on the respondents regarding their thoughts about the STRAP's functionalities and website platform.

3.2.2 SDLC Methodology

The SCRUM Cycle

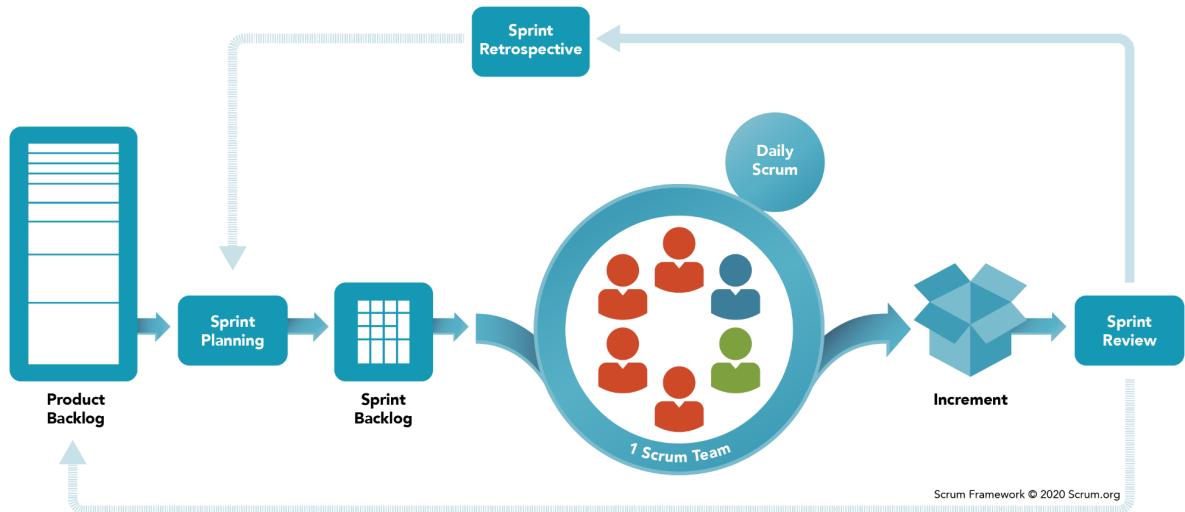


Figure 3.2 - The SCRUM Cycle

The researchers utilized the SCRUM cycle in developing the Specialized TRAcker for Pets (STRAP). This methodology is used for implementing agile development and emphasizes meetings and close coordination and collaboration between the members of the team and offers regular checks in order to focus on optimization or bug fixes. SCRUM favors releases that are smaller by working within a 2 - 4 week time period of working also called sprints. SCRUM is identified to have 3 artifacts or parts. These artifacts are used by the team to help them be organized during the development using the SCRUM cycle. These 3 artifacts are a product backlog, a sprint backlog, and an

increment with the developer's definition of "done" (Drumond, 2021). The product backlog, according to Drumond, is the primary list of work that needs to be done and is maintained by the product owner or project manager. This is essentially the team's "To Do" list. This product backlog is always revisited and the prioritization of the features are always adjusted in order to fit what is best for the system with the given amount of time. The sprint backlog is the list of items or bug fixes that are selected by the development team for implementation to the current sprint cycle (Drumond, 2021). The sprint backlog is discussed before each sprint called sprint planning. This is where the team chooses what they will work on from the product backlog. Although the sprint backlog is flexible and can easily be adjusted, Drumond states that the sprint goal, or what the team wants to achieve during the sprint, cannot be changed or compromised. Finally, the increment or the sprint goal is the end-product of a sprint.

The development of STRAP started with the construction of the use cases, this ensures that the project functionalities are fully understood and properly visualized in the form of the use case diagrams. The development and implementation of said features are the first to be added into the sprint backlog for development under the SCRUM framework.

3.3 System Design

Option; the view map option, view pet location menu. The pet menu will have the following options for the user to select, view pet details and add a pet tracker.

- **Activity Diagrams**

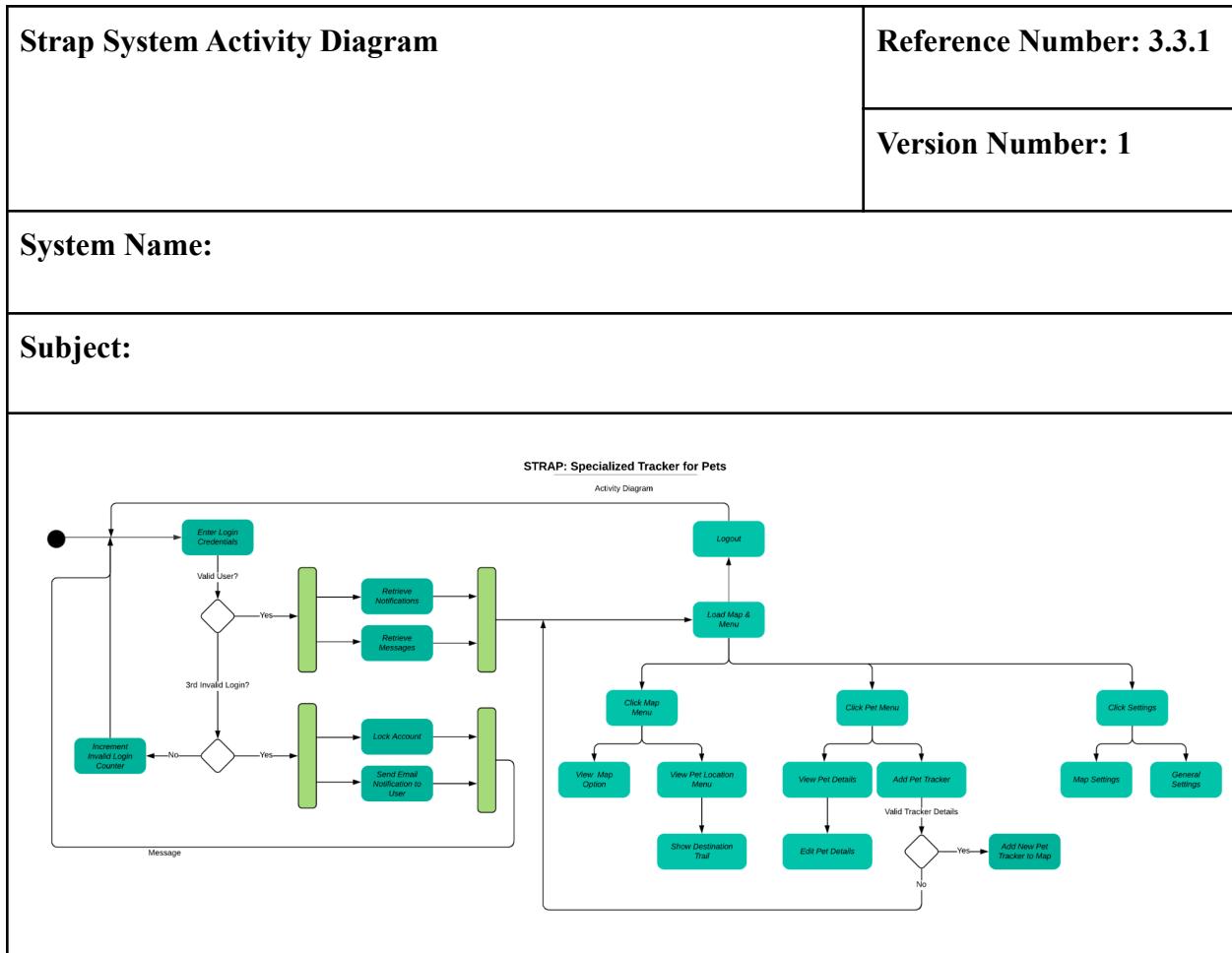


Figure 3.3.1 - Strap System Activity Diagram

The activity diagram is shown in Figure 3.3.1. The user is prompted to enter his/her login credentials. Upon validation, the system will verify if the credentials are correct. When the login fails the system will check the number of logins made by the user, if the login attempt exceeds

the amount of three the system will directly lock the account and send an email notification to the user via email used. Else if the login attempt amounts to less than three the system will increment a login counter to further measure the amount of failed login attempts. Upon a successful login validation, the system will retrieve the user's notification and messages to be displayed via a pop-up on the user interface. The user will now have the ability to Click the Map Menu, Pet Menu, and Settings on the navigation bar. The following features will be available to the Map Menu

- Use Case Diagrams

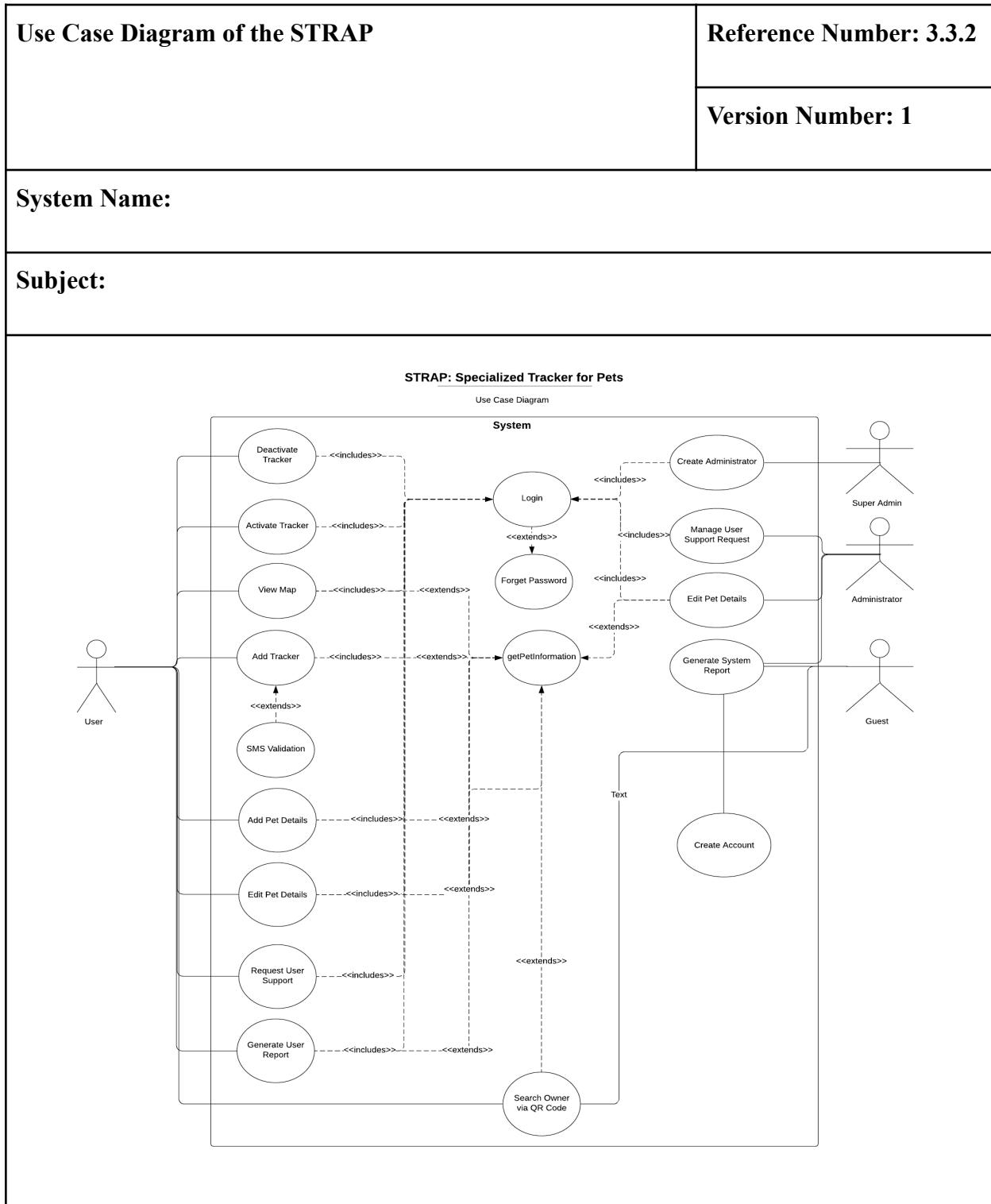


Figure 3.3.2 - Use Case Diagram

The use case diagram is shown in Figure 3.3.2. The super administrator is in control of creating admin accounts. The administrator is responsible for user support and also pet management, moderating the pets for illicit pieces of information. The User has the ability to deactivate the tracker, activate the tracker to show the path to the tracked pet, view a map to display marked pins and the pet's current location, add tracker for adding a new tracker, adding and editing pet details on the pet's profile, request administrator report for problems and lastly access to the search the owner via QR Code. The guest has the ability to also search the Owner as well as creating an account.

- **Use Case Narrative**

Table 3.3.3.1 Create Administrator Account Use Case Narrative

Title:	Create Administrator Account		
Actors:	Super Admin		
Creation Date:	June 17, 2021	Date of Update:	None
Version:	1.0	People-in-Charge:	Dino Gomez
Flow Of Events			
Preconditions	The Super Admin must be logged in.		
Main Success Scenario	<ol style="list-style-type: none"> 1. Super Admin logs in to the system 2. Super Admin fills the user information into the registration form 		

	<p>and ensures that the information is correct.</p> <p>3. Super Admin will activate the administrator account.</p>
Alternative Sequence	None
Error Sequence:	<p>E1: Insufficient Rights</p> <ol style="list-style-type: none"> 1. Login with administrator or lower rights account. 2. Error will come with restricted access error.
Post Condition	None

Table 3.3.3.2 User Support Use Case Narrative

Title:	User Support		
Actors:	Administrator		
Creation Date:	June 17, 2021	Date of Update:	None
Version:	1.0	People-in-Charge:	Dino Gomez
Flow Of Events			
Preconditions	The Administrator must be logged in		
Main Success Scenario	<ol style="list-style-type: none"> 1. The administrator logs in to the system 2. The administrator will select a support ticket in the table. 		

	<p>3. The administrator will add steps to solve the user's problem and await user feedback.</p> <p>4. The user will have to reply and communicate on the support thread.</p> <p>5. The support ticket is resolved.</p>
Alternative Sequence	None
Error Sequence:	<p>E1: Insufficient Rights</p> <ol style="list-style-type: none"> 1. Login with a lower rights account. 2. Error will come with restricted access error. <p>E2: Support Ticket Doesn't Exist</p> <ol style="list-style-type: none"> 1. Enter a support ticket url. 2. Enter a support ticket id. 3. Support ticket does not exist.
Post Condition	The user will close the issue.

Table 3.3.3.3 Edit Pet Details Use Case Narrative

Title:	Edit Pet Detail		
Actors:	Administrator		
Creation Date:	June 17, 2021	Date of Update:	None
Version:	1.0	People-in-Charge:	Dino Gomez
Flow Of Events			
Preconditions	The Administrator must be logged in and a profile report must exist		

Main Success Scenario	<ol style="list-style-type: none"> 1. The administrator logs in to the system 2. The administrator will select a report ticket in the table. 3. The administrator will validate whether the reported profile violates any of the terms of service. 4. The admin will prompt the user for a warning and change details will be requested for the user. 5. The report ticket is resolved.
Alternative Sequence	None
Error Sequence:	<p>E1: Insufficient Rights</p> <ol style="list-style-type: none"> 3. Login with a lower rights account. 4. Error will come with restricted access error. <p>E2: ReportTicket Doesn't Exist</p> <ol style="list-style-type: none"> 4. Enter a report ticket url. 5. Enter a report ticket id. 6. Report ticket does not exist.
Post Condition	The administrator will close the issue. The user will receive an email on the issue.

Table 3.3.3.4 Activate Tracker Use Case Narrative

Title:	Activate Tracker		
Actors:	User		
Creation Date:	June 17, 2021	Date of Update:	None

Version:	1.0	People-in-Charge:	Dino Gomez
Flow Of Events			
Preconditions	The Tracker on the collar must be online.		
Main Success Scenario	1. The user logs in to the system 2. The user goes into the Pet Tab and activates the tracker. 3. The system will show the map trail to the tracked pet from the user's current location.		
Alternative Sequence	None		
Error Sequence:	E1: Tracker Offline 1. Enter Tracker ID 2. Tracker Match 3. Tracker fail to track, Track E2: Invalid Tracker 1. Enter a tracker id. 2. No match for tracker id. 3. Invalid tracker id.		
Post Condition	The system will suggest the user to deactivate the tracker once they are both at the same coordinates.		

Table 3.3.3.5 View Map Use Case Narrative

Title:	View Map		
Actors:	User		
Creation Date:	June 18, 2021	Date of Update:	None
Version:	1.0	People-in-Charge:	Dino Gomez
Flow Of Events			
Preconditions	The user must be logged in.		
Main Success Scenario	1. The user logs in to the system 2. The map is selected 3. The system will load the map along with the following pins and the pet's location.		
Alternative Sequence	None		
Error Sequence:	E1: Not Logged In 1. Enter Map Url 2. Please Login Popup 3. User prompted to login		
Post Condition	None		

- ERD Diagrams

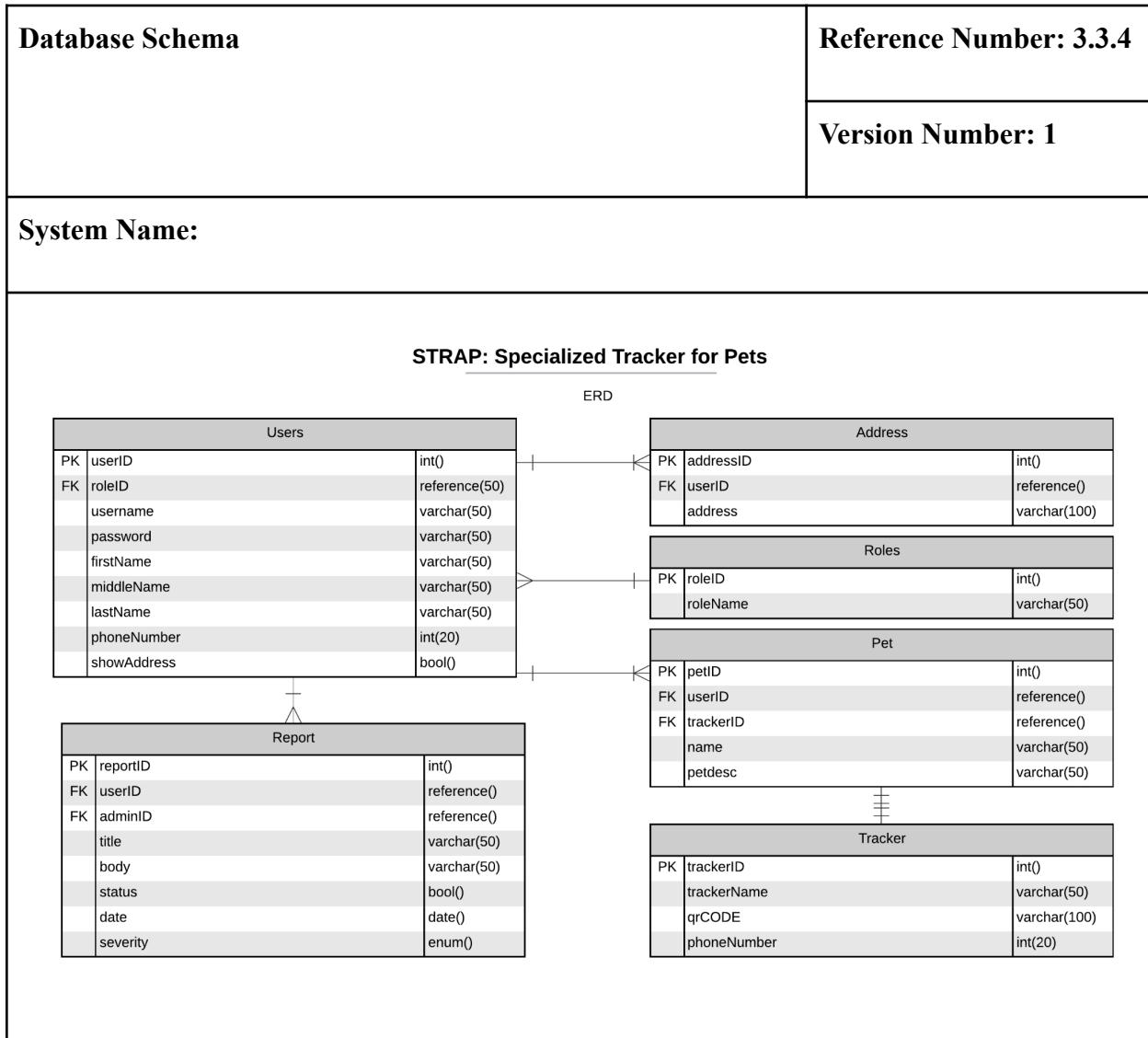


Figure 3.3.4 - STRAP Database Schema

Table 3.3.5 Specialized TRacker for Pets: Users Data Dictionary

Data Dictionary	Reference Number: 3.3.5
	Version Number: 1
System Name: Specialized TRacker for Pets	
Subject: Users	

PK	Field Name	Data Type	Length	Nullable	Default Value	Description
YES	userID	int	0	NO	Auto Increment	Primary Key
NO	roleID	reference	50	NO	“”	Role Foreign Key
NO	username	varchar	50	NO	“”	Username
NO	password	varchar	50	NO	“”	Password
NO	firstName	varchar	50	NO	“”	User first name
NO	middleName	varchar	50	NO	“”	User middle name
NO	lastName	varchar	50	NO	“”	User last name
NO	phoneNumber	int	20	NO	“”	User phone number
NO	showAddress	bool	0	NO	“”	Boolean Address

Table 3.3.6 Specialized TRAcker for Pets: Report Data Dictionary

Data Dictionary		Reference Number: 3.3.6
		Version Number: 1
System Name: Specialized TRAcker for Pets		
Subject: Report		

PK	Field Name	Data Type	Length	Nullable	Default Value	Description
YES	reportID	int	0	NO	Auto Increment	Primary Key
NO	userID	reference	0	NO	“”	User FK
NO	adminID	reference	0	NO	“”	Admin FK
NO	title	varchar	50	NO	“”	Report title
NO	body	varchar	50	NO	“”	Report text body
NO	status	bool	0	NO	“”	Report current status
NO	date	date	0	NO	“”	Report Date
NO	severity	enum	0	NO	“”	Report Severity

Table 3.3.7 Specialized TRAcker for Pets: Address Data Dictionary

Data Dictionary	Reference Number: 3.3.7
	Version Number: 1
System Name: Specialized TRAcker for Pets	
Subject: Address	

PK	Field Name	Data Type	Length	Nullable	Default Value	Description
YES	addressID	int	0	NO	Auto Increment	Primary Key
NO	userID	reference	0	NO	“”	User FK
NO	address	varchar	100	NO	“”	User address

Table 3.3.8 Specialized TRacker for Pets: Roles Data Dictionary

Data Dictionary		Reference Number: 3.3.8
		Version Number: 1
System Name: Specialized TRacker for Pets		
Subject: Roles		

PK	Field Name	Data Type	Length	Nullable	Default Value	Description
YES	roleID	int	0	NO	Auto Increment	Primary Key
NO	roleName	varchar	50	NO	“”	Role Name

Table 3.3.9 Specialized TRacker for Pets: Pet Data Dictionary

Data Dictionary		Reference Number: 3.3.9
		Version Number: 1
System Name: Specialized TRacker for Pets		
Subject: Pet		

PK	Field Name	Data Type	Length	Nullable	Default Value	Description
YES	petID	int	0	NO	Auto	Primary Key

					Increment	
NO	userID	reference	0	NO	“”	User FK
NO	trackerID	reference	0	NO	“”	Tracker FK
NO	name	varchar	50	NO	“”	Pet Name
NO	petDesc	varchar	50	NO	“”	Pet Description

Table 3.3.10 Specialized TRAcker for Pets: Tracker Data Dictionary

Data Dictionary	Reference Number: 3.3.10
	Version Number: 1
System Name: Specialized TRAcker for Pets	
Subject: Tracker	

PK	Field Name	Data Type	Length	Nullable	Default Value	Description
YES	trackerID	int	0	NO	Auto Increment	Primary Key
NO	trackerName	varchar	50	NO	“”	Tracker Name
NO	qrCODE	varchar	100	NO	“”	Tracker QR Code

3.4 Development Plan

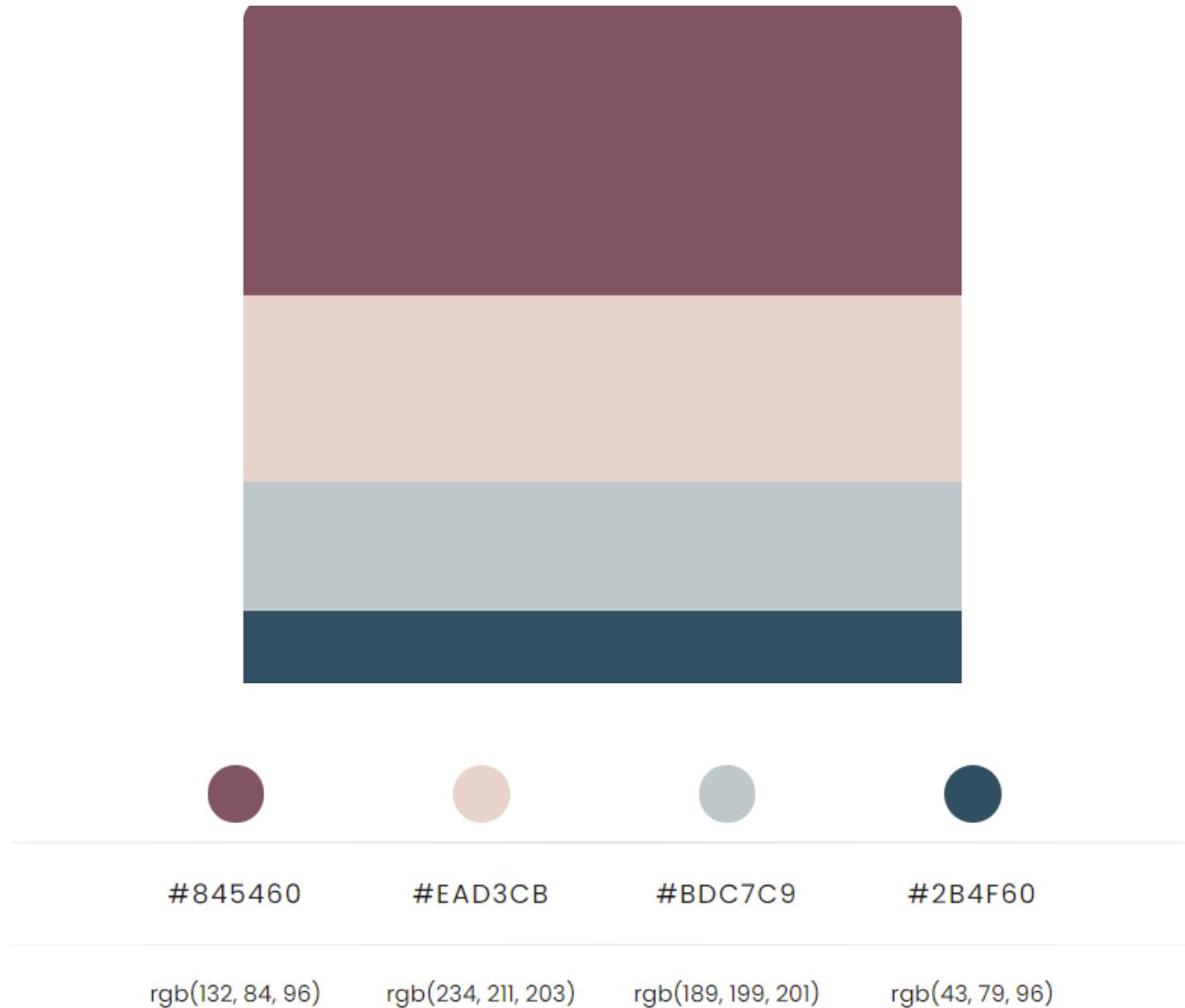
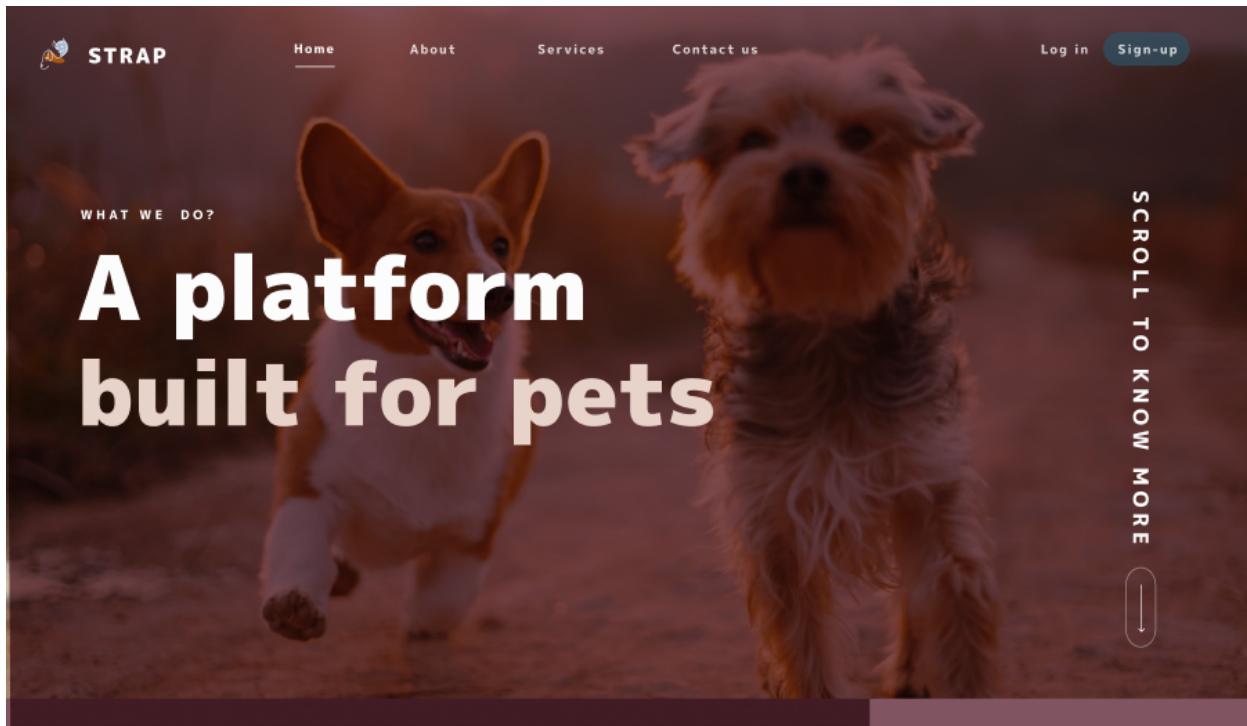


Figure 3.4.1 Color Palette for Website



STRAP

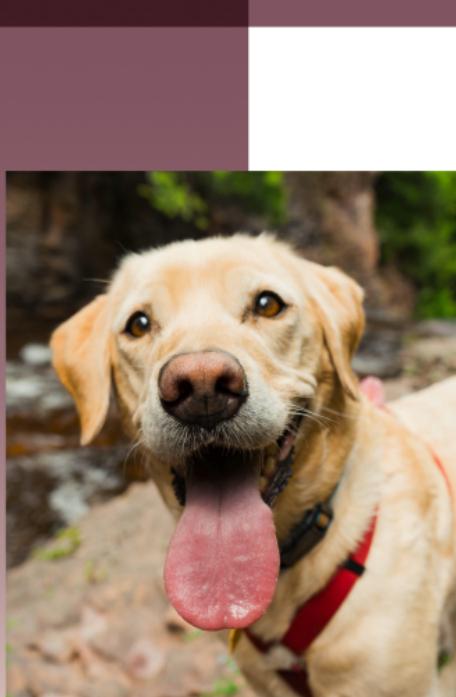
Home About Services Contact us Log in Sign-up

WHAT WE DO?

A platform built for pets

SCROLL TO KNOW MORE

↓



ABOUT US

Specialized TRacker for Pets (STRAP)

It aims to provide real-time data location to the pets of the owner by using a Global Positioning System (GPS) collars.

Also, its' a platform for pet owners to store their pet's identification information.

LEARN MORE

BUILT FOR PETS

YELLOW LABRADOR RETRIEVER WITH TONGUE OUT BY LUCAS LUDWIG

STRAP'S OBJECTIVES

GPS Collar
To build a GPS collar using Arduino for real-time data location of the pets.

Web Application
To create a web application that stores the pet's identification information.

Quick Response (QR) code
To allow users to access the pet's personal information using a Quick Response (QR) code from the specialized collar.

[LEARN MORE](#)

STRAP
aims to provide real-time data location to the pets of the owner by using a Global Positioning System (GPS) collars.

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Figure 3.4.2 Main Page

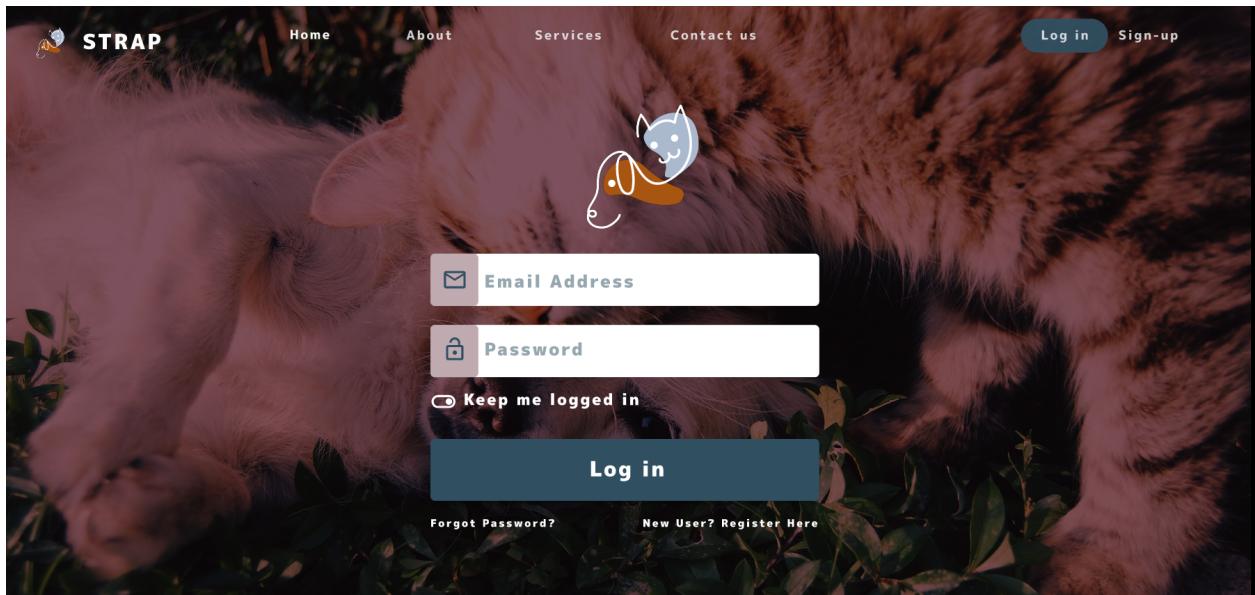


Figure 3.4.3 Log-in Page

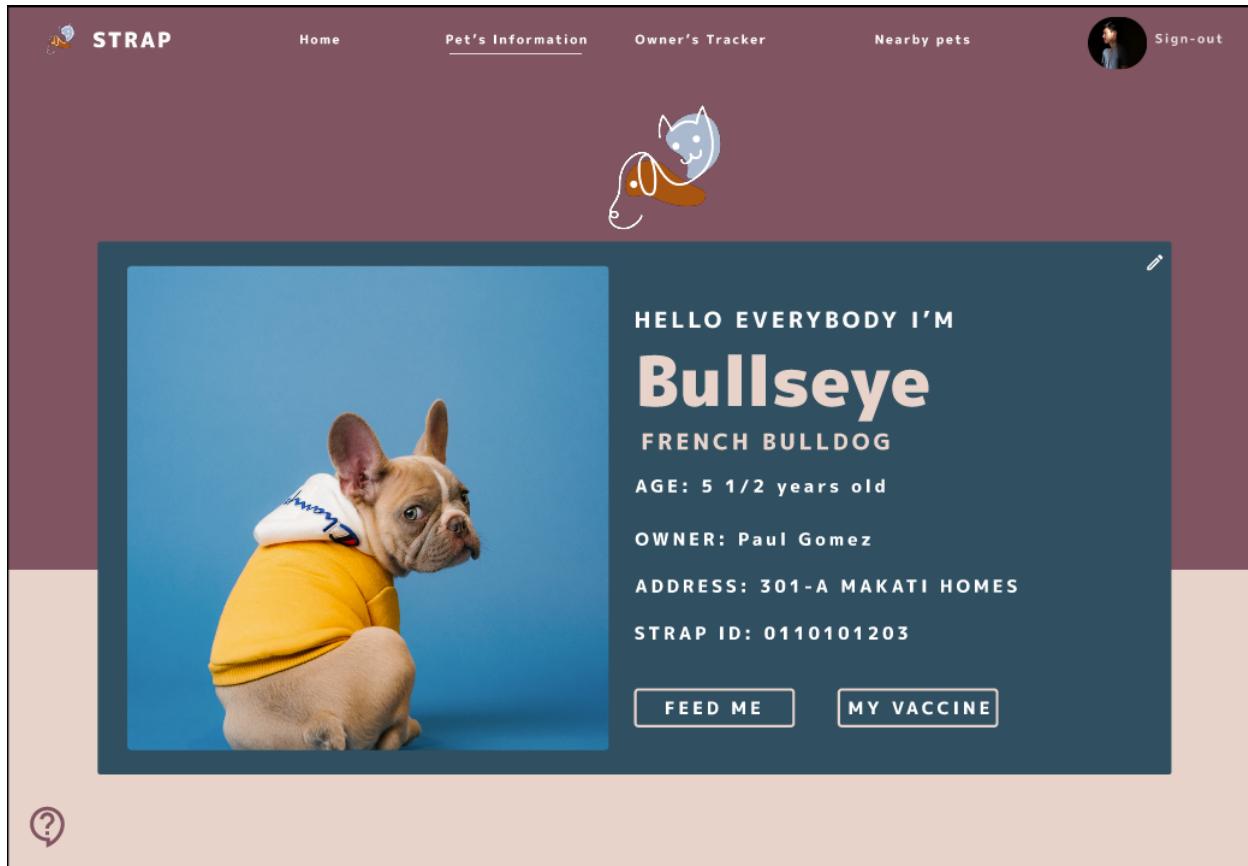


Figure 3.4.4 Pet's Information Page

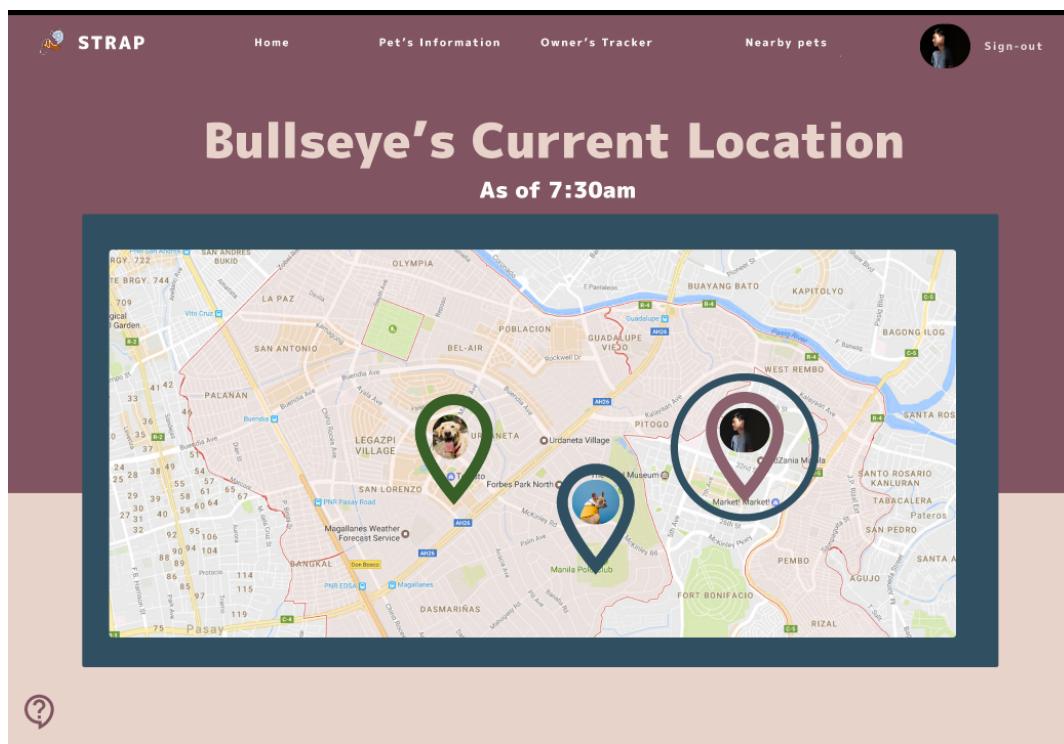


Figure 3.4.5 Pet's Geo Location Page

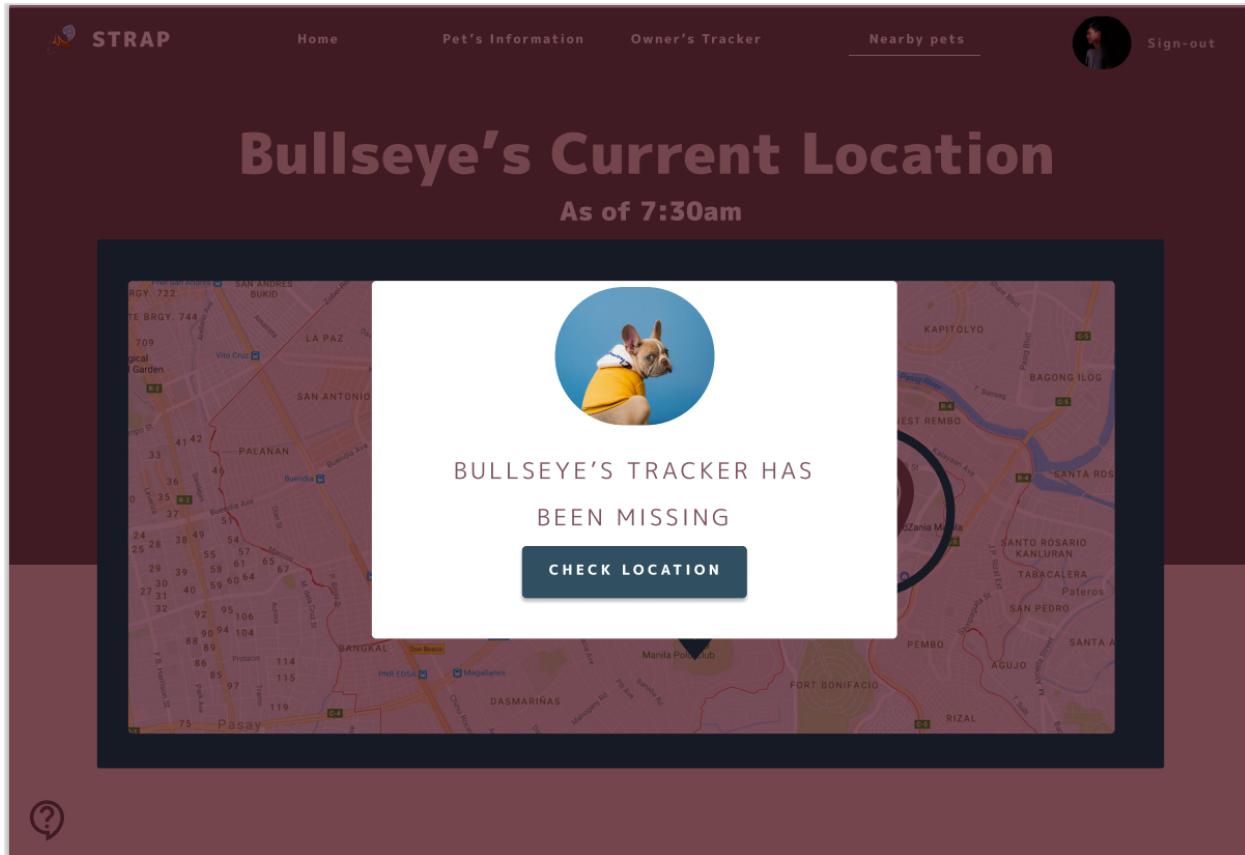


Figure 3.4.6 Missing Notification Page

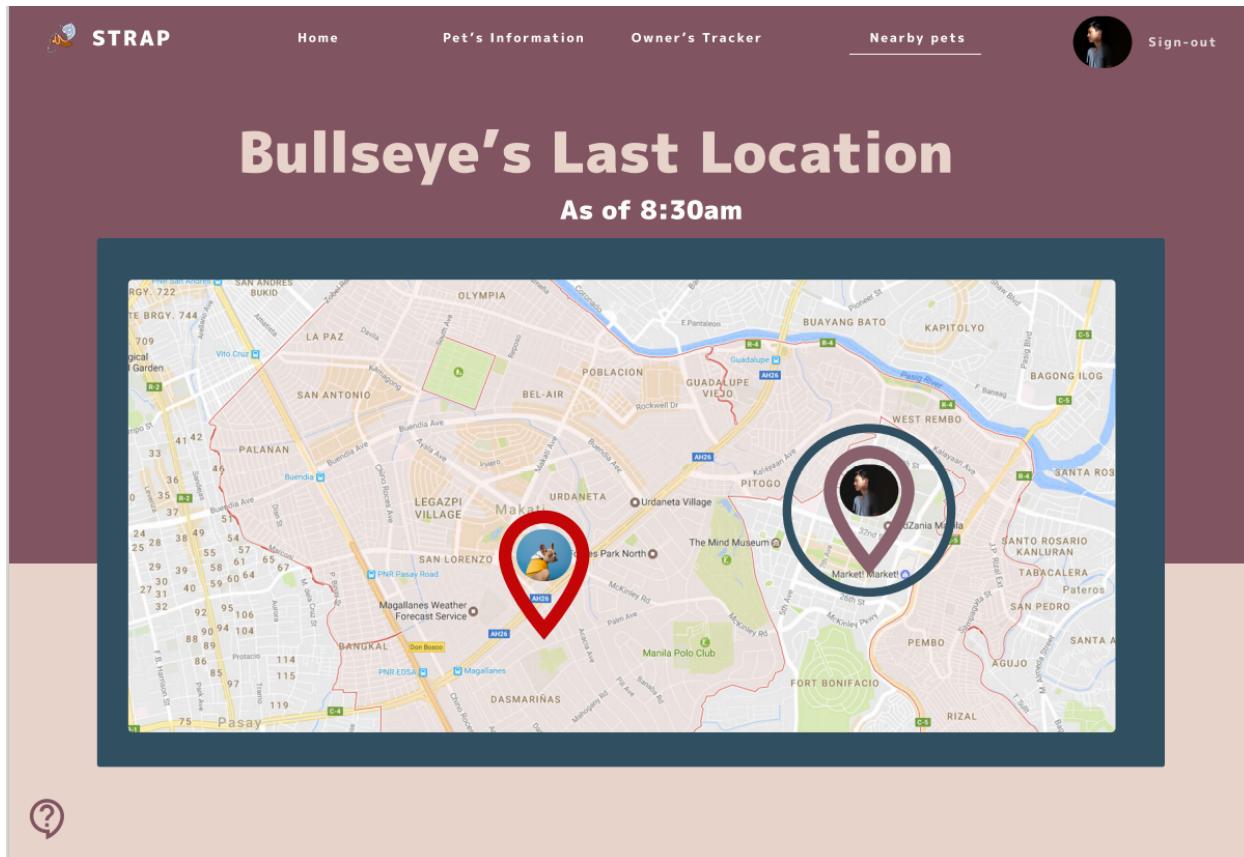


Figure 3.4.7 Last Location Page

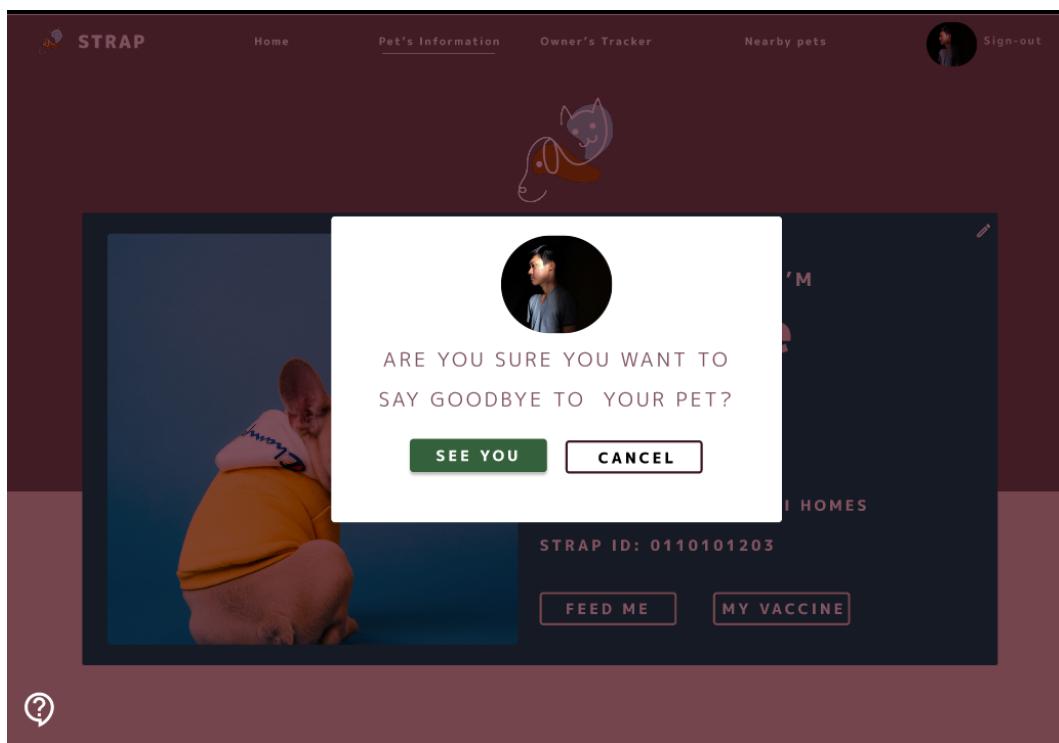


Figure 3.4.6 Log-out Page

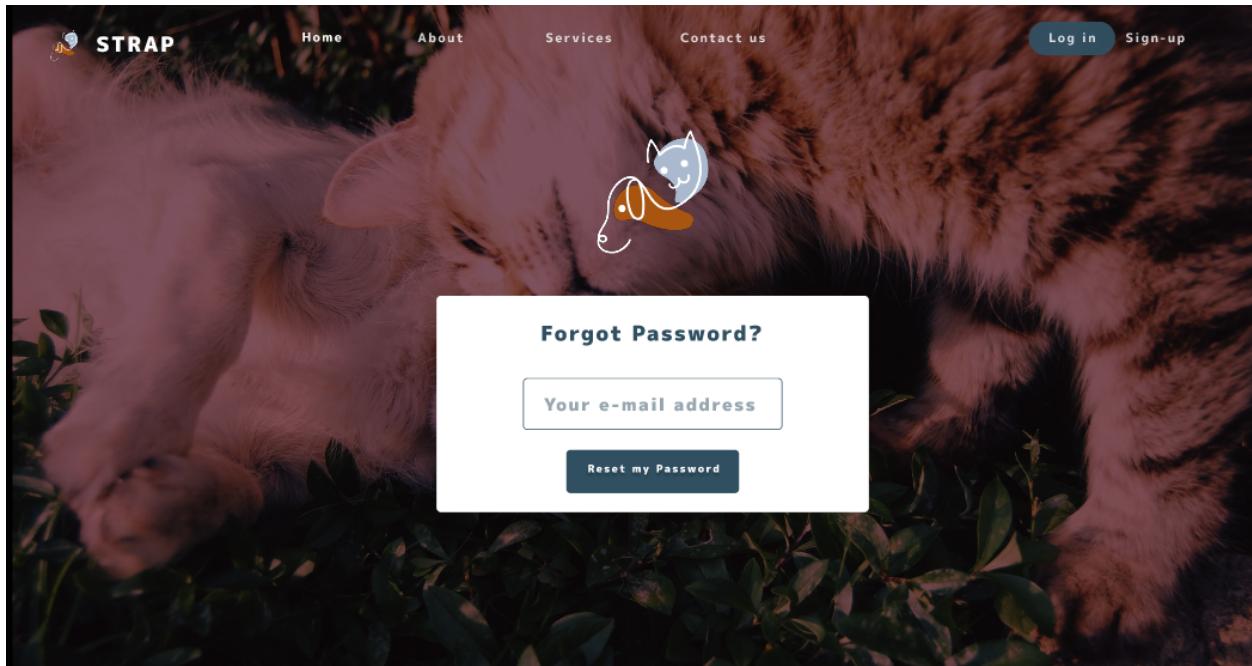


Figure 3.4.7 Forgot Password Page

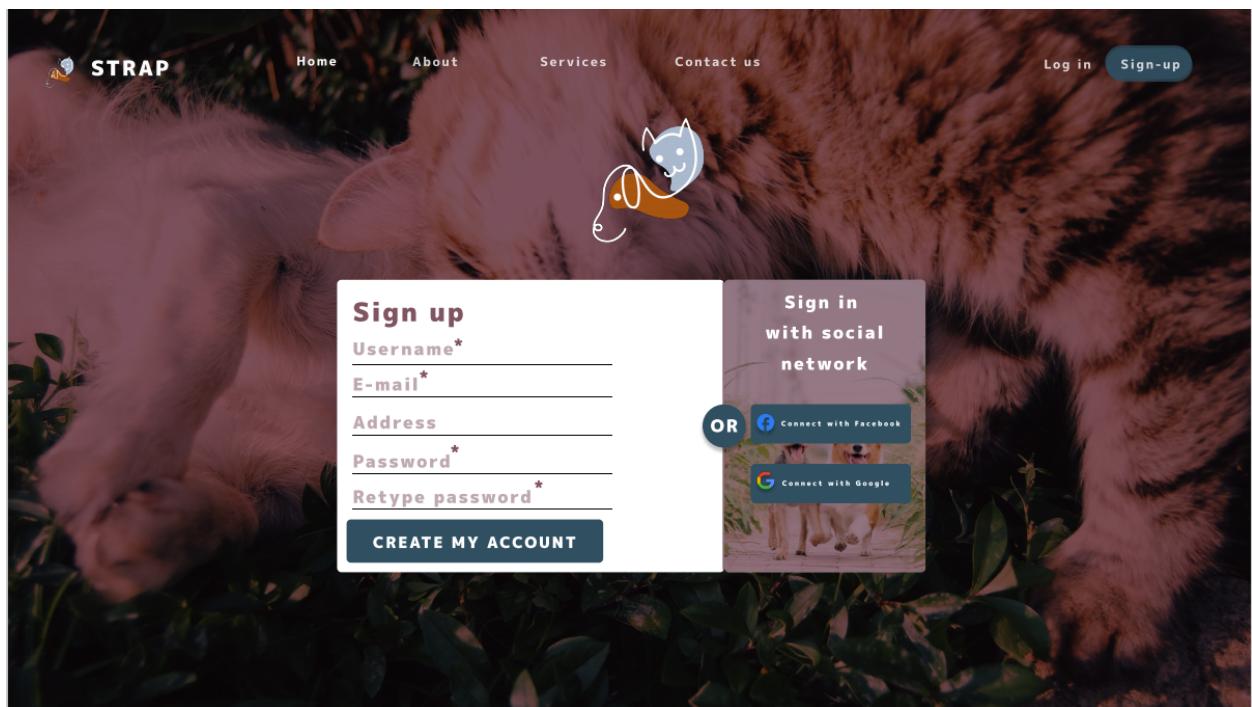


Figure 3.4.8 Sign-up Page

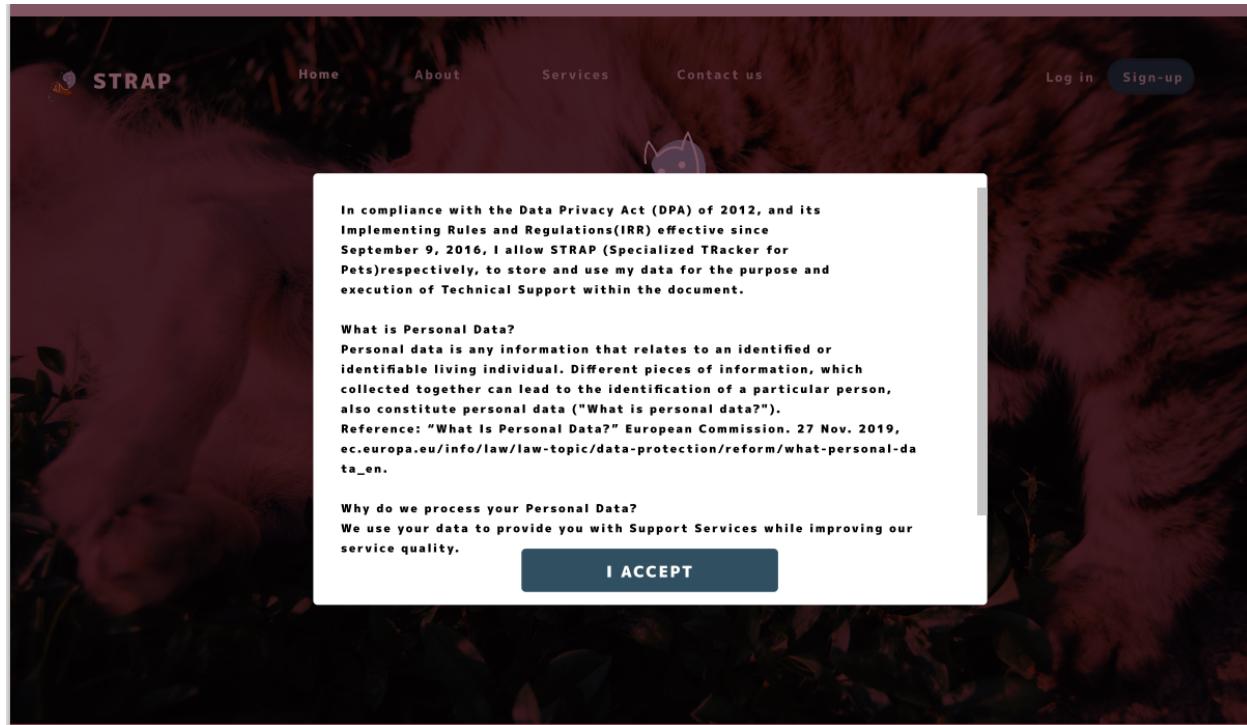


Figure 3.4.9 Data Privacy Page

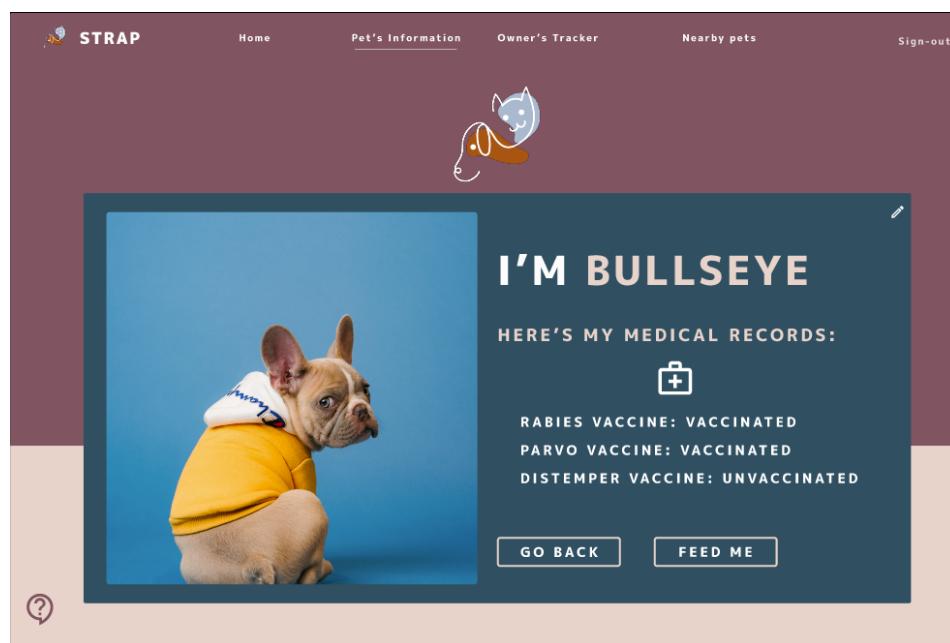


Figure 3.4.10 Medical Records Page

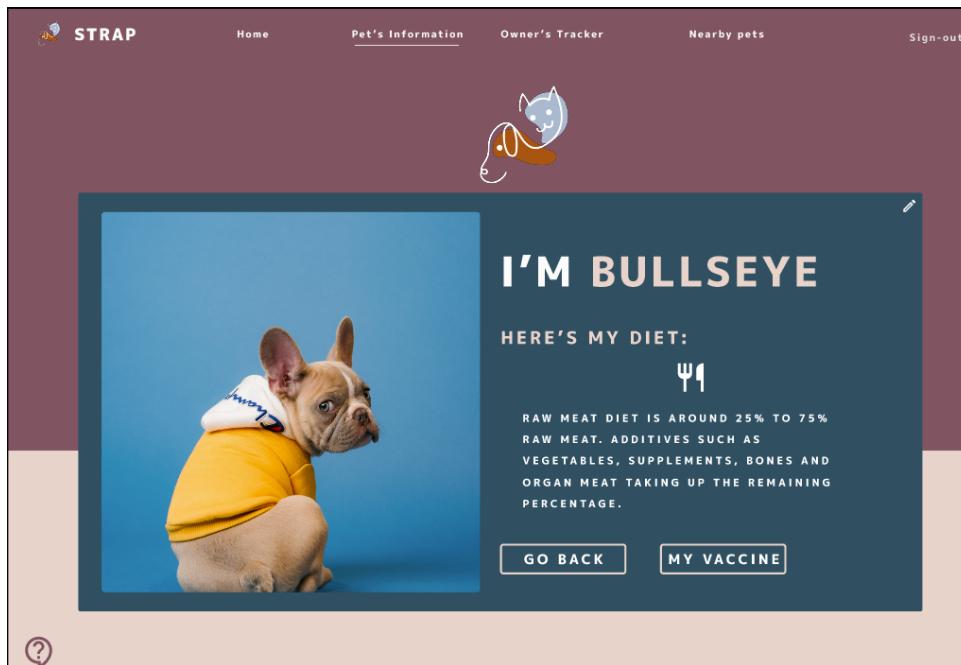


Figure 3.4.11 Diets Page

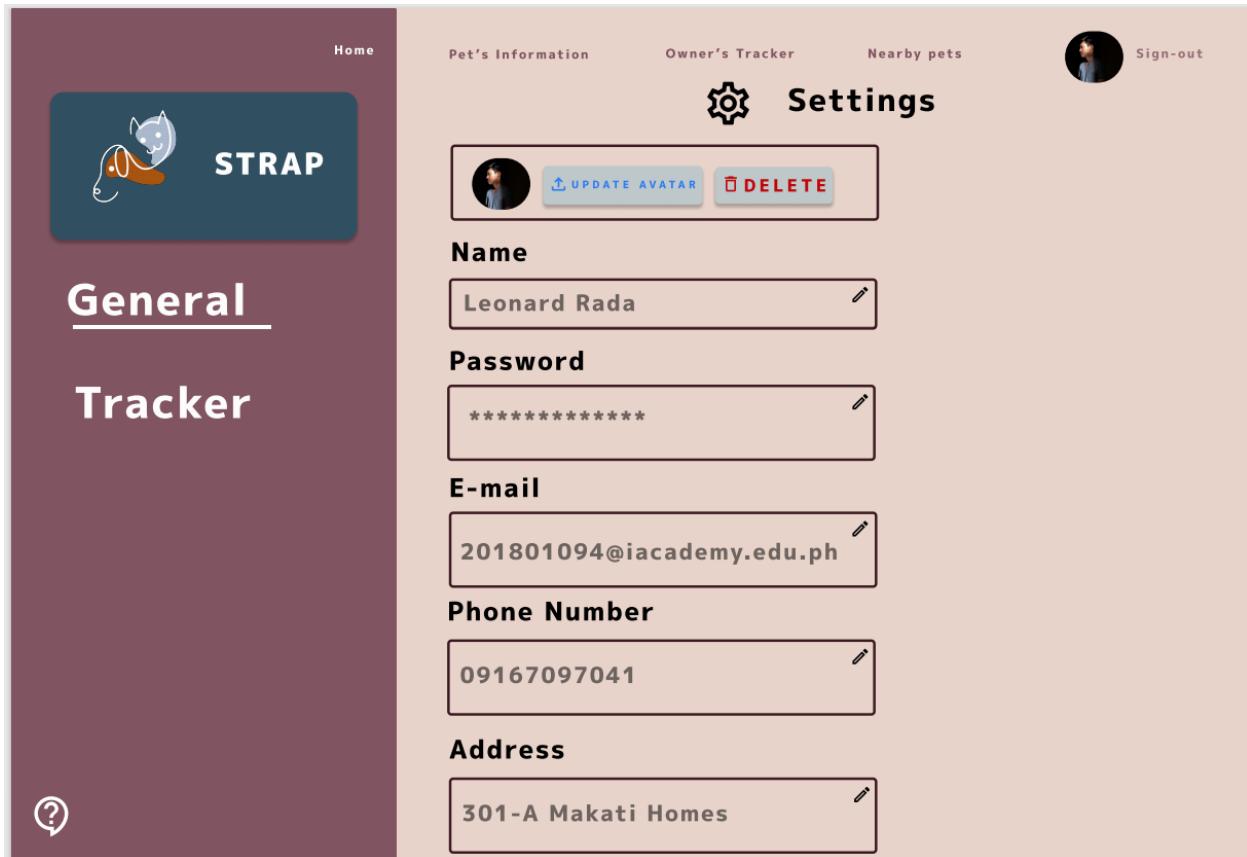


Figure 3.4.12 General Settings Page

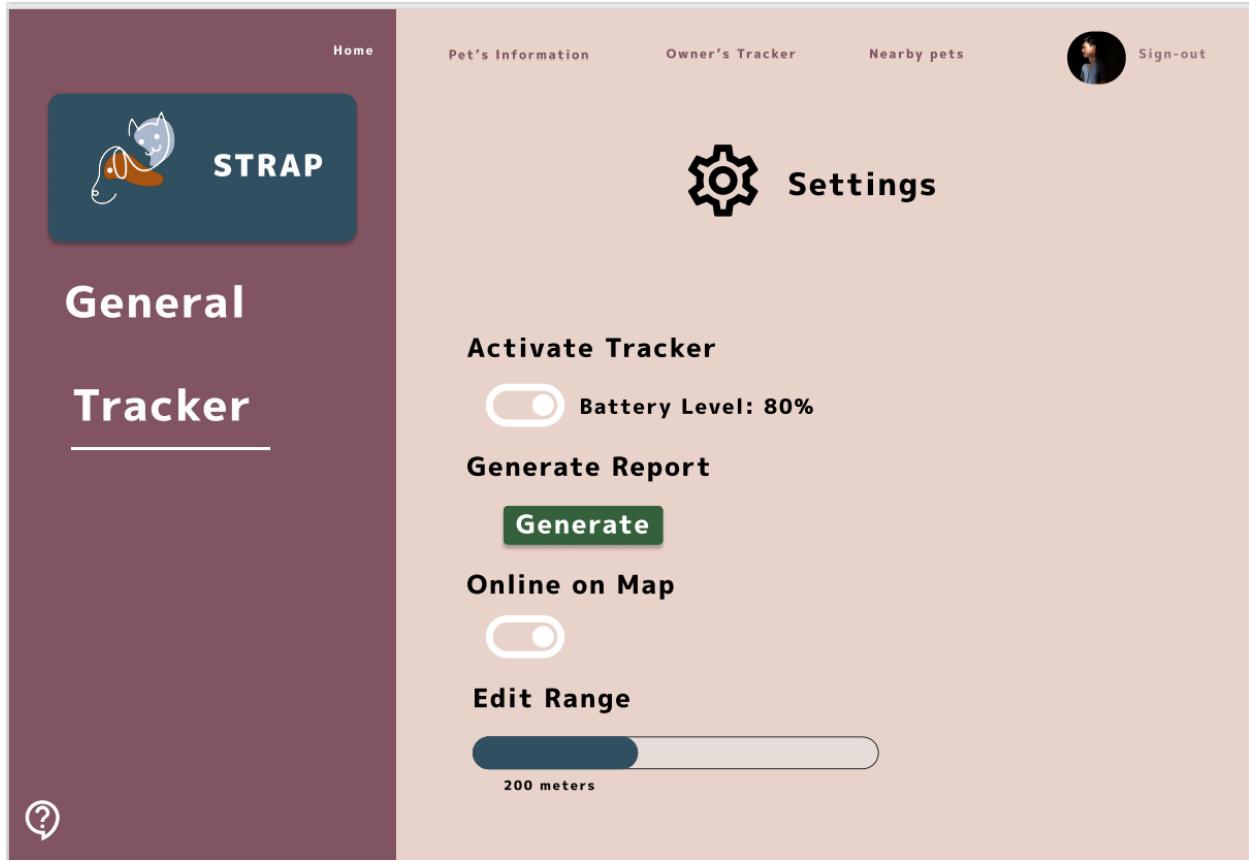


Figure 3.4.13 Tracker Settings Page

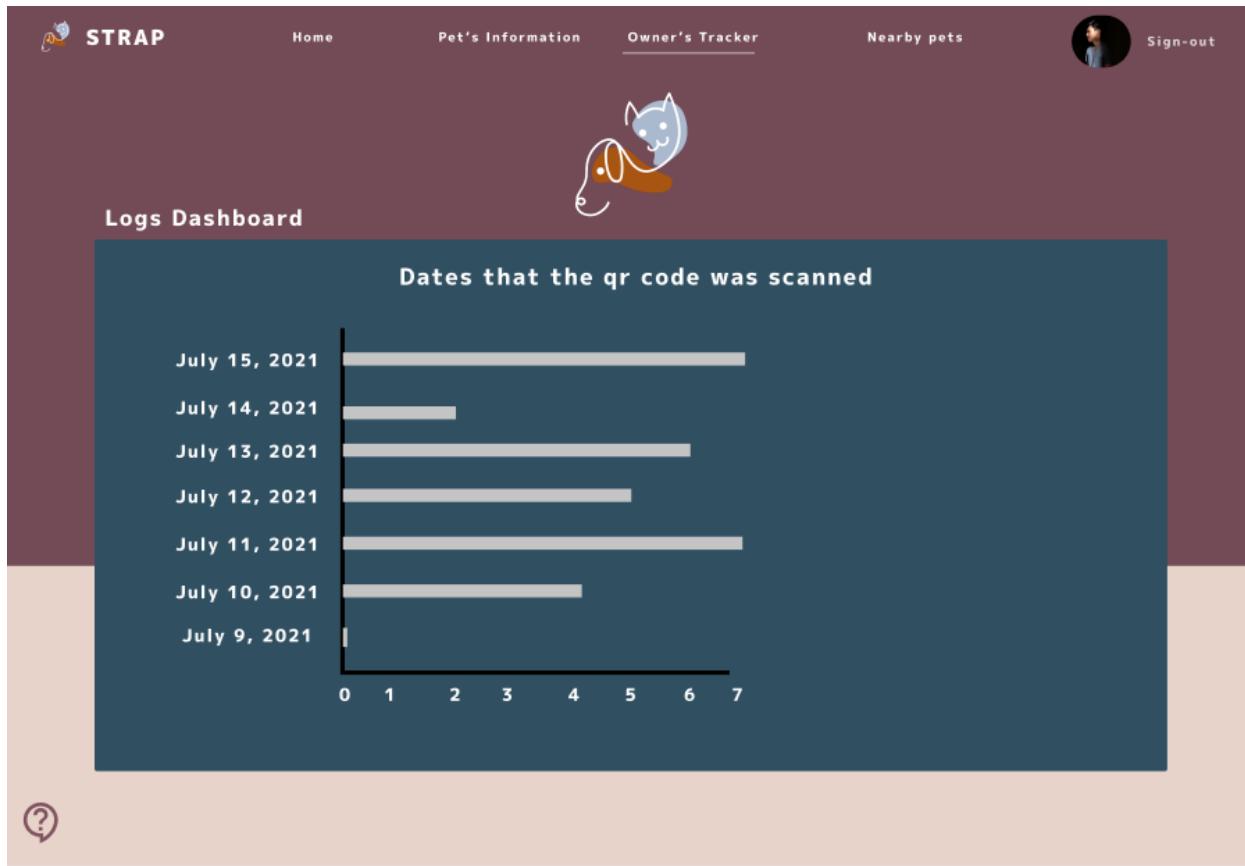


Figure 3.4.14 Owner Trackers Logs Dashboard Page

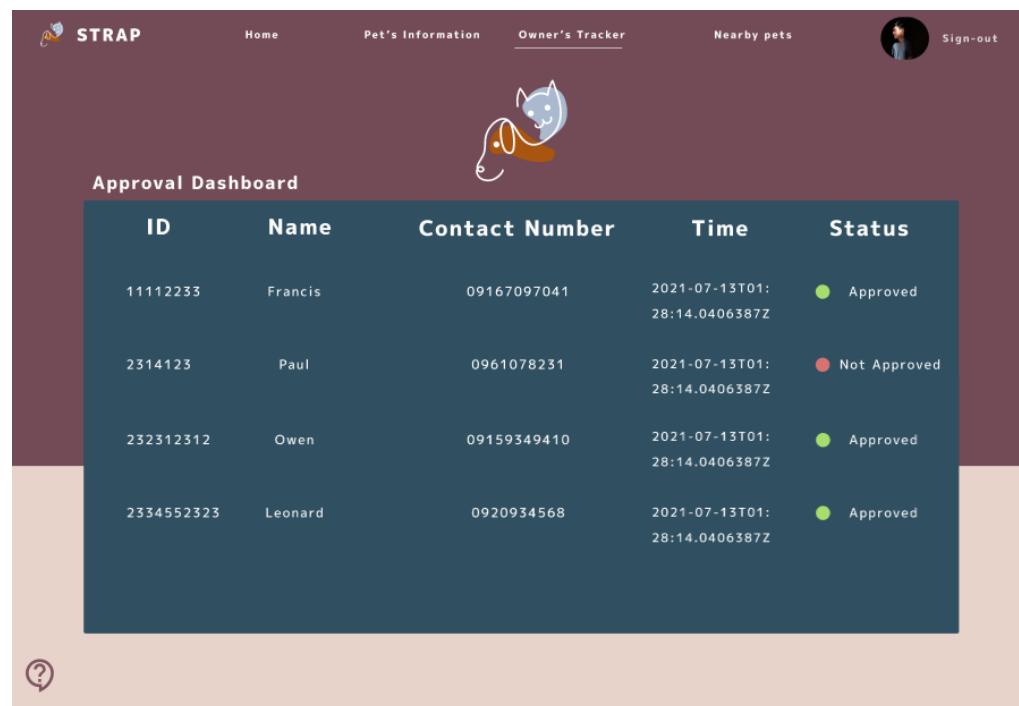


Figure 3.4.15 Owner Trackers Approval Dashboard Page

ID	Name	Status
11112233	Francis	Approved
2314123	Paul	Not Approved
232312312	Owen	Approved
2334552323	Leonard	Approved

A NEW USER SCANNED YOUR PET'S QR CODE

Name: **Hadwin**

Contact Information:
09994567123

ACCEPT **DECLINE**

Figure 3.4.15 Scanned QR Code Owners Page

3.5 Test Plan

Table 3.5.1 - Test Case:Check if User is Able to Activate a New Tracker

Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	A1	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on “Add Tracker” 5. Input Tracker details on required fields (correct details) 	Devices are successfully paired and new STRAP is added	
	A2	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on “Add Tracker” 5. Input Tracker details on required fields (incorrect details) 	Devices cannot be paired due to incorrect tracker details	
	A3	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP 2. Open the STRAP web application 3. Log in (incorrect credentials) 4. Click on “Add Tracker” 5. Input Tracker details on required fields (incorrect details) 	Devices cannot be paired due to incorrect log in details	

Table 3.5.2 - Test Case:Check if User Can Connect Web Application to STRAP

Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	B1	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP 2. Open the STRAP web application. 3. Log in (correct credentials) 4. Click on “Pets” 5. Detect and connect STRAP Arduino board 	STRAP Arduino and STRAP application are successfully connected	
	B2	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP 2. Open the STRAP web application 3. Log in (incorrect credentials) 	STRAP Arduino cannot connect to the STRAP application due to incorrect credentials	
	B3	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP 2. Open the STRAP web application. 3. Log in (correct credentials) 4. Click on “Pets” 5. Detect and connect STRAP Arduino board (STRAP is not activated) 	STRAP Arduino cannot connect to the STRAP application due to it not being activated and cannot be detected.	

Table 3.5.3 - Test Case: Check if STRAP Web Application Can Scan QR Code and View Pet Profile

Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	C1	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (activated) 2. Open any QR scanner application 3. Scan QR code on collar 	Scan is successful and the pet profile is viewed on the web application upon authorization of the owner.	
	C2	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (unactivated) 2. Open any QR scanner application 3. Scan QR code on collar 	Scan is not successful as STRAP is unactivated.	

Table 3.5.4 - Test Case: Check if STRAP Will Notify User if Pet Exceeds a 200 Meter Distance

Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	D1	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (correct credentials) 4. Move STRAP Arduino away from the STRAP application greater than 200 meters 	Push notification sent to user and alarm is turned on	
	D2	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (unactivated) 2. Open the STRAP web application 3. Log in (correct credentials) 	No notification or alarm sent as STRAP is not activated.	

		<p>credentials)</p> <p>4. Move STRAP Arduino away from the STRAP</p>		
	D3	<p>1. Turn on Arduino for STRAP (activated)</p> <p>2. Open the STRAP web application</p> <p>3. Log in (incorrect credentials)</p> <p>4. Move STRAP Arduino away from the STRAP</p>	No notification or alarm sent as the user is not logged in to the application due to incorrect credentials.	

Table 3.5.5 - Test Case:Check if User Can View GPS Location of STRAP Using the Application

Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	E1	<p>1. Turn on Arduino for STRAP (activated)</p> <p>2. Open the STRAP web application</p> <p>3. Log in (correct credentials)</p> <p>4. Click on “Map”</p>	Live feed of the GPS location for STRAP is viewed on the map feature of the application	
	E2	<p>1. Turn on Arduino for STRAP (activated)</p> <p>2. Open the STRAP web application</p> <p>3. Log in (incorrect credentials)</p> <p>4. Click on “Map”</p>	Improper login credentials prevent user from accessing the application features	
	E3	<p>1. Turn on Arduino for STRAP (activated)</p> <p>2. Open the STRAP web application</p> <p>3. Log in (correct credentials)</p> <p>4. Turn on another Arduino for STRAP (separate</p>	Live feed of both STRAP GPS location is viewed on the Map feature	

		activated STRAP collar) 5. Click on “ <i>Map</i> ”		
	E4	1. Turn on Arduino for STRAP 2. Open the STRAP web application 3. Log in (correct credentials) 4. Turn on another Arduino for STRAP (separate unactivated STRAP collar) 5. Click on “ <i>Map</i> ”	Live feed for only one STRAP collar is viewed as the other collar is not activated.	

Table 3.5.6 - Test Case:Check if User Can View Pet's Profile on the Web Application

Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	F1	1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on “ <i>Profile</i> ”	Pet's profile and information is viewed on the STRAP application	
	F2	1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (incorrect credentials) 4. Click on “ <i>Profile</i> ”	Profile feature is not accessed due to incorrect credentials on login.	
	F3	1. Turn on Arduino for STRAP (unactivated) 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on “ <i>Profile</i> ”	Pet's profile is blank as there is no STRAP detected and connected to the application	

Table 3.5.7 - Test Case:Check if User Can Edit Pet's Profile on the Web Application

Test Case: check if user can edit pet's profile on the web application				
Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	G1	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on "Profile" 5. Click on "Edit" 	Users are able to view and edit pet's profile on the web application	
	G2	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (incorrect credentials) 4. Click on "Profile" 5. Click on "Edit" 	Users are unable to access the features due to incorrect login details.	
	G3	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (unactivated) 2. Open the STRAP web application 3. Log in (incorrect credentials) 4. Click on "Profile" 5. Click on "Edit" 	Users are not able to edit the profile for this specific STRAP device as it is not activated and cannot be connected to the application.	
	G4	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on "Profile" (no profile for any pet created) 	The user is not able to edit as there is no profile available to edit.	

		5. Click on “ Edit ”		
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Table 3.5.8 - Test Case:Check if User Can Add Pet Profile for Newly Activated STRAP Collar

Test Case: check if user can add pet profile for newly activated STRAP collar				
Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	H1	1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on “ Profile ”	STRAP detects newly activated collar and asks user to create pet profile on click of “ Profile ”	
	H2	1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (incorrect credentials) 4. Click on “ Profile ”	Users cannot access the application due to incorrect credentials	
	H3	1. Turn on Arduino for STRAP (unactivated) 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on “ Profile ”	Users cannot add a profile as no STRAP collar is activated and detected by the application.	

Table 3.5.9 - Test Case:Check if User Can Customize the Safe Zone Range of 200 meters for
STRAP

Test Case: check if user can customize the range of 200 meters for STRAP				
Date	Test Case	Steps to Reproduce	Expected Result	Actual Result
	I1	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (correct credentials) 4. Click on “Map” 5. Click on “Safe Area” 6. Adjust the safe area from 200 meters to a specific distance. 	Users are able to adjust the set safe zone area from 200 meters to any specific distance they choose.	
	I2	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (activated) 2. Open the STRAP web application 3. Log in (incorrect credentials) 4. Click on “Map” 5. Click on “Safe Area” 6. Adjust the safe area from 200 meters to a specific distance. 	Users are not able to adjust the safe zone as the credentials entered are incorrect	
	I3	<ol style="list-style-type: none"> 1. Turn on Arduino for STRAP (unactivated) 2. Open the STRAP web application 3. Log in (incorrect credentials) 4. Click on “Map” 5. Click on “Safe Area” 6. Adjust the safe area from 200 meters to a specific distance. 	Users cannot view any STRAP device as the STRAP device is not connected and activated to the web app.	

3.6 Implementation Plan

3.6.1 Hardware Specifications

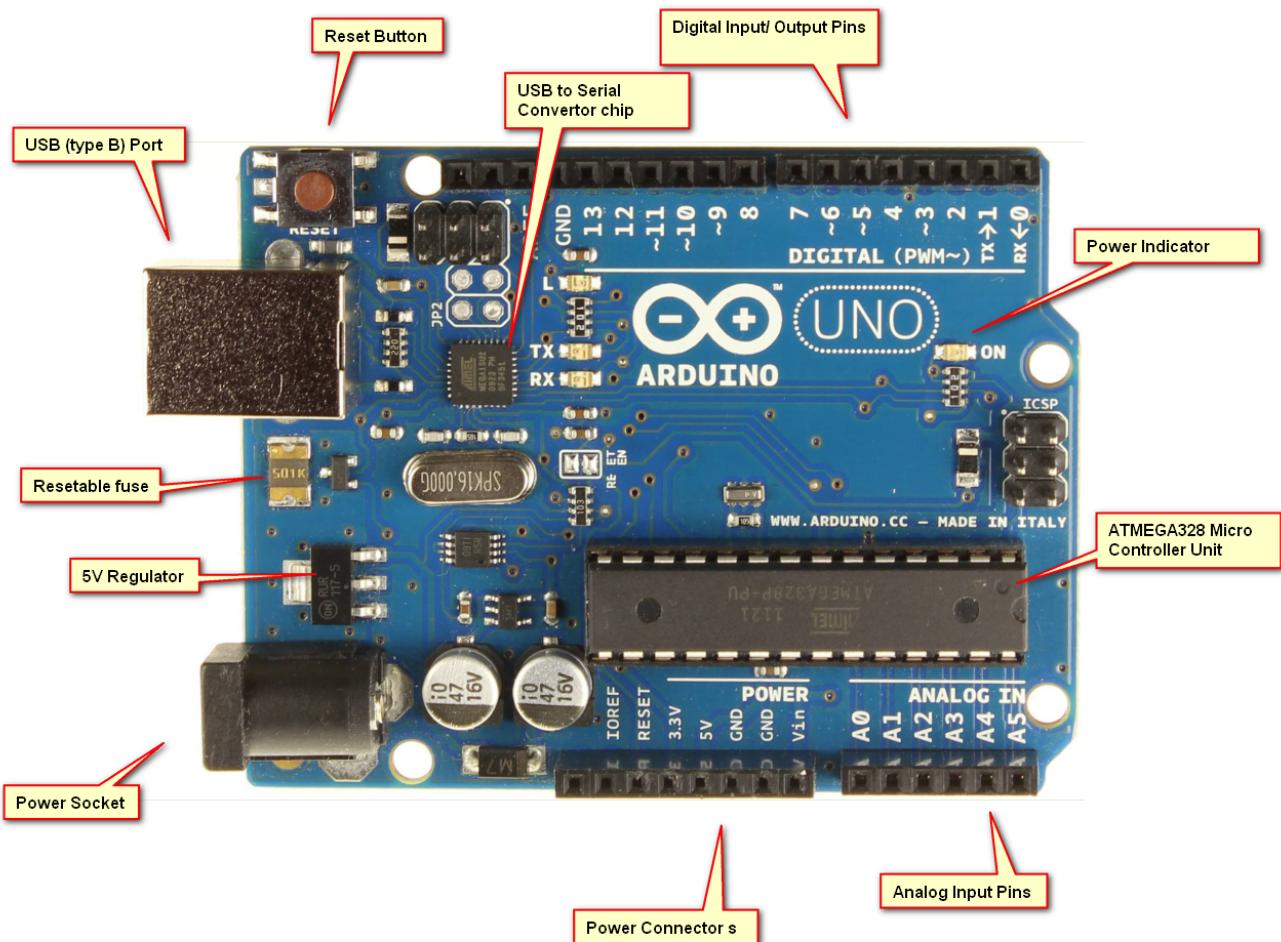
Arduino UNO

Arduino/Genuino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller

Table 3.6.1 Arduino UNO Technical Specifications

	Technical Specification
Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA

DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz



Arduino Shield GSM SIM900

GSM SIM900 is a dual-band GSM/GPRS engine that works on frequencies EGSM 900MHz and DCS 1800MHz. SIM900A features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

Table 3.6.2 Arduino Shield GSM SIM900 Technical Specifications

	Technical Specification
Power Supply	Single Supply Voltage 3.4V - 4.5V
Power Saving	Typical power consumption in SLEEP mode is 1.5mA
Frequency Bands	<ul style="list-style-type: none">• SIM900 Dual-Band: EGSM900, DCS1800. The SIM900 can search the 2 frequency bands automatically. The frequency bands can also be set by the AT command.• Compliant to GSM Phase 2/2+
GSM Class	Small MS
Transmitting Power	<ul style="list-style-type: none">• Class 4 (2W) at EGSM 900• Class 1 (1W) at DCS 1800

GPRS Connectivity

- GPRS multi-slot class 10 (default)
- GPRS multi-slot class 8 (option)
- GPRS mobile station class B



NEO-6M GPS Module

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. In order to monitor the status of the module, it can be done using the power and signal indicators. The module can save the data when the main power shuts down accidentally thanks to its data backup battery.

Table 3.6.3 NEO-6M GPS Module Pin Configuration and Technical Specifications

Pin Configuration	
Vcc	Power Supply
TX	UART Transmit pin
RX	UART Receiver pin
GND	Ground

Technical Specification	
Operating Voltage	3v - 3.6v
Communication	UART
Default Baud Rate	9600 bits/sec

Signal indicator	LED(Blue/ Red)
Time-To-First-fix	Cold Start 32s, For Warm Start 23s, For Hot Start <1s
Battery Backup	Yes
EEPROM	Yes
Operating Temperature Range	-40°C to 85°C
Maximum Navigation Update Rate	5 Hz
Tracking & Navigation(Sensitivity)	-160 dBm
NMEA – Protocol	Input/output, ASCII, 0183, 2.3 (Compatible to 3.0)
UBX - Protocol	Input/output, binary, u-blox proprietary
DC Current Through any Digital I/O pin (Except Supplies)	10ma
Max. Supply current(Power Requirement)	67ma



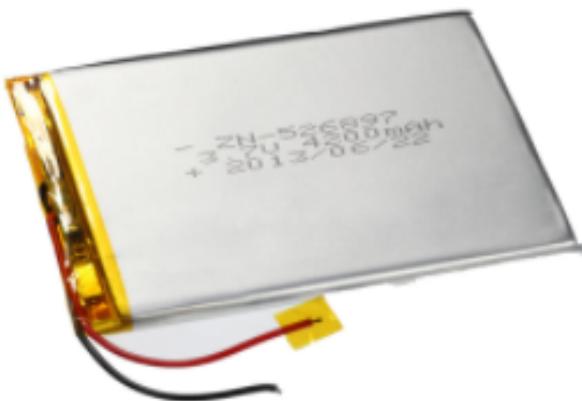
LiPo Battery 3.7V 4000mAh

The LP945170 3.7V 4000mAh is a Lithium Polymer Battery (LiPo) that uses a polymer electrolyte. This new type of battery is now being used in wearable devices, medical devices, radio controlled equipment, personal electronics, and electric vehicles.

Table 3.6.4 LiPo Battery 3.7V 4000mAh Technical Specifications

Technical Specification	
Battery Type	Rechargeable LiPo Battery
Model	LP945170, 945170
Nominal Voltage	3.7V
Capacity	4000mAh
Size	9.4mm x 51.0mm x 70.0mm
Protection circuit module(PCM)	Yes
Thermistor(NTC)	No
Connector	Yes
Configuration	1S1P
Weight	80g
Wat-Hou Rating:	14.8Wh
Max. Operating Voltage Range:	2.75V to 4.2V

Max. Charge Voltage:	4.2V±50mV
Max. Charge Current:	2000mA
Max. Continuous Discharge Current:	3000mA
Discharge Cut-off	2.75V
Internal Impedance:	<200mΩ
Expected Cycle Life	500 cycles ≥ 80%



3.6.2 Software Specification

Microsoft Visual Studio

Visual Studio is an Integrated Development Environment(IDE) from Microsoft and it is used to develop computer programs, websites, web applications, web services, and mobile applications. It has a built-in languages such as C, C++/CLI, Visual Basic, .NET, C#, F#, JavaScript, TypeScript, XML, XSLT, HTML, and CSS.

Table 3.6.5 Microsoft Visual Studio Specifications

	Technical Specification(Minimum Requirements)
Supported Operating Systems	<p>Visual Studio 2019 will install and run on the following operating systems (64 bit recommended; ARM is not supported):</p> <ul style="list-style-type: none">● Windows 10 version 1703 or higher: Home, Professional, Education, and Enterprise (LTSC and S are not supported)● Windows Server 2019: Standard and Datacenter● Windows Server 2016: Standard and Datacenter● Windows 8.1 (with Update

	<p>2919355): Core, Professional, and Enterprise</p> <ul style="list-style-type: none"> • Windows Server 2012 R2 (with Update 2919355): Essentials, Standard, Datacenter • Windows 7 SP1 (with latest Windows Updates): Home Premium, Professional, Enterprise, Ultimate
Hardware	<ul style="list-style-type: none"> • 1.8 GHz or faster processor. Quad-core or better recommended • 2 GB of RAM; 8 GB of RAM recommended (2.5 GB minimum if running on a virtual machine) • Hard disk space: Minimum of 800MB up to 210 GB of available space, depending on features installed; typical installations require 20-50 GB of free space. • Hard disk speed: to improve performance, install Windows and Visual Studio on a solid state drive

	<p>(SSD).</p> <ul style="list-style-type: none"> • Video card that supports a minimum display resolution of 720p (1280 by 720); Visual Studio will work best at a resolution of WXGA (1366 by 768) or higher.
Supported Languages	<p>Visual Studio is available in English, Chinese (Simplified), Chinese (Traditional), Czech, French, German, Italian, Japanese, Korean, Polish, Portuguese (Brazil), Russian, Spanish, and Turkish.</p> <p>You can select the language of Visual Studio during installation. The Visual Studio Installer is available in the same fourteen languages, and will match the language of Windows, if available.</p> <p>Note: Visual Studio Team Foundation Server Office Integration 2019 is available in the ten languages supported by Visual</p>

	Studio Team Foundation Server 2019.
Additional Requirements	<ul style="list-style-type: none"> ● Administrator rights are required to install Visual Studio. ● .NET Framework 4.5.2 or above is required to install Visual Studio. Visual Studio requires .NET Framework 4.7.2 to run, and this will be installed during setup. ● .NET Core has specific Windows prerequisites for Windows 8.1 and earlier. ● Windows 10 Enterprise LTSC edition, Windows 10 S and Windows 10 Team Edition are not supported for development. You may use Visual Studio 2019 to build apps that run on Windows 10 LTSC, Windows 10 S and Windows 10 Team Edition. ● Internet Explorer 11 or Edge is required for internet-related

scenarios. Some features might not work unless these, or a later version, are installed.

- The Server Core and Minimal Server Interface options are not supported when running Windows Server.
- Visual Studio does not support application virtualization solutions such as Microsoft App-V for Windows or third-party app virtualization technologies.
- Running Visual Studio in a virtual machine environment requires a full Windows operating system. Visual Studio does not support multiple simultaneous users using the software on the same machine, including shared virtual desktop infrastructure machines or a pooled Windows Virtual Desktop hostpool.
- Running Visual Studio 2019

(Professional, Community, and Enterprise) in Windows containers is not supported.

- For Hyper-V emulator support, A supported 64-bit operating system is required. A processor that supports Client Hyper-V and Second Level Address Translation (SLAT) is also required.
- For Android Emulator support, a supported processor and operating system is required.
- Xamarin.Android requires a 64-bit edition of Windows and the 64-bit Java Development Kit (JDK).
- Universal Windows app development, including designing, editing, and debugging, requires Windows 10. Windows Server 2019, Windows Server 2016, and Windows Server 2012 R2 may be used to build Universal Windows apps from the command line.

- Team Foundation Server 2019
- Office Integration requires Office 2016, Office 2013, or Office 2010.
- PowerShell 3.0 or higher is required on Windows 7 SP1 to install the Mobile Development with C++, JavaScript, or .NET workloads.

3.6.3 Work Breakdown

Table 3.6.1 Work Breakdown

Task ID	Task Name	Duration	Start Date	End Date	Predecessor	Resource
SPRINT 1 (2 Weeks)						
1	Install and Test of Arduino UNO	1.0	09/06/2021	09/07/2021	-	
2	Install LiPo Battery Module to Arduino UNO	1.5	09/07/2021	09/08/2021	1	
3	Test LiPo Battery from the Arduino UNO	1.0	09/08/2021	09/09/2021	2	
4	Code the Connection of LiPo Battery Module to Arduino UNO	2.0	09/09/2021	09/11/2021	3	
5	Install GPS Module to Arduino UNO	1.5	09/11/2021	09/13/2021	1,2	

6	Test GPS Module from the Arduino UNO	1.0	09/13/2021	09/14/2021	5	
7	Code the Connection of GPS Module to Arduino UNO	2.0	09/14/2021	09/16/2021	6	
8	Create Database Tables for the Responsive Website.	0.5	09/16/2021	09/16/2021	-	
9	Install GSM Module to Arduino UNO	1.5	09/16/2021	09/18/2021	1,2,5	
10	Test GSM Module from the Arduino UNO	1.0	09/18/2021	09/19/2021	9	
SPRINT 2 (2 Weeks)						
11	Code the Connection of GSM Module to Arduino UNO	2.0	09/19/2021	09/21/2021	10	
12	Create Registration	1.5	09/21/2021	09/22/2021	8	

	Page with Functionalities					
13	Create UI Design of Registration Page	1.0	09/22/2021	09/23/2021	12	
14	Create Login Page with Functionalities	1.5	09/23/2021	09/25/2021	8	
15	Create UI Design of Registration Page	1.0	09/25/2021	09/26/2021	14	
16	Test Registration	0.5	09/26/2021	09/26/2021	12	
17	Test Login	0.5	09/26/2021	09/27/2021	14	
18	Create Home Page	1.5	09/27/2021	09/28/2021	-	
19	Create About Page	1.5	09/28/2021	09/30/2021	18	
20	Create Services Page	1.5	10/01/2021	10/02/2021	18	
21	Create Contact Us Page	1.5	10/02/2021	10/04/2021	18	
SPRINT 3 (2 Weeks)						
22	Connect Arduino to a Mobile Device	1.0	10/04/2021	10/05/2021	11	

23	Create QR Code with Authentication Functionalities	2.0	10/05/2021	10/07/2021	-	
24	Implement the Arduino with its components to the Collar	4.0	10/07/2021	10/11/2021	1,2,5,9	
25	Implement QR Code to the Collar	2.0	10/11/2021	10/13/2021	23	
26	Test connection of the GSM Module to the Mobile Device.	5.0	10/13/2021	10/18/2021	22	
SPRINT 4 (2 Weeks)						
27	Test QR Code	2.0	10/18/2021	10/20/2021	23	
28	Create Pet's Information Page	1.5	10/20/2021	10/21/2021	8	
29	Create Owner's Information Page	1.0	10/21/2021	10/22/2021	8	
30	Create Nearby Pet's	1.0	10/22/2021	10/23/2021	8	

	Page					
31	Create Settings Page	1.0	10/23/2021	10/24/2021	-	
31	Create Sign-Out Functionality	1.0	10/24/2021	10/25/2021	14	
32	Test Insertion of Data in	0.5	10/25/2021	10/26/2021	28,29	
33	Test GPS Module Tracking System from the Mobile Device	6.0	10/26/2021	11/02/2021	26	
SPRINT 5 (2 Weeks)						
34	Test GPS Module Tracking System to locate nearby pets who use the same application.	7.0	11/02/2021	11/09/2021	33	
35	Test the LiPo's Battery Module Continuous Active State	7.0	11/09/2021	11/16/2021	33	
SPRINT 6 (2 Weeks)						

36	Final Rundown Test on the Arduino Collar	7.0	11/16/2021	11/23/2021	33,34, 35	
37	Final Rundown Test on the Responsive Website	7.0	11/23/2021	11/30/2021	8,16,1 7,27,3 2	

CHAPTER 4: IMPLEMENTATION, RESULTS AND DISCUSSION

4.1 Requirements Documentation

Table 4.1.1 Use Case Diagram - STRAP

Use Case Diagram of the STRAP	Reference Number: 4.1.1
	Version Number: 1
System Name: STRAP: Specialized TRacker for Pets	
<p>The diagram illustrates the Use Case Diagram for the STRAP system. It features a central 'System' boundary containing numerous use cases. External actors include 'User', 'Super Admin', 'Administrator', and 'Guest'. Interactions are shown via lifelines connecting the actors to the use cases, primarily through 'includes' and 'extends' relationships.</p> <pre> graph TD User --- AddPet[Add Pet Details] User --- SMSValidation[SMS Validation] User --- AddTracker[Add Tracker] User --- ViewMap[View Map] User --- Deactivate[Deactivate Tracker] User --- Activate[Activate Tracker] User --- RequestSupport[Request User Support] User --- GenerateReport[Generate User Report] User --- SearchQR[Search Owner via QR Code] SuperAdmin --- CreateAdmin[Create Administrator] SuperAdmin --- ManageSupport[Manage User Support Request] SuperAdmin --- EditPet[Edit Pet Details] SuperAdmin --- GenerateReport Admin --- CreateAdmin Admin --- ManageSupport Admin --- EditPet Admin --- GenerateReport Guest --- CreateAccount[Create Account] System --> Login[Login] System --> ForgetPassword[Forget Password] System --> getPetInformation[getPetInformation] System --> SearchQR[Search Owner via QR Code] Login --> ForgetPassword Login --> getPetInformation ForgetPassword --> getPetInformation getPetInformation --> AddPet getPetInformation --> SMSValidation getPetInformation --> AddTracker getPetInformation --> ViewMap getPetInformation --> Deactivate getPetInformation --> Activate getPetInformation --> RequestSupport getPetInformation --> GenerateReport getPetInformation --> SearchQR AddPet --> SMSValidation AddPet --> AddTracker AddPet --> ViewMap AddPet --> Deactivate AddPet --> Activate AddPet --> RequestSupport AddPet --> GenerateReport SMSValidation --> AddTracker SMSValidation --> ViewMap SMSValidation --> Deactivate SMSValidation --> Activate SMSValidation --> RequestSupport SMSValidation --> GenerateReport AddTracker --> ViewMap AddTracker --> Deactivate AddTracker --> Activate AddTracker --> RequestSupport AddTracker --> GenerateReport ViewMap --> Deactivate ViewMap --> Activate ViewMap --> RequestSupport ViewMap --> GenerateReport Deactivate --> Activate Deactivate --> RequestSupport Deactivate --> GenerateReport Activate --> RequestSupport Activate --> GenerateReport RequestSupport --> GenerateReport CreateAdmin --> ManageSupport CreateAdmin --> EditPet CreateAdmin --> GenerateReport ManageSupport --> EditPet ManageSupport --> GenerateReport EditPet --> GenerateReport </pre>	

i. User Login and Register Process

Table 4.1.2: Use Case Narrative - User Login

Title	Specialized Tracker for Pets User Login		
Summary	This use case describes how users can log in to the web application of STRAP		
Actors	User, Admin - Log in to the STRAP website		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			
Preconditions	<ol style="list-style-type: none"> 1. The user has an internet connection. 2. The user knows their login credentials (username, password) 3. The user is already in the web application's login page. 		
Main Success Scenario	<ol style="list-style-type: none"> 1. The user inputs the correct username and password. 2. The system authenticates user input. 3. The system redirects the user to the web application's home page or dashboard. 4. Use case ends. 		
Alternative Sequence	AS1 The user entered incorrect login credentials <ol style="list-style-type: none"> 1. The system displays an error message to the user 2. Go back to step 3 		
Error Sequences	ES1 The system fails to authenticate the user's credentials <ol style="list-style-type: none"> 1. The system displays an error message 		

Post Conditions	<ol style="list-style-type: none"> 2. The system recognizes the user's role. 3. The system creates the user session. 4. The user successfully logs into the web application.
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Table 4.1.3: Use Case Narrative - User Registration

Title	Specialized Tracker for Pets User Registration		
Summary	This use case describes how users can register to the STRAP website.		
Actors	Guest - Register to the STRAP website		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			
Preconditions	<ol style="list-style-type: none"> 1. User has an internet connection 2. The user is in the web application's register page 		
Main Success Scenario	<ol style="list-style-type: none"> 1. The user inputs their details to the register page form. 2. The system validates user input. 3. The user is registered into the database. 4. User is redirected to the web dashboard. 5. Use case ends. 		
Alternative Sequence	AS1 User enters invalid input. <ol style="list-style-type: none"> 1. The system displays an error message to the user. 2. Go back to step 1. 		

Error Sequences	<p>ES1 The system fails to authenticate user input.</p> <ol style="list-style-type: none"> 1. The system displays an error message 2.
Post Conditions	<ol style="list-style-type: none"> 1. The user is successfully registered into the web app.

ii. Adding STRAP to the website

Table 4.1.4: Use Case Narrative - User Add Tracker to Website

Title	Specialized Tracker for Pets User Add Tracker to Website		
Summary	This use case describes how users can add a collar/harness into the STRAP website.		
Actors	User - Add STRAP collar		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			
Preconditions	<ol style="list-style-type: none"> 1. User has an internet connection. 2. User is in possession of a new STRAP collar 3. User is logged into the web application 4. The user is in the Add STRAP Collar Page 		
Main Success Scenario	<ol style="list-style-type: none"> 1. The user selects the ‘Add Collar’ button. 2. The system will ask for the details of the collar. 3. The user will input details into the form. 4. The user will select the ‘Add’ button. 		

	<p>5. The system will verify the information</p> <p>6. The system prompts a success message.</p> <p>7. Use case ends.</p>
Alternative Sequence	<p>AS1 User selects the ‘Cancel’ button</p> <ol style="list-style-type: none"> 1. The system closes the form. 2. Go back to step 1 <p>AS1 Missing or Invalid details.</p> <ol style="list-style-type: none"> 1. The system will prompt an error message. 2. Go back to step 3.
Error Sequences	<p>ES1 The system fails to add the STRAP collar to the database</p> <ol style="list-style-type: none"> 1. The system displays an error message
Post Conditions	<ol style="list-style-type: none"> 1. The system successfully adds a new STRAP collar to the webpage.

Table 4.1.5: Use Case Narrative - User Deactivate Tracker from Website

Title	Specialized Tracker for Pets User Deactivate Tracker to Website		
Summary	This use case describes how users can deactivate a collar/harness into the STRAP website.		
Actors	User - Add STRAP collar		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			

Preconditions	<ol style="list-style-type: none"> 1. User has an internet connection. 2. User is in possession of a new STRAP collar 3. User is logged into the web application 4. The user is in the Tracker Page
Main Success Scenario	<ol style="list-style-type: none"> 1. The user selects the ‘Delete’ button. 2. The system will ask for confirmation of deletion. 3. The user selects the ‘Delete’ button. 4. The system prompts a success message. 5. Use case ends.
Alternative Sequence	AS1 User selects the ‘Cancel’ button <ol style="list-style-type: none"> 1. The system closes the form. 2. Go back to step 1
Error Sequences	ES1 The system fails to deactivate the STRAP collar to the database <ol style="list-style-type: none"> 2. The system displays an error message
Post Conditions	<ol style="list-style-type: none"> 1. The system successfully deletes the STRAP collar to the webpage.

iii. User Add Pet to STRAP website

Table 4.1.6: Use Case Narrative - User Add Pet Details

Title	Specialized Tracker for Pets User Add Pet Details		
Summary	This use case describes how users can add pet details into the STRAP website.		
Actors	User - Add pet details		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			
Preconditions	<ol style="list-style-type: none"> 1. User is logged into the system. 2. Users have a STRAP collar activated in their account. 3. Users have an existing pet detail registered to the STRAP collar. 		
Main Success Scenario	<ol style="list-style-type: none"> 1. The user selects the ‘Add Pet’ button. 2. The system will show a form with empty pet details. 3. The user will input new pet information. 4. The user selects the ‘Done’ button. 5. The system will verify the information. 6. The system will prompt a success message. 7. Use case ends. 		
Alternative Sequence	AS1 User selects the ‘Cancel’ button <ol style="list-style-type: none"> 1. The system closes the form 2. Go back to step 1 AS2 Invalid input		

	<ol style="list-style-type: none"> 1. The system prompts an error message. 2. Go back to step 3.
Error Sequences	<p>ES1 The system fails to record information to the database</p> <ol style="list-style-type: none"> 1. The system will show an error message.
Post Conditions	<ol style="list-style-type: none"> 1. The system successfully adds pet information

Table 4.1.7: Use Case Narrative - User Edit Existing Pet Details

Title	Specialized Tracker for Pets User Edit Existing Pet Details		
Summary	This use case describes how users can edit existing pet details in the STRAP website.		
Actors	User - Edit pet details		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			
Preconditions	<ol style="list-style-type: none"> 1. User is logged into the system. 2. Users have a STRAP collar activated in their account. 3. Users have an existing pet detail registered to the STRAP collar. 		
Main Success Scenario	<ol style="list-style-type: none"> 1. The user selects the 'Edit Details' button. 2. The system will show a form with current pet details. 3. The user will input new pet details. 		

	<ol style="list-style-type: none"> 4. The user selects the ‘Done’ button. 5. The system will verify the information. 6. The system will prompt a success message. 7. Use case ends.
Alternative Sequence	<p>AS1 User selects the ‘Cancel’ button</p> <ol style="list-style-type: none"> 1. The system closes the form 2. Go back to step 1 <p>AS2 Invalid input</p> <ol style="list-style-type: none"> 1. The system prompts an error message. 2. Go back to step 3.
Error Sequences	<p>ES1 The system fails to record information to the database</p> <ol style="list-style-type: none"> 1. The system will show an error message.
Post Conditions	<ol style="list-style-type: none"> 1. The system successfully adds pet information

iv. Admin Edit Pet Details

Table 4.1.8: Use Case Narrative - Admin Edit Existing Pet Details

Title	Specialized Tracker for Pets Admin Edit Existing Pet Details		
Summary	This use case describes how admins can edit existing pet details in the STRAP website.		
Actors	Admin - Edit pet details		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			

Preconditions	<ol style="list-style-type: none"> 1. Admin is logged in the Admin side of the web site. 2. Admin received a request from a user to edit their pet's details.
Main Success Scenario	<ol style="list-style-type: none"> 1. Admin selects the user who requested the edit. 2. Admin selects the pet to be edited. 3. Admin selects the 'Edit Pet' button. 4. The system will show a form with current pet details. 5. Admin will input new pet details. 6. Admin selects the 'Done' button. 7. The system will verify the information. 8. The system will prompt a success message. 9. Use case ends.
Alternative Sequence	<p>AS1 Admin selects the 'Cancel' button</p> <ol style="list-style-type: none"> 1. The system closes the form. 2. Go back to step 3. <p>AS2 Invalid input</p> <ol style="list-style-type: none"> 1. The system prompts an error message. 2. Go back to step 3.
Error Sequences	<p>ES1 The system fails to record information to the database</p> <ol style="list-style-type: none"> 1. The system will show an error message.
Post Conditions	<ol style="list-style-type: none"> 1. The system successfully adds pet information

Table 4.1.9: Use Case Narrative - Admin Manage User Requests

Title	Specialized Tracker for Pets Administrator Manage User Requests		
Summary	This use case describes how administrators can manage user requests in the STRAP website.		
Actors	Admin - Manage user requests		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			
Preconditions	<ol style="list-style-type: none"> 1. Admin is logged in the Admin side of the web site. 2. Admin received a user request from a regular user. 		
Main Success Scenario	<ol style="list-style-type: none"> 1. Admin selects the user request that was received. 2. Admin views the message sent by a regular user. 3. Admin will address the user request. 4. Admin will send a message back to the user for information regarding the decision and action done for the user request. 5. Use Case ends. 		
Alternative Sequence	AS1 Admin deletes the user request. <ol style="list-style-type: none"> 1. The system removes the user request from the database. 2. Go back to step 1. 		
Error Sequences	ES1 The system fails to notify the user after their request has been addressed by the admin. <ol style="list-style-type: none"> 1. The system will show an error message. 		
Post Conditions	<ol style="list-style-type: none"> 1. The admin successfully addresses the user 		

	request and notifies the user.
--	--------------------------------

Table 4.1.10: Use Case Narrative - Super Administrator Add Administrator

Title	Specialized Tracker for Pets Super Admin Add Admin		
Summary	This use case describes how super administrators can add administrators to the STRAP website.		
Actors	Super Admin - Add Administrator		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			
Preconditions	<ol style="list-style-type: none"> 1. Super Admin is logged in the Admin side of the web site. 		
Main Success Scenario	<ol style="list-style-type: none"> 1. The Super Administrator is in the Add Admin page of the website. 2. The Super Administrator selects the ‘Add Administrator’ button. 3. The system will show a form for new Administrator information. 4. The Super Administrator will input new administrator details. 5. The Super Administrator selects the ‘Done’ button. 6. The system will verify the information. 7. The system will prompt a success message. 8. Use Case ends. 		
Alternative Sequence	AS1 Super Admin selects the ‘Cancel’ button <ol style="list-style-type: none"> 1. The system closes the form. 		

	2. Go back to step 2.
Error Sequences	ER1 The system fails to add a new Administrator to the website. 1. The system shows an error message.
Post Conditions	1. New administrator is added to the website and database.

v. User Scan STRAP QR code

Table 4.1.11: Use Case Narrative - User Search For Owner using QR code

Title	Specialized Tracker for Pets Use Case Diagram		
Summary	This use case describes how super administrators can add administrators to the STRAP website.		
Actors	Super Admin - Add Administrator		
Creation Date		Date of Update	
Version	1	Person-in-Charge	
Flow of Events			
Preconditions	<ol style="list-style-type: none"> 1. Users must be in the STRAP landing page. 2. Users must be have a QR code of a STRAP tracker 		
Main Success Scenario	<ol style="list-style-type: none"> 1. User scans QR code on STRAP collar 2. Scanner gives the user a link to pet information on the STRAP website. 3. Pet information is displayed to the user. 4. Use case ends. 		
Alternative Sequence	AS1 User scans but does not have an internet connection. <ol style="list-style-type: none"> 1. QR scanner presents basic information to the user but will not redirect to the website. 		

Error Sequences	<p>ES1 The user scans an invalid QR code.</p> <ol style="list-style-type: none"> 1. The scanner will not redirect to the website.
Post Conditions	<ol style="list-style-type: none"> 1. The scanner successfully redirects the user to the correct pet with information.

4.1.2 System Requirements

4.1.2.1 Hardware Requirements

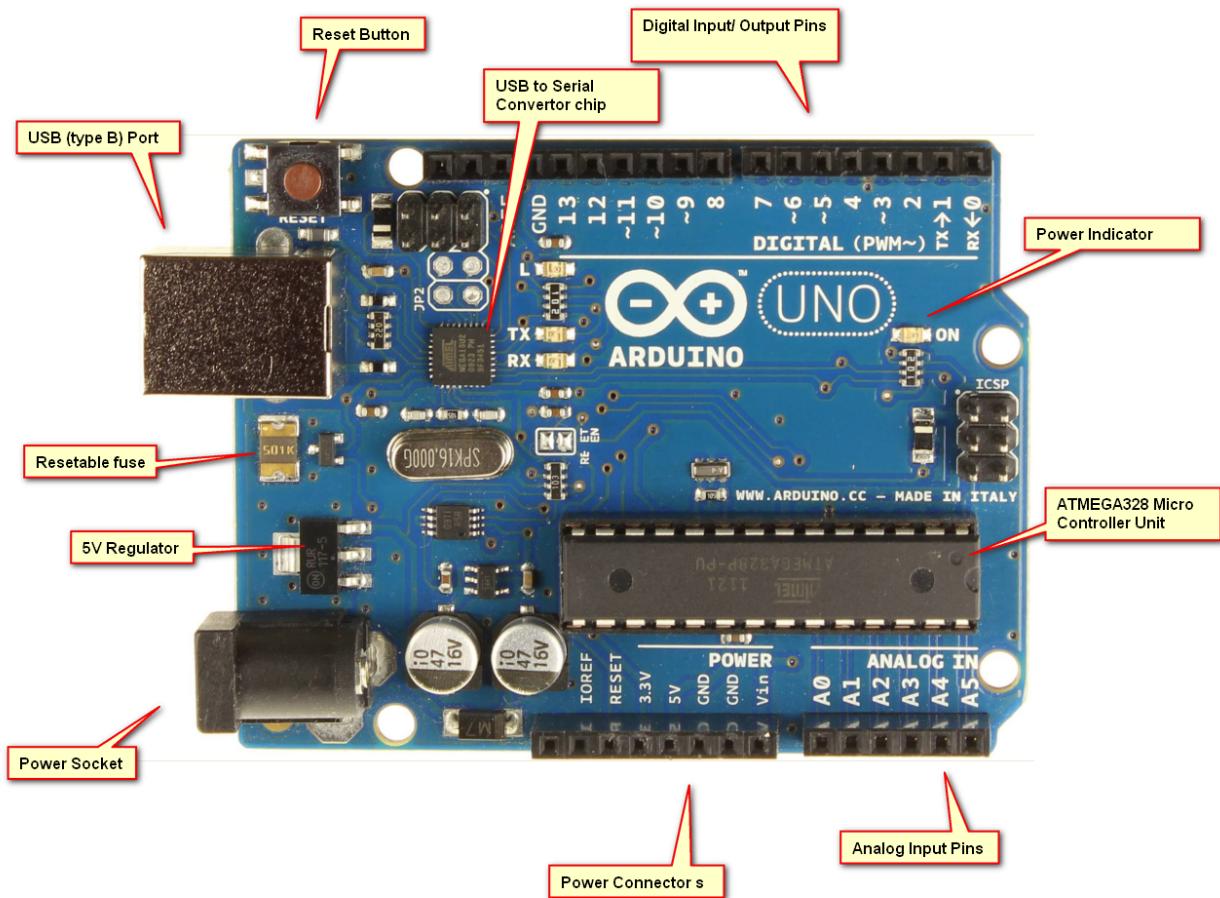
Arduino UNO

Arduino/Genuino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller

Table 4.1.2.1 Arduino UNO Technical Specifications

	Technical Specification
Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA

Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz



Arduino Shield GSM SIM900

GSM SIM900 is a dual-band GSM/GPRS engine that works on frequencies EGSM 900MHz and DCS 1800MHz. SIM900A features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

Table 4.1.2.2 Arduino Shield GSM SIM900 Technical Specifications

	Technical Specification
Power Supply	Single Supply Voltage 3.4V - 4.5V
Power Saving	Typical power consumption in SLEEP mode is 1.5mA
Frequency Bands	<ul style="list-style-type: none"> • SIM900 Dual-Band: EGSM900, DCS1800. The SIM900 can search the 2 frequency bands automatically. The frequency bands can also be set by the AT command. • Compliant to GSM Phase 2/2+
GSM Class	Small MS
Transmitting Power	<ul style="list-style-type: none"> • Class 4 (2W) at EGSM 900 • Class 1 (1W) at DCS 1800
GPRS Connectivity	<ul style="list-style-type: none"> • GPRS multi-slot class 10 (default) • GPRS multi-slot class 8 (option)

- GPRS mobile station class B



NEO-6M GPS Module

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. In order to monitor the status of the module, it can be done using the power and signal indicators. The module can save the data when the main power shuts down accidentally thanks to its data backup battery.

Table 4.1.2.3 NEO-6M GPS Module Pin Configuration and Technical Specifications

Pin Configuration	
Vcc	Power Supply
TX	UART Transmit pin
RX	UART Receiver pin
GND	Ground

Technical Specification	
Operating Voltage	3v - 3.6v
Communication	UART
Default Baud Rate	9600 bits/sec
Signal indicator	LED(Blue/ Red)

Time-To-First-fix	Cold Start 32s, For Warm Start 23s, For Hot Start <1s
Battery Backup	Yes
EEPROM	Yes
Operating Temperature Range	-40°C to 85°C
Maximum Navigation Update Rate	5 Hz
Tracking & Navigation(Sensitivity)	-160 dBm
NMEA – Protocol	Input/output, ASCII, 0183, 2.3 (Compatible to 3.0)
UBX - Protocol	Input/output, binary, u-blox proprietary
DC Current Through any Digital I/O pin (Except Supplies)	10ma
Max. Supply current(Power Requirement)	67ma



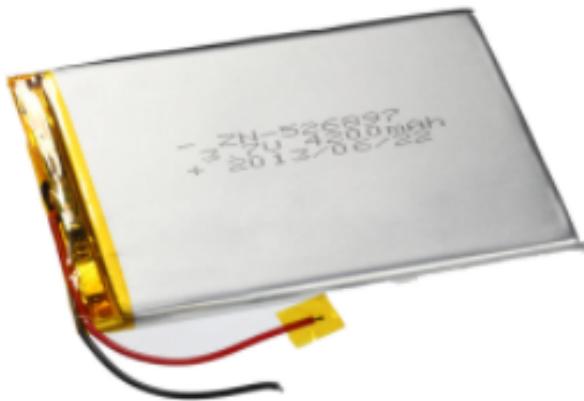
LiPo Battery 3.7V 4000mAh

The LP945170 3.7V 4000mAh is a Lithium Polymer Battery (LiPo) that uses a polymer electrolyte. This new type of battery is now being used in wearable devices, medical devices, radio controlled equipment, personal electronics, and electric vehicles.

Table 4.1.2.4 LiPo Battery 3.7V 4000mAh Technical Specifications

	Technical Specification
Battery Type	Rechargeable LiPo Battery
Model	LP945170, 945170
Nominal Voltage	3.7V
Capacity	4000mAh
Size	9.4mm x 51.0mm x 70.0mm
Protection circuit module(PCM)	Yes
Thermistor(NTC)	No
Connector	Yes
Configuration	1S1P
Weight	80g
Wat-Hou Rating:	14.8Wh
Max. Operating Voltage Range:	2.75V to 4.2V

Max. Charge Voltage:	4.2V±50mV
Max. Charge Current:	2000mA
Max. Continuous Discharge Current:	3000mA
Discharge Cut-off	2.75V
Internal Impedance:	<200mΩ
Expected Cycle Life	500 cycles \geq 80%



4.1.2.2 Software Requirements

Microsoft Visual Studio

Visual Studio is an Integrated Development Environment(IDE) from Microsoft and it is used to develop computer programs, websites, web applications, web services,

and mobile applications. It has a built-in languages such as C, C++/CLI, Visual Basic, .NET, C#, F#, JavaScript, TypeScript, XML, XSLT, HTML, and CSS.

Table 4.1.2.5 Microsoft Visual Studio Specifications

Technical Specification(Minimum Requirements)	
Supported Operating Systems	<p>Visual Studio 2019 will install and run on the following operating systems (64 bit recommended; ARM is not supported):</p> <ul style="list-style-type: none"> ● Windows 10 version 1703 or higher: Home, Professional, Education, and Enterprise (LTSC and S are not supported) ● Windows Server 2019: Standard and Datacenter ● Windows Server 2016: Standard and Datacenter ● Windows 8.1 (with Update 2919355): Core, Professional, and Enterprise ● Windows Server 2012 R2 (with Update 2919355): Essentials,

	<p>Standard, Datacenter</p> <ul style="list-style-type: none"> ● Windows 7 SP1 (with latest Windows Updates): Home Premium, Professional, Enterprise, Ultimate
Hardware	<ul style="list-style-type: none"> ● 1.8 GHz or faster processor. Quad-core or better recommended ● 2 GB of RAM; 8 GB of RAM recommended (2.5 GB minimum if running on a virtual machine) ● Hard disk space: Minimum of 800MB up to 210 GB of available space, depending on features installed; typical installations require 20-50 GB of free space. ● Hard disk speed: to improve performance, install Windows and Visual Studio on a solid state drive (SSD). ● Video card that supports a minimum display resolution of 720p (1280 by 720); Visual Studio

	will work best at a resolution of WXGA (1366 by 768) or higher.
Supported Languages	<p>Visual Studio is available in English, Chinese (Simplified), Chinese (Traditional), Czech, French, German, Italian, Japanese, Korean, Polish, Portuguese (Brazil), Russian, Spanish, and Turkish.</p> <p>You can select the language of Visual Studio during installation. The Visual Studio Installer is available in the same fourteen languages, and will match the language of Windows, if available.</p> <p>Note: Visual Studio Team Foundation Server Office Integration 2019 is available in the ten languages supported by Visual Studio Team Foundation Server 2019.</p>
Additional Requirements	<ul style="list-style-type: none"> ● Administrator rights are required to install Visual Studio.

- .NET Framework 4.5.2 or above is required to install Visual Studio. Visual Studio requires .NET Framework 4.7.2 to run, and this will be installed during setup.
- .NET Core has specific Windows prerequisites for Windows 8.1 and earlier.
- Windows 10 Enterprise LTSC edition, Windows 10 S and Windows 10 Team Edition are not supported for development. You may use Visual Studio 2019 to build apps that run on Windows 10 LTSC, Windows 10 S and Windows 10 Team Edition.
- Internet Explorer 11 or Edge is required for internet-related scenarios. Some features might not work unless these, or a later version, are installed.
- The Server Core and Minimal Server Interface options are not

supported when running Windows Server.

- Visual Studio does not support application virtualization solutions such as Microsoft App-V for Windows or third-party app virtualization technologies.
- Running Visual Studio in a virtual machine environment requires a full Windows operating system. Visual Studio does not support multiple simultaneous users using the software on the same machine, including shared virtual desktop infrastructure machines or a pooled Windows Virtual Desktop hostpool.
- Running Visual Studio 2019 (Professional, Community, and Enterprise) in Windows containers is not supported.
- For Hyper-V emulator support, A supported 64-bit operating system

is required. A processor that supports Client Hyper-V and Second Level Address Translation (SLAT) is also required.

- For Android Emulator support, a supported processor and operating system is required.
- Xamarin.Android requires a 64-bit edition of Windows and the 64-bit Java Development Kit (JDK).
- Universal Windows app development, including designing, editing, and debugging, requires Windows 10. Windows Server 2019, Windows Server 2016, and Windows Server 2012 R2 may be used to build Universal Windows apps from the command line.
- Team Foundation Server 2019 Office Integration requires Office 2016, Office 2013, or Office 2010.
- PowerShell 3.0 or higher is required on Windows 7 SP1 to

install the Mobile Development
with C++, JavaScript, or .NET
workloads.

4.2 Design of Software, Systems, Product, and/or Processes

4.2.1 System Sequence Diagrams

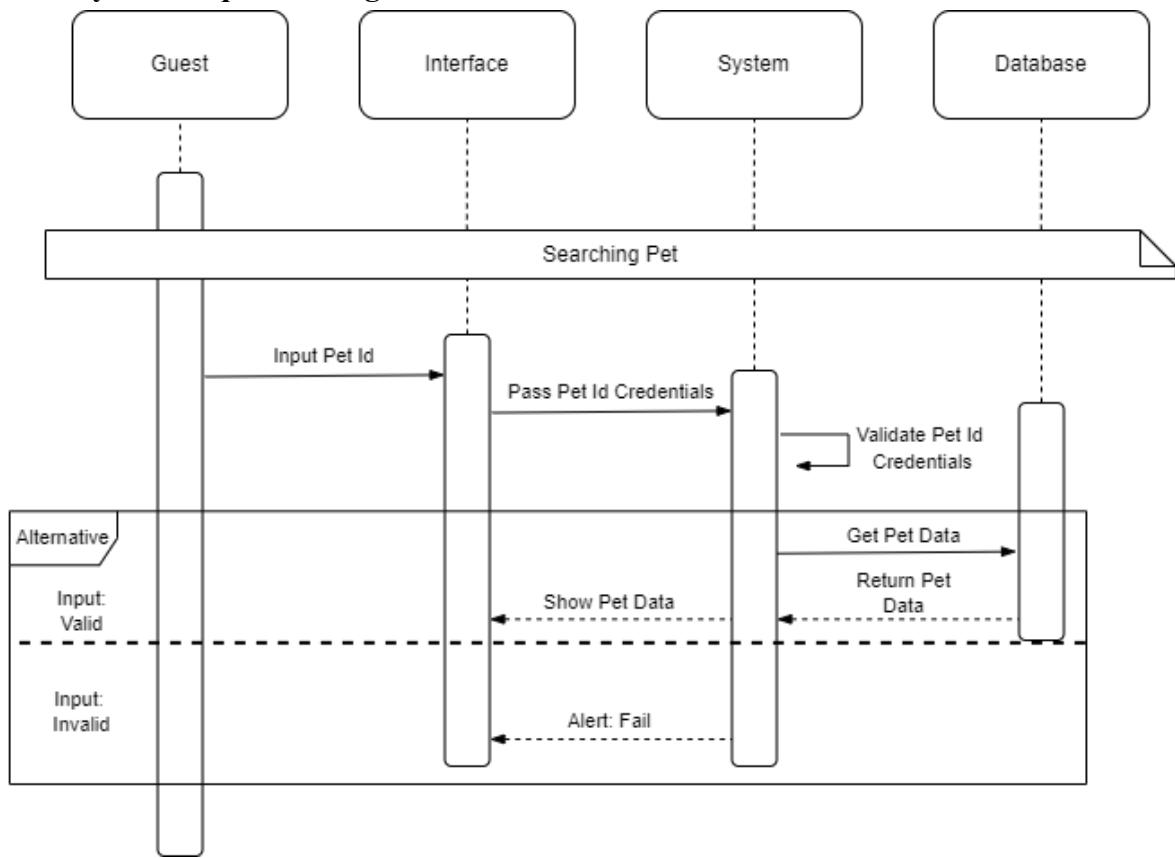


Figure 4.2.1.1 System Sequence Diagram - Guest Management Module

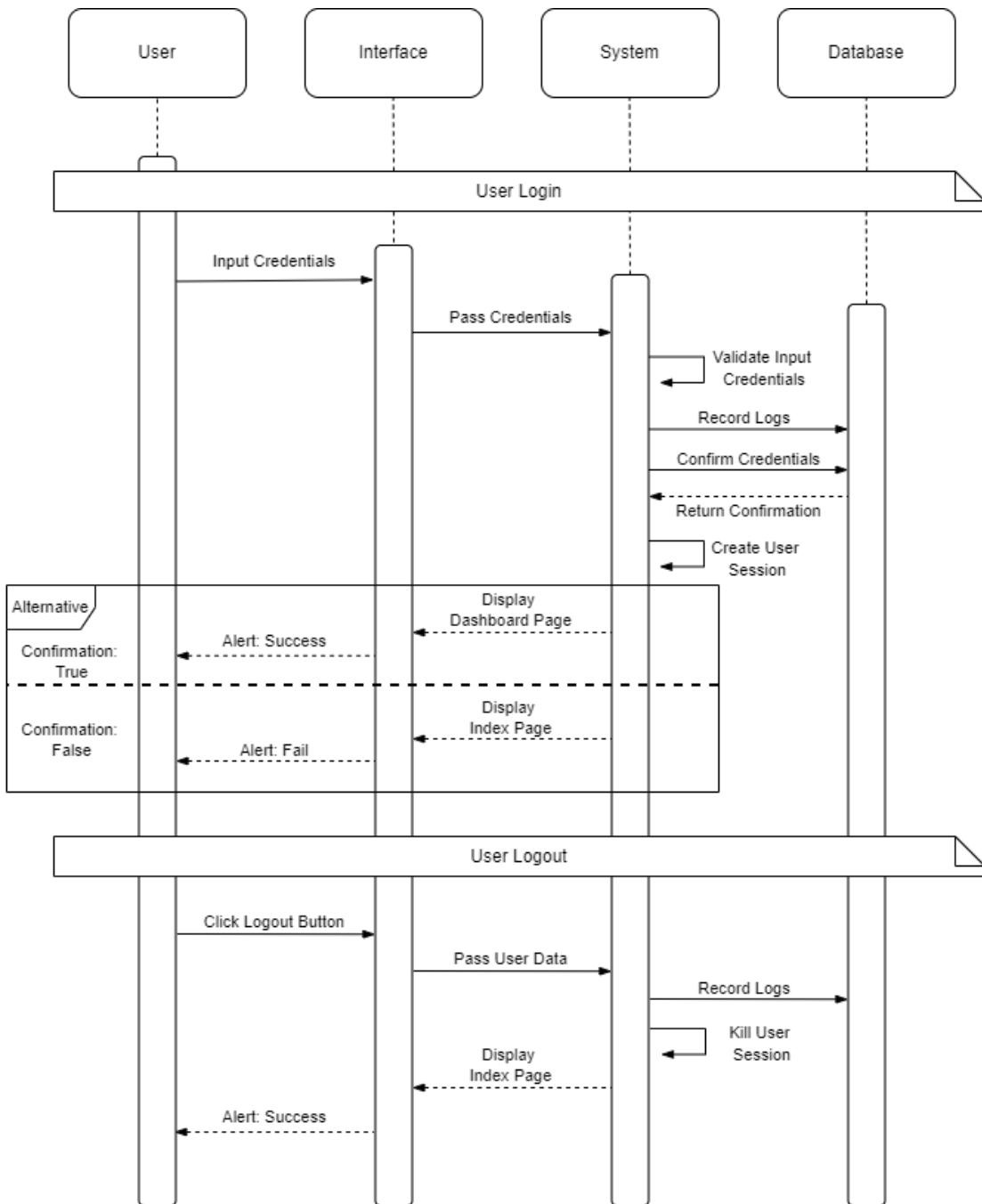


Figure 4.2.1.2 System Sequence Diagram - Profile Management Module

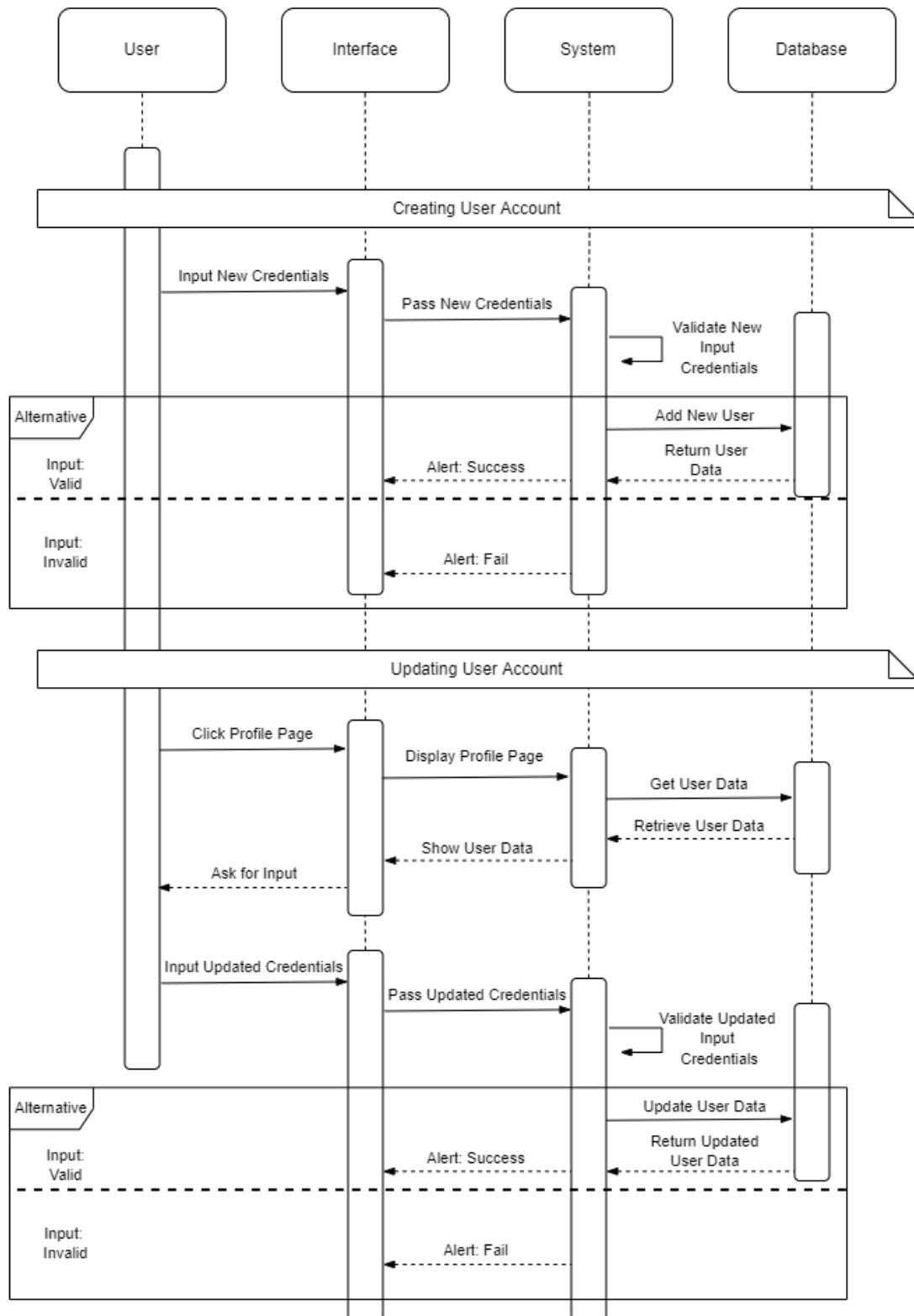


Figure 4.2.1.3 System Sequence Diagram - User Management Module

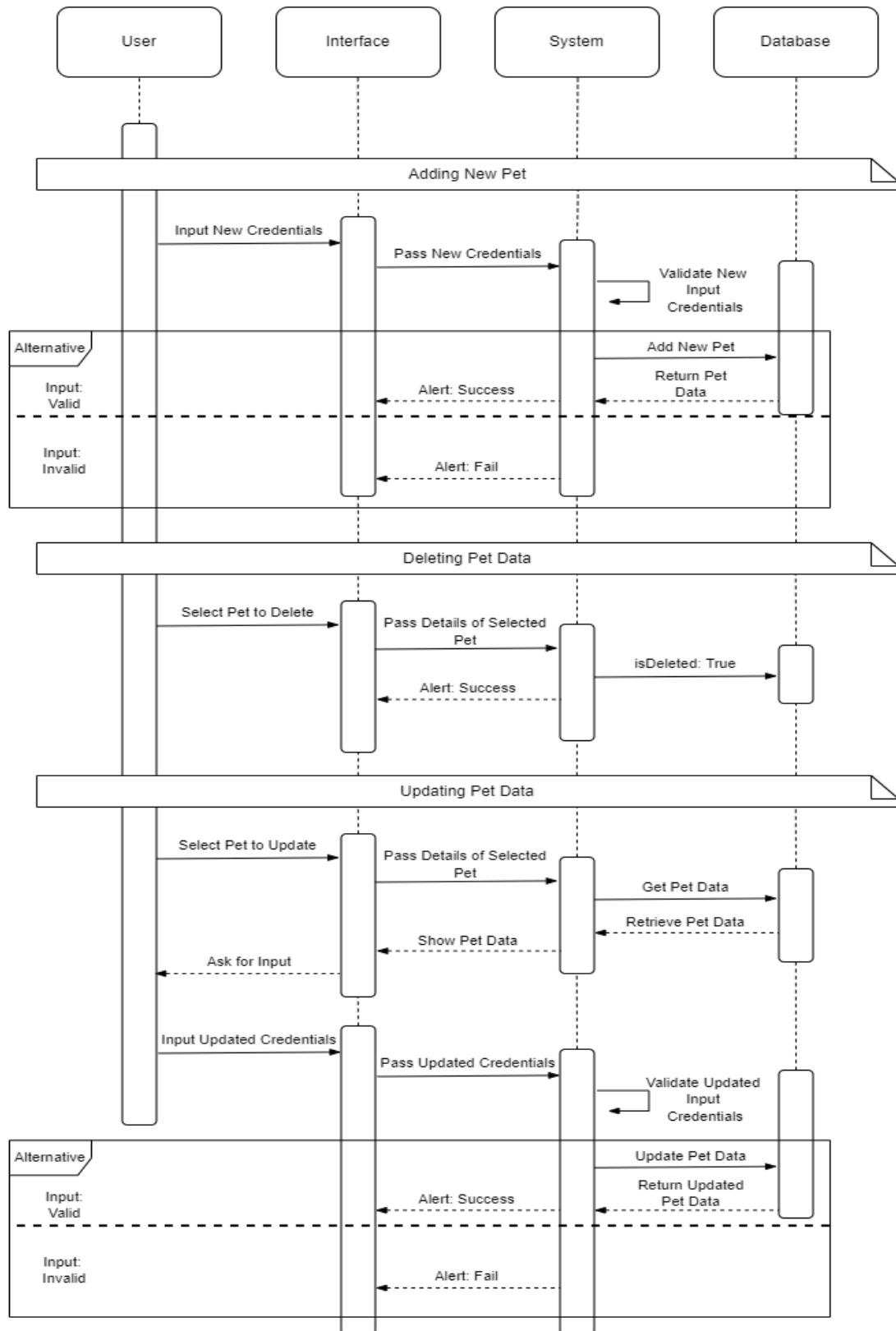


Figure 4.2.1.4 System Sequence Diagram - Pet Management Module

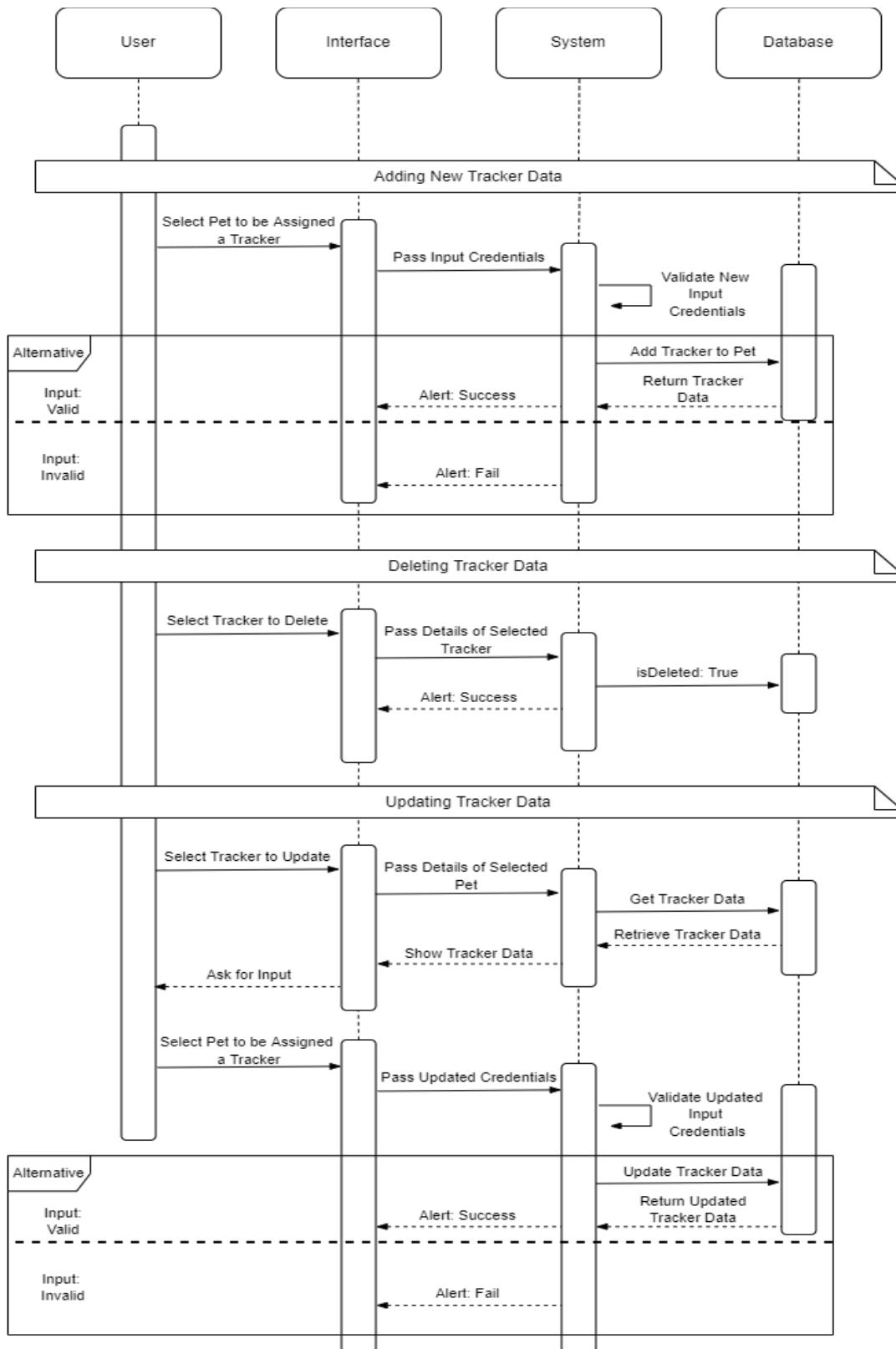


Figure 4.2.1.5 System Sequence Diagram - Tracker Management Module

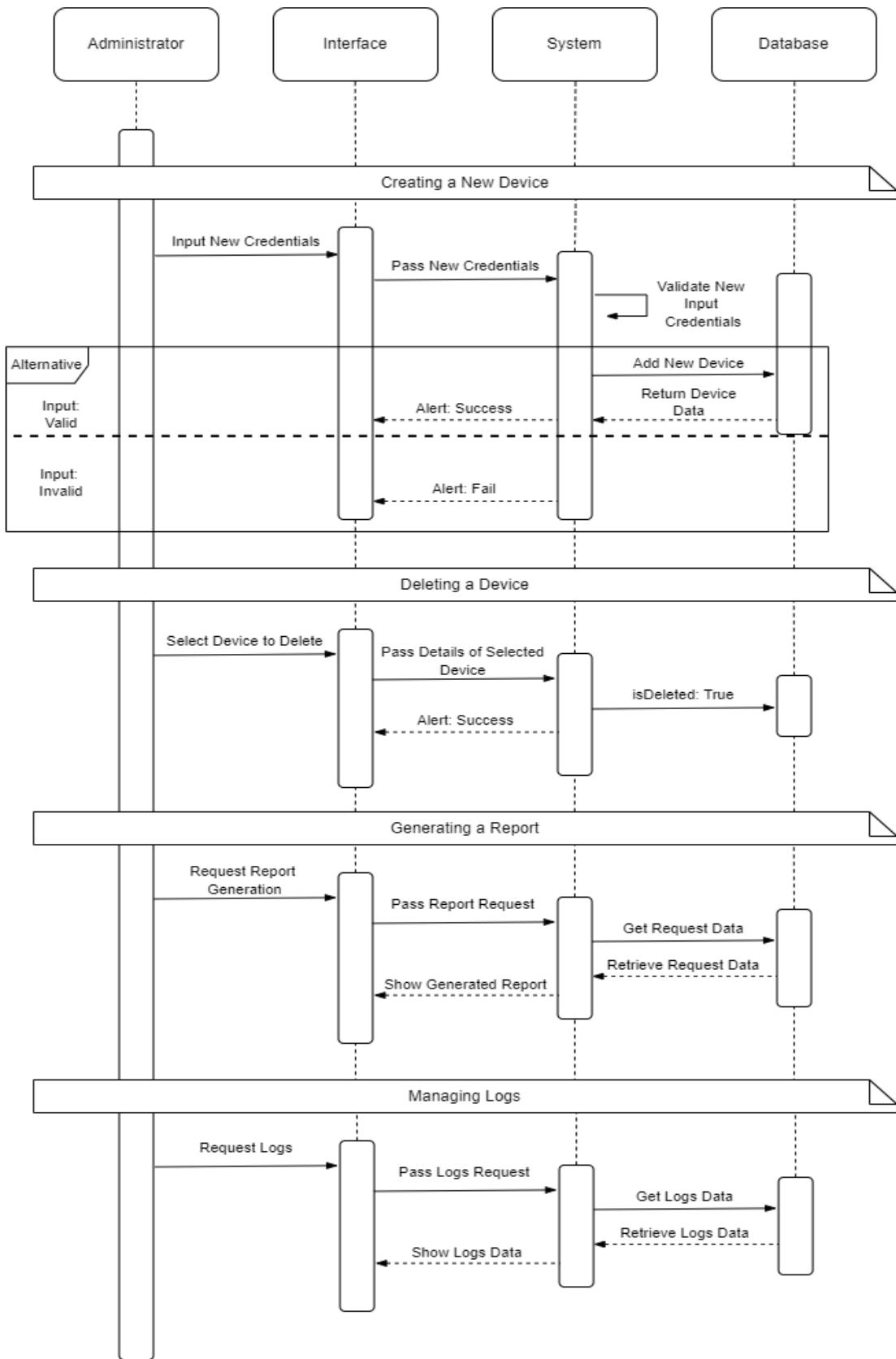


Figure 4.2.1.6 System Sequence Diagram - Admin Management Module

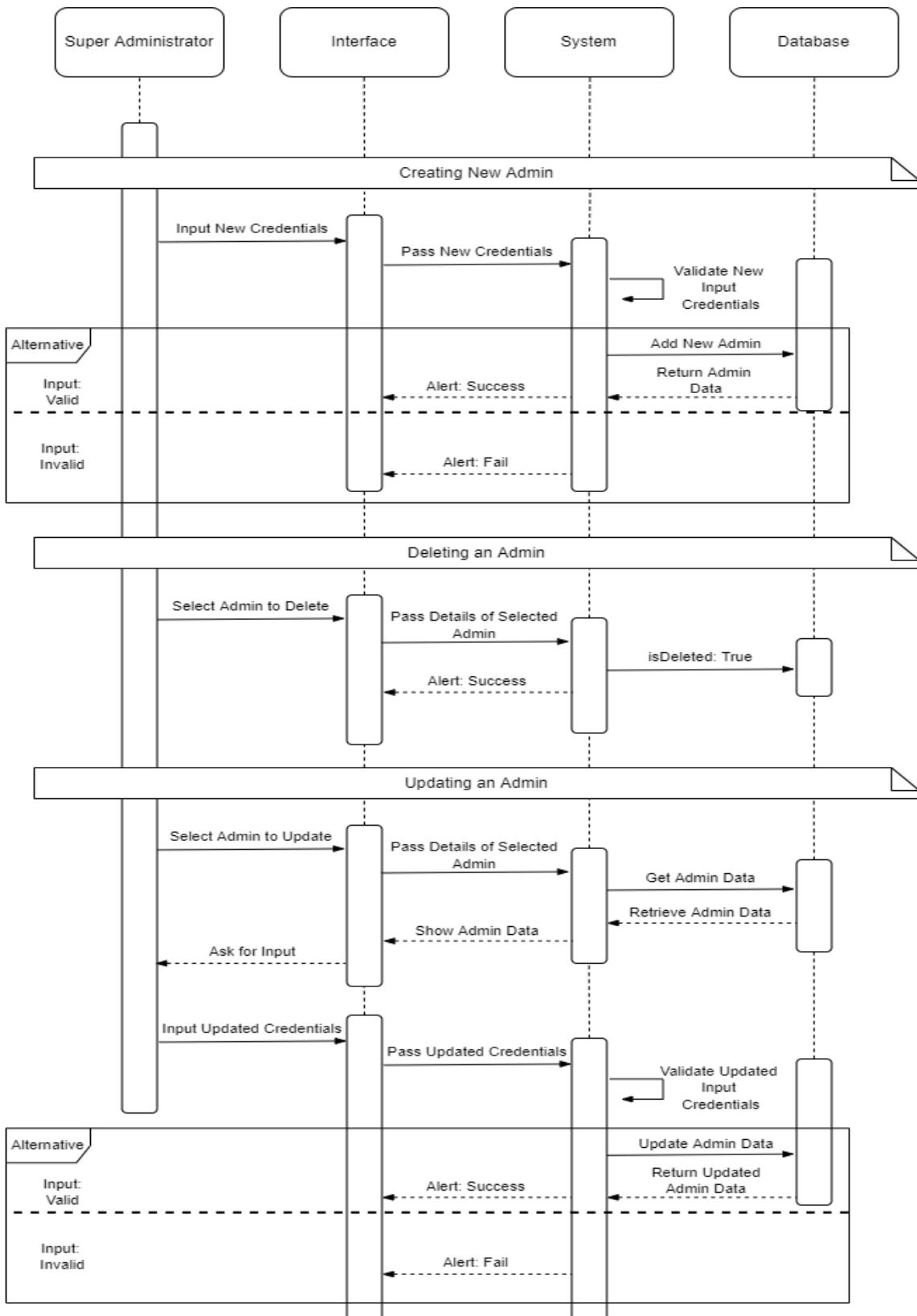


Figure 4.2.1.7 System Sequence Diagram - Super Admin Management Module

4.2.2 Network Design

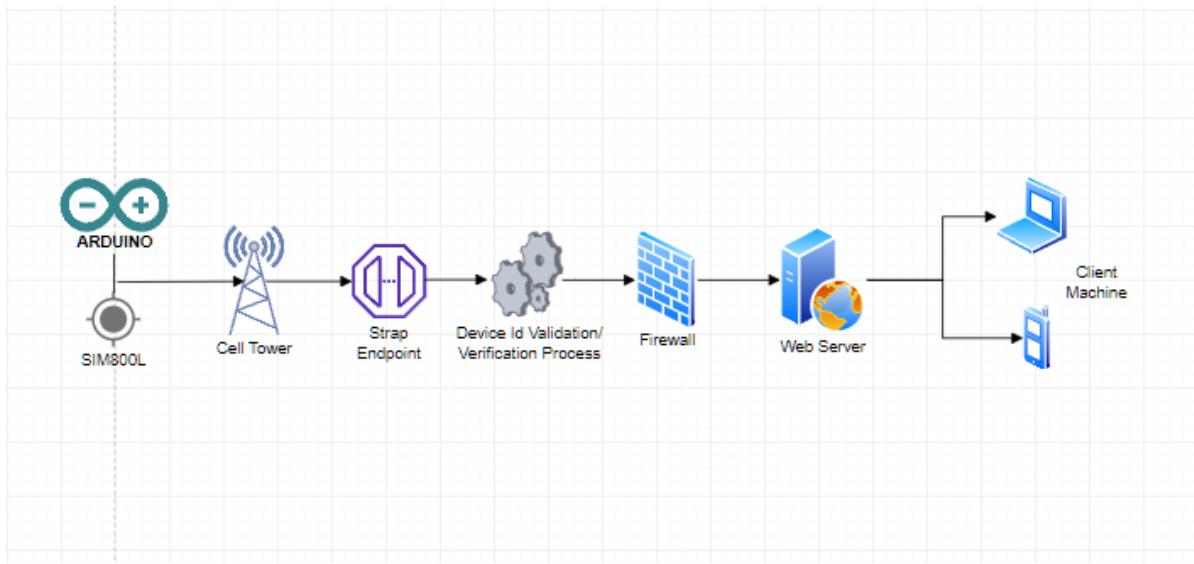


Figure 4.2.2 STRAP Network Diagram

4.2.3 Database Design

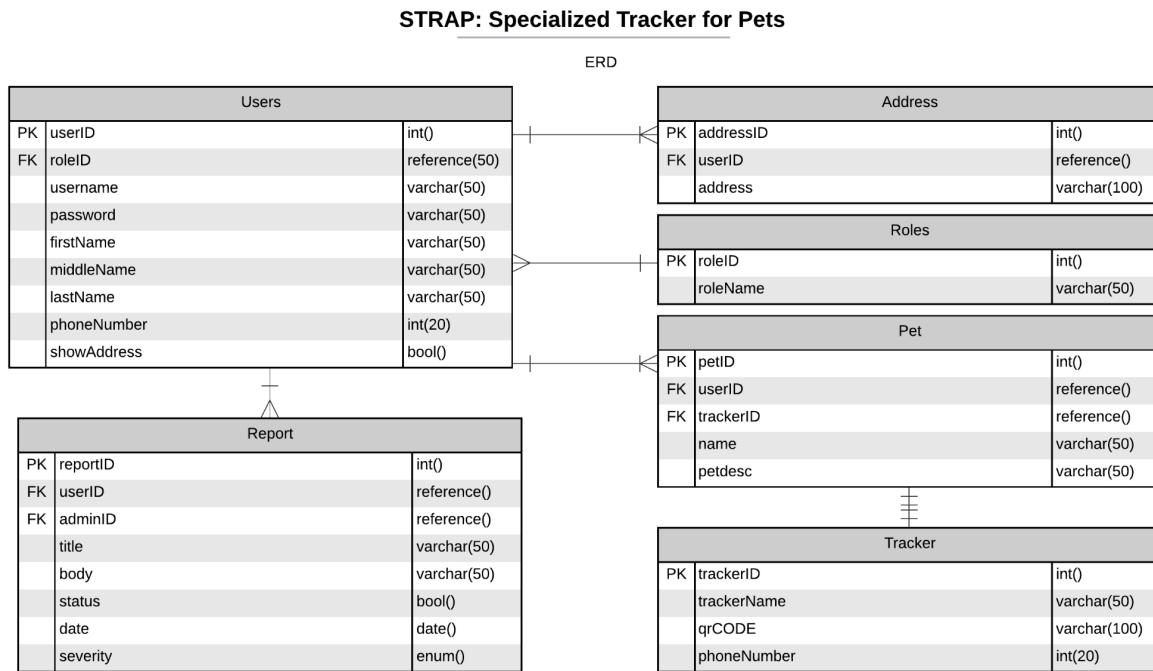


Figure 4.2.3 STRAP Entity Relationship Diagram

4.2.4 Circuit Diagram

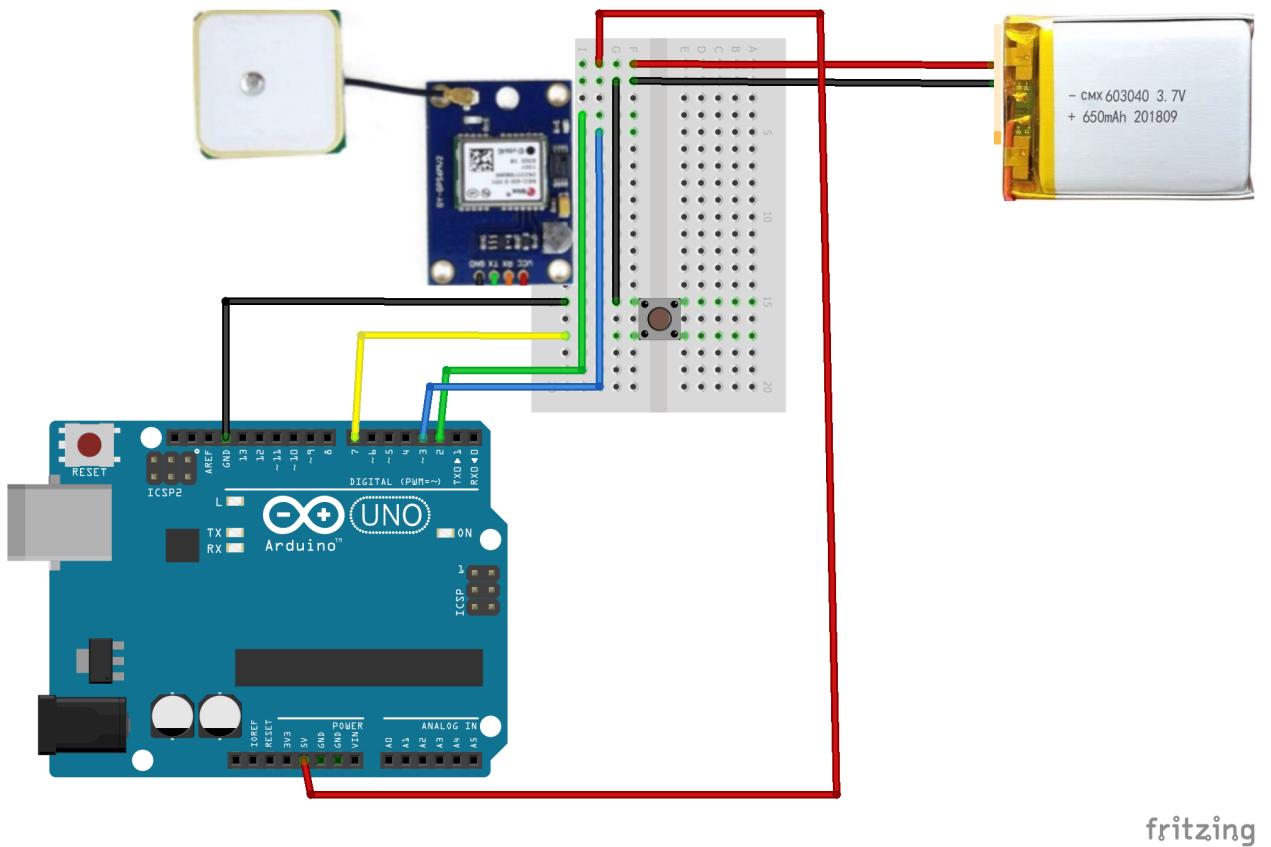


Figure 4.2.4 Circuit Diagram - STRAP GPS Device

4.2.5 Data Dictionary

Table 4.2.5.1 STRAP Data Dictionary - User Registration

Variable	Variable Name	Data Type	Description
ID	id	INT	Primary Key
Username	username	VARCHAR	Username of the User
Email	email	VARCHAR	Email of the User
Address	address	VARCHAR	Address of the User
Password	password	VARCHAR	Password of the User
Confirm password	confirm_password	VARCHAR	Checks if confirm_password = password

Table 4.2.5.2 STRAP Data Dictionary - User Login

Variable	Variable Name	Data Type	Description
ID	id	INT	Primary Key
Username	username	VARCHAR	Username of the User
Password	password	VARCHAR	Password of the User

Table 4.2.5.3 STRAP Data Dictionary - Search Pet

Variable	Variable Name	Data Type	Description
ID	id	INT	Primary Key
Pet Unique Id	pet_id	VARCHAR	Key used to identify specific pets

Table 4.2.5.4 STRAP Data Dictionary - Add Pet

Variable	Variable Name	Data Type	Description
ID	id	INT	Primary Key
Pet Unique Id	pet_id	VARCHAR	Key used to identify specific pets
Pet Image	pet_image	VARCHAR	Image of the Pet
Pet Name	pet_name	VARCHAR	Name of the Pet
Pet Type	pet_type	INT	The pet types are as follows: 0 - Dog 1 - Cat 2 - Other

Pet Breed	pet_breed	VARCHAR	Breed of the Pet
Pet Diet	pet_diet	VARCHAR	Diet information of the pet
Pet Vaccines	pet_vaccine	VARCHAR	Vaccine information of the pet
Contact Name	contact_name	VARCHAR	Contact name of the owner of the pet
Contact Number	contact_number	VARCHAR	Contact number of the owner of the pet

Table 4.2.5.5 STRAP Data Dictionary - Add Tracker

Variable	Variable Name	Data Type	Description
ID	id	INT	Primary Key
Device Unique Id	device_id	VARCHAR	Key used to identify specific device
Pet Unique Id	pet_id	VARCHAR	Foreign Key <i>Add Pet . pet_name</i>

4.3. Testing and Results

Test Case Scenario: Navigation Bar

Table 4.3.1: Test Cases - Navigation Bar

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	NAV-00	1. Click ‘About’ button	Redirects the user to our objectives section	Redirected the user to the our objectives section	
	NAV-01	1. Input ‘622a0cb2407 21’ (correct pet id) as pet id 2. Click ‘Search’ button	Redirects the user to the search pets page and shows a pet’s information	Redirected the user to the search pets page and shows a pet’s information	Successful
	NAV-02	1. Input ‘2323131231 231’ (wrong pet id) as pet id 2. Click ‘Search’ button	Redirects the user to the search pets page and prompts an error that it doesn’t match any pets	Redirected the user to the search pets page and prompts an error message	
	NAV-02	1. Click ‘FAQ’ button 2. Click ‘GPS’ button	Redirects the user to the GPS documentation page	Redirected the user to the GPS documentation page	
	NAV-03	1. Click ‘FAQ’ button 2. Click ‘Pet Collar’ button	Redirects the user to the Pet Collar documentation page	Redirected the user to the Pet Collar documentation page	
	NAV-04	1. Click ‘FAQ’ button 2. Click ‘Pet Interaction’ button	Redirects the user to the Pet Interaction documentation page	Redirected the user to the Pet Interaction documentation page	

	NAV-04	<ol style="list-style-type: none"> 1. Click 'FAQ' button 2. Click 'Research Document' button 	Redirects the user to the Research Document page	Redirected the user to the Pet Interaction documentation page	
	NAV-05	<ol style="list-style-type: none"> 1. Click 'Sign-in' button 	Redirects the user to the login page	Redirected the user to the login page	Successful
	NAV-06	<ol style="list-style-type: none"> 1. Click 'JuanDelaCruz' button 2. Click 'Logout' button 	Logouts the user	Logouts the user	Successful

Test Case Scenario: Login Page

Table 4.3.2: Test Cases - Login Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	LOG-00	<ol style="list-style-type: none"> 1. Click 'Sign-in' button 2. Input 'JuanDelaCruz' (correct username) as username 3. Input '03152022@J' 	Login should be successful	Login is successful	Successful

		<p>uan' (correct password) as password</p> <p>4. Click 'Login' button</p>			
	LOG-01	<p>1. Click 'Sign-in' button</p> <p>2. Input '' (blank username) as username</p> <p>3. Input '03152022@Juan' (correct password) as password</p> <p>4. Click 'Login' button</p>	Login should not be successful - Error message stating that account has incomplete credentials	Login is not successful - Error message states that account has incomplete credentials	Successful
	LOG-02	<p>1. Click 'Sign-in' button</p> <p>2. Input 'JuanDelaCruz' (correct username) as username</p> <p>3. Input '' (blank password) as password</p> <p>4. Click 'Login' button</p>	Login should not be successful - Error message stating that account has incomplete credentials	Login is not successful - Error message states that account has incomplete credentials	Successful
	LOG-03	<p>1. Click 'Sign-in' button</p> <p>2. Input '' (blank username) as username</p> <p>3. Input '123' (incorrect password) as</p>	Login should not be successful - Error message stating that account has incomplete credentials	Login is not successful - Error message states that account has incomplete credentials	Successful

		password 4. Click 'Login' button			
	LOG-04	1. Click 'Sign-in' button 2. Input '' (blank username) as username 3. Input '03152022@Juan' (correct password) as password 4. Click 'Login' button	Login should not be successful - Error message stating that account has incomplete credentials	Login is not successful - Error message states that account has incomplete credentials	Successful
	LOG-05	1. Click 'Sign-in' button 5. Click 'Create Account' button	Redirects the user to create account page	Redirected the user to create account page	Successful

Test Case Scenario: Register Page

Table 4.3.3: Test Cases - Register Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	REG-00	1. Click 'Sign-in' button 2. Click 'Create Account' button 3. Input 'JuanDelaCruz' (correct username) as username	Creates the account and redirects the user to the pets page of the user	Created the account and redirected the user to the pets page of the user	

		<p>4. Input 'juan.delacruz 1@raksoedux. com' (correct email) as email</p> <p>5. Input 'Philippines' (correct address) as address</p> <p>6. Input '03152022@Juan' (correct password) as password</p> <p>7. Input '03152022@Juan' (correct confirm password) as confirm password</p> <p>8. Click 'Create' button</p>			
	REG-01	<p>1. Click 'Sign-in' button</p> <p>2. Click 'Create Account' button</p> <p>3. Input '' (blank username) as username</p> <p>4. Input '' (blank email) as email</p> <p>5. Input '' (blank address) as address</p> <p>6. Input '' (blank password) as</p>	<p>Prompts an error message to user that they need to input information</p>	<p>Prompted an error message to user to fill-up registration input fields</p>	

		<p>password</p> <p>7. Input “ ” (blank confirm password) as confirm password</p> <p>8. Click ‘Create’ button</p>			
	REG-02	<p>1. Click ‘Sign-in’ button</p> <p>2. Click ‘Create Account’ button</p> <p>3. Input ‘Ablaze0313’ (existing username) as username</p> <p>4. Input ‘juan.delacruz1@raksoedux.com’ (existing email) as email</p> <p>5. Input ‘Philippines’ (existing address) as address</p> <p>6. Input ‘03152022@Ablaze’ (correct password) as password</p> <p>7. Input ‘03152022@Ablaze’ (correct confirm password) as</p>	<p>Prompts an error message to the user that the current username is already existing. It won’t prompt an error message to the email and address fields.</p>	<p>Prompted an error message to the user that the current username is already existing. It won’t prompt an error message to the email and address fields</p>	Successful

		<p>confirm password</p> <p>8. Click ‘Create’ button</p>			
	REG-03	<p>1. Click ‘Sign-in’ button</p> <p>2. Click ‘Create Account’ button</p> <p>3. Input ‘Ablaze#’ (wrong username) as username</p> <p>4. Input ‘juan.delacruz_1@raksoedux.com’ (correct) as email</p> <p>5. Input ‘Philippines’ (correct address) as address</p> <p>6. Input ‘03152022@Ablaze’ (correct password) as password</p> <p>7. Input ‘03152022@Ablaze’ (correct confirm password) as confirm password</p> <p>8. Click ‘Create’ button</p>	<p>Prompts an error message to the user that the username must contain only alphabet, numbers and space</p>	<p>Prompted an error message to the user that the username must contain only alphabet, numbers and space</p>	
	REG-04	<p>1. Click ‘Sign-in’</p>	<p>Prompts the user that the email is</p>	<p>Prompted the user that the</p>	Successful

		<p>button</p> <ol style="list-style-type: none"> 2. Click ‘Create Account’ button 3. Input ‘JuanDelaCruz’ (correct username) as username 4. Input ‘juan.delacruz@raksoedux.com’ (incorrect) as email 9. Input ‘Philippines’ (correct address) as address 10. Input ‘03152022@Ablaze’ (correct password) as password 11. Input ‘03152022@Ablaze’ (correct confirm password) as confirm password 12. Click ‘Create’ button 	missing an @ and it's not a valid email	email is missing an @ and it's not a valid email	
	REG-05	<ol style="list-style-type: none"> 1. Click ‘Sign-in’ button 2. Click ‘Create Account’ button 3. Input ‘JuanDelaCruz’ (correct username) as 	Prompts the user that the password should have at least one uppercase	Prompted the user that the password should have at least have one uppercase	

		<p>username</p> <p>4. Input 'juan.delacruz 1@raksoedux. com' (correct email) as email</p> <p>5. Input 'Philippines' (correct address) as address</p> <p>6. Input 'juan03152022' (incorrect password) as password</p> <p>7. Input 'juan03152022' (incorrect confirm password) as confirm password</p> <p>8. Click 'Create' button</p>			
	REG-06	<p>1. Click 'Sign-in' button</p> <p>2. Click 'Create Account' button</p> <p>3. Input 'JuanDelaCruz' (correct username) as username</p> <p>4. Input 'juan.delacruz 1@raksoedux. com' (correct email) as email</p> <p>5. Input 'Philippines'</p>	<p>Prompts the user that the password should at least have a minimum of 8 characters</p>	<p>Prompted the user that the password should at least have a minimum of 8 characters</p>	

		<p>(correct address) as address</p> <p>6. Input ‘Juan03’ (incorrect password) as password</p> <p>7. Input ‘Juan03’ (incorrect confirm password) as confirm password</p> <p>9. Click ‘Create’ button</p>			
	REG-07	<p>1. Click ‘Sign-in’ button</p> <p>2. Click ‘Create Account’ button</p> <p>3. Input ‘JuanDelaCruz’ (correct username) as username</p> <p>4. Input ‘juan.delacruz_1@raksoedux.com’ (correct email) as email</p> <p>5. Input ‘Philippines’ (correct address) as address</p> <p>6. Input ‘juan03’ (incorrect password) as password</p> <p>8. Input ‘juan03’ (incorrect</p>	<p>Prompts the user that the password should at least have a minimum of 8 characters and at least one uppercase</p>	<p>Prompted the user that the password should at least have a minimum of 8 and at least one uppercase</p>	

		<p>confirm password) as confirm password</p> <p>10. Click ‘Create’ button</p>			
	REG-09	<ol style="list-style-type: none"> 1. Click ‘Sign-in’ button 2. Click ‘Create Account’ button 3. Input ‘JuanDelaCruz’ (correct username) as username 4. Input ‘juan.delacruz1@raksoedux.com’ (correct email) as email 5. Input ‘Philippines’ (correct address) as address 6. Input ‘03152022@Juan’ (correct password) as password 7. Input ‘03152022@Ablaze’ (incorrect confirm password) as confirm password 8. Click ‘Create’ button 	<p>Prompts the user an error message that the password and confirm password doesn’t match</p>	<p>Prompted the user an error message that the password and confirm password doesn’t match</p>	
	REG-10	1. Click	Redirects the	Redirected the	Successful

		<p>‘Sign-in’ button</p> <p>2. Click ‘Create Account’ button</p> <p>3. Click ‘Sign In’ button</p>	user to the sign-in page	user to the sign-in page	
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Test Case Scenario: Pet Registration Page

Table 4.3.4: Test Cases - Pet Registration Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	PET-01	<p>1. Click ‘Pet’ button</p> <p>2. Click ‘Add Pet’ button</p>	Redirects the user to the pet registration page	Redirected the user to the pet registration page	Successful
	PET-02	<p>1. Click ‘Pet’ button</p> <p>2. Click ‘Add Pet’ button</p> <p>3. Attach a png file (correct pet picture) as Pet Picture</p> <p>4. Input ‘Disney’ (correct pet name) as Pet Name</p> <p>5. Input ‘Dog’ (correct pet type) as Pet Type</p> <p>6. Input ‘Golden Retriever’(correct pet breed) as Pet Breed</p> <p>7. Input ‘3x a week of dog food’ (correct pet diet) as</p>	Redirects the user to the view pets page	Redirected the user to the view pets page	Successful

		<p>Pet Diet</p> <p>8. Input ‘Dewormed and Anti rabies’ (correct pet vaccine) as Pet Vaccines</p> <p>9. Input ‘Francis Parreñas’ (correct contact name) as Contact Name</p> <p>10. Input ‘0916709704 1’ (correct contact number) as Contact Number</p> <p>11. Click ‘Submit’ button</p>			
	PET-03	<p>1. Click ‘Pet’ button</p> <p>2. Click ‘Add Pet’ button</p> <p>3. Attach no file as Pet Picture</p> <p>4. Input ‘’ (blank input in Pet name)as Pet Name</p> <p>5. Input ‘Dog’ (blank input in Pet Type)as Pet Type</p> <p>6. Input ‘Golden Retriever’ (blank input in Pet Breed) as Pet Breed</p> <p>7. Input ‘3x a</p>	<p>Prompts an error message to the user that they need to input information in text fields</p>	<p>Prompted an error message to the user to input pet details in the text fields</p>	

		<p>week of dog food' (blank input in Pet Diet) as Pet Diet</p> <p>8. Input 'Dewormed and Anti rabies'(blank input in Pet Vaccine) as Pet Vaccines</p> <p>9. Input “ ”(blank input in Contact Name) as Contact Name</p> <p>10. Input “ ”(blank input in Contact Number) as Contact Number</p> <p>11. Click 'Submit' button</p>			
	PET-04	<p>1. Click 'Pet' button</p> <p>2. Click 'Add Pet' button</p> <p>3. Attach a png file (correct pet picture) as Pet Picture</p> <p>4. Input 'Disney' as Pet Name</p> <p>5. Input 'Dog' (correct pet type) as Pet Type</p> <p>6. Input 'Golden Retriever'(correct pet breed) as Pet Breed</p>	<p>Prompts an error message to the user that the contact number is invalid</p>	<p>Prompted an error message to the user that the contact number is invalid</p>	

		<p>7. Input ‘3x a week of dog food’ (correct pet diet) as Pet Diet</p> <p>8. Input ‘Dewormed and Anti rabies’ (correct pet vaccine) as Pet Vaccines</p> <p>9. Input ‘Francis Parreñas’ as Contact Name</p> <p>10. Input ‘FFF’ (incorrect contact number) as Contact Number</p> <p>11. Click ‘Submit’ button</p>			
	PET-05	<p>1. Click ‘Pet’ button</p> <p>2. Click ‘View Pets’ button</p>	Redirects the user to the view pets page	Redirected the user to the view pets page	Successful

Test Case Scenario: View Pets Page

Table 4.3.5: Test Cases - View Pets Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	VIEW-01	<p>1. Click ‘Pet’ button</p> <p>2. Click ‘Edit’ button</p>	Redirects the user to the pet update page	Redirected the user to the pet update page	Successful
	VIEW-02	1. Click ‘Pet’ button	Creates a designated QR code	Created a QR code for the pet	Successful

		2. Click 'QR icon' button 3. Click 'Download' button	code for the pet		
	VIEW-02	1. Click 'Pet' button 2. Click 'Delete icon' button 3. Click 'Delete' button	It should delete the pet's information	It deleted the pet's information	Successful

Test Case Scenario: Pet Update Page

Table 4.3.6: Test Cases - Pet Update Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	UPD-01	1. Click 'Pet' button 2. Click 'Edit' button 3. Attach new png file (correct and new pet picture) as Pet Picture 4. Input 'Francis'(correct and new pet name) as Pet Name 5. Input 'Other' (correct and new pet type) as Pet Type 6. Input 'Raccoon'(correct and new pet breed) as Pet Breed 7. Input '2x a week of dog'	Redirects the user to the view pets page and update pets information	Redirected the user to the view pets page and update pets information	Successful

		<p>food' (correct and new pet diet) as Pet Diet</p> <p>8. Input 'Dewormed' (correct and new pet vaccine) as Pet Vaccines</p> <p>9. Input 'Francis Parreñas' (correct and new contact name) as Contact Name</p> <p>10. Input '0916709704 1' (correct contact number) as Contact Number</p> <p>12. Click 'Submit' button</p>			
	UPD-02	<p>1. Click 'Pet' button</p> <p>2. Click 'Edit' button</p> <p>3. Attach new png file (correct and new pet picture) as Pet Picture</p> <p>4. Input 'Francis'(correct and new pet name) as Pet Name</p> <p>5. Input 'Other' (correct and new pet type) as Pet Type</p>	<p>Prompts an error message to the user that the contact number is invalid</p>	<p>Prompted an error message to the user that the contact number is invalid</p>	

		<p>6. Input ‘Raccoon’(correct and new pet breed) as Pet Breed</p> <p>7. Input ‘2x a week of dog food’ (correct and new pet diet) as Pet Diet</p> <p>8. Input ‘Dewormed’ (correct and new pet vaccine) as Pet Vaccines</p> <p>9. Input ‘Francis Parreñas’ (correct and new contact name) as Contact Name</p> <p>10. Input ‘FF’ (correct contact number) as Contact Number</p> <p>11. Click ‘Submit’ button</p>			
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Test Case Scenario: Add Tracker Page

Table 4.3.7: Test Cases - Add Tracker Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	ADD-00	<p>1. Click ‘Tracker’ button</p> <p>2. Click ‘Add Tracker’</p>	Redirects the user and adds the device id to the view tracker page	Redirected the user and adds the device id to the view tracker page	Successful

		<p>button</p> <p>3. Input ‘6b7b3d916c5 7729c’ (correct and new device id) as device id</p> <p>4. Click ‘Disney’ as pet assigned</p> <p>5. Click ‘Add’ button</p>			
	ADD-01	<p>1. Click ‘Tracker’ button</p> <p>2. Click ‘Add Tracker’ button</p> <p>3. Input ‘6b7b3d916c5 7729c’ (existing device id) as device id</p> <p>4. Click ‘Disney’ as pet assigned</p> <p>5. Click ‘Add’ button</p>	Prompts the user that the device ID is already tracking a pet	Prompts the user that the device ID is already tracking a pet	Successful
	ADD-01	<p>1. Click ‘Tracker’ button</p> <p>2. Click ‘Add Tracker’ button</p> <p>3. Input ‘111’ (wrong device id) as device id</p> <p>4. Click ‘Disney’ as pet assigned</p> <p>5. Click ‘Add’ button</p>	Prompts the user that the device ID does not exist	Prompted the user that the device ID does not exist	Successful

		button			
	ADD-02	1. Click 'Tracker' button 2. Click 'Edit icon' button	Prompts the user to a modal that can change the assigned pets on that device ID	Prompted the user to a model that can change the pets assigned on that device ID	Successful
	ADD-03	1. Click 'Tracker' button 2. Click 'Delete icon' button 3. Click 'Delete' button	Deletes the tracker information	It deleted the tracker information	Successful

Test Case Scenario: Search Pets Page

Table 4.3.8: Test Cases - Search Pets Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	SRCH-00	1. Click 'Search' button 2. Enter '6b7b3d916c57729c' (correct pet unique id) as pet unique id	Prompts the user of the pet information of the pet	Prompted the user of the pet information of the pet	Successful
	SRCH-01	1. Click 'Search' button 2. Enter '11111' (incorrect pet unique id) as pet unique id	Prompts the user that the ID does not match any pets	Prompted the user that the ID does not match any pets	Successful

Test Case Scenario: Dashboard Page

Table 4.3.9: Test Cases - Dashboard Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	DSHBRD-00	<ol style="list-style-type: none"> Click ‘Dashboard’ button Click ‘Disney’ navbar button Click ‘Track’ button 	Boots up the current GPS location of the said pet	Booted up the current GPS location of the said pet	Successful

Test Case Scenario: Edit Profile Page

Table 4.3.10: Test Cases - Edit Profile Page

Date	Bug ID	Steps to Reproduce	Expected Result	Actual Result	Status
	EDIT-00	<ol style="list-style-type: none"> Click ‘JuanDelaCruz’ button Click ‘Edit Profile’ button Input ‘Francis’ (correct and new username) as username Input ‘juan1.delacruz1@raksoedux.com’ (correct and new email) as email Input ‘Switzerland’ (correct and new address) as address 	Updates the user profile information	Updated the user profile information	

		<p>6. Input ‘03152022@Francis’ (correct and newpassword) as password</p> <p>7. Input ‘03152022@Francis’ (correct and new confirm password) as confirm password</p> <p>8. Click ‘Update’ button</p>			
	EDIT-01	<p>1. Click ‘JuanDelaCruz’ button</p> <p>2. Click ‘Edit Profile’ button</p> <p>3. Input ‘’ (blank username) as username</p> <p>4. Input ‘’ (blank email) as email</p> <p>5. Input ‘’ (blank address) as address</p> <p>6. Input ‘’ (blank password) as password</p> <p>7. Input ‘’ (blank confirm password) as confirm password</p> <p>8. Click ‘Update’ button</p>	<p>Prompts an error message to user that they need to input information</p>	<p>Prompted an error message to user to fill-up registration input fields</p>	

	EDIT-02	<ol style="list-style-type: none"> 1. Click ‘JuanDelaCruz’ button 2. Click ‘Edit Profile’ button 3. Input ‘Ablaze0313’ (existing username) as username 4. Click ‘Update’ button 	<p>Prompts an error message to the user that the current username is already existing. It won’t prompt an error message to the email and address fields.</p>	<p>Prompted an error message to the user that the current username is already existing. It won’t prompt an error message to the email and address fields</p>	
	EDIT-03	<ol style="list-style-type: none"> 1. Click ‘JuanDelaCruz’ button 2. Click ‘Edit Profile’ button 3. Input ‘Ablaze#’ (wrong username) as username 4. Click ‘Update’ button 	<p>Prompts an error message to the user that the username must contain only alphabet, numbers and space</p>	<p>Prompted an error message to the user that the username must contain only alphabet, numbers and space</p>	
	EDIT-04	<ol style="list-style-type: none"> 1. Click ‘JuanDelaCruz’ button 2. Click ‘Edit Profile’ button 3. Input ‘juan.delacruz1r@aksoedux.com’ (incorrect) as email 4. Click ‘Update’ button 	<p>Prompts the user that the email is missing an @ and it’s not a valid email</p>	<p>Prompted the user that the email is missing an @ and it’s not a valid email</p>	
	EDIT-05	<ol style="list-style-type: none"> 1. Click ‘JuanDelaCruz’ button 2. Click ‘Edit Profile’ button 3. Input 	<p>Prompts the user that the password should have at least one uppercase</p>	<p>Prompted the user that the password should have at least one uppercase</p>	

		<p>‘juan03152022’ (incorrect password) as password</p> <p>4. Input ‘juan03152022’ (incorrect confirm password) as confirm password</p> <p>5. Click ‘Update’ button</p>			
	EDIT-06	<p>1. Click ‘JuanDelaCruz’ button</p> <p>2. Click ‘Edit Profile’ button</p> <p>3. Input ‘Juan03’ (incorrect password) as password</p> <p>4. Input ‘Juan03’ (incorrect confirm password) as confirm password</p> <p>5. Click ‘Update’ button</p>	Prompts the user that the password should at least have a minimum of 8 characters	Prompted the user that the password should at least have a minimum of 8 characters	
	EDIT-07	<p>1. Click ‘JuanDelaCruz’ button</p> <p>2. Click ‘Edit Profile’ button</p> <p>3. Input ‘juan03’ (incorrect password) as password</p> <p>4. Input ‘juan03’ (incorrect confirm password) as</p>	Prompts the user that the password should at least have a minimum of 8 characters and at least one uppercase	Prompted the user that the password should at least have a minimum of 8 and at least one uppercase	

		<p>confirm password</p> <p>5. Click ‘Create’ button</p>			
	EDIT-08	<p>1. Click ‘JuanDelaCruz’ button</p> <p>2. Click ‘Edit Profile’ button</p> <p>3. Input ‘03152022@Juan’ (correct password) as password</p> <p>4. Input ‘03152022@Ab laze’ (incorrect confirm password) as confirm password</p> <p>5. Click ‘Update’ button</p>	<p>Prompts the user an error message that the password and confirm password doesn’t match</p>	<p>Prompted the user an error message that the password and confirm password doesn’t match</p>	

CHAPTER 5: CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

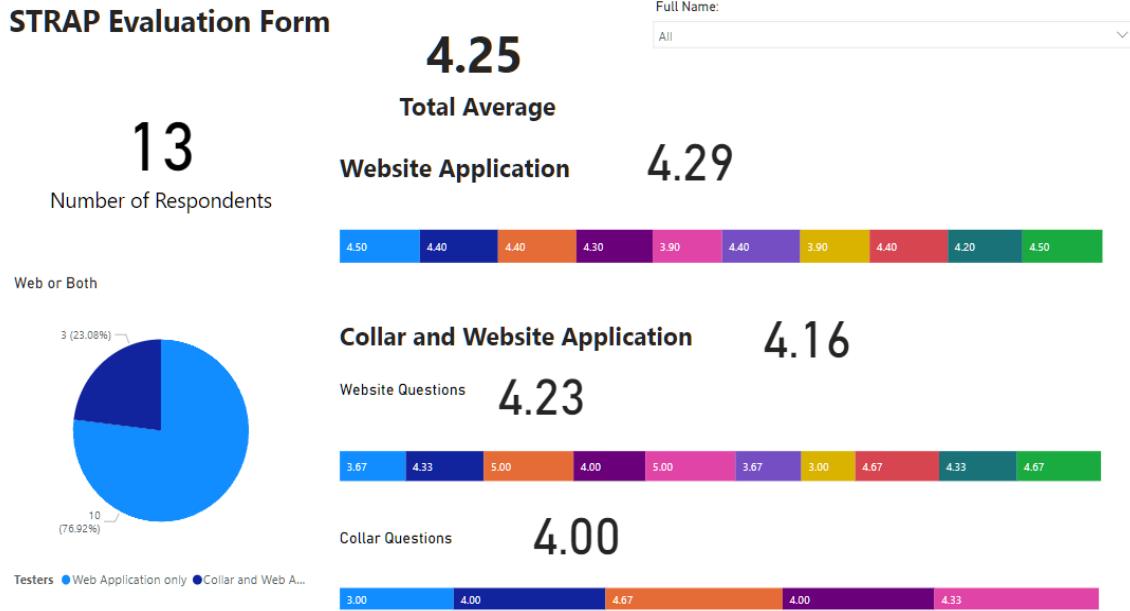


Figure 5.1 STRAP Evaluation Form

The total combined average for the pet owners who tested the web application and both the collar and web application is 4.25.

An average of 4.29 to the pet owners who beta tested the website application. The lowest average question is "STRAP gives messages that tell me how to fix the issues" which is 3.90. While no question had a perfect score.

For the pet owners who beta tested the tracker and website application, the average is 4.16. A -0.13 difference than the testers who only tested the web application. But, if we take a closer look at the data, it is only a -0.06 difference if we only take into account the questions that relate to the website application is 4.23. The average of the tracker questions greatly affected the average with a score of 4.0

In conclusion, using the tracker itself then the website may influence the beta testers. Thus, the slightly lowered average of the website questions for the people who used both.

We could also conclude that STRAP's web application and tracker are functional and can meet its objectives to its users.

5.2 Recommendations

Increase the total number of respondents especially to the respondents who tested both the tracker and web application. An answer could greatly affect the averages since there are only three people for it.

We recommend that possibly it could have a smaller and more compact container for the gps location

PRIVACY POLICY

Privacy Policy of STRAP

Updated at 2021-07-18

STRAP is committed to protecting your privacy. This Privacy Policy explains how your personal information is collected, used, and disclosed by STRAP.

This Privacy Policy applies to our website, and its associated subdomains (collectively, our “Service”) alongside our application, STRAP. By accessing or using our Service, you signify that you have read, understood, and agree to our collection, storage, use, and disclosure of your personal information as described in this Privacy Policy and our Terms of Service.

Definitions and Key Terms

To help explain things as clearly as possible in this Privacy Policy, every time any of these terms are referenced, are strictly defined as:

- Cookie: small amount of data generated by a website and saved by your web browser. It is used to identify your browser, provide analytics, and remember information about you such as your language preference or login information.
- Company: when this policy mentions “Company,” “we,” “us,” or “our,” it refers to STRAP, which is responsible for your information under this Privacy Policy.
- Country: where STRAP or the owners/founders of STRAP are based, in this case is Philippines

- Customer: refers to the company, organization or person that signs up to use the STRAP Service to manage the relationships with your consumers or service users.
- Device: any internet connected device such as a phone, tablet, computer or any other device that can be used to visit STRAP and use the services.
- IP address: Every device connected to the Internet is assigned a number known as an Internet protocol (IP) address. These numbers are usually assigned in geographic blocks. An IP address can often be used to identify the location from which a device is connecting to the Internet.
- Personnel: refers to those individuals who are employed by STRAP or are under contract to perform a service on behalf of one of the parties.
- Personal Data: any information that directly, indirectly, or in connection with other information — including a personal identification number — allows for the identification or identifiability of a natural person.
- Service: refers to the service provided by STRAP as described in the relative terms (if available) and on this platform.
- Third-party service: refers to advertisers, contest sponsors, promotional and marketing partners, and others who provide our content or whose products or services we think may interest you.
- Website: STRAP's site, which can be accessed via this URL: strap.com.ph
- You: a person or entity that is registered with STRAP to use the Services.

What Information Do We Collect?

We collect information from you when you visit our website, register on our site, place an order, subscribe to our newsletter, respond to a survey or fill out a form.

- Name / Username
- Email Addresses
- Phone Numbers
- Addresses
- Medical Records of Pets
- Diet Records of Pets
- GPS Location of the Collar
- GPS Location of the Pet

We also collect information from mobile devices for a better user experience, although these features are completely optional:

- Location (GPS): Location data helps to create an accurate representation of your interests, and this can be used to bring more targeted and relevant ads to potential customers.

When does STRAP use end user information from third parties?

STRAP will collect End User Data necessary to provide the STRAP services to our customers. End users may voluntarily provide us with information they have made available on social media websites. If you provide us with any such information, we may collect publicly available information from the social media websites you have indicated. You can control how much of your information social media websites make public by visiting these websites and changing your privacy settings.

When does STRAP use customer information from third parties?

We receive some information from the third parties when you contact us. For example, when you submit your email address to us to show interest in becoming a STRAP customer, we receive information from a third party that provides automated fraud detection services to STRAP. We also occasionally collect information that is made publicly available on social media websites. You can control how much of your information social media websites make public by visiting these websites and changing your privacy settings.

Do we share the information we collect with third parties?

We may share the information that we collect, both personal and non-personal, with third parties such as advertisers, contest sponsors, promotional and marketing partners, and others who provide our content or whose products or services we think may interest you. We may also share it with our current and future affiliated companies and business partners, and if we are involved in a merger, asset sale or other business reorganization, we may also share or transfer your personal and non-personal information to our successors-in-interest.

We may engage trusted third party service providers to perform functions and provide services to us, such as hosting and maintaining our servers and the website, database storage and management, email management, storage marketing, credit card processing, customer service and fulfilling orders for products and services you may purchase through the website. We will likely share your personal information, and possibly some non-personal information, with these third parties to enable them to perform these services for us and for you.

We may share portions of our log file data, including IP addresses, for analytics purposes with third parties such as web analytics partners, application developers, and ad networks. If your IP

address is shared, it may be used to estimate general location and other technographics such as connection speed, whether you have visited the website in a shared location, and type of the device used to visit the website. They may aggregate information about our advertising and what you see on the website and then provide auditing, research and reporting for us and our advertisers.

We may also disclose personal and non-personal information about you to government or law enforcement officials or private parties as we, in our sole discretion, believe necessary or appropriate in order to respond to claims, legal process (including subpoenas), to protect our rights and interests or those of a third party, the safety of the public or any person, to prevent or stop any illegal, unethical, or legally actionable activity, or to otherwise comply with applicable court orders, laws, rules and regulations.

Where and when is information collected from customers and end users?

STRAP will collect personal information that you submit to us. We may also receive personal information about you from third parties as described above.

How Do We Use The Information We Collect?

Any of the information we collect from you may be used in one of the following ways:

- To personalize your experience (your information helps us to better respond to your individual needs)
- To improve our website (we continually strive to improve our website offerings based on the information and feedback we receive from you)

- To improve customer service (your information helps us to more effectively respond to your customer service requests and support needs)
- To process transactions
- To administer a contest, promotion, survey or other site feature
- To send periodic emails

How Do We Use Your Email Address?

By submitting your email address on this website, you agree to receive emails from us. You can cancel your participation in any of these email lists at any time by clicking on the opt-out link or other unsubscribe option that is included in the respective email. We only send emails to people who have authorized us to contact them, either directly, or through a third party. We do not send unsolicited commercial emails, because we hate spam as much as you do. By submitting your email address, you also agree to allow us to use your email address for customer audience targeting on sites like Facebook, where we display custom advertising to specific people who have opted-in to receive communications from us. Email addresses submitted only through the order processing page will be used for the sole purpose of sending you information and updates pertaining to your order. If, however, you have provided the same email to us through another method, we may use it for any of the purposes stated in this Policy. Note: If at any time you would like to unsubscribe from receiving future emails, we include detailed unsubscribe instructions at the bottom of each email.

How Long Do We Keep Your Information?

We keep your information only so long as we need it to provide STRAP to you and fulfill the purposes described in this policy. This is also the case for anyone that we share your information with and who carries out services on our behalf. When we no longer need to use your information and there is no need for us to keep it to comply with our legal or regulatory obligations, we'll either remove it from our systems or depersonalize it so that we can't identify you.

How Do We Protect Your Information?

We implement a variety of security measures to maintain the safety of your personal information when you place an order or enter, submit, or access your personal information. We offer the use of a secure server. All supplied sensitive/credit information is transmitted via Secure Socket Layer (SSL) technology and then encrypted into our Payment gateway providers database only to be accessible by those authorized with special access rights to such systems, and are required to keep the information confidential. After a transaction, your private information (credit cards, social security numbers, financials, etc.) is never kept on file. We cannot, however, ensure or warrant the absolute security of any information you transmit to STRAP or guarantee that your information on the Service may not be accessed, disclosed, altered, or destroyed by a breach of any of our physical, technical, or managerial safeguards.

Could my information be transferred to other countries?

STRAP is incorporated in the Philippines. Information collected via our website, through direct interactions with you, or from use of our help services may be transferred from time to time to our offices or personnel, or to third parties, located throughout the world, and may be viewed and

hosted anywhere in the world, including countries that may not have laws of general applicability regulating the use and transfer of such data. To the fullest extent allowed by applicable law, by using any of the above, you voluntarily consent to the trans-border transfer and hosting of such information.

Is the information collected through the STRAP Service secure?

We take precautions to protect the security of your information. We have physical, electronic, and managerial procedures to help safeguard, prevent unauthorized access, maintain data security, and correctly use your information. However, neither people nor security systems are foolproof, including encryption systems. In addition, people can commit intentional crimes, make mistakes or fail to follow policies. Therefore, while we use reasonable efforts to protect your personal information, we cannot guarantee its absolute security. If applicable law imposes any non-disclaimable duty to protect your personal information, you agree that intentional misconduct will be the standards used to measure our compliance with that duty.

Can I update or correct my information?

The rights you have to request updates or corrections to the information STRAP collects depend on your relationship with STRAP. Personnel may update or correct their information as detailed in our internal company employment policies.

Customers have the right to request the restriction of certain uses and disclosures of personally identifiable information as follows. You can contact us in order to (1) update or correct your personally identifiable information, (2) change your preferences with respect to communications and other information you receive from us, or (3) delete the personally identifiable information

maintained about you on our systems (subject to the following paragraph), by cancelling your account. Such updates, corrections, changes and deletions will have no effect on other information that we maintain, or information that we have provided to third parties in accordance with this Privacy Policy prior to such update, correction, change or deletion. To protect your privacy and security, we may take reasonable steps (such as requesting a unique password) to verify your identity before granting you profile access or making corrections. You are responsible for maintaining the secrecy of your unique password and account information at all times.

You should be aware that it is not technologically possible to remove each and every record of the information you have provided to us from our system. The need to back up our systems to protect information from inadvertent loss means that a copy of your information may exist in a non-erasable form that will be difficult or impossible for us to locate. Promptly after receiving your request, all personal information stored in databases we actively use, and other readily searchable media will be updated, corrected, changed or deleted, as appropriate, as soon as and to the extent reasonably and technically practicable.

If you are an end user and wish to update, delete, or receive any information we have about you, you may do so by contacting the organization of which you are a customer.

Sale of Business

We reserve the right to transfer information to a third party in the event of a sale, merger or other transfer of all or substantially all of the assets of STRAP or any of its Corporate Affiliates (as defined herein), or that portion of STRAP or any of its Corporate Affiliates to which the Service relates, or in the event that we discontinue our business or file a petition or have filed against us a

petition in bankruptcy, reorganization or similar proceeding, provided that the third party agrees to adhere to the terms of this Privacy Policy.

Affiliates

We may disclose information (including personal information) about you to our Corporate Affiliates. For purposes of this Privacy Policy, "Corporate Affiliate" means any person or entity which directly or indirectly controls, is controlled by or is under common control with STRAP, whether by ownership or otherwise. Any information relating to you that we provide to our Corporate Affiliates will be treated by those Corporate Affiliates in accordance with the terms of this Privacy Policy.

Governing Law

This Privacy Policy is governed by the laws of the Philippines without regard to its conflict of laws provision. You consent to the exclusive jurisdiction of the courts in connection with any action or dispute arising between the parties under or in connection with this Privacy Policy except for those individuals who may have rights to make claims under Privacy Shield, or the Swiss-US framework.

The laws of the Philippines, excluding its conflicts of law rules, shall govern this Agreement and your use of the website. Your use of the website may also be subject to other local, state, national, or international laws.

By using STRAP or contacting us directly, you signify your acceptance of this Privacy Policy. If you do not agree to this Privacy Policy, you should not engage with our website, or use our services. Continued use of the website, direct engagement with us, or following the posting of

changes to this Privacy Policy that do not significantly affect the use or disclosure of your personal information will mean that you accept those changes.

Your Consent

We've updated our Privacy Policy to provide you with complete transparency into what is being set when you visit our site and how it's being used. By using our STRAP, registering an account, or making a purchase, you hereby consent to our Privacy Policy and agree to its terms.

Links to Other Websites

This Privacy Policy applies only to the Services. The Services may contain links to other websites not operated or controlled by STRAP. We are not responsible for the content, accuracy or opinions expressed in such websites, and such websites are not investigated, monitored or checked for accuracy or completeness by us. Please remember that when you use a link to go from the Services to another website, our Privacy Policy is no longer in effect. Your browsing and interaction on any other website, including those that have a link on our platform, is subject to that website's own rules and policies. Such third parties may use their own cookies or other methods to collect information about you.

Cookies

STRAP uses "Cookies" to identify the areas of our website that you have visited. A Cookie is a small piece of data stored on your computer or mobile device by your web browser. We use Cookies to enhance the performance and functionality of our website but are non-essential to their use. However, without these cookies, certain functionality like videos may become

unavailable or you would be required to enter your login details every time you visit the website as we would not be able to remember that you had logged in previously. Most web browsers can be set to disable the use of Cookies. However, if you disable Cookies, you may not be able to access functionality on our website correctly or at all. We never place Personally Identifiable Information in Cookies.

Blocking and disabling cookies and similar technologies

Wherever you're located you may also set your browser to block cookies and similar technologies, but this action may block our essential cookies and prevent our website from functioning properly, and you may not be able to fully utilize all of its features and services. You should also be aware that you may also lose some saved information (e.g. saved login details, site preferences) if you block cookies on your browser. Different browsers make different controls available to you. Disabling a cookie or category of cookie does not delete the cookie from your browser, you will need to do this yourself from within your browser, you should visit your browser's help menu for more information.

Kids' Privacy

We collect information from kids under the age of 13 just to better our services. If You are a parent or guardian and You are aware that Your child has provided Us with Personal Data without your permission, please contact Us. If We become aware that We have collected Personal Data from anyone under the age of 13 without verification of parental consent, We take steps to remove that information from Our servers.

Changes To Our Privacy Policy

We may change our Service and policies, and we may need to make changes to this Privacy Policy so that they accurately reflect our Service and policies. Unless otherwise required by law, we will notify you (for example, through our Service) before we make changes to this Privacy Policy and give you an opportunity to review them before they go into effect. Then, if you continue to use the Service, you will be bound by the updated Privacy Policy. If you do not want to agree to this or any updated Privacy Policy, you can delete your account.

Third-Party Services

We may display, include or make available third-party content (including data, information, applications and other products services) or provide links to third-party websites or services ("Third- Party Services").

You acknowledge and agree that STRAP shall not be responsible for any Third-Party Services, including their accuracy, completeness, timeliness, validity, copyright compliance, legality, decency, quality or any other aspect thereof. STRAP does not assume and shall not have any liability or responsibility to you or any other person or entity for any Third-Party Services.

Third-Party Services and links thereto are provided solely as a convenience to you and you access and use them entirely at your own risk and subject to such third parties' terms and conditions.

Tracking Technologies

- Google Maps API

Google Maps API is a robust tool that can be used to create a custom map, a searchable map, check-in functions, display live data synching with location, plan routes, or create a mashup just to name a few.

Google Maps API may collect information from You and from Your Device for security purposes.

Google Maps API collects information that is held in accordance with its Privacy Policy

- Cookies

We use Cookies to enhance the performance and functionality of our but are non-essential to their use. However, without these cookies, certain functionality like videos may become unavailable or you would be required to enter your login details every time you visit the as we would not be able to remember that you had logged in previously.

- Local Storage

Local Storage, sometimes known as DOM storage, provides web apps with methods and protocols for storing client-side data. Web storage supports persistent data storage, similar to cookies but with a greatly enhanced capacity and no information stored in the HTTP request header.

- Sessions

Use "Sessions" to identify the areas of our website that you have visited. A Session is a small piece of data stored on your computer or mobile device by your web browser.

What is personal data?

Any data that relates to an identifiable or identified individual. GDPR covers a broad spectrum of information that could be used on its own, or in combination with other pieces of information, to identify a person. Personal data extends beyond a person's name or email address. Some examples include financial information, political opinions, genetic data, biometric data, IP addresses, physical address, sexual orientation, and ethnicity.

Personal data is any information that relates to an identified or identifiable living individual. Different pieces of information, which collected together can lead to the identification of a particular person, also constitute personal data

The Data Protection Principles include requirements such as:

- Personal data collected must be processed in a fair, legal, and transparent way and should only be used in a way that a person would reasonably expect.
- Personal data should only be collected to fulfil a specific purpose and it should only be used for that purpose. Organizations must specify why they need the personal data when they collect it.
- Personal data should be held no longer than necessary to fulfil its purpose.
- People have the right to access their own personal data. They can also request a copy of their data, and that their data be updated, deleted, restricted, or moved to another organization.

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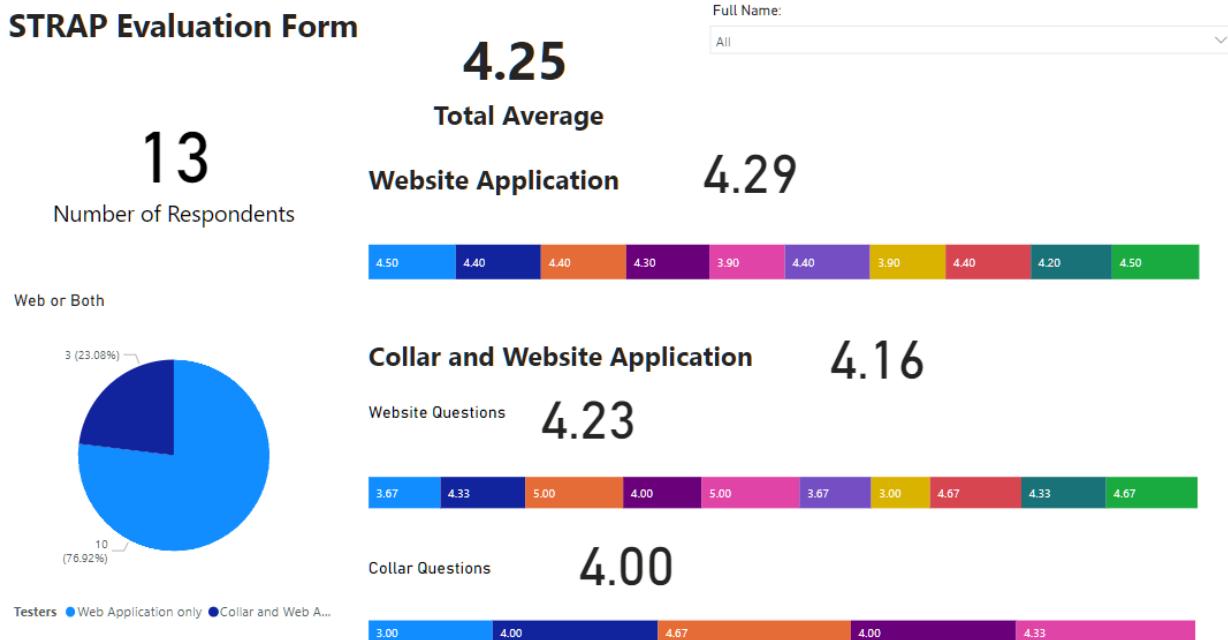
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APPENDICES

Appendix A: Project Link

<http://dinogomez.studio/>

Appendix B: Summarized Responses for Computer System Usability Questionnaire and Hardware Product Evaluation Survey Template for STRAP



https://app.powerbi.com/view?r=eyJrIjoiNjI0NzBkMTktN2ViNy00ODJkLTk1OTMtNWRIMDNiZDMzYzlkIiwidCI6IjUzNTlkNTM5LWJmMTMtNDVkMi1hZTY1LTJiYjE5N2FlMGExYiIsImMiOjEwfQ%3D%3D&fbclid=IwAR0n2YA4q8o9YOWiBwfY8YcbfQV9JZO rmBm_OwaO5b3J1g15cNtocyfsTME

Appendix C: Screen Layouts



Welcome to,

Specialized Tracker For Pets

It aims to provide real-time data location to the pets of the owner by using a Global Positioning System (GPS) collars. Also, it is a platform for pet owners to store their pet's identification information.

[Read More](#)

Our Objectives ✓

These are the goals we hope to achieve.

GPS Collar 🐾

To build a GPS collar using Arduino for real-time data location of the pets.

Web Application 🌐

To create a web application that stores the pet's identification information.

Quick Response Codes 📱

To embed the pet's personal information for identification on the QR Code.

The purpose of this project is to develop an application that will help track and monitor pets, including the ability to see the basic information of other pets through the use of QR scanning on the collar. Instead of posting banners and social media posts when the user's pet is lost. The user can now refer to the web application where he can track the current location via GPS. When a pet is lost, a bystander can scan the QR code to see the pet's details and also the owner's details like name and contact number to help with its return.

Our Team

The following individuals are the developers and creators of STRAP.



Dino Paulo Gomez

Technical Lead, Backend and Hardware Developer

I'm glad that I got to experience building this project where I got to meet and collaborate with other developers.



John Leonard Rada

Backend and Database Developer

I'm glad that I got to experience building this project where I got to meet and collaborate with other developers.



Owen Jorelle Clamor

Frontend Developer and Design

I'm glad that I got to experience building this project where I got to meet and collaborate with other developers.



Francis Geofrey Parreñas

Frontend Lead Developer

I'm glad that I got to experience building this project where I got to meet and collaborate with other developers.



aims to provide real-time data location to the pets of the owner by using a Global Positioning System (GPS) collars.

MENU

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[Contact](#)

CONTACT

 STRAP@examplegmail.com

 +01 234 567 89

Figure C.1 and Figure C.2 - Home Page Layout

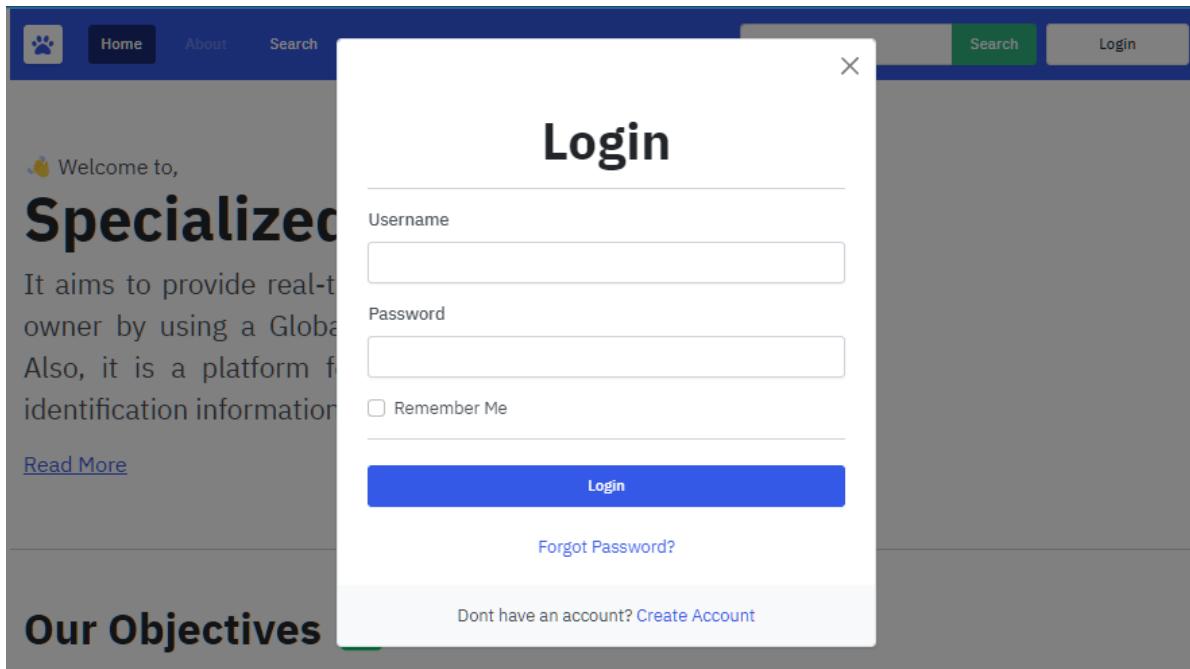


Figure C.3 - Login Modal Layout

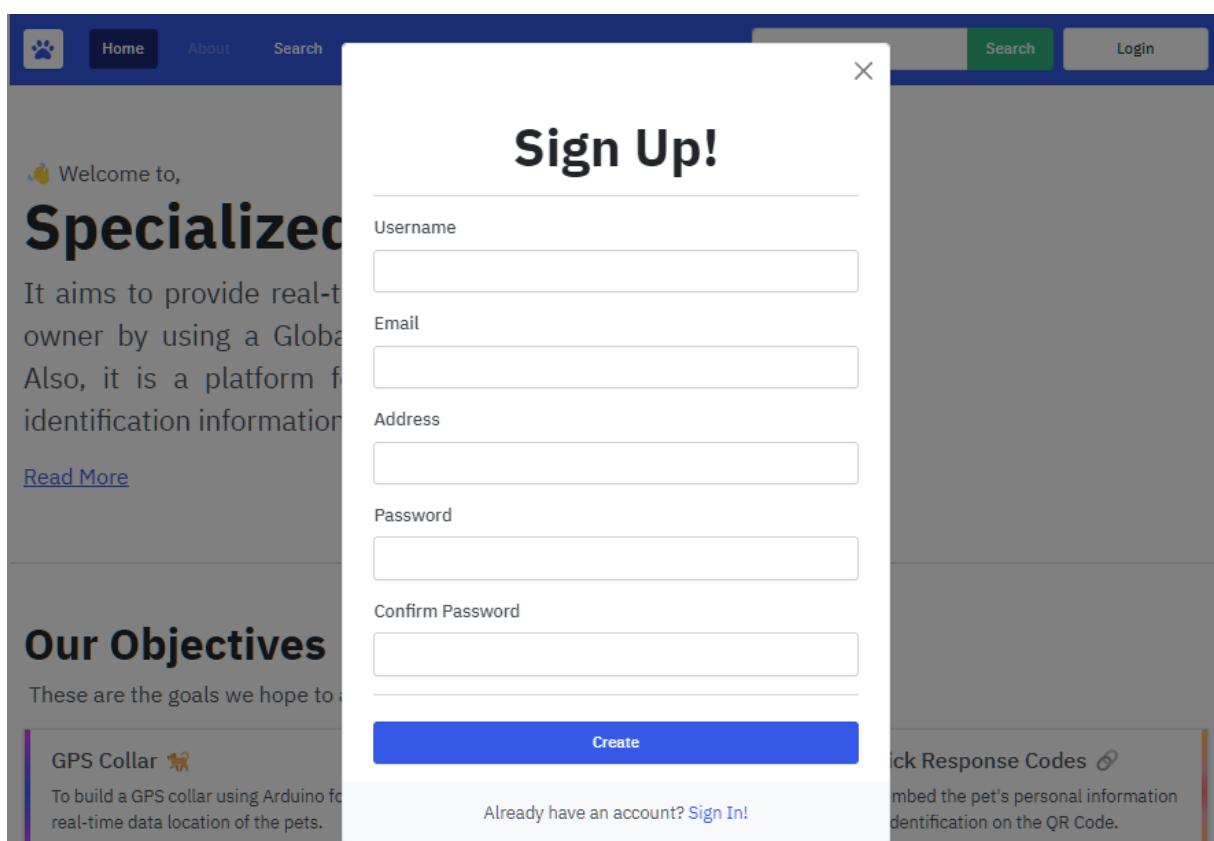


Figure C.4 - Registration Modal Layout

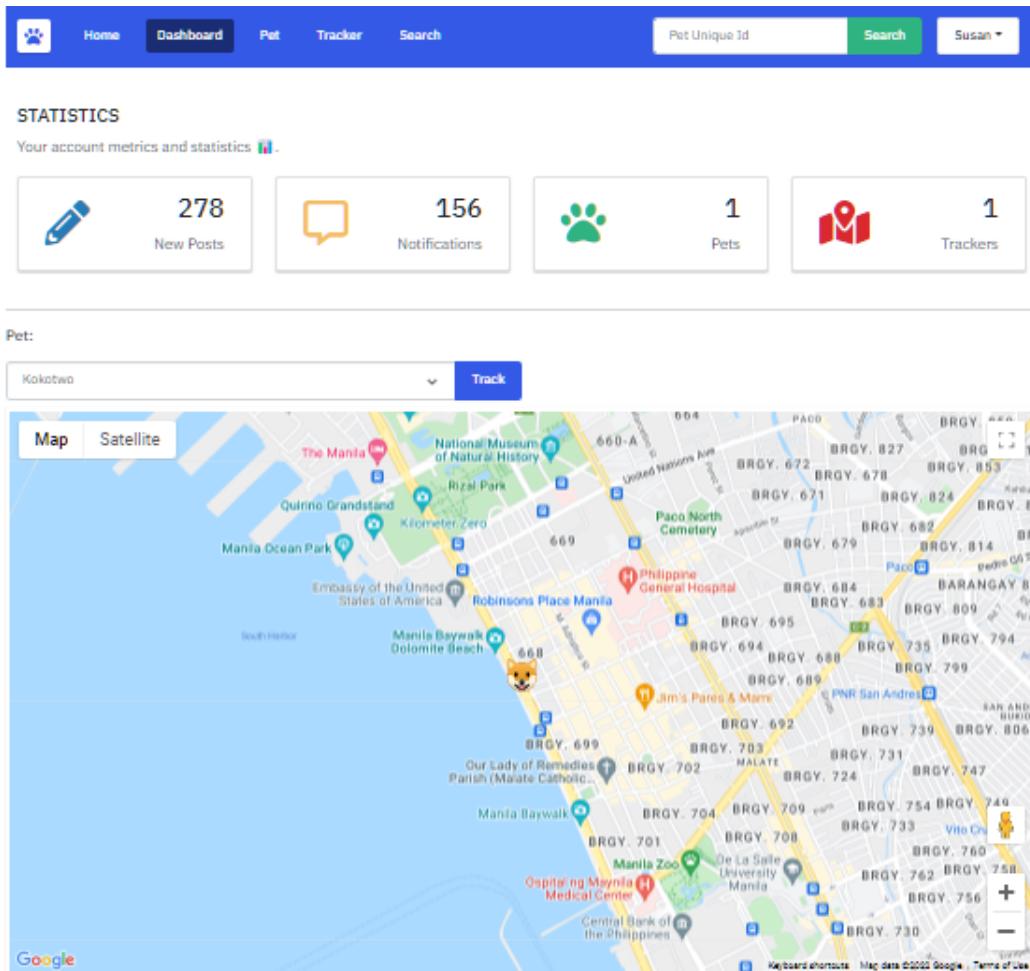


Figure C.5 - Dashboard Page Layout

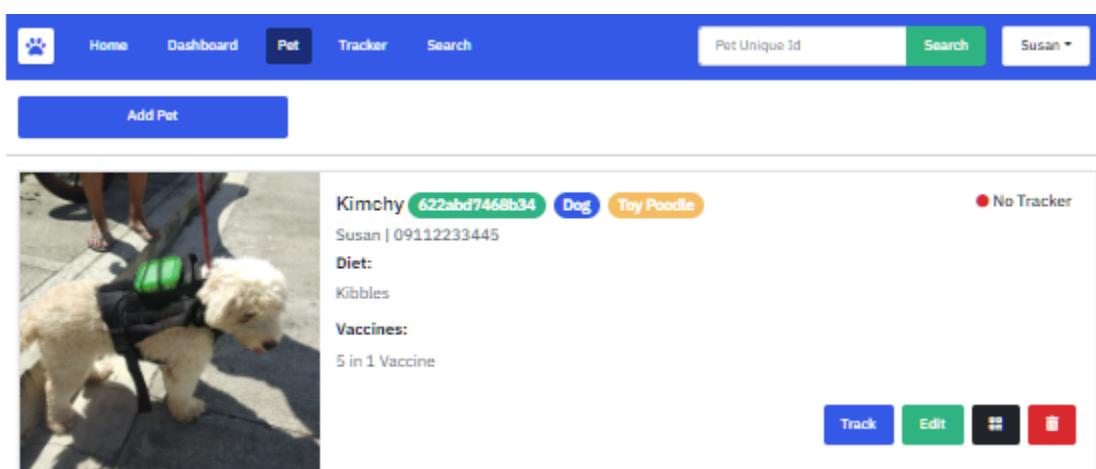


Figure C.6 Pet Information Page Layout

Home Dashboard Pet Tracker Search				Pet Unique Id	Search	Susan ▾	
Add Tracker							
#	DEVICE ID	PET ASSIGNED	OPERATION				
40	6b7b3d916c57729c	Kokotwo					
43	Bc45383955595519	Disney					

Figure C.7 Tracker Information Page Layout

Home Dashboard Pet Tracker Search				Pet Unique Id	Search	Susan ▾	
<h2>Search Pets! </h2>							
<input type="text" value="622abe768c756"/> Search							
✓ You found "Moonlight" try contacting their owner via the contact number!							
 <div style="display: flex; justify-content: space-between;"> <p>Moonlight 622abe768c756 Dog Good Dog</p> <p>CJ Lumbay 09122233445</p> <p>Diet: Dog Food</p> <p>Vaccines: 5 in 1 Vaccine</p> </div>							

Figure C.8 Search Pet Page Layout

Appendix D: Relevant Source Code

```
function initialize() {

    var latlng = new google.maps.LatLng(position[0], position[1]);
    var myOptions = {
        zoom: 15,
        center: latlng,
        mapTypeId: google.maps.MapTypeId.ROADMAP
    };
    map = new google.maps.Map(document.getElementById("mapCanvas"), myOptions);

    marker = new google.maps.Marker({
        position: latlng,
        map: map,
        icon: '/dogmarker',
        title: "Latitude:"+position[0]+" | Longitude:"+position[1]
    });

    const contentString = "<?php echo "<div id='content'><div id='siteNotice'>
</div><h1 id='firstHeading' class='firstHeading text-center'>".$tracker[2]."
</h1><div id='bodyContent'><p>Latitude: ".$row['lat']."' | Longitude: ".$row['lon']".
" </p></div></div>"; ?>";

    const infowindow = new google.maps.InfoWindow({
        content: contentString,
    });

    marker.addListener("click", () => {
        infowindow.open({
            anchor: marker,
            map,
            shouldFocus: false,
        });
    });
}
```

```

//Load google map
google.maps.event.addDomListener(window, 'load', initialize);
var numDeltas = 100;
var delay = 10; //milliseconds
var i = 0;
var deltaLat;
var deltaLng;

function transition(result){
    i = 0;
    deltaLat = (result[0] - position[0])/numDeltas;
    deltaLng = (result[1] - position[1])/numDeltas;
    moveMarker();
}

function moveMarker(){
    position[0] += deltaLat;
    position[1] += deltaLng;
    var latlng = new google.maps.LatLng(position[0], position[1]);
    marker.setTitle("Latitude:"+position[0]+" | Longitude:"+position[1]);
    marker.setPosition(latlng);

    if(i!=numDeltas){
        i++;
        setTimeout(moveMarker, delay);
    }
}

function loadDoc() {
    const xhttp = new XMLHttpRequest();
    xhttp.onload = function () {
        let current = this.responseText.split(/\r?\n/);
        current_split = current[current.length-1].split(" ");
        console.log(current_split);
        var result = [current_split[0], current_split[1]];
        transition(result);
    };
    xhttp.open("GET", "/gps-retrieve?did=1");
    xhttp.send();
    setTimeout(loadDoc, 5000);
}
loadDoc();
</script>

```

Figure D.1 and Figure D.2 GPS Tracker with Marker in Google Map

```

<?php
    if(isset($_POST["submit"])){
        $data = $_POST["data"];
        if($_POST["width"]==""){
            $width = $_POST["width"];
        }else{
            $width = "256";
        }

        if($_POST["height"]==""){
            $height = $_POST["height"];
        }else{
            $height = "256";
        }
        $url = "https://chart.googleapis.com/chart?cht=qr&chs={$width}x{$height}&chl={$data}";
        $output["img"] = $url;
    }else{
        unset($_POST);
    }
?>

<div class="container mt-5 py-5">
    <div class="row">
        <div class="col-md-5 col-12 mx-auto py-5shadow">
            <h2>STRAP QR CODE GENERATOR</h2>
            <?php if(isset($output)){?>
                <div class="mb-3">
                    <img src=<?php echo $output["img"]?> alt="QR Code" width="100%" height="100%">
                    <a class="btn btn-success mt-3" href=<?php echo $output["img"]?> download>Download</a>
                </div>
            <?php }?>
            <form action="/qr" method="POST">
                <div class="form-group mb-3">
                    <label class="form-label" for="data">Data</label>
                    <input type="text" id="data" name="data" class="form-control">
                </div>
                <div class="form-group row">
                    <div class="col-6">
                        <label class="form-label" for="width">Width</label>
                        <input type="text" id="width" name="width" class="form-control">
                    </div>
                    <div class="col-6">
                        <label class="form-label" for="height">Height</label>
                        <input type="text" id="height" name="height" class="form-control">
                    </div>
                </div>
                <div class="mt-3">
                    <button type="submit" name="submit" value="Generate" class="btn w-100 btn-outline-success">Generate</button>
                </div>
            </form>
        </div>
    </div>
</div>

<?php require_once 'include/footer.php'?>

```

Figure D.3 QR Code Generator

```
<?php


<form class="d-flex my-2" action="/search" method="GET" method="GET">
    <div class="input-group me-2">
        <?php if(isset($_GET['id'])){ ?>
            <input type="text" class="form-control" name="id" value='<?php echo $_GET['id'] ?>' placeholder="Pet Unique Id" aria-label="Recipient's username" aria-describedby="basic-addon2">
        <?php } else { ?>
            <input type="text" class="form-control" name="id" placeholder="Pet Unique Id" aria-label="Recipient's username" aria-describedby="basic-addon2">
        <?php }?>
        <input class="input-group-text btn btn-success" type="submit" value="Search" id="basic-addon2">
    </div>
</form>
<br>
<?php
include 'server/process-pet-search.php';


```

Figure D.4 Search Pet using Unique Pet Id

```

<?php

require_once 'db/connection.php';

$userId = (int) $_SESSION['id'];
$deviceID = mysqli_real_escape_string($conn,$_POST['deviceID']);
$petID = (int) mysqli_real_escape_string($conn,$_POST['petID']);

try {

    $sql = "SELECT * FROM trackers WHERE petID = '$petID'";
    $result = mysqli_query($conn,$sql);
    $row = mysqli_fetch_array($result,MYSQLI_ASSOC);
    $count = mysqli_num_rows($result);

    if ($count > 0) {
        throw new Exception("<strong>Pet</strong> already has a tracker!");
    }

    $sql = "SELECT devices.deviceID FROM trackers LEFT JOIN devices ON trackers.deviceID = devices.id";
    $result = mysqli_query($conn,$sql);
    $row = mysqli_fetch_array($result,MYSQLI_ASSOC);
    $count = mysqli_num_rows($result);

    if ($row['deviceID'] == $deviceID) {
        throw new Exception("<strong>Tracker</strong> is already tracking a pet!");
    }

    $sql = "SELECT * FROM devices WHERE deviceID ='$deviceID'";
    $result = mysqli_query($conn,$sql);
    $row = mysqli_fetch_array($result,MYSQLI_ASSOC);
    $count = mysqli_num_rows($result);

    if ($count<= 0) {
        throw new Exception("<strong>Device ".$deviceID."</strong> does not exist");
    } else {

        try {
            $stmt = $conn->prepare("INSERT INTO trackers (deviceID, petID, userId) VALUES (?, ?, ?)");
            $stmt->bind_param("iii", $row['id'], $petID, $userId);
            $stmt->execute();

            $stmt->close();
            header('Location: /tracker');

        } catch (Exception $e) {
            setcookie("trackerRegisterError",
                "".$e->getMessage()." ".$row['id']." ".$petID." ".$userId,
                time() + (5),
                "/");
            header('Location: /tracker');
        }
    }
}

} catch (Exception $e) {
    setcookie("trackerRegisterError",
        "".$e->getMessage()." ",
        time() + (5),
        "/");
    header('Location: /tracker');
}
}

```

Figure D.5 Assigning Device to Pet

Appendix E: Production Photos



Figure E.1 - Equipment Gathering

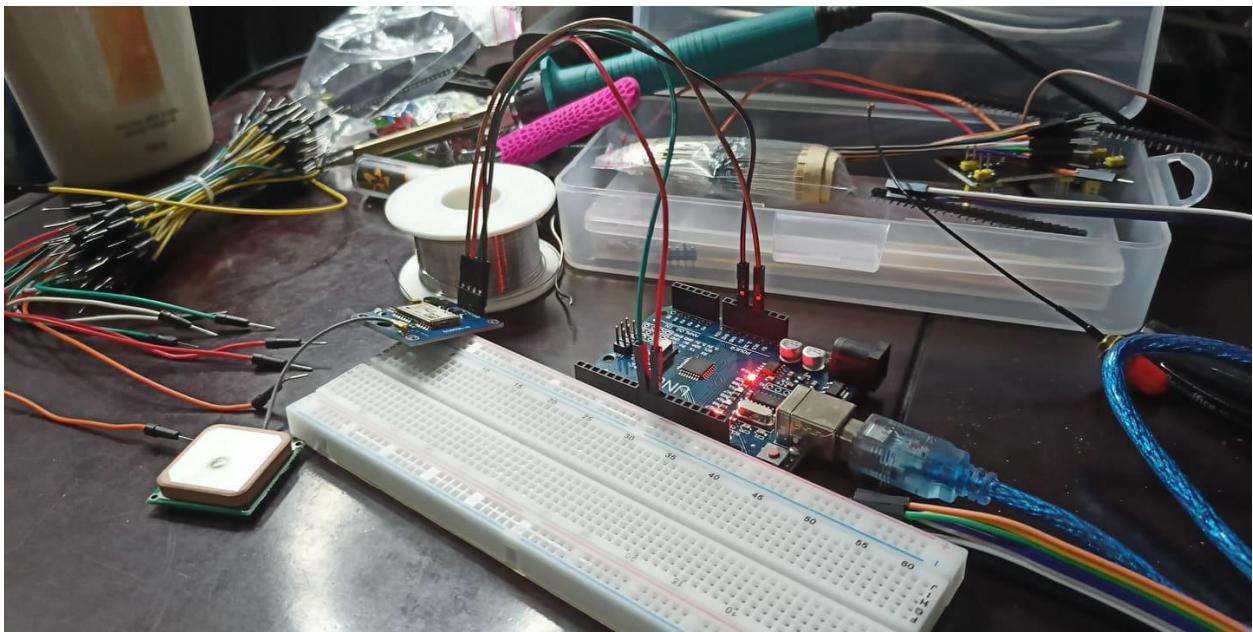


Figure E.2 - Testing Modules

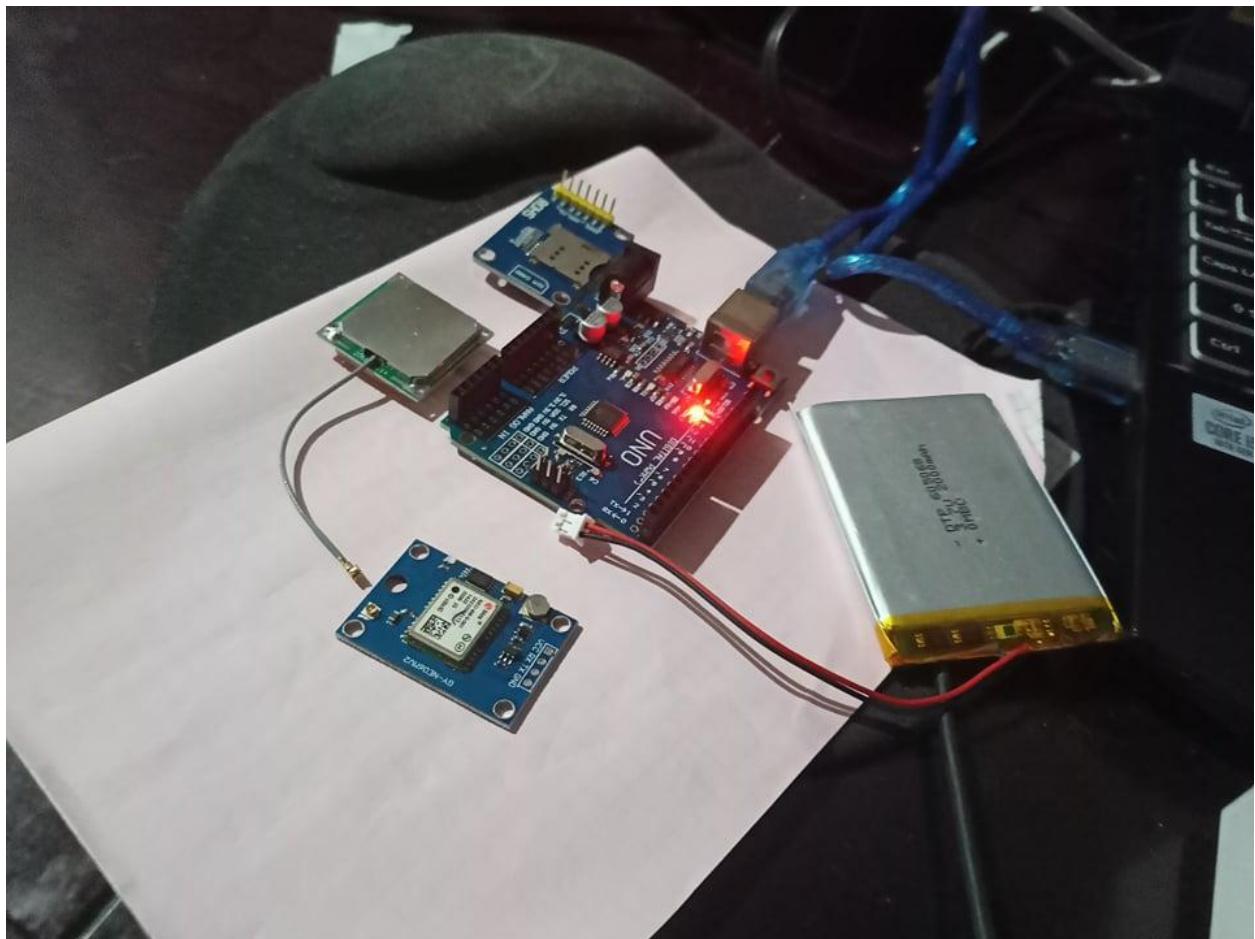


Figure E.3 - Assembling Modules

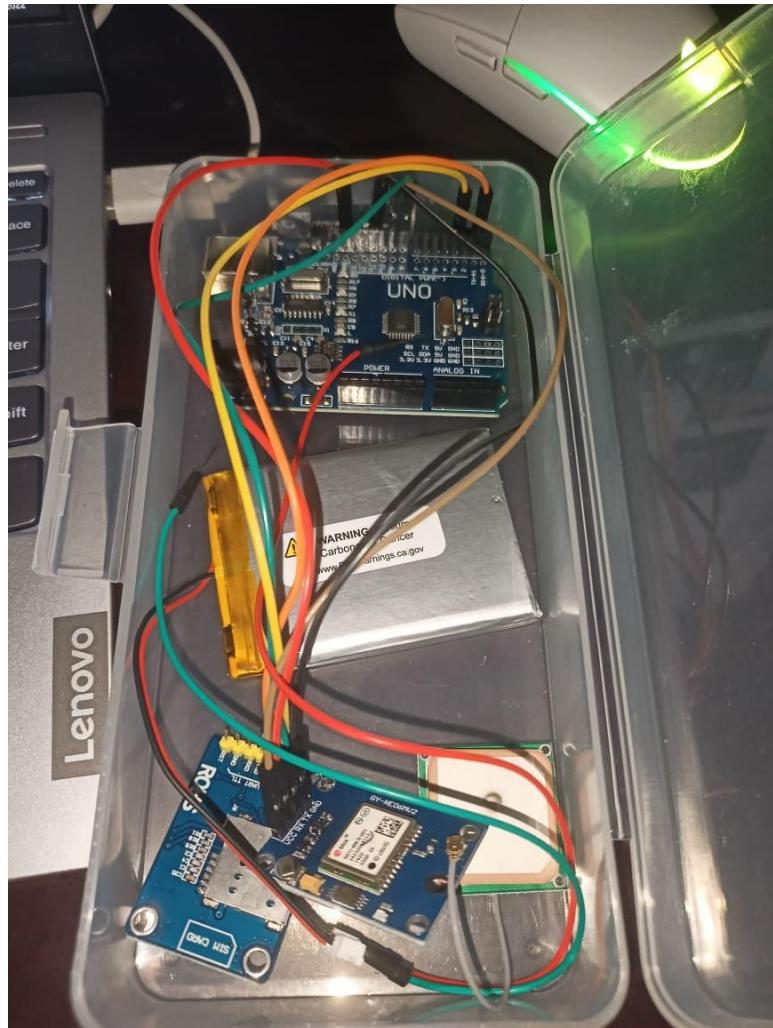


Figure E.4 - Testing Device on a Temporary Container

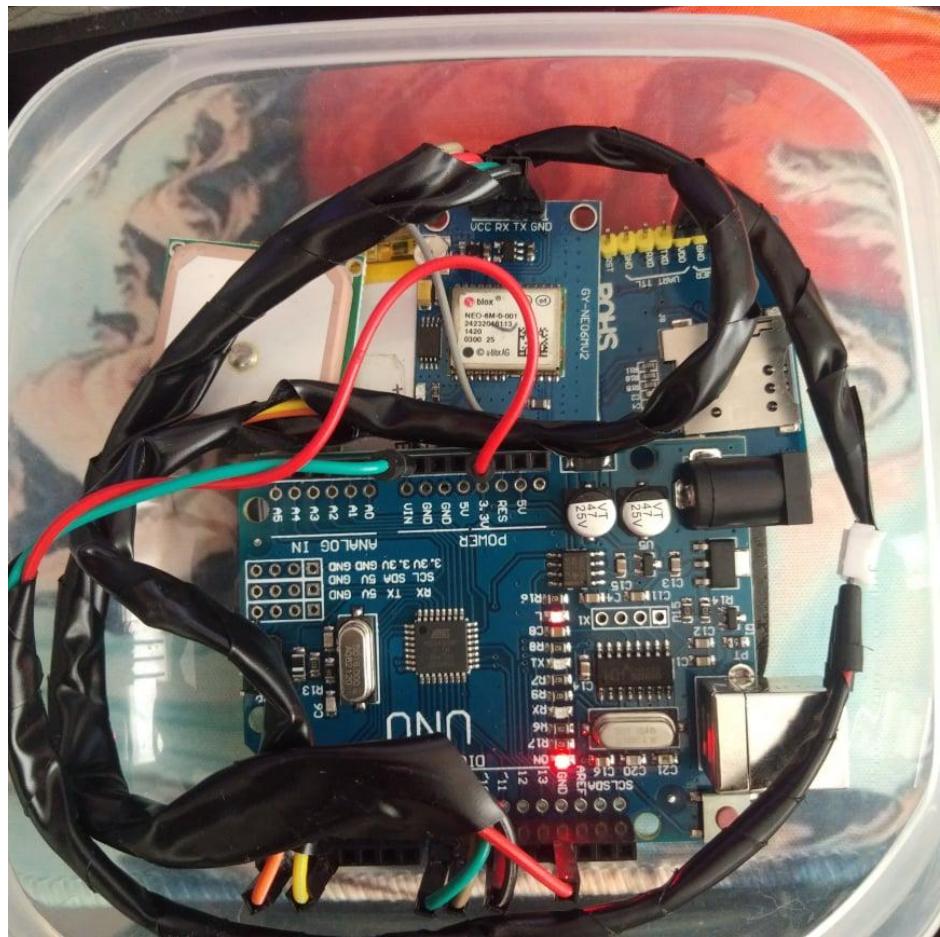


Figure E.5 - Testing Device on a Small Compact Container

Appendix F: Product Testing

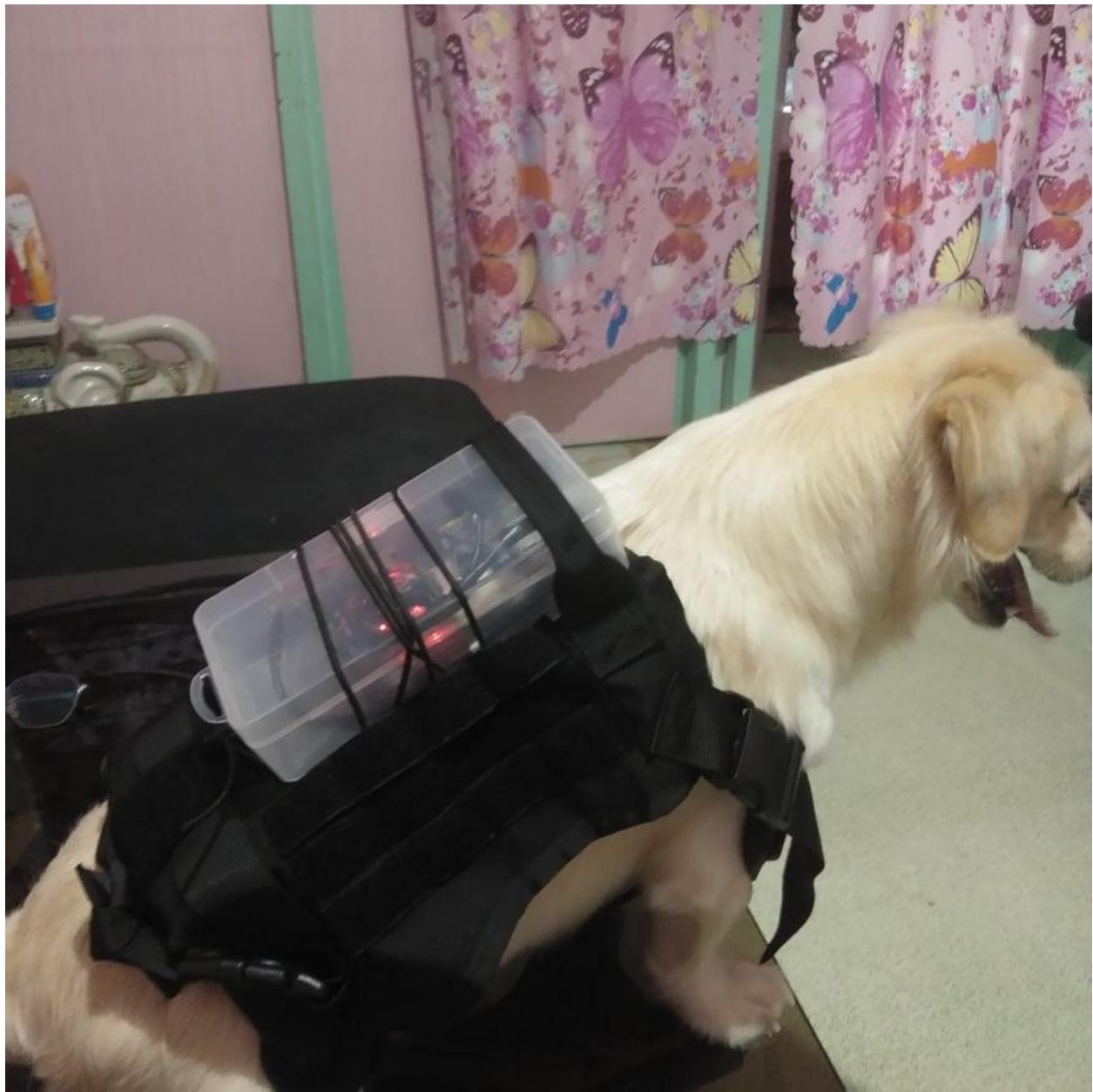


Figure F.1 - Testing Device on Moonlight with Temporary Container

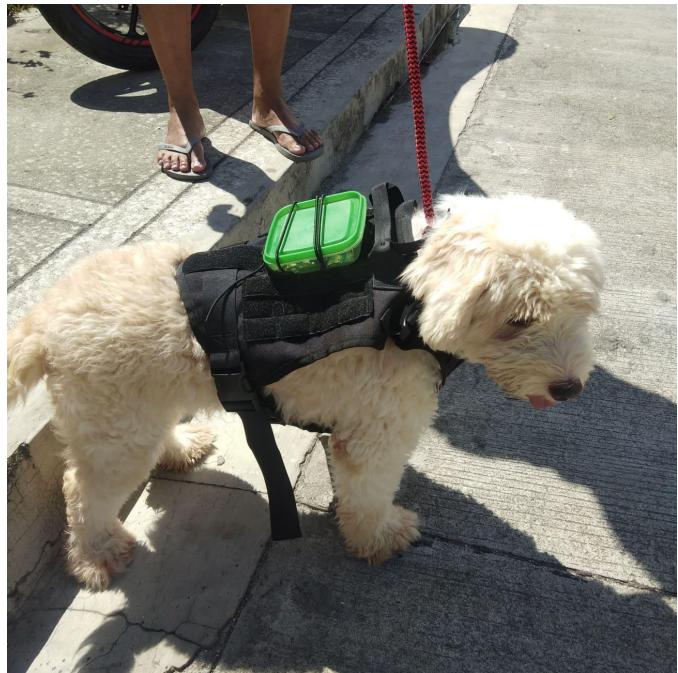


Figure F.2 - Testing Device on Kimchy with New Container

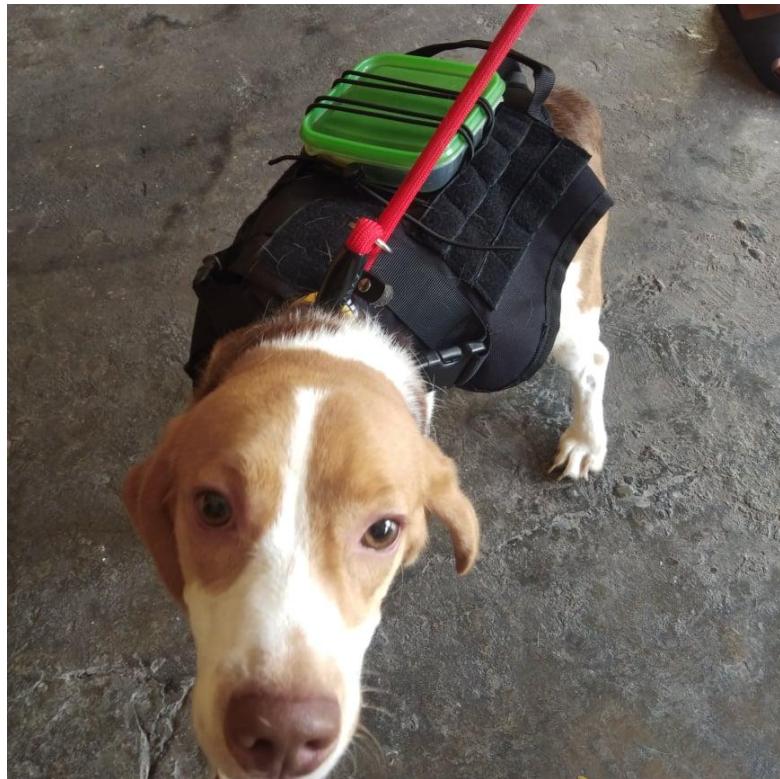


Figure F.3 - Testing Device on Vicky with New Container

Appendix G: Curriculum Vitae

OWEN JORELLE CLAMOR

owenclamor22@gmail.com | 09152274317

Education

iAcademy	July 2019 - Current
Bachelor of Science in Computer Science	
• Courses: OOP in C++, Core Java Programming, Enterprise Java, Algorithms, Computer Architecture, Data Structures, C# .NET Programming, Fundamentals of Web Programming	

Skills

Languages:	C++, Python, Java, Ruby, Javascript, PHP
Technologies:	Ruby on Rails, MySQL, HTML, CSS, SCSS, Git, Laravel

Certifications

Certificate of Training for Cybersecurity Awareness	Sept. 19 2020
Certificate of Completion for Identifying and Safeguarding PII	Sept. 29 2020
Certificate of Training for Marking Classified Information	Sept. 22 2020

Workshops

RETRO Attacking Web Applications #SOCWEEK	May 2019
RETRO Crash Course on Data Mining #SOCWEEK	May 2019
RETRO Cloud Computing with APS #SOCWEEK	May 2019
BASICS Of Kotlin Workshop	May 2019

Professional Experience

Make Technology inc.	Makati, Philippines
Web Development Intern - Development Team	Nov. 2021 – Current
•Completed 3 week training program of Make Technology	
•Building full mobile responsive websites along with discussion of concepts of web development such as Atomic design, ITCSS, and basics of Wordpress.	
•Built UI components for company clients and fixed bugs of live websites with HTML and CSS/SCSS, and Javascript.	
•Worked on internal projects for Make Technology using PHP and Laravel with technologies such as Docker and Jetstream.	

Dino Paulo Gomez

✉ 201801017@iacademy.edu.ph | ☎ (+63) 915-117-7924 | 🏢 Pearl of the Orient Tower, Roxas Blvd, Manila | 🌐 <https://dinogomez.github.io/>

Work Experience

Gtech Online Systems Inc.

INTERN

- I assisted in maintaining and repairing office desktop computers.
- I observed in helping setting up Network Firewalls and Servers.
- Developed modules for a commissioned website.

VIP Building Manila

2019 – 2020

Skills

Programming Languages: Javascript, Python, PHP, Java, C++, SQL

Programming Tools: Git, Docker, VSCode, VMWare Workstation

Operating Systems: Ubuntu, Ubuntu Server, Windows

Projects

Depot

AN E-COMMERCE SITE FOCUSED ON THE POPULAR VALVE GAME TEAM FORTRESS 2.

PHP, Javascript, HTML, CSS, TSQL

<https://github.com/dinogomez/depot>

EVE

EVÉ IS A WEB-BASED VISITATION MANAGEMENT SYSTEM THAT PLANS TO REPLACE TRADITIONAL LOG BOOK SYSTEMS.

PHP, Javascript, HTML, CSS

<https://github.com/dinogomez/eve>

Valheim-World-Backup

AN EXTERNAL TOOL THAT I WROTE TO ADDRESS THE ONGOING SERVER CORRUPTION BUG DURING THE EARLY STAGES OF THE GAME "VALHEIM".

C++

<https://github.com/dinogomez/vb.valheim-World-Backup>

Timediff.JS

A SIMPLE WEBSITE THAT FINDS THE DIFFERENCE BETWEEN TWO DATES AND TIME.

<https://github.com/dinogomez/Timediff.js>

Javascript

LGU COVID19-Budget Tracker

OUR HACKATHON PROJECT PROPOSAL PROTOTYPE DESIGN. WHICH PLANS TO TRACK AND DISPLAY PUBLICLY HOW EACH LGU BUDGETS THEIR ALLOCATED RESOURCES FOR THE PANDEMIC. THIS WAS SELECTED FOR THE INCUBATION STAGE.

<https://github.com/OKSC/Hackathon-COVID19-Tracker>

dinogomez.github.io

MY PERSONAL WEBSITE WHERE I CONNECT WITH OTHER PEOPLE AND SHOW MY WORK.

Vue.js

<http://dinogomez.github.io/>

Education

iACADEMY

BACHELOR OF SCIENCE IN COMPUTER SCIENCE WITH SPECIALIZATION IN SOFTWARE ENGINEERING

Makati City

GPA: 1.0 Dean's List

July 2018 – Present

EXTRA

Aug 2020	Open Source Contributor , Contributed to the popular GitHub project "github-readme-stats" by anuraghazra	anuraghazra
Aug 2020	Impact Hackathon Online , Participated in the Impact Hub Hackathon during August 2020. Was selected to join the next stage and participate in the incubation phase.	JACADEMY
Oct 2020	Python Lecture , Was selected to give a lecture on Python for the upcoming students in the iACADEMY's Prime Workshop 2020.	JACADEMY
May 2021	Dean's List First Honer , with a 1.00 GWA during last semester. DL during the previous semester as well.	JACADEMY



Francis Geoffrey R.
Parreñas
Student

CONTACT

- 📞 +6 (916) 709-7041
📍 301-A Makati Homes Milkweed St.
Brgy. Rizal Makati City
✉️ geoffreyparenas@gmail.com
💻 www.github.com/Ablaze0313/
LinkedIn www.linkedin.com/in/feparrenas

*SCAN THE QR CODE for
Accomplishments,
Certificates, and
Research Papers
Portfolio*



EDUCATION

2018 -present Bachelor of Science in Computer Science
Specialized in Software Engineering

2012-2018 iACADEMY
Science, Technology, Engineering, and
Mathematics
Makati Science High School

EXPERIENCE

Associate Software Quality Assurance Engineer, RaksoCT
May 2021-present

Intern, DESCO Philippines PTE LTD
2018-2018

Served as an intern in DESCO Philippines for Work Immersion

References

John Francis Nacional

Rakso Computer Technology Inc., Education Technology Manager
+63(936)936-6448

Rowena Andaya Reyes

Head Teacher, Makati Science High School
+63(922)836-9554

Brendo Toledo

Software Engineer, Exist Software Labs
+63(906)211-1695

Hard Skills

JavaScript HTML UI/UX Designer
CSS Quality Assurance

Soft Skills

Flexible Adaptability Easy to work with

Interests



JOHN LEONARD RADA

3RD YEAR SOFTWARE ENGINEERING STUDENT

TOOLS

Android Studio
Atom
Eclipse IDE
Sublime

TECHNICAL SKILLS

C++
Java
HTML & CSS
JavaScript
Object Oriented Programming
Mobile Computing

GENERAL SKILLS

Active Listener
Adaptability
Reliable and Professional
Organized
Responsibility
Time Management
Team Player
Fast learner

LANGUAGES

Filipino
English

CONTACT

+63 9566 723 091
johnleonard.rada@gmail.com
201801141@iacademy.edu.ph

EDUCATION

BACHELOR OF SCIENCE IN COMPUTER SCIENCE MAJOR IN SOFTWARE ENGINEERING
Information and Communications Technology Academy (iACADEMY) | 2018 - Present

EXTRACURRICULAR EXPERIENCE

CO-VICE PRESIDENT EXTERNAL

Software Engineering through Academics and Leadership | Aug 2020-Present
Organized needed requirements for upcoming events
Helped for the marketing of the event
Monitored ongoing events

PUBLIC RELATIONS OFFICER

Software Engineering through Academics and Leadership | Aug 2019-May 2020
Maintained and organized organization page
Handled page publications of the organization page
Handled user inquiries

MEMBER OF EVENTS COMMITTEE

Software Engineering through Academics and Leadership | Aug 2018-June 2019
Organized needed requirements for upcoming events
Helped for the marketing of the event
Monitored ongoing events

CERTIFICATIONS

IDENTIFYING AND SAFEGUARDING PERSONALLY IDENTIFIABLE INFORMATION (PII)

Department of Defense | Sep 2020

CYBERSECURITY AWARENESS

Security Awareness Hub | Sep 2020

MARKING CLASSIFIED INFORMATION

Security Awareness Hub | Nov 2020