System Combined Requirements and Design Document (SCRD)

for

System for Intelligent E-Bikes (SIE)

Version 1.0 approved

<December 4th 2019>

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Table of Contents:

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1. Introduction

1.1 Purpose

Electric Bicycles (E-Bikes) are geometrically similar to regular, human powered bikes. But instead, E-Bikes contain a small electric motor that provides the Biker assistant with pedaling, accelerating, hill climbing, and as well as overcoming wind resistance more easily. This system we created focuses on people who want to own an E-Bike with full safety measures, security system, and outstanding feature services. This system allows owners to register their E-Bike through a mobile application and make use of great features for a smooth experience riding the E-Bike. the system is connected to a Global Positioning System, tracks overall usage and quality of the E-Bike, and provides many other useful features a Biker needs to optimize their ride at the tip of their hands for as soon as they begin to ride their E-Bike. For that reason, our E-Bike company decided to utilize the technology by creating an application and a website to provide the bikers to own an account for their E-Bikes.

1.2 Document Conventions

- This SCRD documented can be read in however order the reader wishes. There is use of referrals which will guide the reader either way.
- Use case diagrams are constructed below the Functional Requirements.
- Functional Requirements are referred to by numbers 4.1 and Nonfunctional Requirements are referred to by numbers 4.2.
- Referral to different requirements within other requirements are italicized and numbered as mentioned above.
- The title of each use case mentioned in the functional requirements is written in bold. Ex: (**UseCaseTitle)**

1.3 Intended Audience and Reading Suggestions

The type of readers this document is intended for are mainly the developers and manufacturers of the E-Bike. This SCRD also contains detailed features of what the E-Bike is capable of doing, so that it is also intended for marketing specialists. This document is set to flow in information chronologically, however, we suggest for marketing specialists to begin reading from section 4.1 throughout 4.2. As all features are included in those sections.
This document could also be beneficial for customers as it mentions many useful and necessary information for them to use per using the E-Bike.

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1.4 System Scope

The purpose of our SY system is to create an E-Bike software that will have full technology features. The system allows the owners to own an E-bike through the company website. Also, the system allows the biker to register their E-bike through either the website of the mobile application once downloaded on their mobile phones. When the biker logs in through the mobile application the biker selects register E- Bike, the system asks the biker to enter or scan their E-Bike's product code, the E-Bike company registrar confirms E-Bike product code with biker ownership, the system displays a successfully connected confirmation on the mobile application. The system tracks overall usage and quality of the E-Bike, when the Biker begins to ride their E-Bike, the E-Bike company registrar activates usage tracking on the Biker's E-Bike, the system tracking up-to-date measures of the E-Bike's battery life, safety controls, location and statistics. It makes it easier for those who want to own an E-Bike with full safety controls and successful services.

1.5 References

Arlow, Jim, and Ila Neustadt. Unified Process Practical Object-Oriented Analysis and Design.TPB. 2005.

Regulations of E-Bikes in North America. National Institute of Transportation and Communities (NITC) , Aug. 2014.

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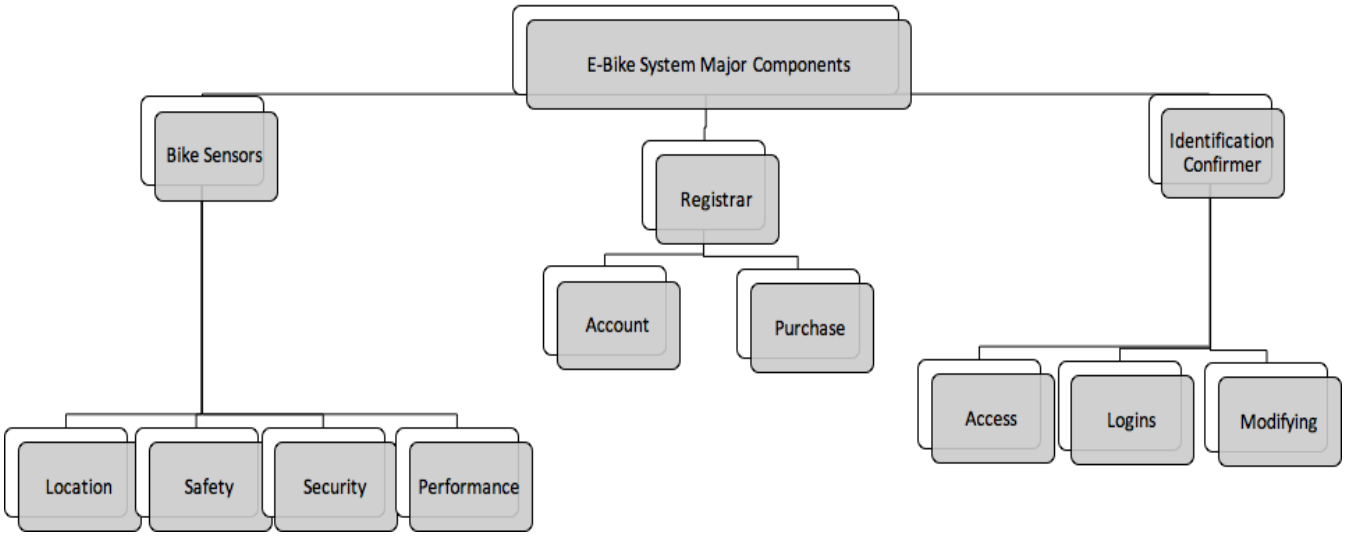
2. Overall Description

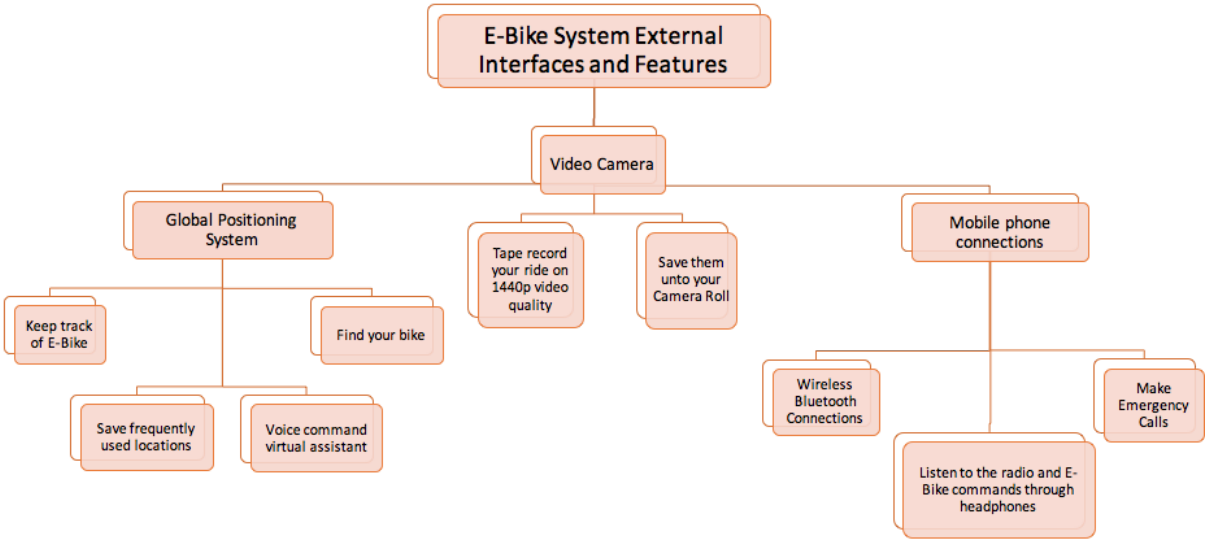
2.1 System Perspective

This SCRD brings forth a new, self-contained system that we call SY System. It contains components put together in this order for the first time in the motorbike-vehicle industry.

2.1.1 System perspective for developers



2.1.2 System perspective for marketers



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2.2 System Functions

- The system must let the Biker creates an own account.
- The system must allow the biker to purchase E-Bike through the company website.
- The system must allow the Biker to register their E-Bike through the company website or mobile application.
- The system must track overall usage and quality of the E-Bike.
- The system must automatically locks E-Bike when turned off.
- The system must be connected to the mobile application at all times when using E-Bike

2.3 User Classes and Characteristics

Bikers who choose to purchase our E-Bike must be at least 16 years of age (Refer to constraint 2.5.5) , and knowledgeable in riding our E-Bike to maintain safety, like how to balance, make wide turns, and possibly how to go up or down hills, some Bikers should also carry a license to be eligible to ride the E-Bike (Refer to constraint 2.5.6). One thing our consumer should not be are experts in using technology.

However, minimal knowledge and background on how connections work through mobile application and external devices such as our E-Bikes is recommended, as it could be helpful for optimizing the ride and making good use for easier operation on the E-Bike and a more exciting experience.

2.4 Operating Environment

The systematic operating environment for our system includes a communication protocol of FTP through the mobile application, and a communication protocol of HTTP through the company website, and they both shall have communications to integrate with the E-Bike.

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2.5 Design and Implementation Constraints

System constraints include the following:

2.5.1 A fully charged battery should last up to 10 hours without recharging.

2.5.2 Memory of locations, performance overview, saved recording, and overall data saved in the system should be contained in a 320 GB storage.

2.5.3 The E-Bike should operate in 8 different languages: English, Spanish, French, Arabic, Italian, Chinese, Porteguese, Japanease

2.5.4 Customer is responsible for maintaining E-Bike data through our mobile application, which requires a smart device. Our communication protocols require both two entities the E-Bike and the Mobile Application to transmit information and data as specified in the requirements below.

2.5.5 The minimum age of operating our E-Bikes is 16 years

2.5.6 It is considered by federal laws in most states that a bike is only considered a non-motor vehicle if its speed doesn't exceed 20mph. Given performance requirements references below (4.2.1.2); our E-Bikes are considered motor vehicles in many states, and our customers are required to go through the licensing, registration, and/or insurance process with their local Department of Motor Vehicle to travel and ride safely across the United States. Refer to Figure 1 and Figure 2.

- **DISCLAIMER: it is against the law to drive around a motor vehicle without a license or a registration.**

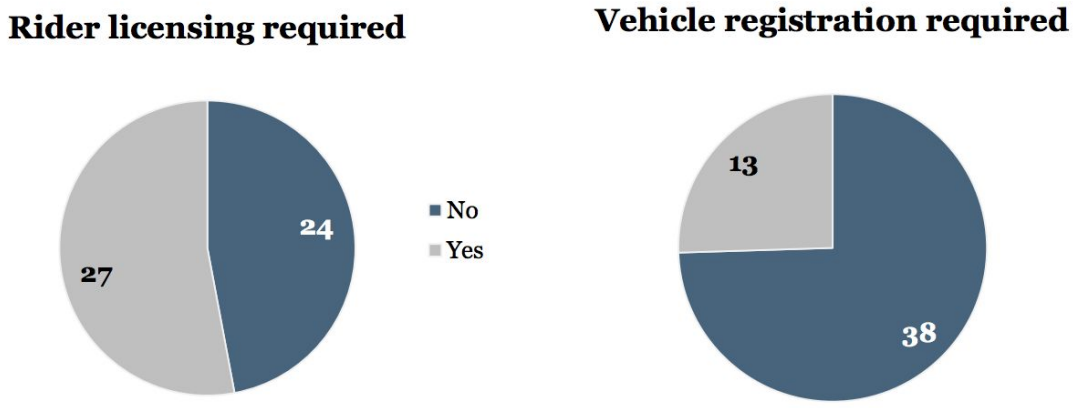

Figure 1: Licensing and Registration Statistics. (National Institute of Transportation and Communities 2014)

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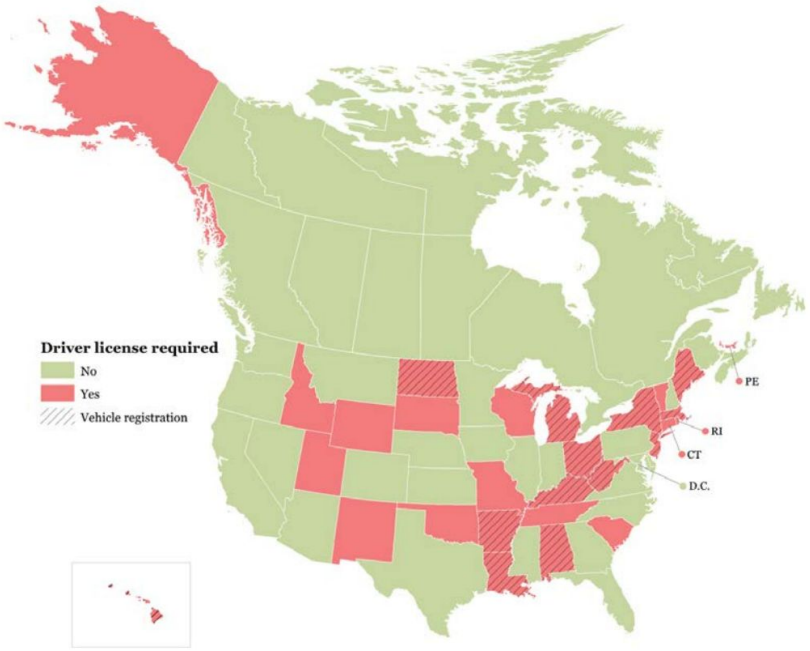

Figure 2: Motorbikes classified as a vehicle that require a license in the United States. (National Institute of Transportation and Communities 2014.)

2.6 Assumptions and Dependencies

Some requirements might be affected in terms of future assumed factors such as the development of technology and communication protocols. These dependencies and assumptions will affect more hardware and external interfaces rather than software interfaces.

Per requirement 4.2.4.4: The system shall update software every 4-6 weeks automatically, meaning it will take a longer period of time for our software to face issues with future development. Given current development pace for systematic software across different motor industries, our software should last up to 10 years with no assumption and dependable issues. However, hardware and external interfaces might face minor issues in approximately 3-5 years after being manufactured. Therefor, our company plans on developing new E-Bike generations in the future to implement the latest manufactured pieces that keep up with our technology features. (ex: E-Bike 2.0, launching 2024)

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3. External Interface Requirements

3.1 User Interfaces

3.1.1 ApplicationMainGUI

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3.1.2 RegistrationGUI

3.1.3 ApplicationLoginGUI

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3.1.4 CreateAccountGUI

3.1.5 ChangeRideGUI

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3.1.6 WebsiteMainGUI

3.2 Hardware Interfaces

3.2.1 Mobile Phone:

Will use a communication protocol of TCP/IP to aggregate data with different interfaces

3.2.2 External Camera:

A hardware interface interconnected with mobile application software to send over tape recordings and save them within the mobile phone memory.

3.2.3 Computer:

Will use a communication protocol of HTTP to aggregate data with different interfaces

3.2.4 Global Positioning System:

Hardware that is interconnected to the E-Bike Location Detector, and sends over data in protocols TCP/IP over to the mobile phone application.

3.2.5 Bike Sensors

Hardware that includes sensing:

- AutoLock Sensor
- Object Sensor
- Heart Rate Sensor

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3.2.6 Bike Screen

Hardware that displays relevant aggregated data for the Biker through the system.

3.3 Software Interfaces

- The app shall have access to the stated up to date internet browser:
  - Internet Explorer 11.0.145
  - Chrome 78.0.3904.108
  - Firefox 19.0 or 68.1
  - Safari 10.12. 6 or 10.13.6
  - Opera 62
- The app shall work on any smart device such as iOS (iPhone), Google Pixel, and Android (Samsung).
- Server connection: The app shall only allow users to ride the E-Bike when they are connected to the internet to ensure security is never compromised.
- The system shall aggregate data and analytics between E-Bike System and the Mobile Application.

3.4 Communications Interfaces

- Bank Account:

The user shall have an existing bank account linked to their profile
to be able to own an E-Bike, and make future payments if needed.
Protocol: FTP

- Smart Device:

The user shall have a working smartphone if they want to enhance and take advantage of their E-Bike experience fully to use application features.
Protocol: FTP, TCP/IP

- Available Storage Space:

The user shall have enough storage in their mobile
device to install the app.

- Valid Email Address:

The user shall have a valid email address for verification and to allow reaccess into the account if the user forgets their password.
Protocol: SMTP

Valid Phone number: The user shall have a valid phone number connected to the account.

4. Requirements

Requirement Statements:

4.1 Functional Requirements:

4.1.1 The system shall provide the capability for the biker to **CreateAccount** including email and password through the company website.

4.1.2 The system shall provide the capability for the biker to **PurchaseEBike** through the company website.

4.1.3 The system shall provide the capability for the biker to **RegisterEBike** through the mobile app.

4.1.4 The system shall **TrackUsage** and data of the bike.

4.1.5 The system shall **DisplayUsage** and data on the mobile app.

4.1.6 The system shall **AutoLockBike** once the biker signs out of the system.

4.1.7 The system shall allow the owner to use headphones **BluetoothPairing** for the biker.

4.1.8 The system shall allow the biker to place an **EmergencyCall** in case of urgent situations.

4.1.9 The system shall **DisplayRealTimeLocation** of the bike when the biker uses the (Find My Bike) feature

4.1.10 The system shall allow the Biker to get **FingerprintAccess** to the bike.

4.1.11 The system shall detect bikers real-time heartbeats and **DisplayHeartRate**

4.1.12 The system shall allow the biker to **EditProfileOnWeb** information on the company website

4.1.13 The system shall allow the biker to **DeleteProfileOnWeb** on the company website

4.1.14 The system shall allow the user to **EditProfileOnApp** information on the mobile application.

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4.1.15 The system shall allow the user to **DeleteProfileOnApp** information on the mobile application.

4.1.16 The system shall have the option for the biker to **TapeRecordAndSaveRides** via external camera connected wirelessly to mobile application.

4.1.17 TThe system shall allow the biker to **ChangeRideMode** from the mobile application.

4.1.18 The system shall detect helmet and **DisplayHelmetAlert** if biker is not wearing the helmet when beginning the ride.

4.1.19 The system shall detect if approaching near objects when riding the bike and **DisplayObjectAlert** for biker.

4.1.20 The system shall **DisplayRideOverview** on the mobile application after each ride for the biker.

4.1.21 The system shall detect tire's condition and **DisplayTirePressureAlert** if pressure is under or over normal rate.

4.2 Nonfunctional Requirements:

4.2.1 Performance Requirements

4.2.1.1 The system shall sense the intensity of the gas and brake pressed by biker and adjust speed accordingly

4.2.1.2 The system shall allow the bike a maximum speed limit of 45 mph

4.2.1.3 The system shall have a cruise, sport, and off-road performance options

4.2.1.4 The system shall give the option of auto cruise speed control

4.2.1.5 The system shall increase speed response to gas pedal pressed by less than 1 second when using the sport performance option.

4.2.1.6 The system shall sense road type and suggest performance adjustment accordingly.

4.2.1.7 The system shall have an uphill capability of 45 degrees when using the the off-road performance option

4.2.1.8 The system shall give performance reports after each ride including (performance type, average speed, time used)

4.2.2 Safety Requirements

4.2.2.1 The system shall notify the biker if there's a malfunction in the tires.

4.2.2.2 The system shall warn biker for 15 seconds if helmet attached to bike is not worn when bike starts.

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4.2.2.3 The system shall notify the biker to recharge when the bike is on 20% battery life.

4.2.2.4 The system shall allow the biker to call 911 in case of an emergency.

4.2.2.5 The system shall allow bike locating to emergency calls made.

4.2.2.6 The system shall use the emergency brakes if biker approaches any object 5 feet away in a speed above 10 mph

4.2.3 Security Requirements

4.2.3.1 The system shall notify the biker if someone tries to break in bike when its locked.

4.2.3.2 The system shall give permission to reset passcode only once two-authorizing identification process is successful.

4.2.3.4 The system shall lock-down bike for 1-hour if passcode is entered incorrectly 10 times in a row in less than 2 minutes.

4.2.3.5 The system shall lock-down bike for 3-hours if passcode is entered 5 times in a row in less than 1 minutes after first lock-down referring requirement *4.2.3.4.*

4.2.3.6 The system shall identify biker by finger prints.

4.2.3.7 The system shall auto lock bike if bike is not in use for over 5 minutes.

4.2.4 Software Quality Attributes.

4.2.4.1 The system shall actively use a Global Positioning System (GPS) to track real-time location of the bike.

4.2.4.2 The system shall have a (Find My Bike) attribute in the application linked to quality attribute 4.2.4.1 in case biker misplaces bike.

4.2.4.3 The system shall be programmed in C language.

4.2.4.4 The system shall update software every 4-6 weeks automatically.

4.2.4.5 The system shall have a virtual assistant through the Global Positioning System that activates on voice commands.

4.2.4.6 The system shall utilize eco-friendly software linked to power and battery for the bike to operate.

4.2.4.7 The system shall have a recording software connected to a camera on E-Bike and is able to record and save rides as requested by Biker.

4.2.4.8 The system shall connect to the radio of FM and AM frequencies.

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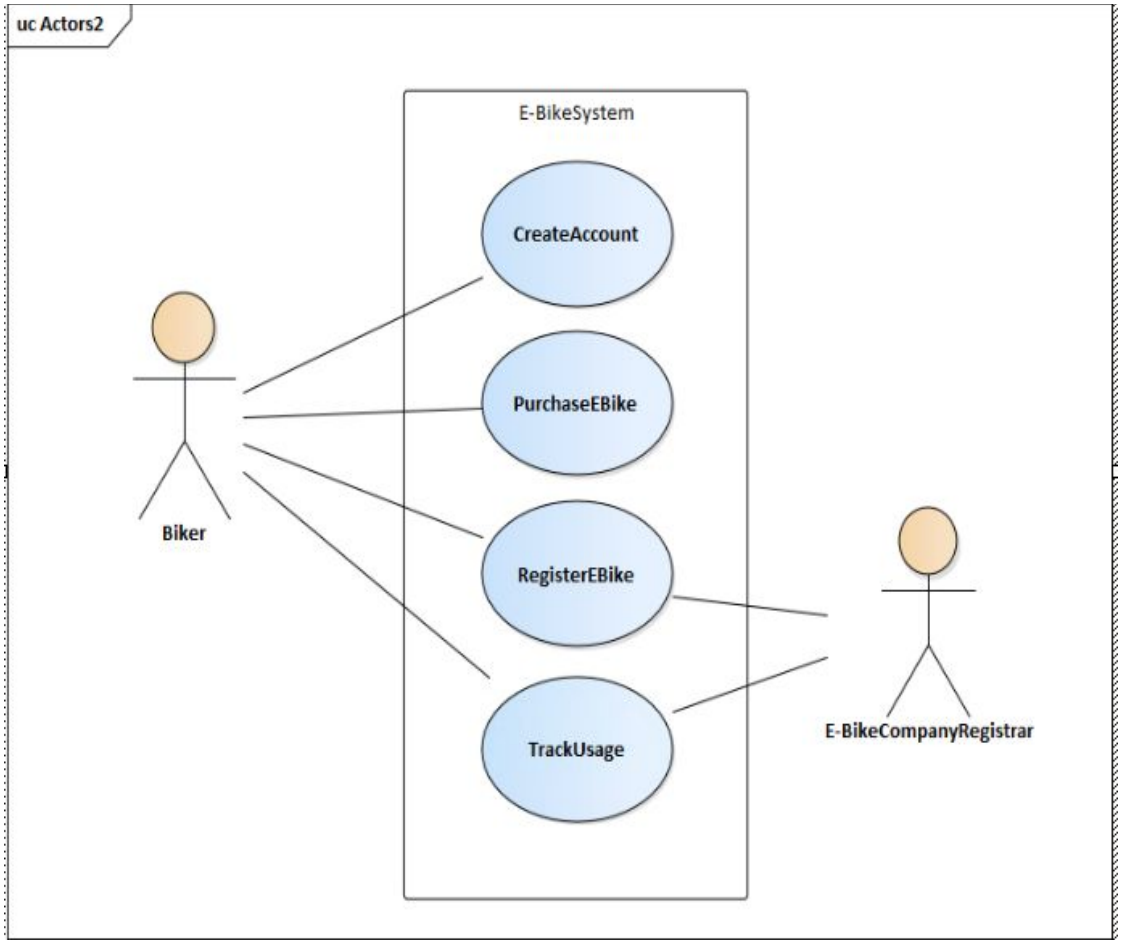
Use Case Diagrams



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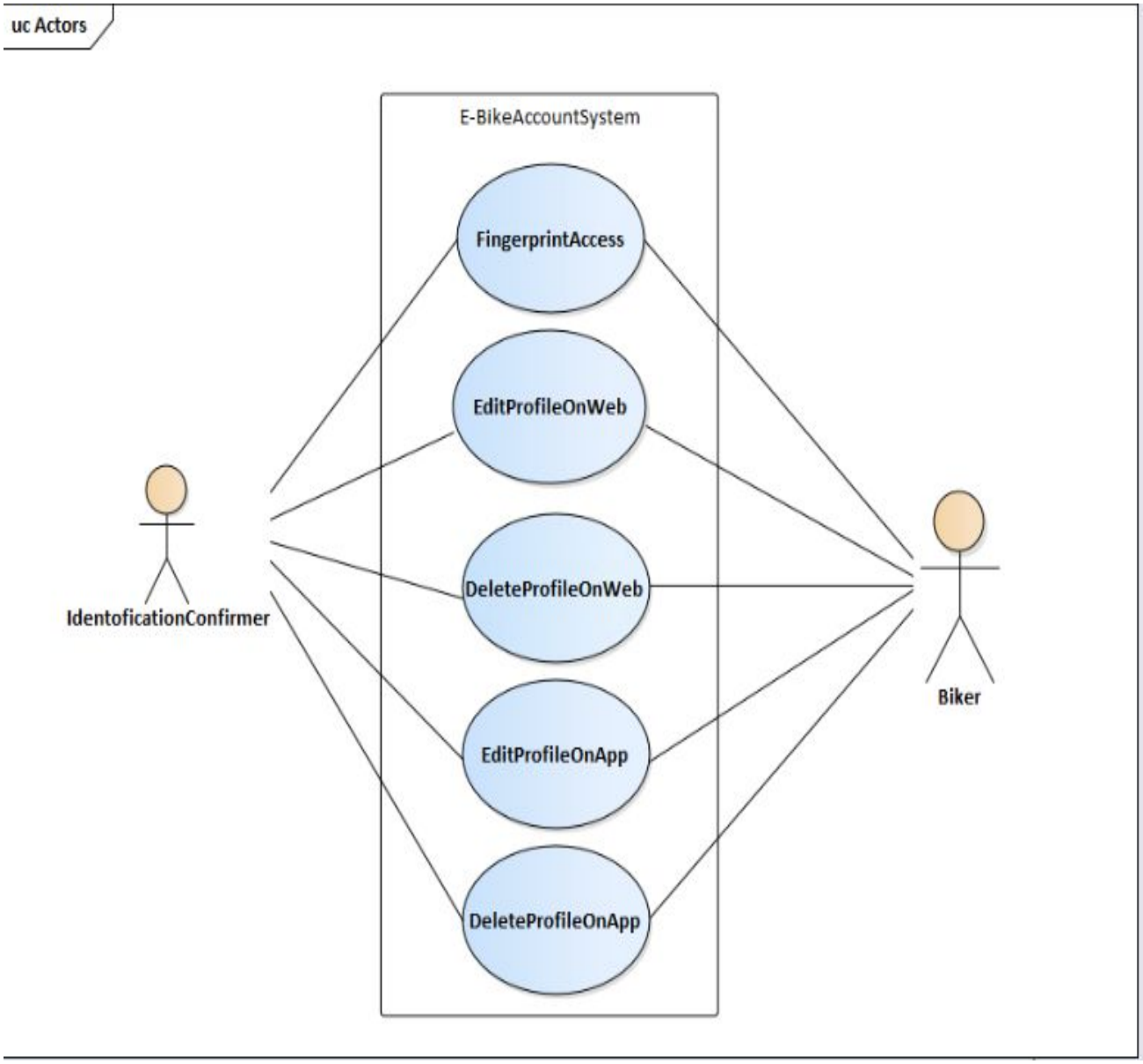

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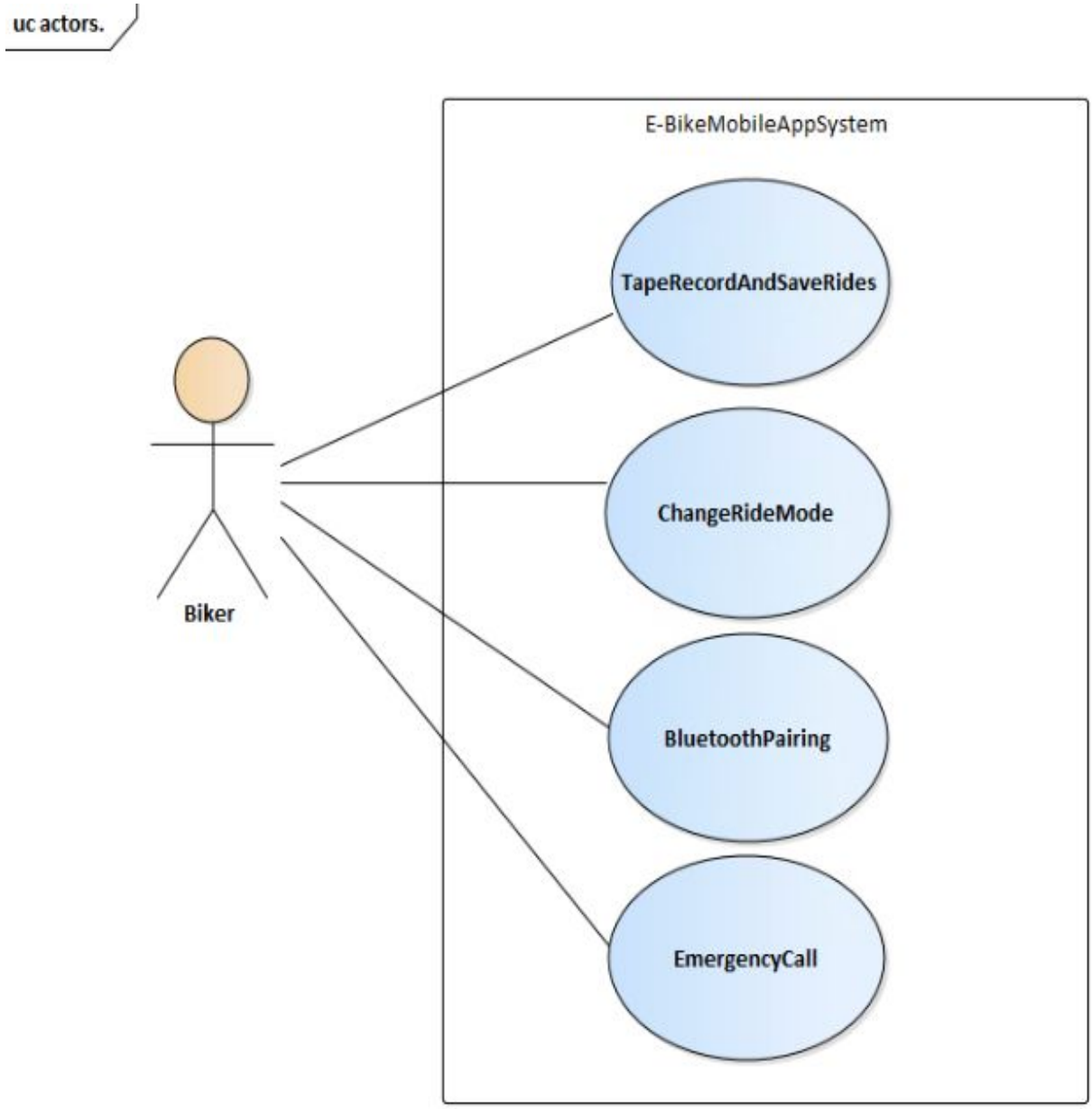

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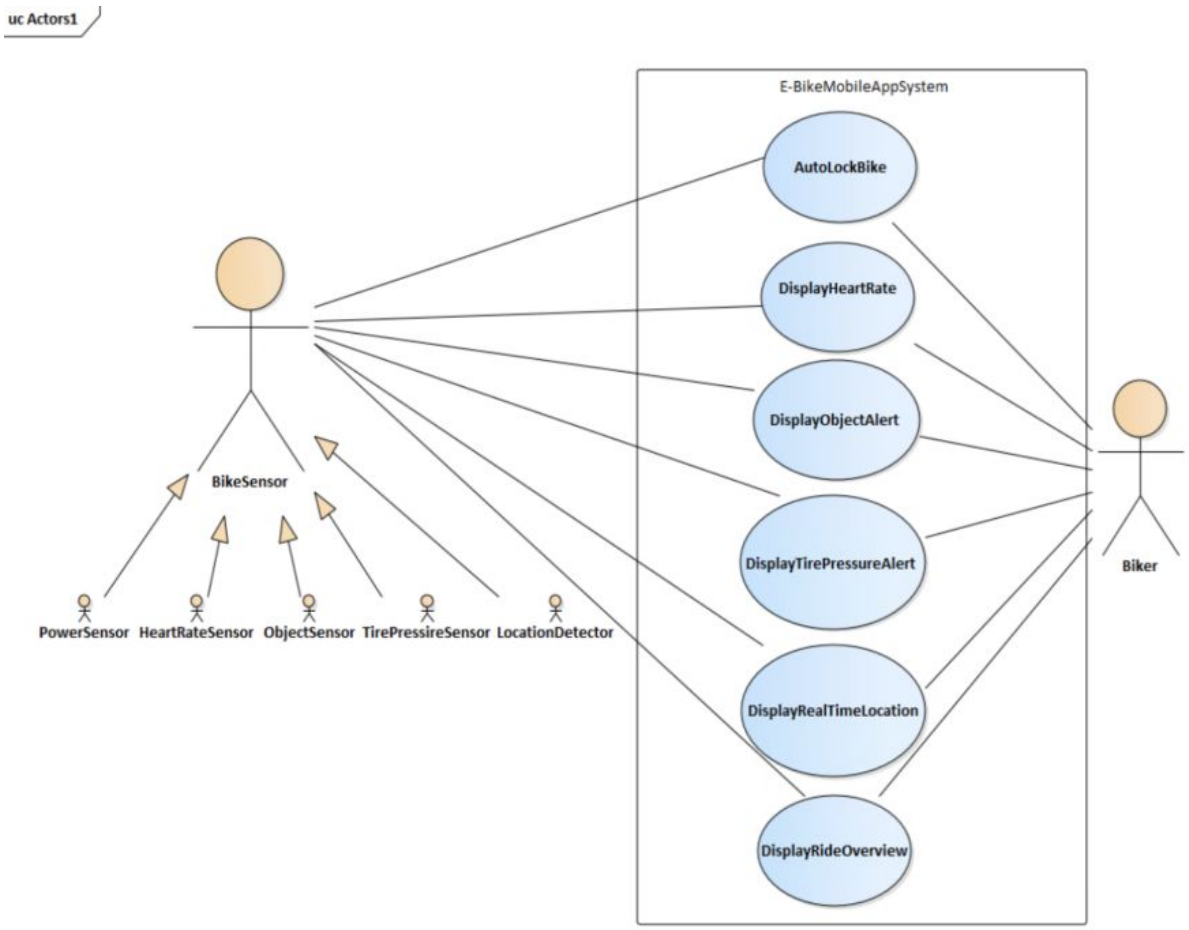

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Use Cases

Use Case: **CreateAccount**
ID: SY-1
Brief Description: Biker create account by entering his email and password through the company website.
Primary Actor: Biker
Secondary Actors: None
Precondition: None
Main Flow: a. Use case begins when the biker clicks on “Create Account” through the WebsiteMainGUI b. The E-Bike company system asks for an email address and password. c. The biker enters all the information requested and selects Create Account on the CreateAccountGUI. d. The E-Bike company system displays a message that the system sent a confirmation link to the Biker’s email. f. The use case ends.
PostCondition: The Biker creates an own account.
Alternative Flow: None

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Use Case: **PurchaseEBike**
ID: SY-2
Brief Description: The system allows the biker to purchase an E-bike through the company website.
Primary Actor: Biker
Secondary Actors: None
Precondition: The Biker creates an account
Main Flow: a. Use case begins when the Biker selects “Purchase E-Bike” on the WebsiteMainGUI b. The system displays PaymentGUI for Biker to enter credit card information and delivery address c. The Biker enter information and clicks “Submit Order” d. The system displays the order confirmation message e. The use case ends
PostCondition: Biker purchases the Bike through the E-Bike Company
Alternative Flow: None

Use Case: **RegisterEBike**
ID: SY-3
Brief Description: The system allows the Biker to register their E-Bike through the mobile application
Primary Actor: Biker
Secondary Actors: E-BikeCompanyRegistrar
Precondition: Biker has the mobile application installed
Main Flow: a. Use case begins when the Biker logs in through the ApplicationLoginGUI on the mobile application b. The Biker selects “Register E-Bike” c. The system asks the Biker to enter or scan their E-Bike’s product code on the RegistrationGUI d. The E-BikeCompanyRegistrar confirms E-Bike product code with Biker ownership e. The system displays a “successfully connected” confirmation on the ApplicationMainGUI f. The use case ends
PostCondition: The E-Bike is registered into the system
Alternative Flow: None

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Use Case: **TrackUsage**
ID: SY-4
Brief Description: The system tracks overall usage and quality of the E-Bike
Primary Actor: Biker
Secondary Actors: EBikeCompanyRegistrar
Precondition: The Biker has their E-Bike. Registered
Main Flow: a. Use case begins when the Biker begins to ride their E-Bike. b. The EBikeCompanyRegistrar activates usage tracking on the Biker's E-Bike through the UsageGUI c. The system begins tracking up-to-date measures of the E-Bike's battery life, safety controls, location, and statistics. d. The use case ends
PostCondition: The system has data of E-Bike usage
Alternative Flow: None

Use Case: **DisplayUsage**
ID: SY-5
Brief Description: The system display's E-Bike usage on the mobile application
Primary Actor: Biker
Secondary Actors: None
Precondition: The E-Bike is registered and in use
Main Flow: a. The use case begins when the Biker selects "Display Usage" b. The system redirects the Biker the UsageGUI. c. The system displays battery life, location E-Bike was ridden, safety control measures, and usage statistics d. The use case ends.
PostCondition: The data usage is displayed on the mobile app
Alternative Flow: None

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Use Case: **AutoLockBike**
ID: SY-4.1.6
Brief Description: The system automatically locks E-Bike after a ride.
Primary Actor: Biker
Secondary Actors: BikeSensor
Precondition: The E-Bike is in use and/or signed in on the ApplicationMainGUI
Main Flow: a. The use case begins when the Biker turns off E-Bike power or signs off of ApplicationMainGUI b. The BikeSensor detects the change in the E-Bike power and/or the status from the ApplicationLoginGUI c. The system automatically locks the E-Bike. d. The use case ends.
PostCondition: E-Bike is locked.
Alternative Flow: None

Use Case: **BluetoothPairing**
ID: SY-4.1.7
Brief Description: The system pairs bluetooth sounds to headphones connected to mobile phone through the ApplicationMainGUI
Primary Actor: Biker
Secondary Actors: None
Precondition: E-Bike is powered on and headphones are connected to a mobile phone.
Main Flow: a. The use case begins when the Biker selects “Bluetooth Pairing” on the ApplicationMainGUI b. The system redirects the Biker and displays available nearby compatible bluetooth pairings on the ConnectionGUI c. The Biker selects their choice of sound pairing through bluetooth. e. The use case ends.
PostCondition: The E-Bike is paired with headphones
Alternative Flow: None

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Use Case: **EmergencyCall**
ID: SY-4.1.8
Brief Description: The system allows bike to make a 911 call in case of emergency
Primary Actor: Biker
Secondary Actors: None
Precondition: Biker gets in an emergency situation such as a crash, suspicious surrounding activity, or a health problem.
Main Flow: a. The use case begins when the Biker selects “Call 911” button on the ApplicationMainGUI. b. The system redirects Biker to the ConnectionGUI and places the call. c. The system connects sound to Bluetooth Paired headphones, or if there's none automatically connects to E-Bike speakers. d. The use case ends.
PostCondition: Emergency call is placed.
Alternative Flow: None

Use Case: **DisplayRealTimeLocation**
ID: SY-4.1.9
Brief Description: The system allows Biker to know the real time location of the bike.
Primary Actor: Biker
Secondary Actors: BikeSensor
Precondition: None
Main Flow: e. The use case begins when the Biker selects “Find My Bike” button on the ApplicationMainGUI. f. The BikeSensor detects location of E-Bike at the time and sends it over to the system. g. The system displays the real time location of E-Bike on the MapGUI. h. The use case ends.
PostCondition: Location of E-Bike is detected and displayed.
Alternative Flow: None.

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Use Case: **FingerPrintAccess**
ID: SY-4.1.10
Brief Description: The system allows the Biker to access the ApplicationMainGUI and E-Bike by their fingerprint.
Primary Actor: Biker
Secondary Actors: IdentificationConfirmer
Precondition: mobile phone has a fingerprint sensor
Main Flow: a. The use case begins when the Biker signs on the ApplicationMainGUI or turns on E-Bike b. The system asks the Biker to place their fingerprint on their mobile phone sensor. c. The IdentificationConfirmer confirms identity of Biker. d. The systems grants access to Biker if the identification process is successful. e. The use case ends.
PostCondition: E-Bike is unlocked.
Alternative Flow: None.

Use Case: **DisplayHeartRate**
ID: SY-4.1.11
Brief Description: The system displays Biker heart rate on the ApplicationMainGUI
Primary Actor: Biker
Secondary Actors: BikeSensor
Precondition: E-Bike is powered on and Biker has hands placed on handlebar.
Main Flow: a. The use case begins when the Biker selects “Display Heart Rate” on the ApplicationMainGUI b. The BikeSensor detects biker heart rate as they place hands on the handlebar grip. c. The system displays current and updated heart rate throughout the ride. d. The use case ends.
PostCondition: Heart rate is displayed.
Alternative Flow: None.

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Use Case: **EditProfileOnWeb**
ID: SY-4.1.12
Brief Description: The system allows biker edit profile on the WebsiteMainGUI.
Primary Actor: Biker
Secondary Actors: IdentificationConfirmer
Precondition: Biker is signed on through the WebsiteMainGUI
Main Flow: a. The use case begins when the Biker selects “Edit Profile” on the WebsiteMainGUI. b. The system redirects Biker to confirm passcode again through WebsiteLoginGUI for security purposes. c. The IdentificationConfirmer confirms the success of Biker identification and redirects page to edit profile. d. The Biker modifies information of account, and then selects “Save” e. The system displays a confirmation message of saved information. f. The use case ends.
PostCondition: Profile account is successfully updated on company website.
Alternative Flow: None.

Use Case: **DeleteProfileOnWeb**
ID: SY-4.1.13
Brief Description: The system allows biker delete profile on the WebsiteMainGUI.
Primary Actor: Biker
Secondary Actors: IdentificationConfirmer
Precondition: Biker is signed on through the WebsiteMainGUI
Main Flow: a. The use case begins when the Biker selects “Delete Profile” on the WebsiteMainGUI. b. The system sends a code to Biker registered email. c. The system redirects Biker to confirm a two-authentication identification process. d. The Biker enters authorizing code from email and their account passcode. e. The IdentificationConfirmer confirms the success of Biker identification and displays a message saying “Are you sure you want to delete account?” f. The Biker selects “Yes, delete account” g. The system displays a message confirming deleted account. h. The use case ends.

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PostCondition: Profile account is deleted.
Alternative Flow: None.

Use Case: **EditProfileOnApp**
ID: SY-4.1.14
Brief Description: The system allows biker edit profile on mobile application
Primary Actor: Biker
Secondary Actors: IdentificationConfirmer
Precondition: Biker is signed on.
Main Flow: a. The use case begins when the Biker selects “Edit Profile” on the ApplicationMainGUI. b. The system redirects Biker to confirm passcode again through ApplicationLoginGUI for security purposes. c. The IdentificationConfirmer confirms the success of Biker identification and redirects page to edit profile. d. The Biker modifies information of account, and then selects “Save” e. The system displays a confirmation message of saved information. f. The use case ends.
PostCondition: Profile account is successfully updated on mobile Application.
Alternative Flow: None.

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Use Case: **DeleteProfileOnApp**
ID: SY-4.1.15
Brief Description: The system allows biker delete profile.
Primary Actor: Biker
Secondary Actors: IdentificationConfirmer
Precondition: Biker is signed on.
Main Flow: a. The use case begins when the Biker selects “Delete Profile” on the ApplicationMainGUI. b. The system sends a code to Biker registered phone number. c. The system redirects Biker to confirm a two-authorization identification process. d. The Biker enters authorizing code from messages and their account passcode. e. The IdentificationConfirmer confirms the success of Biker identification and displays a message saying “Are you sure you want to delete account?”. f. The Biker selects “Yes, delete account” g. The system displays a message confirming deleted account. h. The use case ends.
PostCondition: Profile account is deleted.
Alternative Flow: None.

Use Case: **TapeRecordAndSaveRide**
ID: SY-4.1.16
Brief Description: The system allows Biker to record their ride on camera attached to E-Bike.
Primary Actor: Biker
Secondary Actors: None
Precondition: E-Bike is powered on and in use.
Main Flow: a. The use case begins when the Biker selects “Record Ride” on the ApplicationMainGUI. b. The system displays a confirmation message that recording has begun. c. The system records the ride until Biker selects “Stop Recording” d. The system automatically saves recording to ApplicationMainGUI. e. The use case ends.
PostCondition: Ride is successfully recorded and saved.

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Alternative Flow: None.

Use Case: **ChangeRideMode**
ID: SY-4.1.17
Brief Description: The system allows Biker to change riding mode
Primary Actor: Biker
Secondary Actors: None
Precondition: E-Bike is turned on and in full-stop.
Main Flow: a. The use case begins when the Biker selects “Change Ride Mode” on the ApplicationMainGUI. b. The system redirects Biker to ride mode selections: “Cruise, Sport, or Off-Road” c. The Biker selects their choice of ride on ChangeRideGUI. d. The system changes riding mode and displays a confirmation message of changes made. e. The use case ends.
PostCondition: Riding mode is successfully changed.
Alternative Flow: None.

Use Case: **DisplayHelmetAlert**
ID: SY-4.1.18
Brief Description: The system alerts biker when helmet is not worn when E-Bike starts.
Primary Actor: Biker
Secondary Actors: BikeSensor
Precondition: E-Bike is turned on and helmet is not worn.
Main Flow: a. The use case begins when the Biker begins riding the E-Bike. b. The BikeSensor detects if helmet is in trunk. c. The system confirms place of helmet in trunk and then displays an alert message saying “Safety Helmet Is Not In Use” d. The use case ends.
PostCondition: Alert message is displayed.
Alternative Flow: None.

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Use Case: **DisplayObjectAlert**
ID: SY-4.1.19
Brief Description: The system alerts the Biker of non-moving objects approached when riding the E-Bike
Primary Actor: Biker
Secondary Actors: BikeSensor
Precondition: The E-Bike is turned on and in use.
Main Flow: a. The use case begins when the Biker approaches an object 5 feet away in a speed over 20 mph. b. The BikeSensor detects non-moving object and current speed of Biker c. The system displays a message saying “Look Ahead, Obstacle Ahead.” d. The use case ends.
PostCondition: Object alert is displayed
Alternative Flow: None.

Use Case: **DisplayTirePressureAlert**
ID: SY-4.1.20
Brief Description: The system alerts the Biker of tire-pressure if under or over normal rate.
Primary Actor: Biker
Secondary Actors: BikeSensor
Precondition: Tire-pressure is not in normal rate.
Main Flow: a. The use case begins when the Biker turns on E-Bike or signs on through the ApplicationLoginGUI b. The BikeSensor detects tire-pressure rate. c. The system displays an alert message saying “TPM malfunction” d. The use case ends.
PostCondition: Tire pressure alert is displayed.
Alternative Flow: None.

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Use Case: **DisplayRideOverview**
ID: SY-4.1.21
Brief Description: The system displays the overview of the ride when finished.
Primary Actor: Biker
Secondary Actors:BikeSensor
Precondition: E-Bike is in full stop and ride is finished.
Main Flow: a. The use case begins when the Biker selects “Ride Overview”. b. The BikeSensor pulls ride information like: location throughout ride, average speed, battery used, and time of ride from memory. c. The system redirects biker and displays overview d. The use case ends.
PostCondition: Overview of ride is displayed.
Alternative Flow: None.

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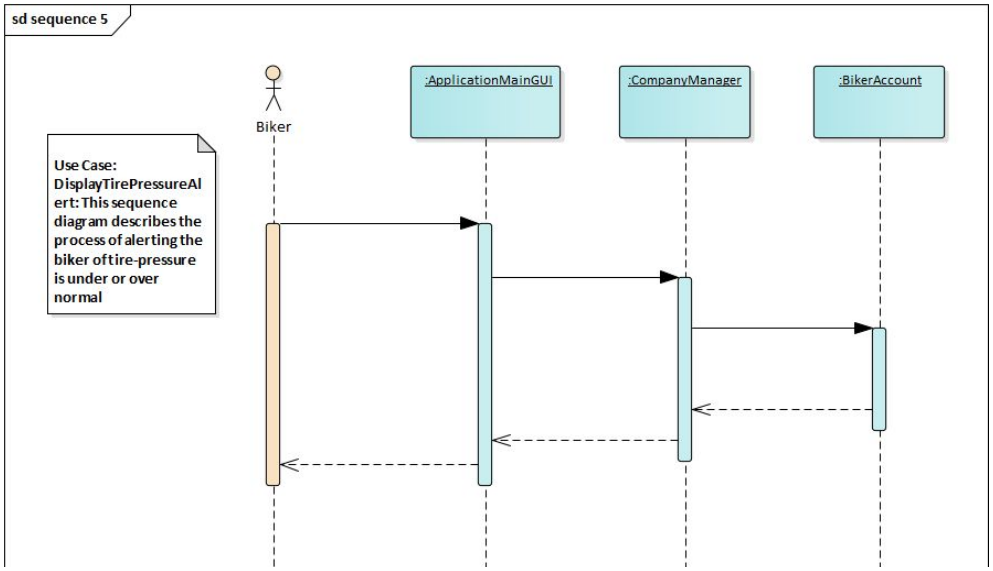
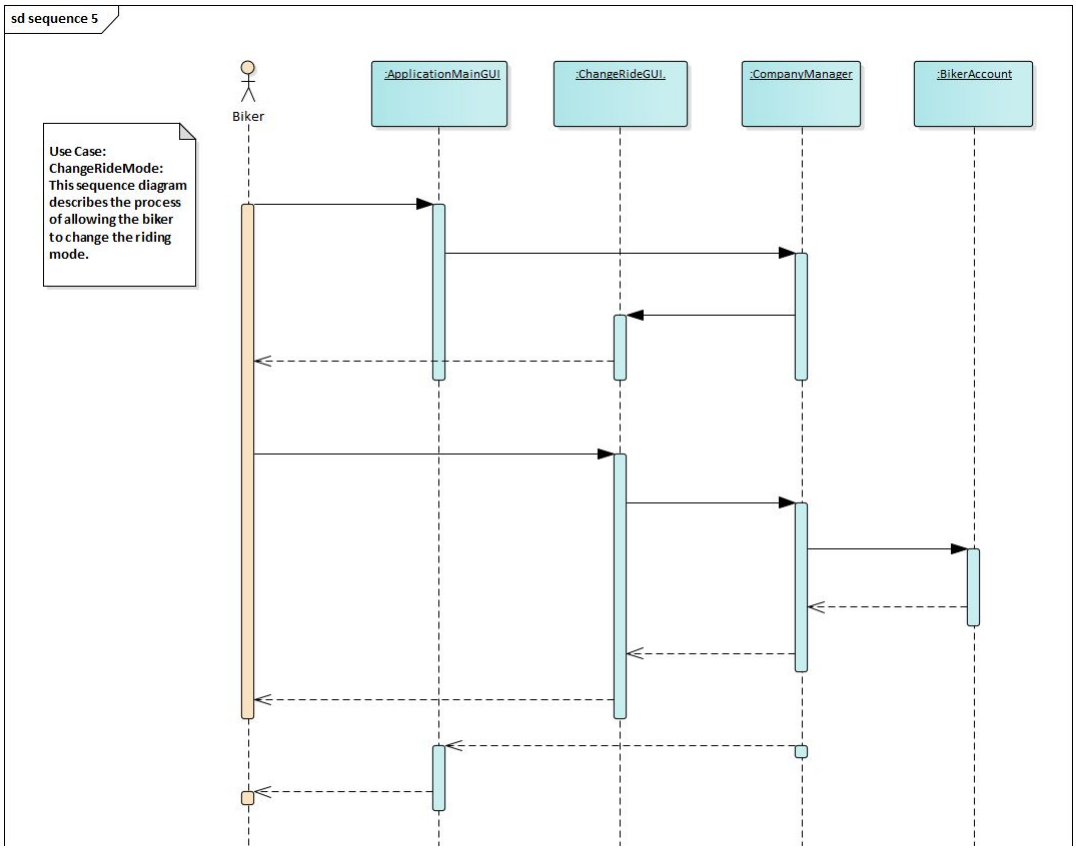
5. Analysis

5.1 Use Case Realization at The Analysis Level





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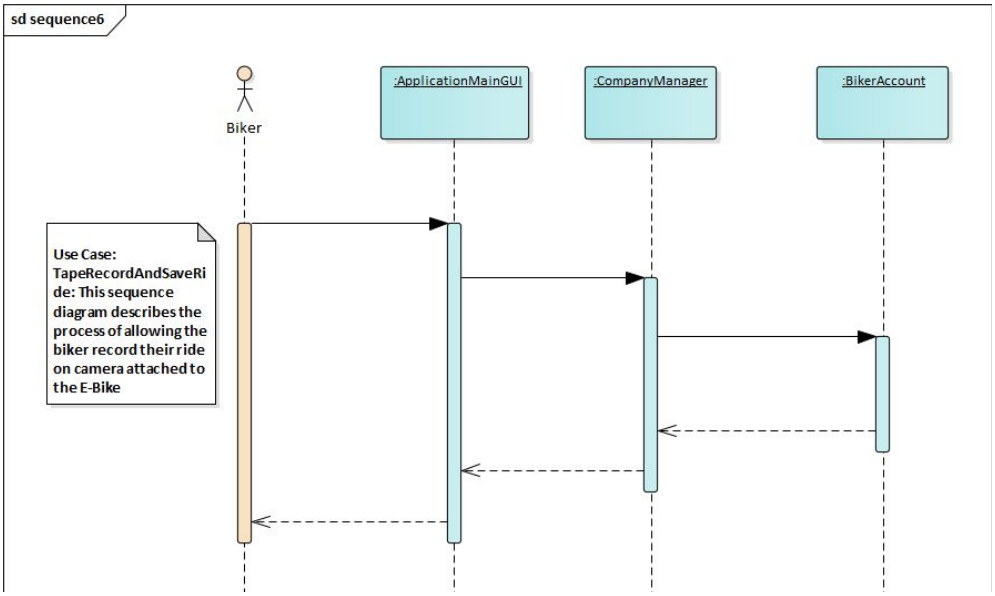

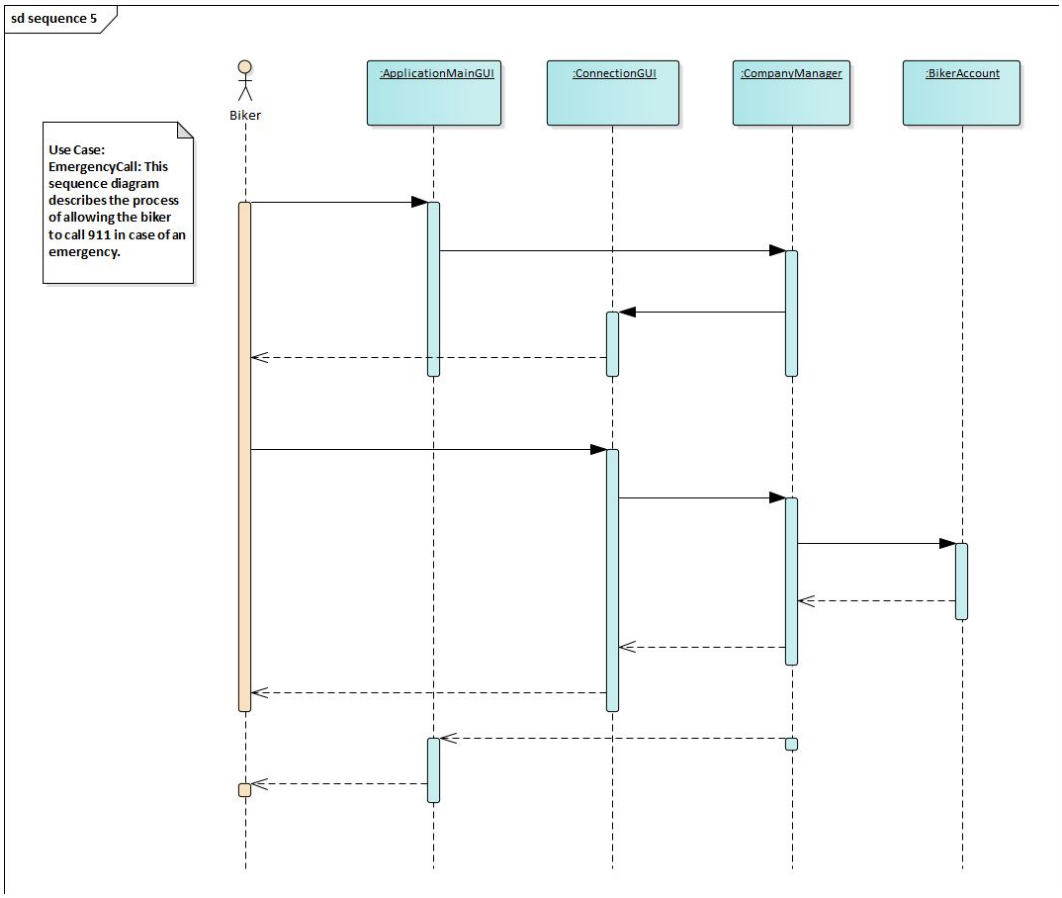

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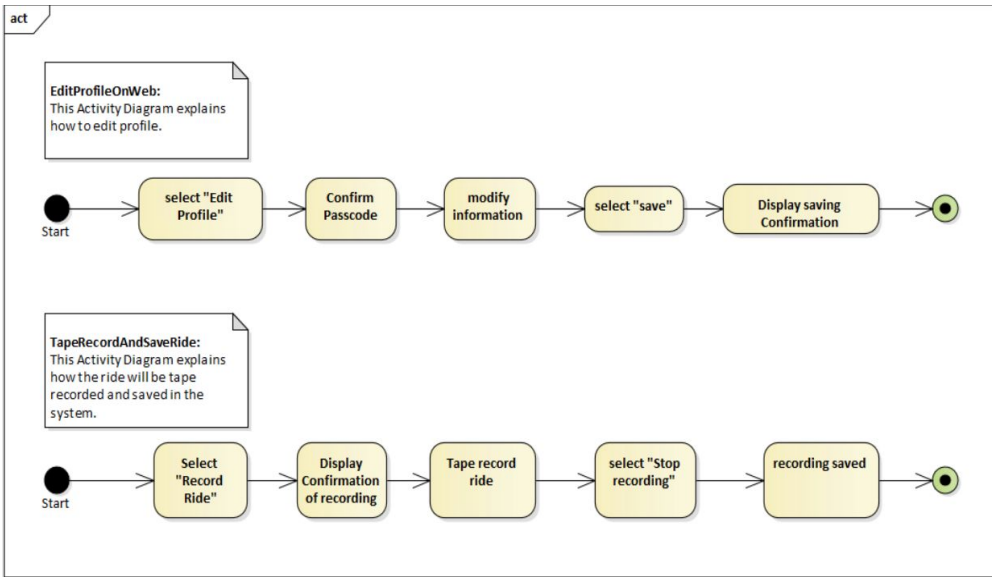
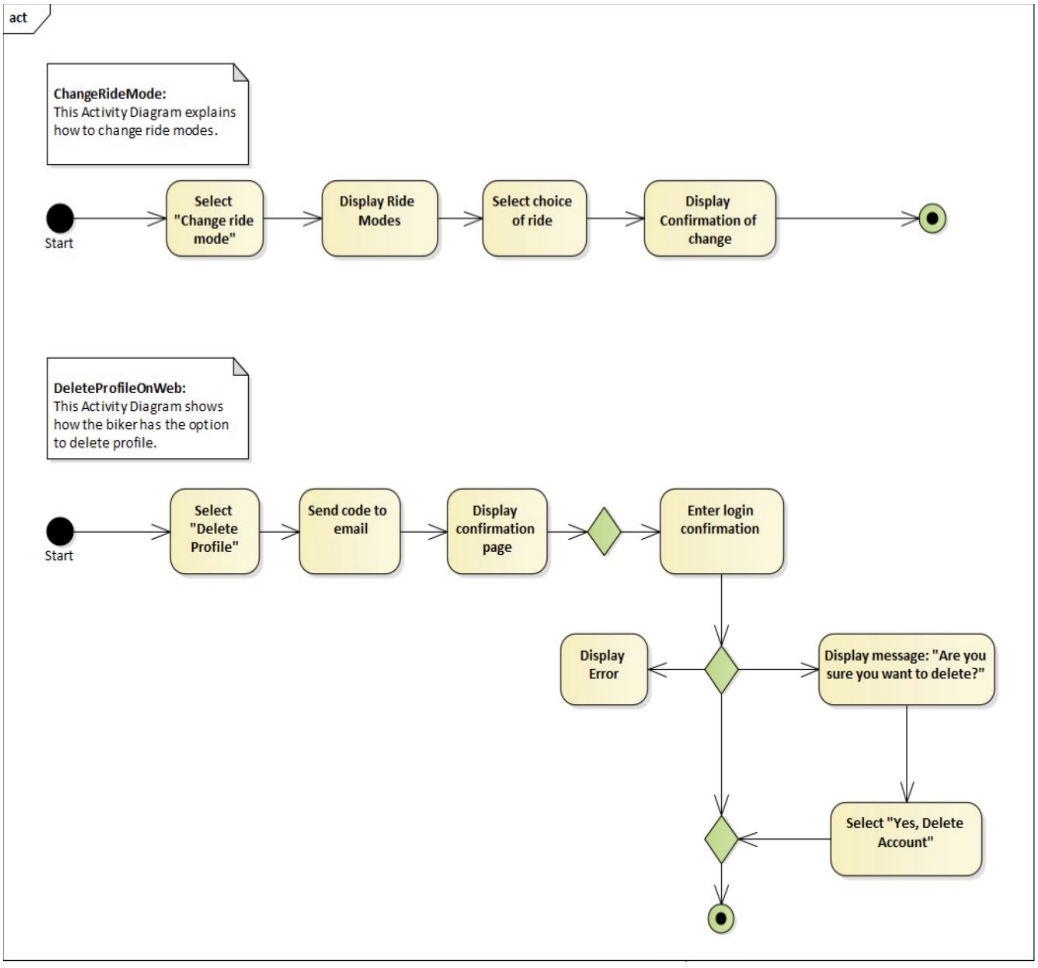
5.2 Activity Diagram at The Analysis Level





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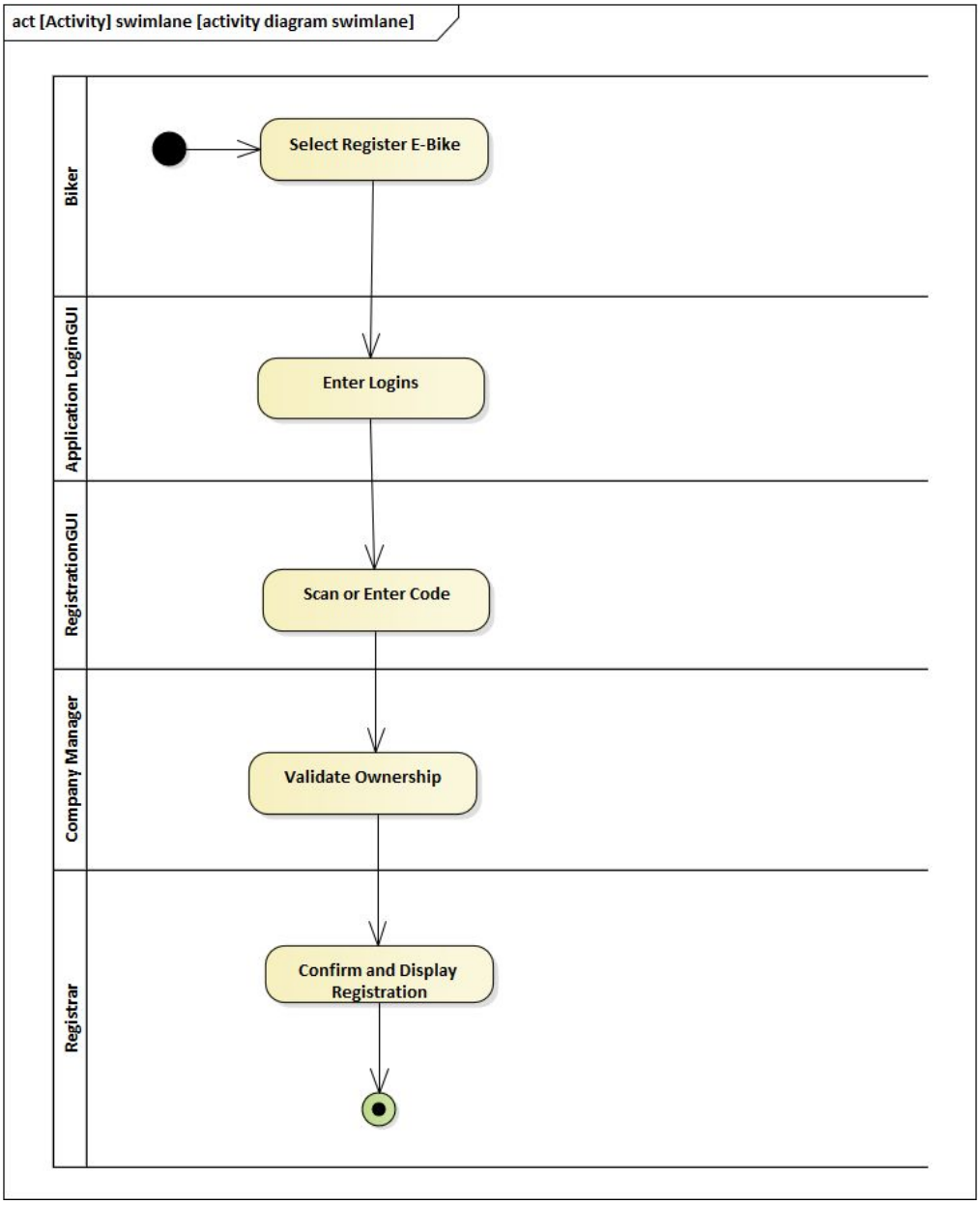
5.3 Swim Lanes at The Analysis Level



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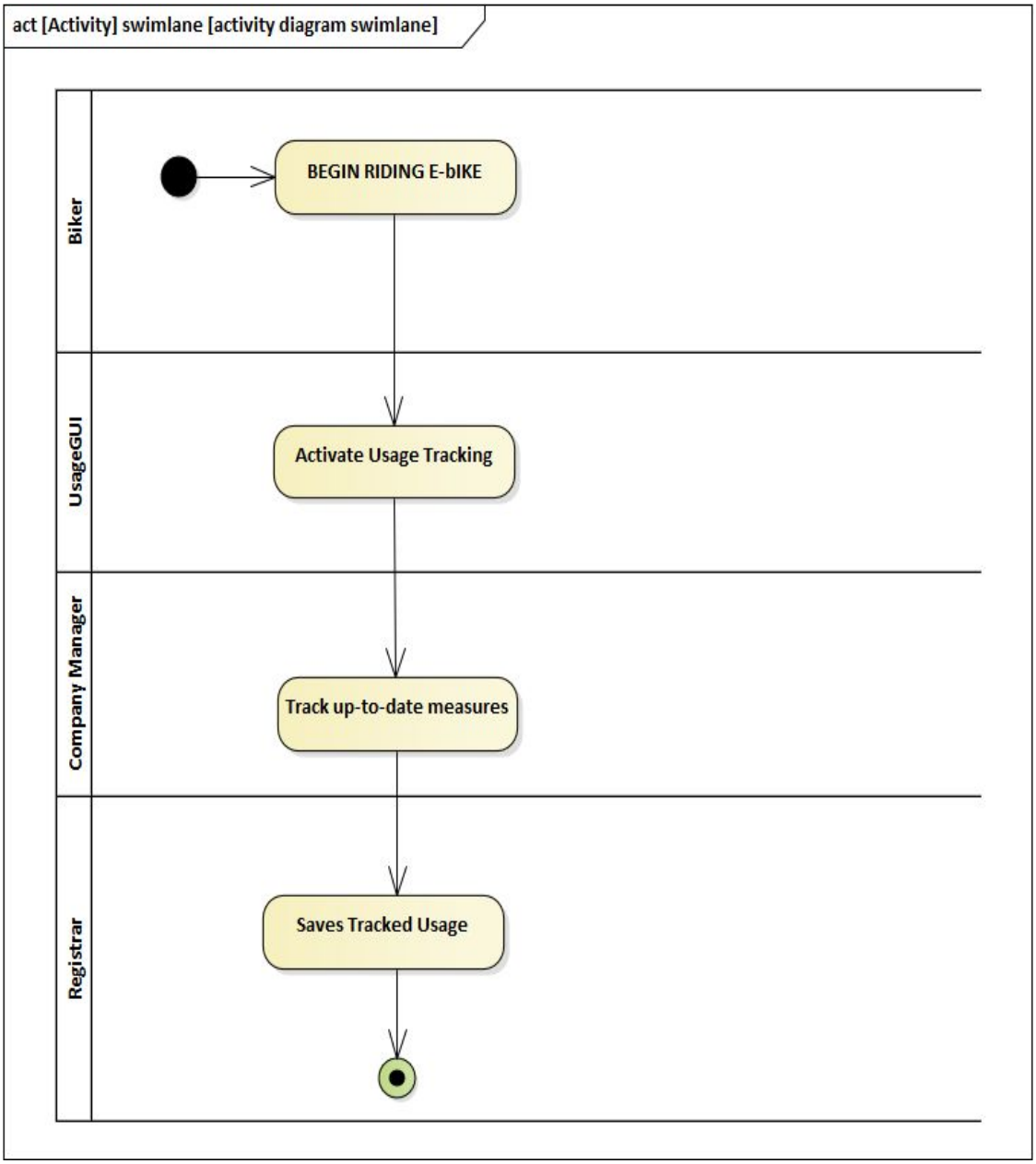

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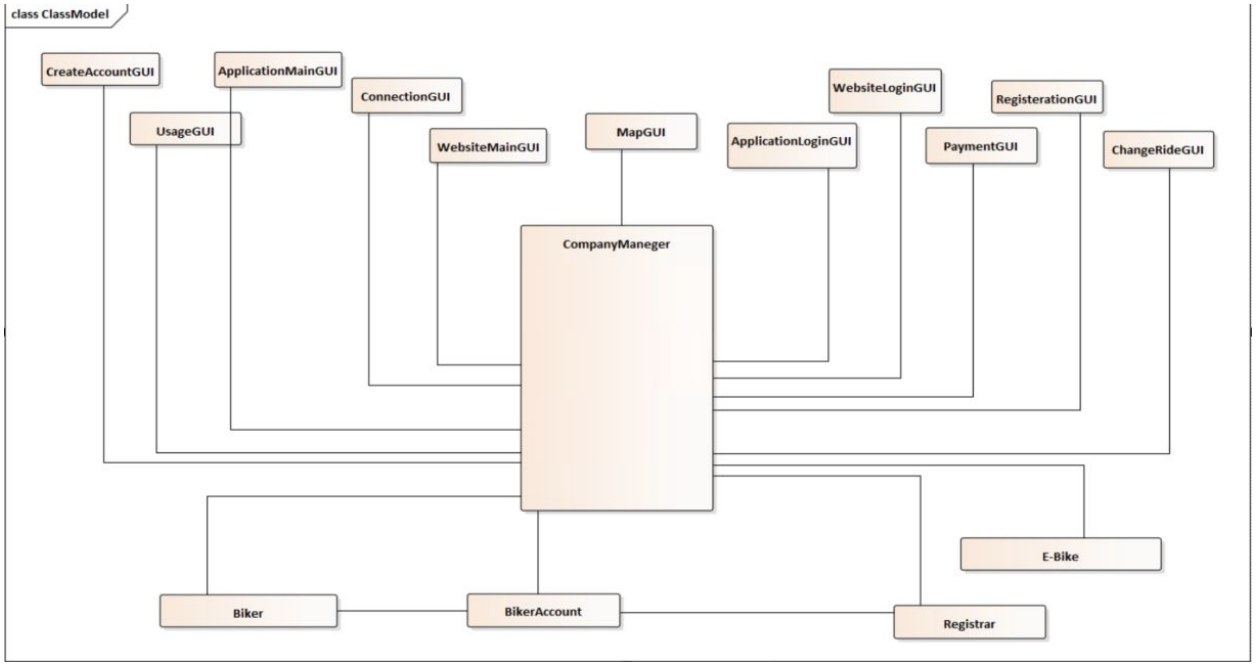
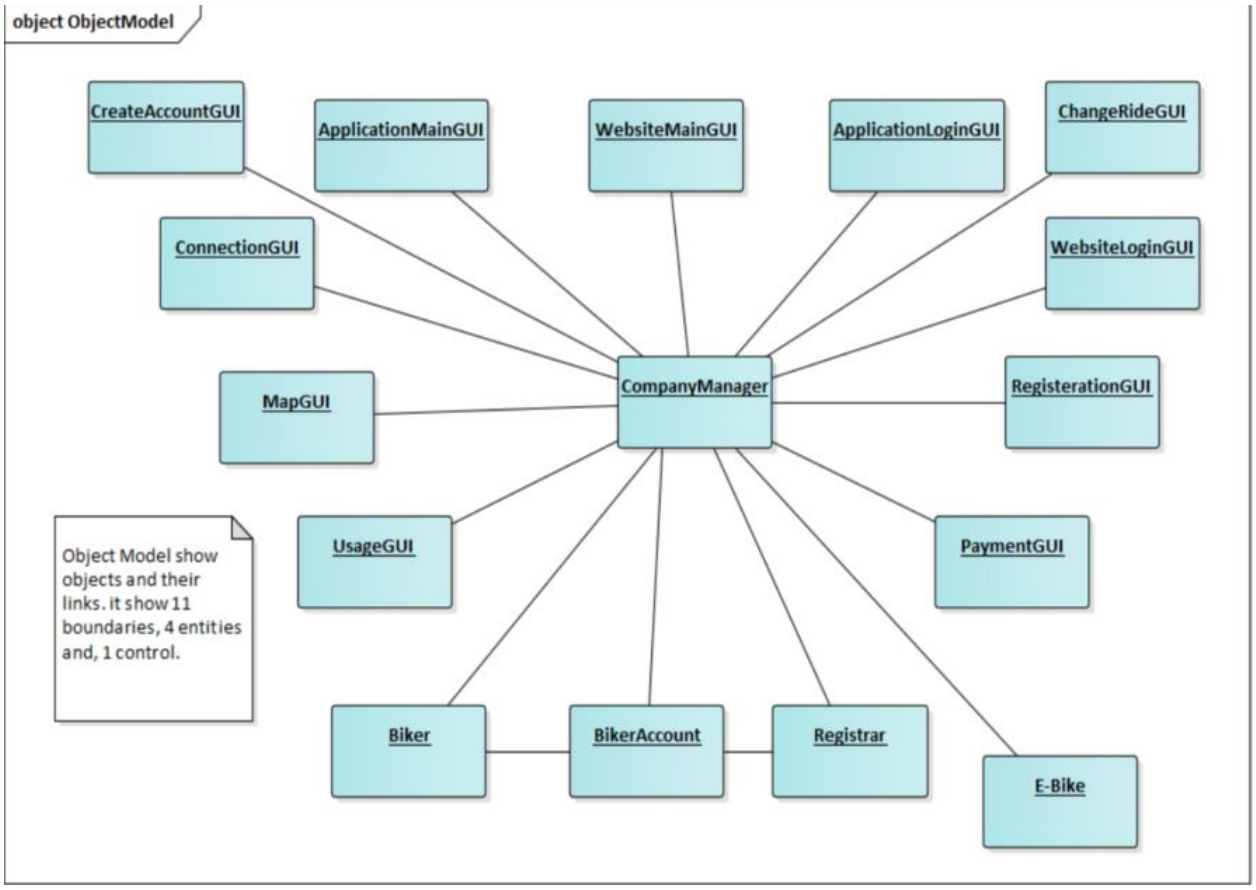
5.4 Class Model at The Analysis Level



5.5 Object Model at The Analysis Level



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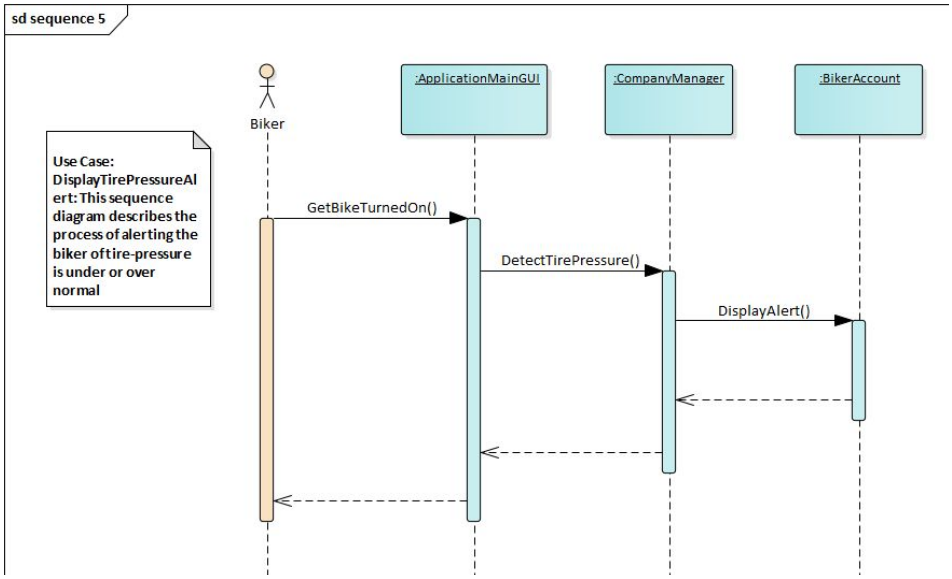
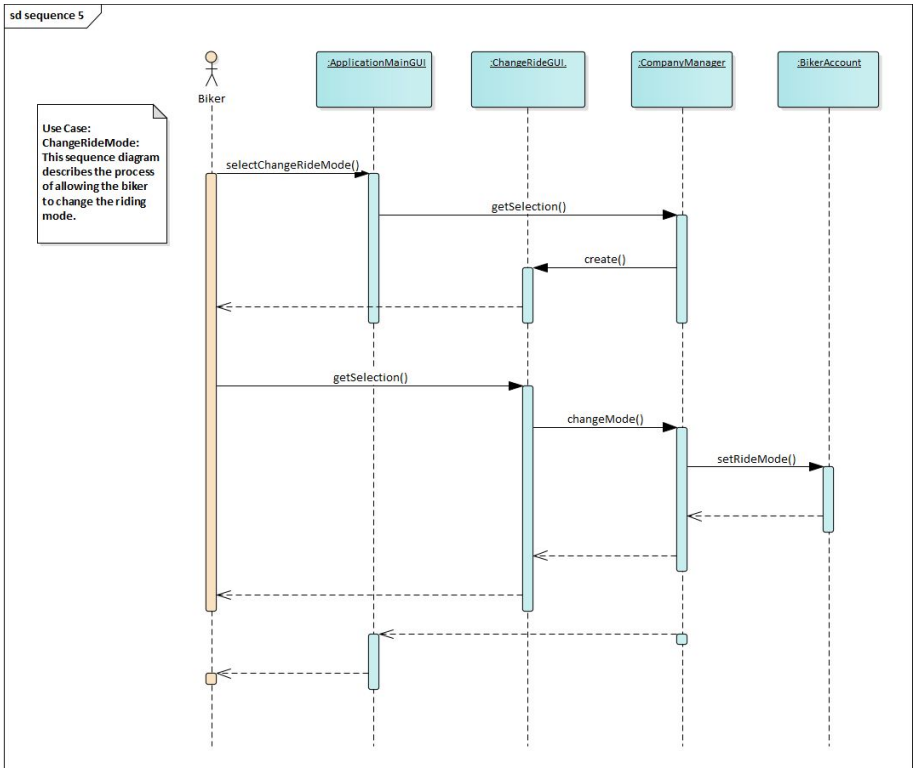
6. Design

6.1 Use Case Realizations At The Design Level:





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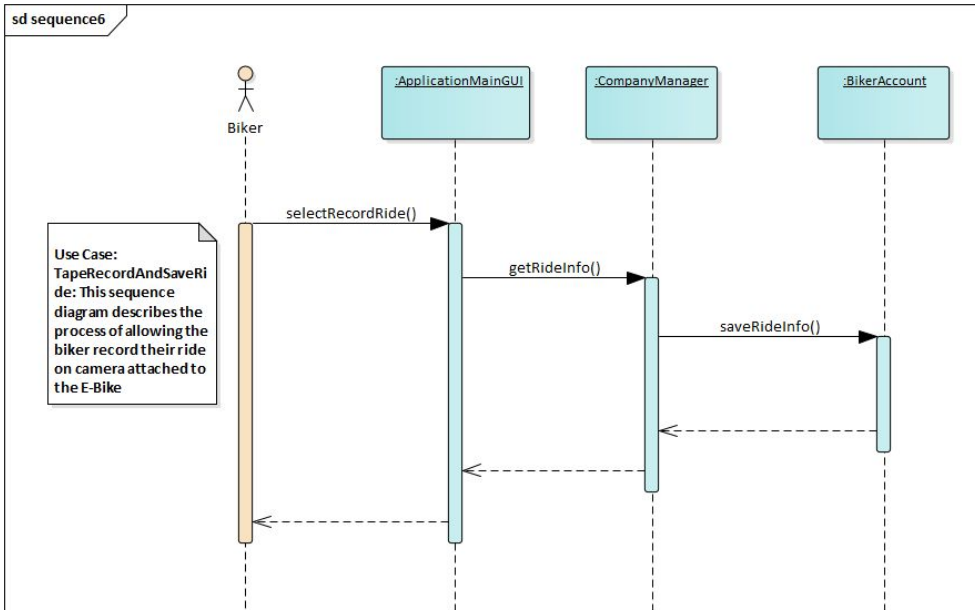

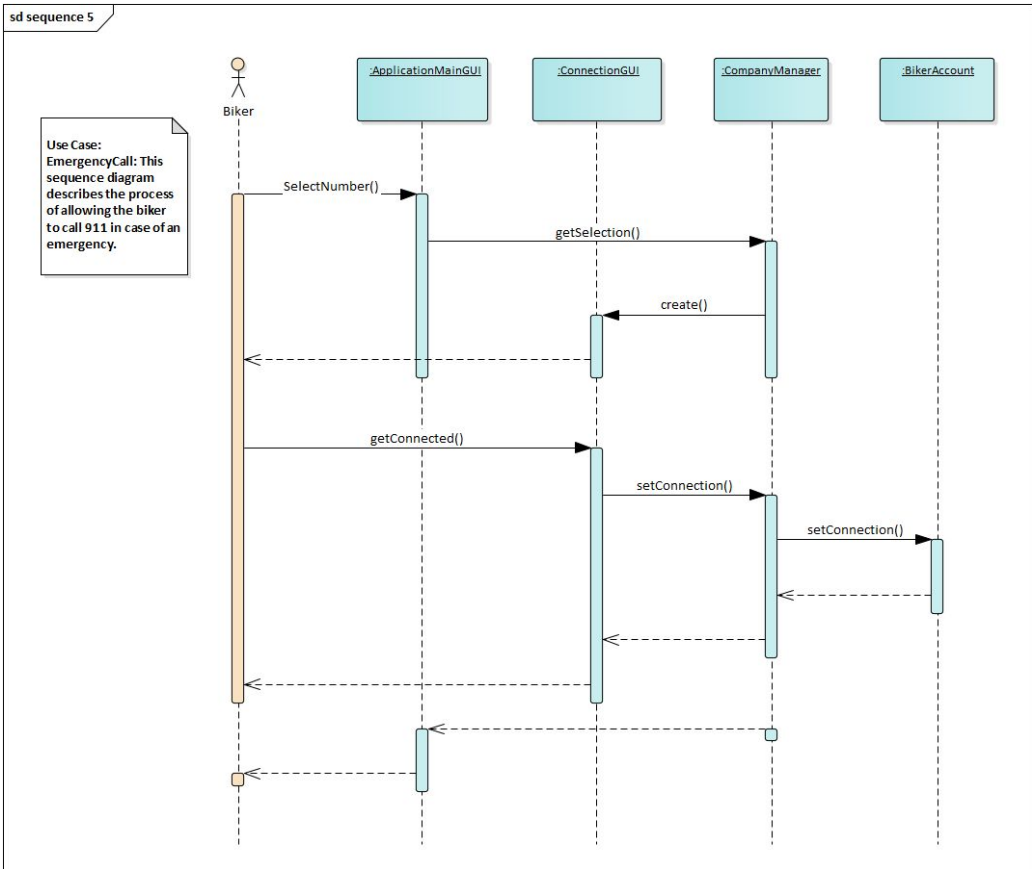

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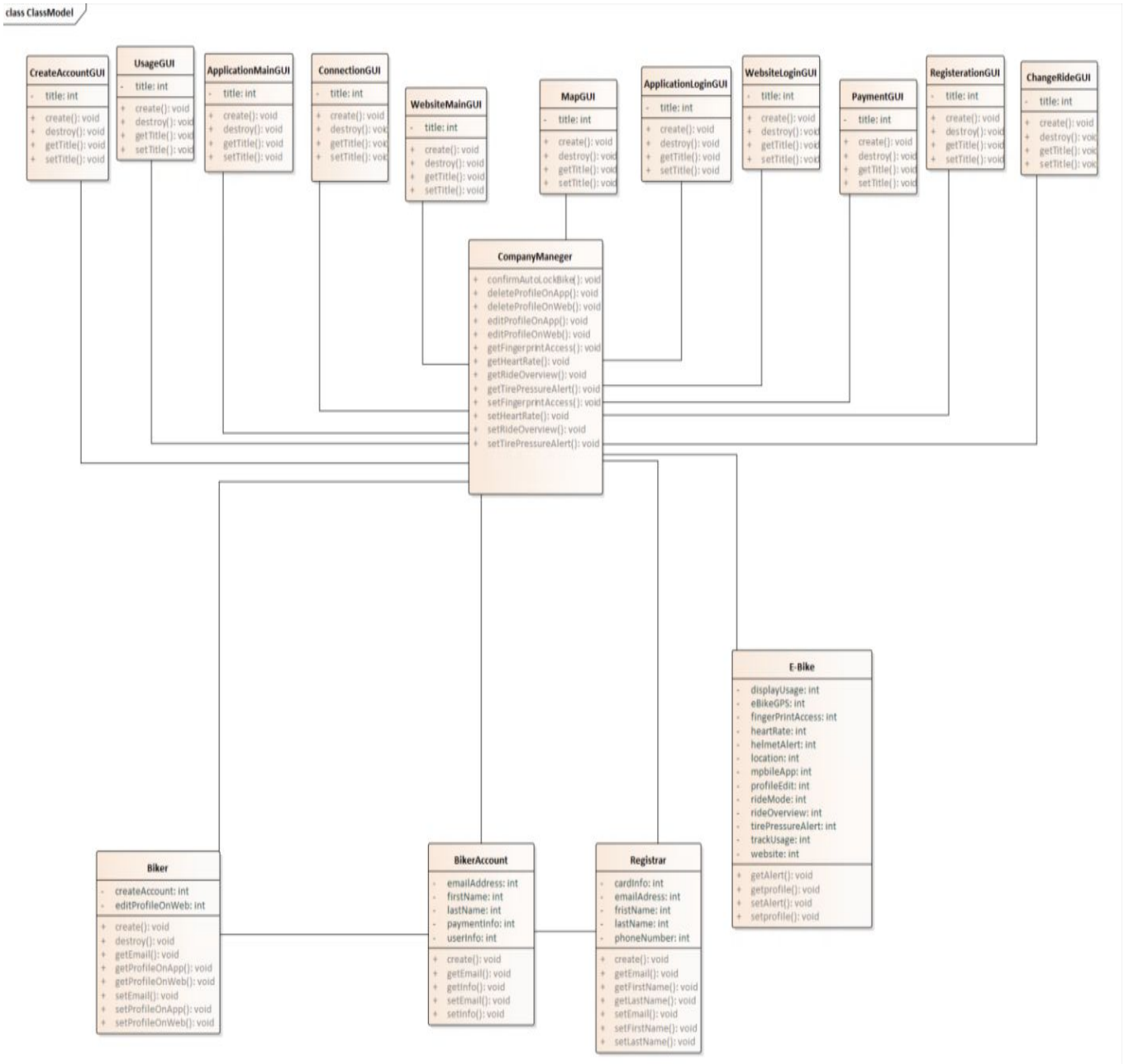
6.2 Classes At The Design Level:



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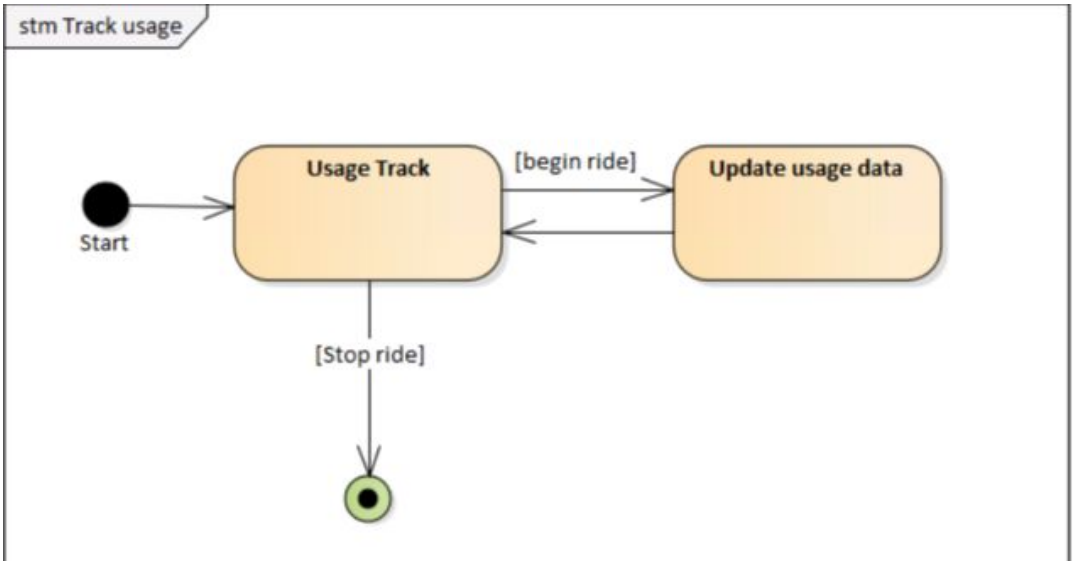
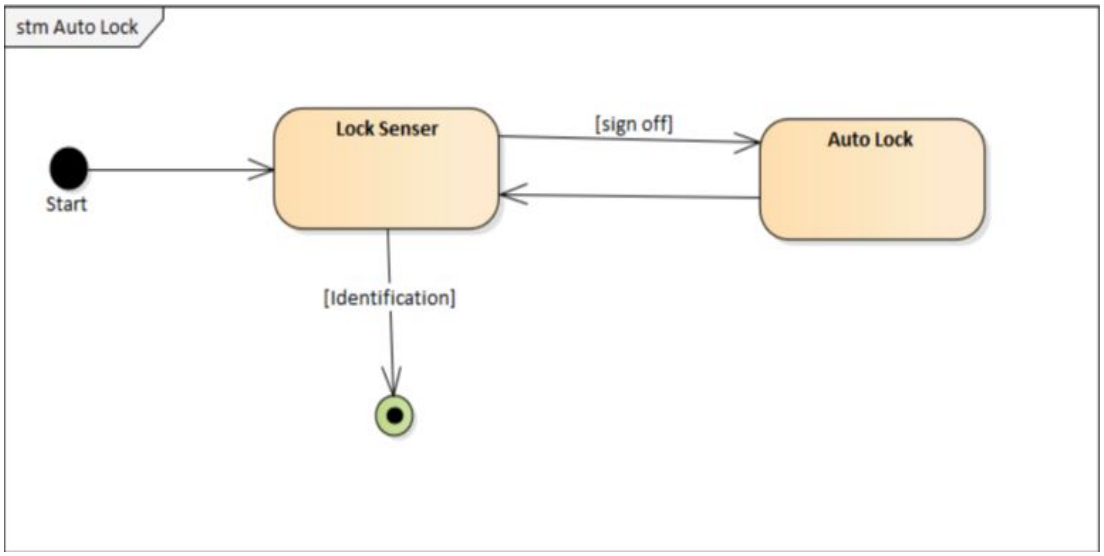
6.2 State Machines at the Design Level:

6.2.1 *TrackUsage* State Machine



6.2.2 *AutoLock* State Machine



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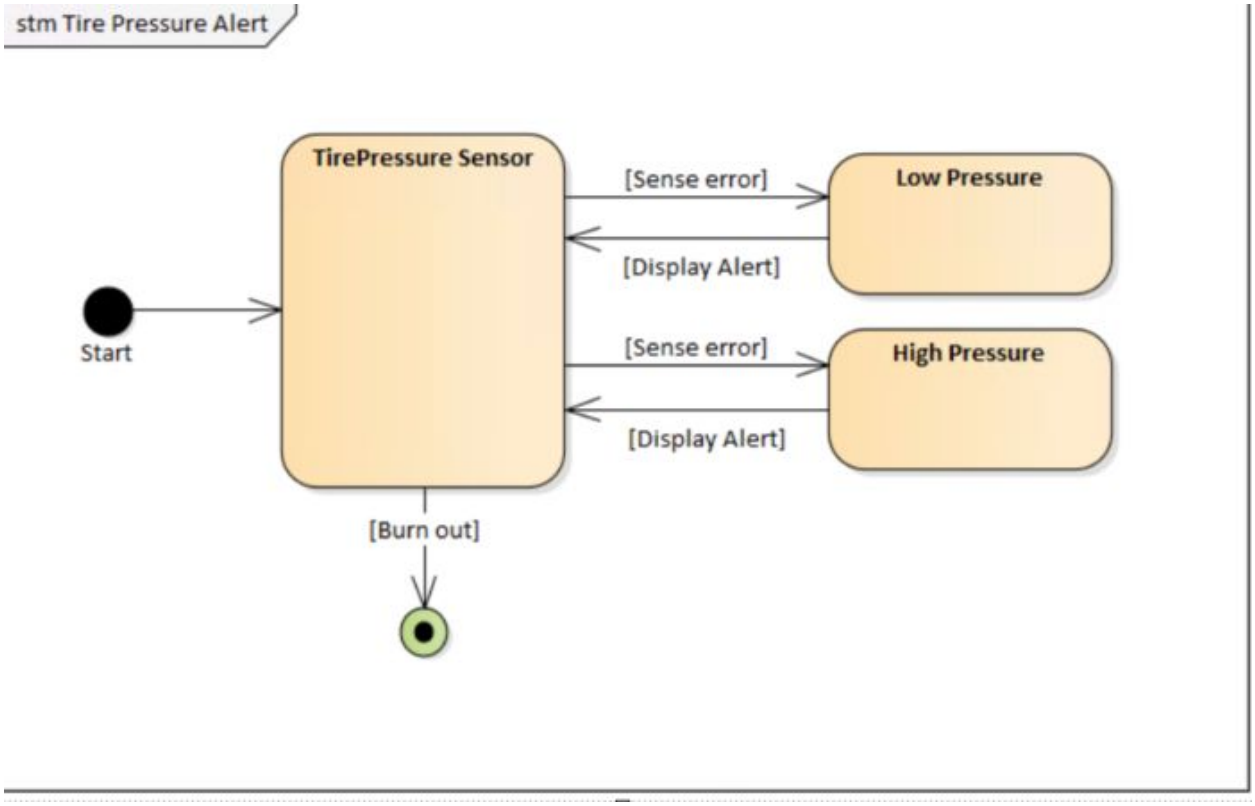
6.2.1 *TirePressureAlert* State Machine



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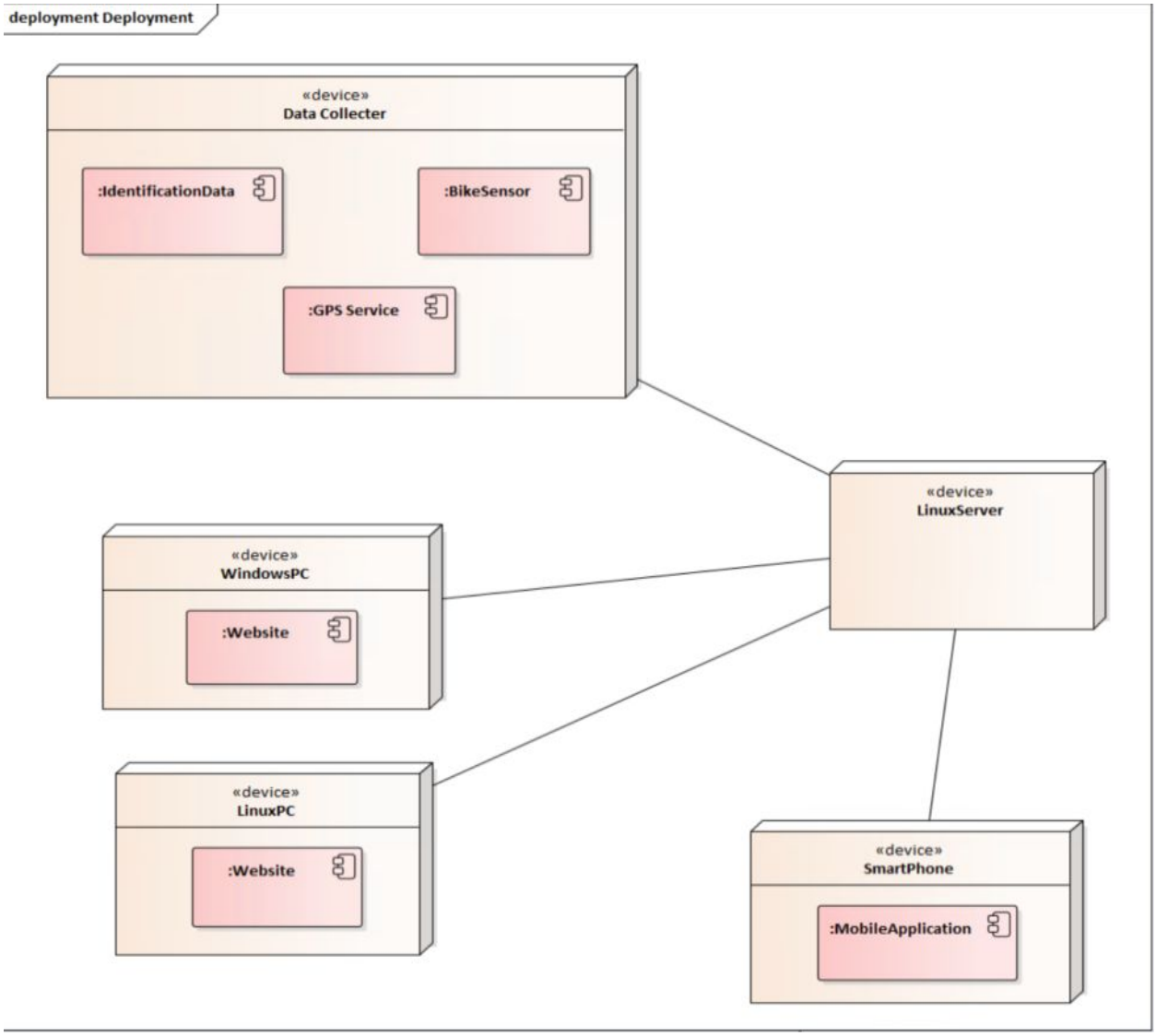
7. Implementation

7.1 Deployment Model



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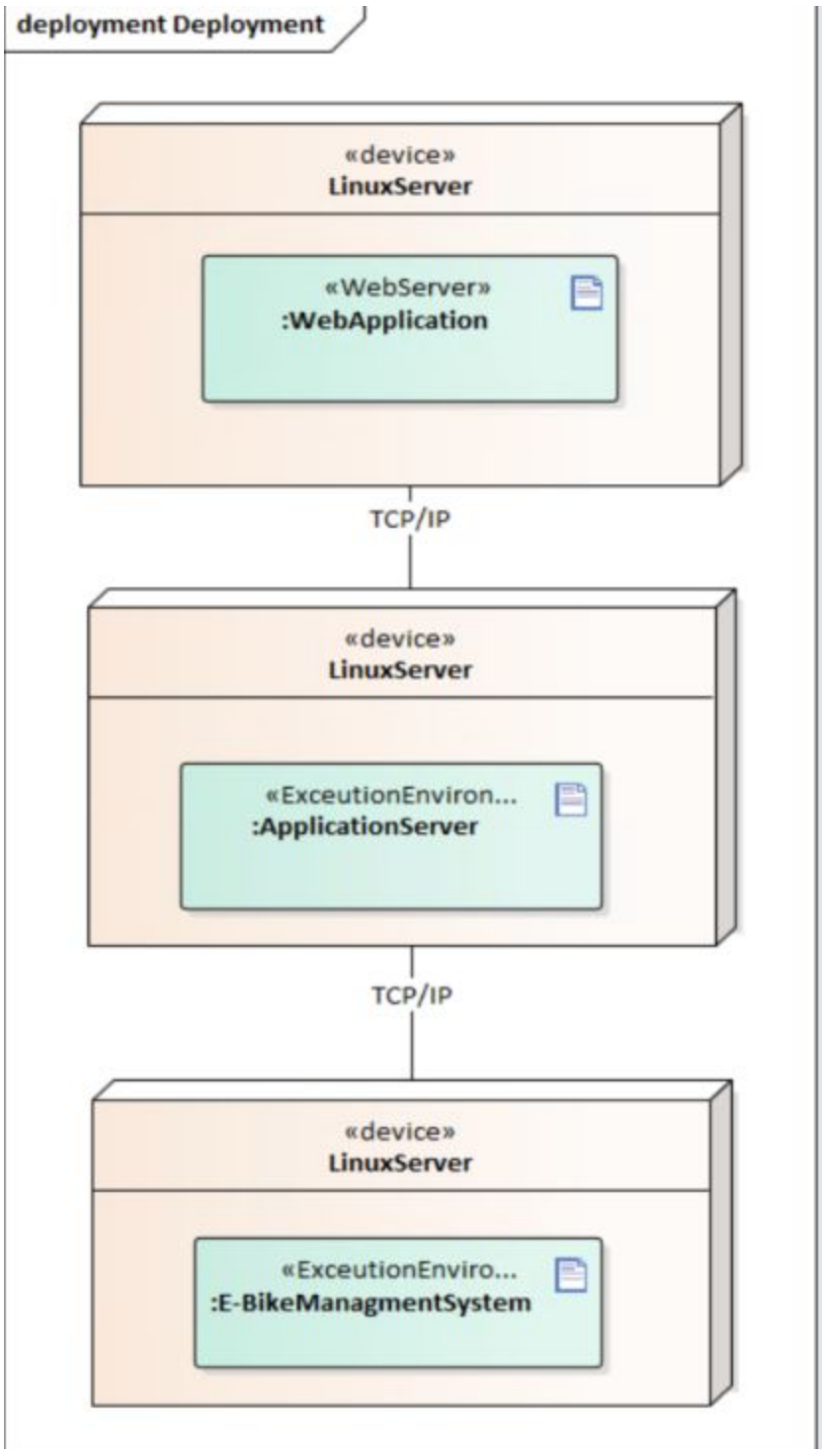
7.2 Clouds in The Server



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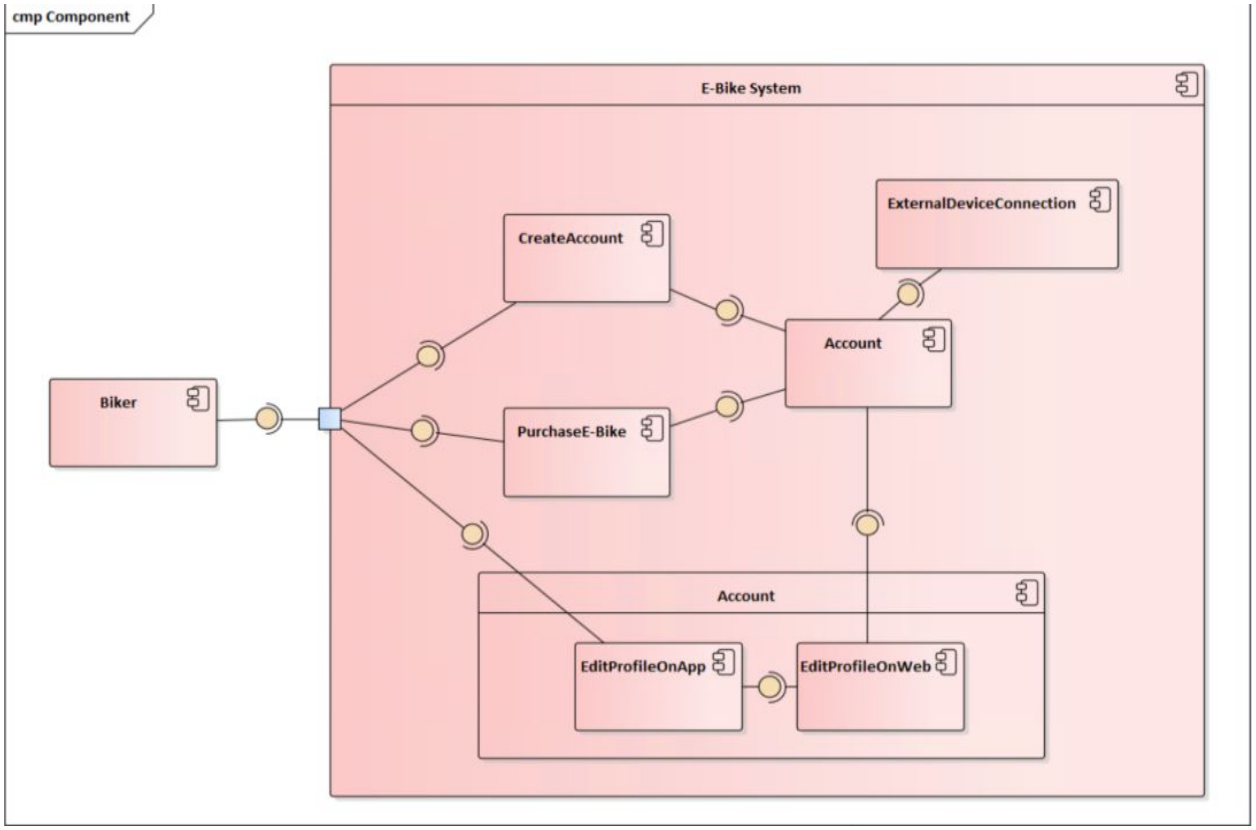
7.3 Component Model:



Appendix A: Glossary

SY System	The E-Bike Company that implemented this SCRD and self-contained the system
GPS	(Global Positioning System) a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world
E-Bike	(Electric Bicycle) is a bicycle with an integrated electric motor which can be used for propulsion. Depending on local laws, E-Bikes might legally be classified as bicycles rather than mopeds or motorcycles
FTP	(File Transfer Protocol) is a standard network protocol used for the transfer of computer files between a client and server on a computer network
TCP	(Transmission Control Protocol) is a standard that defines how to establish and maintain a network conversation through which application programs can exchange data.
HTTP	(HyperText Transfer Protocol) is the underlying protocol used by the World Wide Web and this protocol defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands.
IP	(Internet Protocol address) (IP address) is a numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication

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Appendix B: Requirements and Use Case Traceability Matrix

		Use Cases				
		CreateAcoount	PurchaseEBike	RegisterEBike	TrackUsage	DisplayUsage
Requirements	4.1.1	x				
	4.1.2		x			
	4.1.3			x		
	4.1.4				x	
	4.1.5					x

		Use Cases				
		AutoLockBike	BlutoothPairing	EmergencyCall	DisplayRealTimeLocation	FingerprintAccess
Requirements	4.1.6	x				
	4.1.7		x			
	4.1.8			x		
	4.1.9				x	
	4.1.10					x

		Use Cases				
		DisplayHeartRate	EditProfileOnWeb	DeleteProfileOnWeb	EditProfileOnApp	DeleteProfileOnApp
Requirements	4.1.11	x				
	4.1.12		x			
	4.1.13			x		
	4.1.14				x	
	4.1.15					x

		Use Cases				
		TapeRecordAndSaveRides	ChangeRideMode	DisplayHelmetAlert	DisplayObjectAlert	DisplayRideOverview
Requirements	4.1.16	x				
	4.1.17		x			
	4.1.18			x		
	4.1.19				x	
	4.1.20					x

		Use Cases				
		DisplayTirePressureAlert				
Requirements	4.1.21	x				

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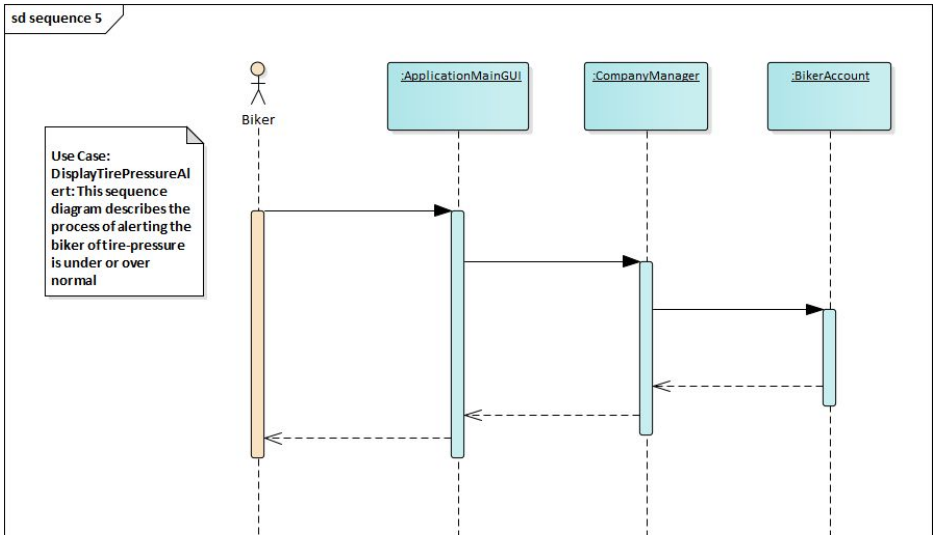
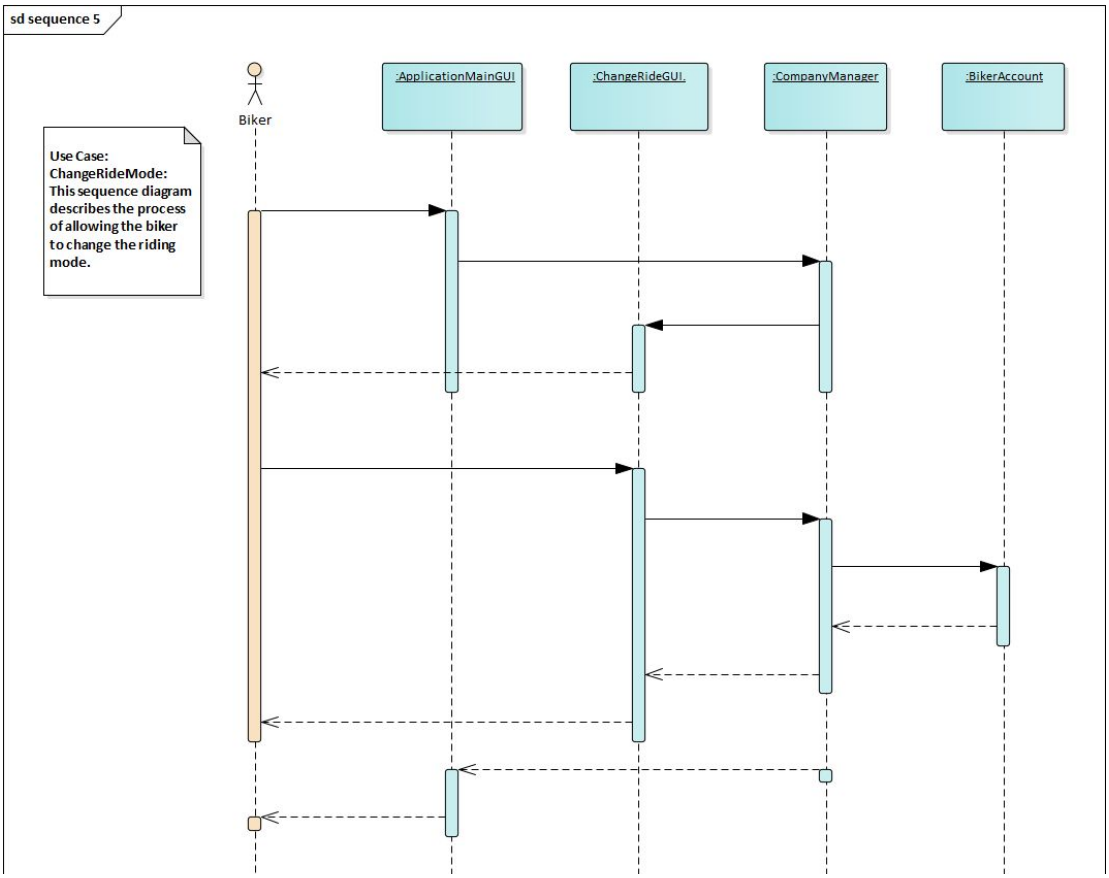
Appendix C: Analysis Models





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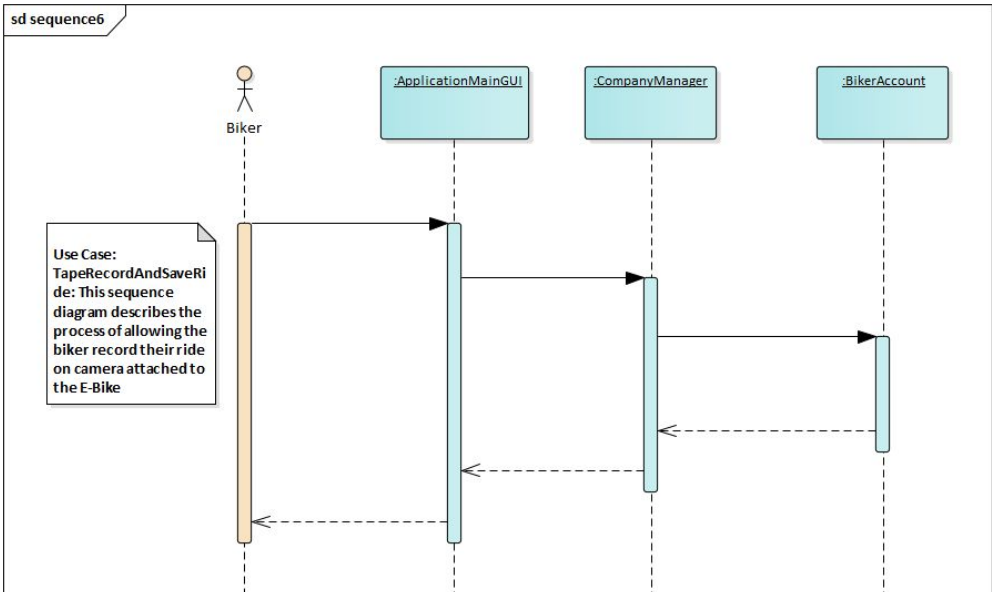

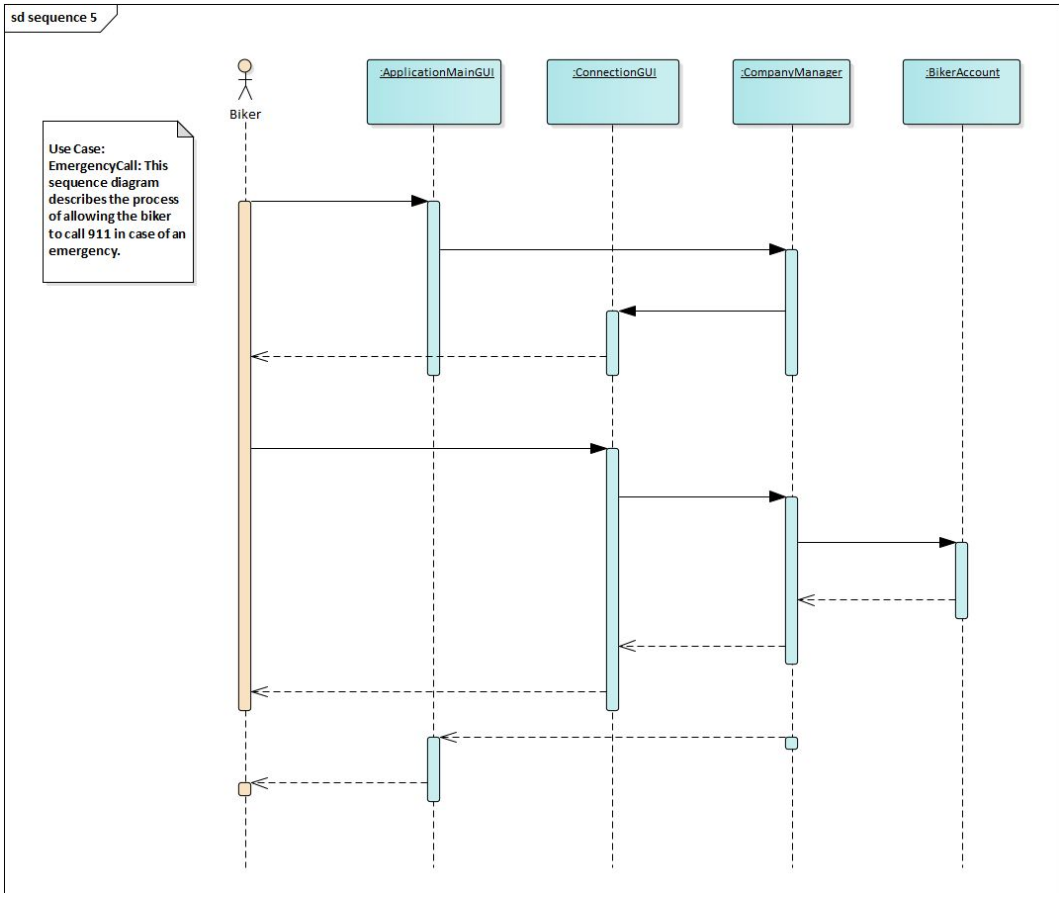

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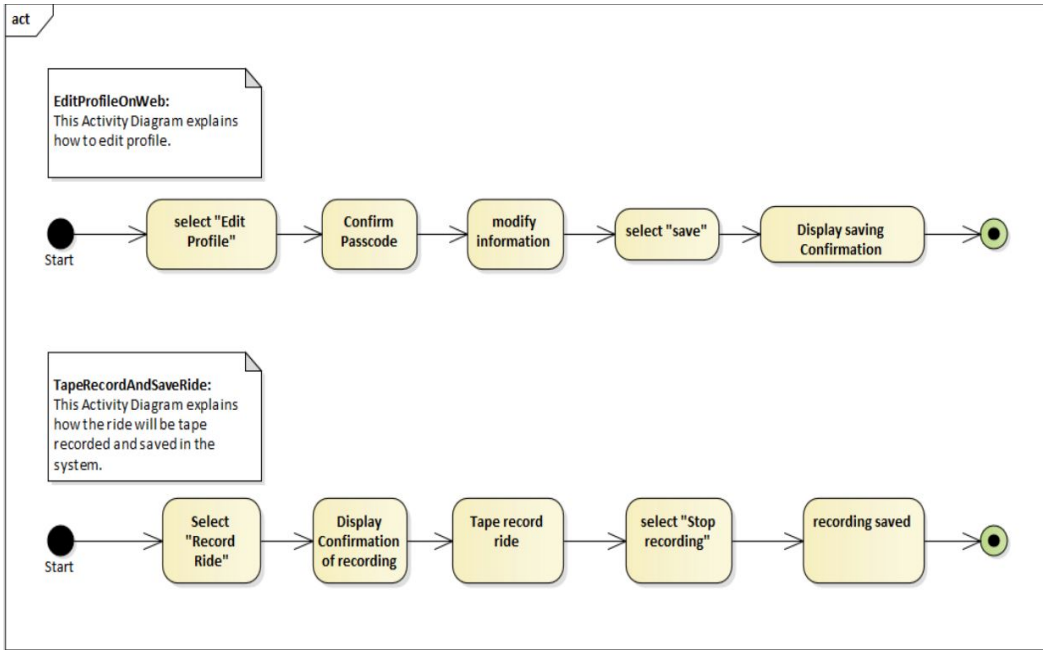

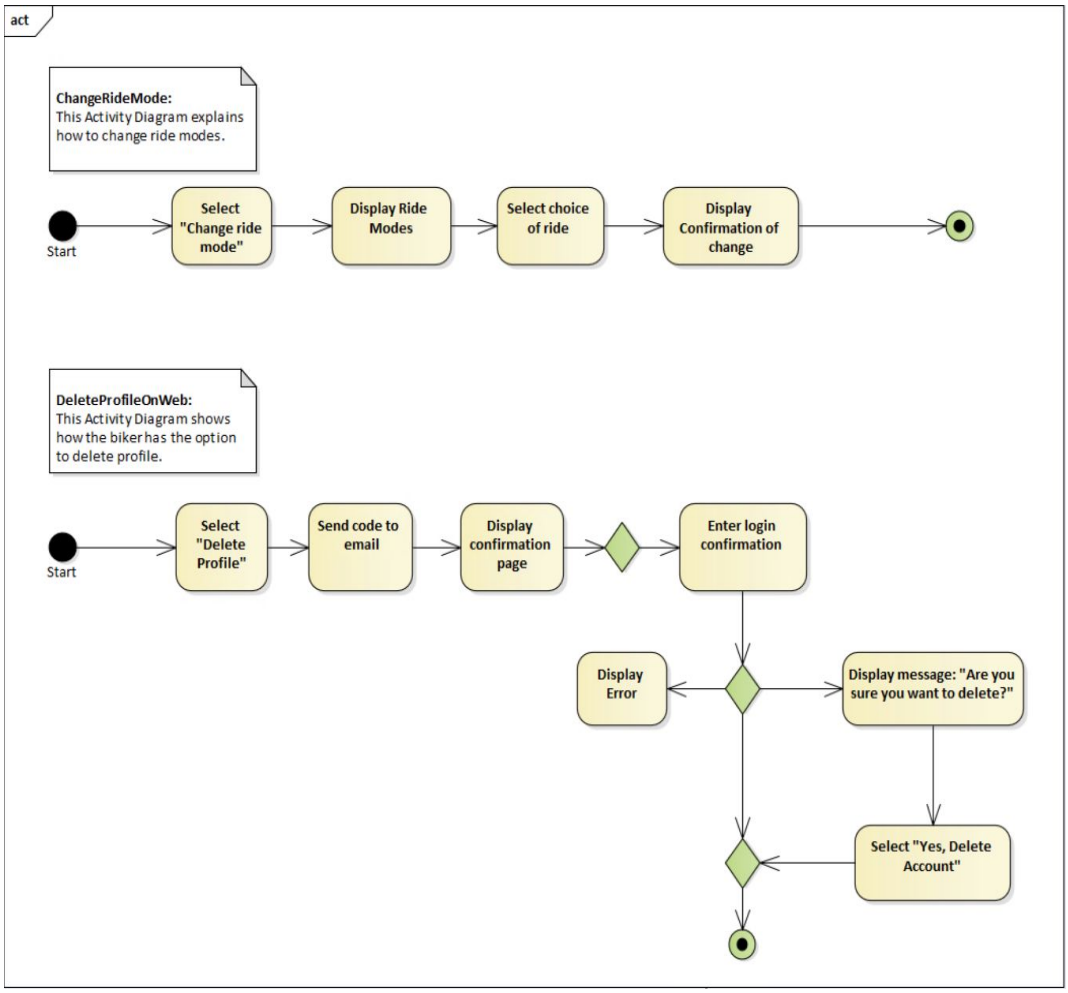

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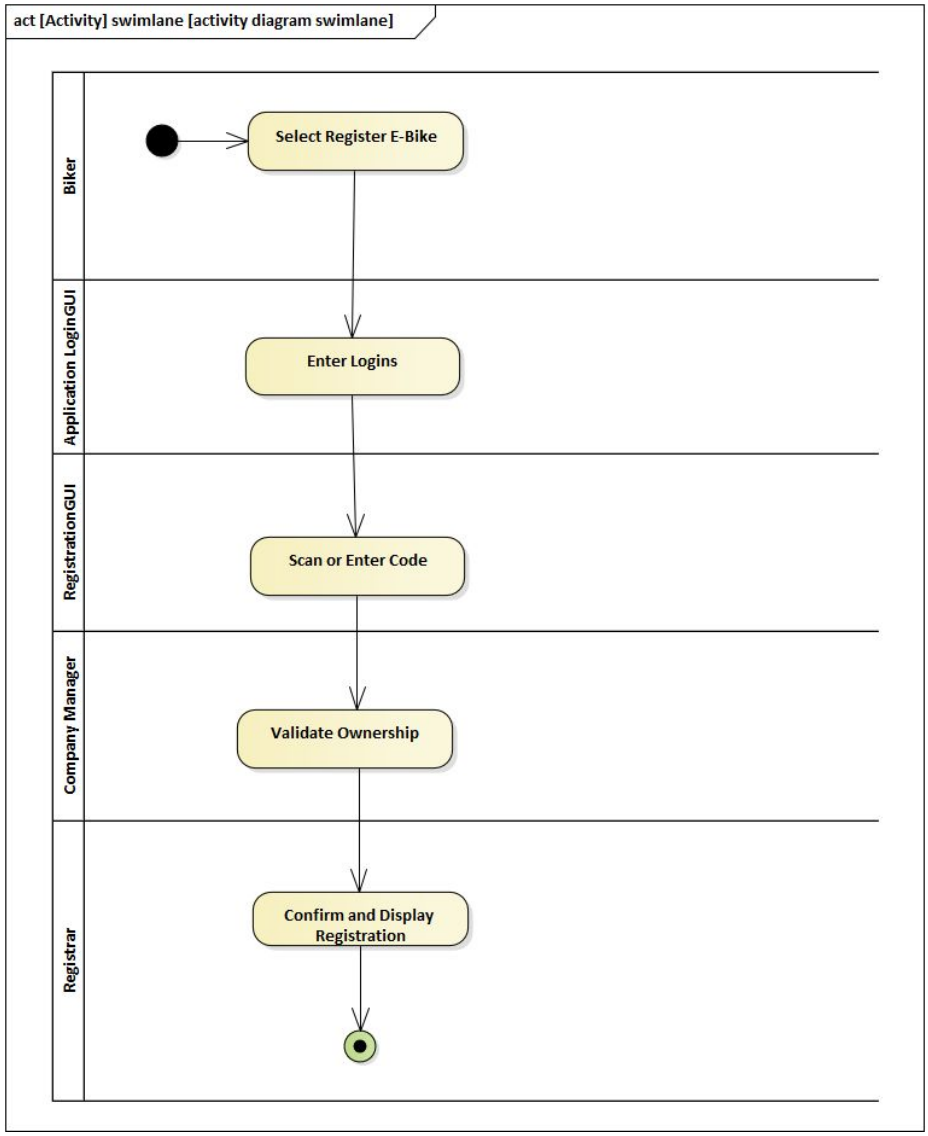

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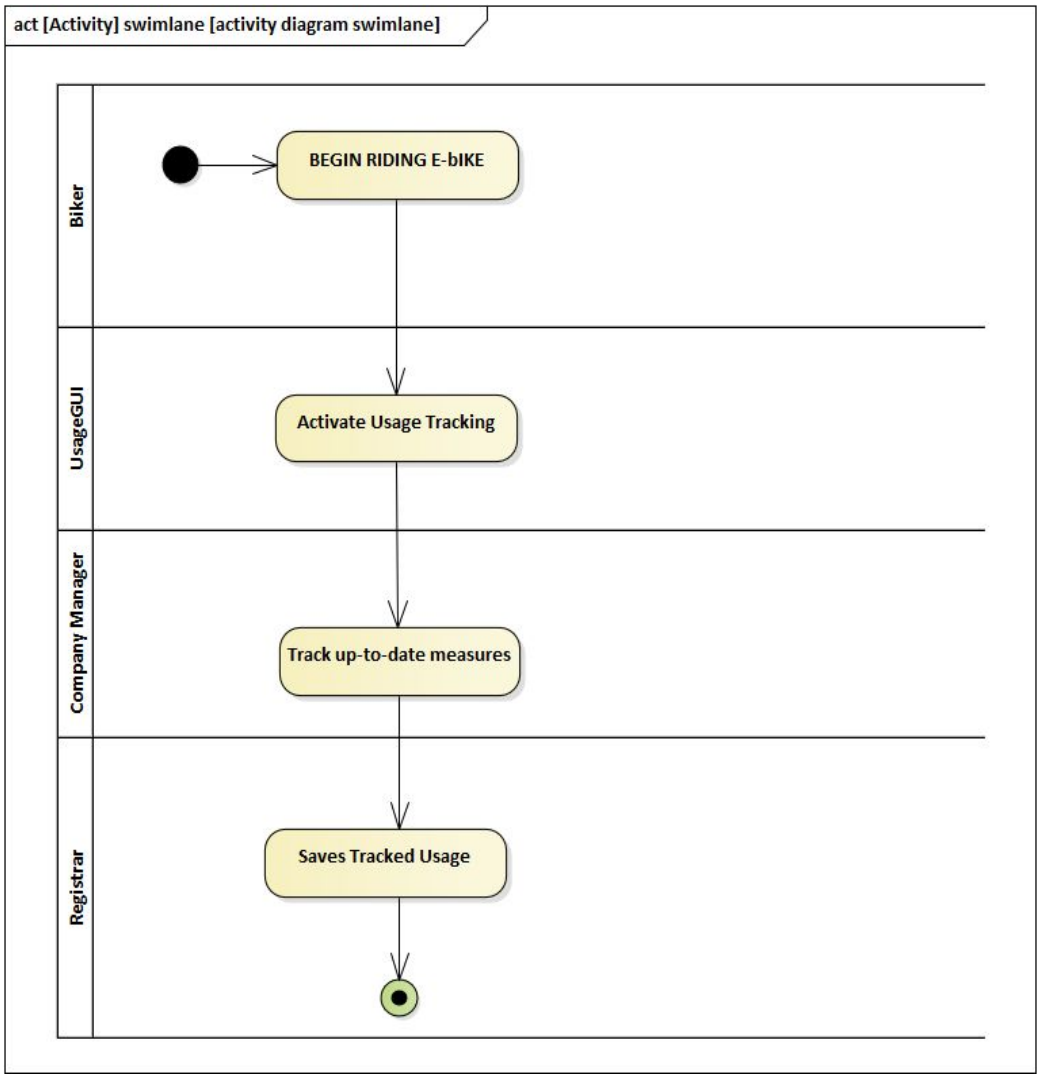

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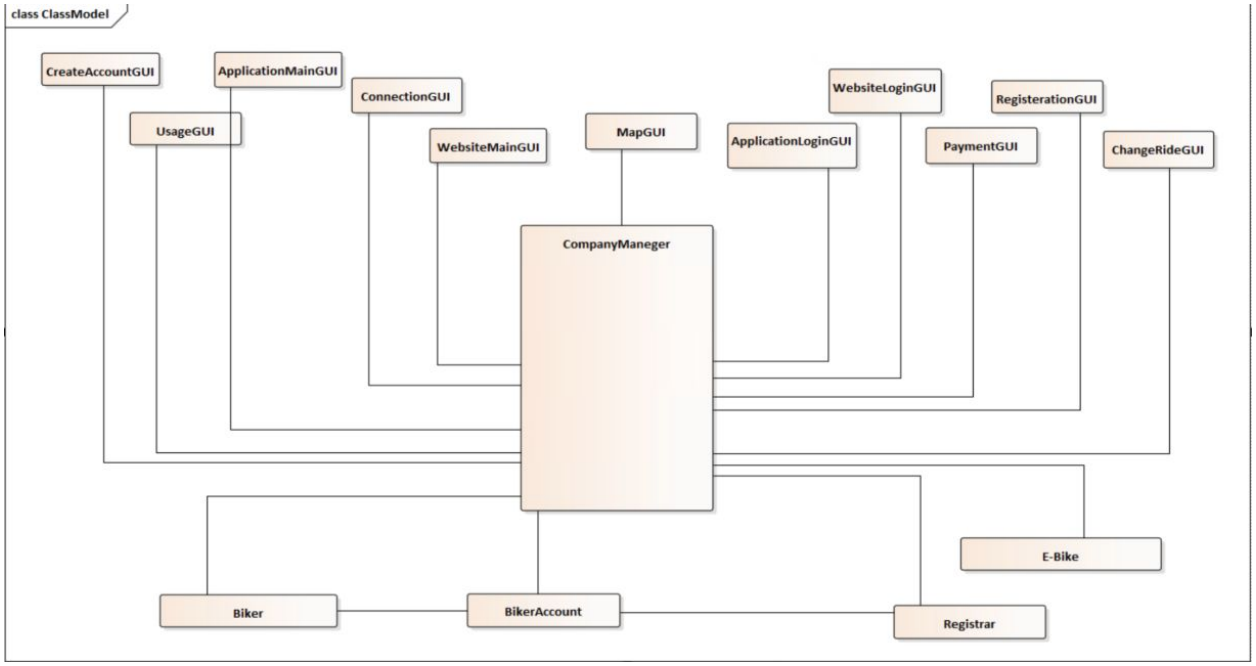

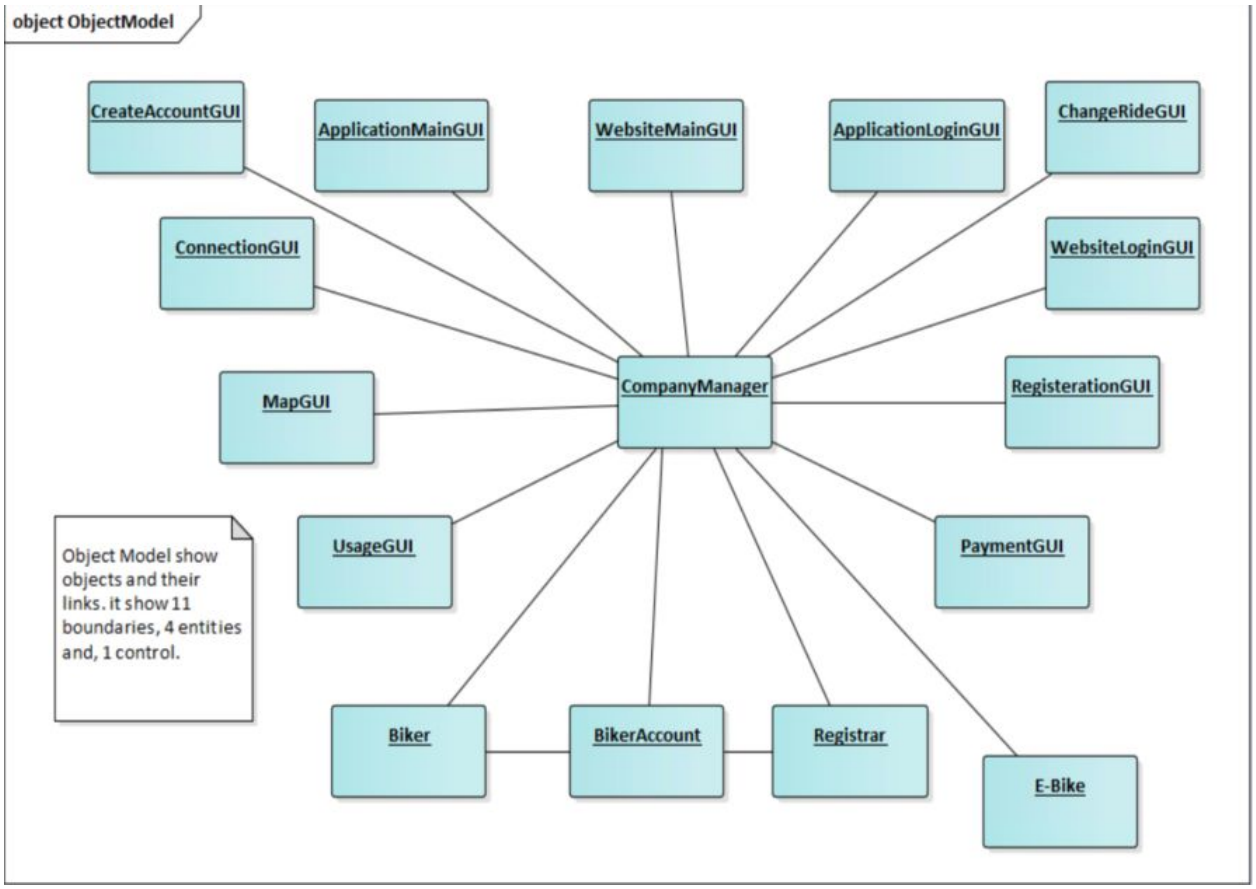

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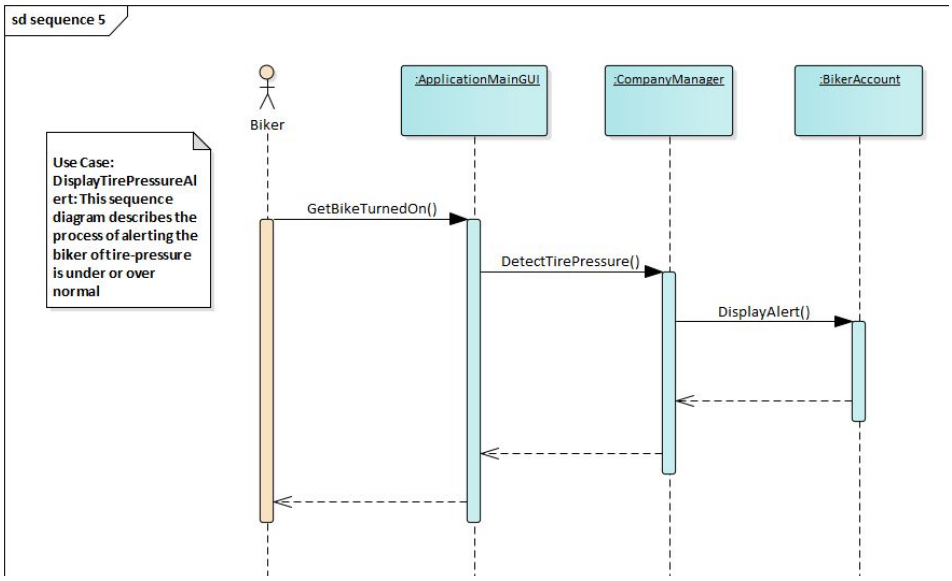
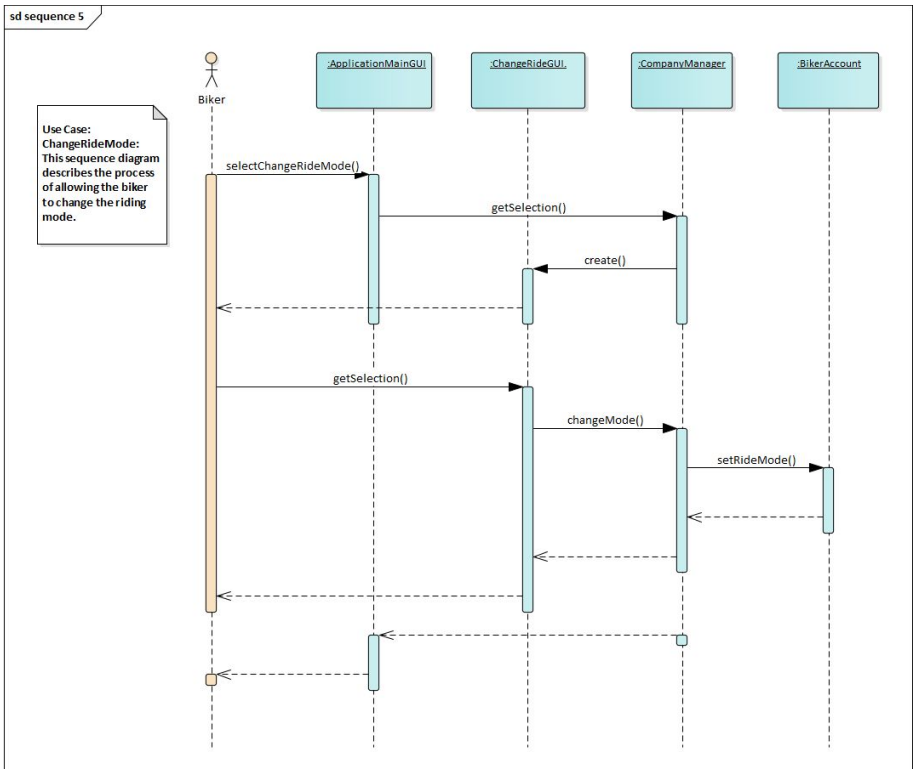
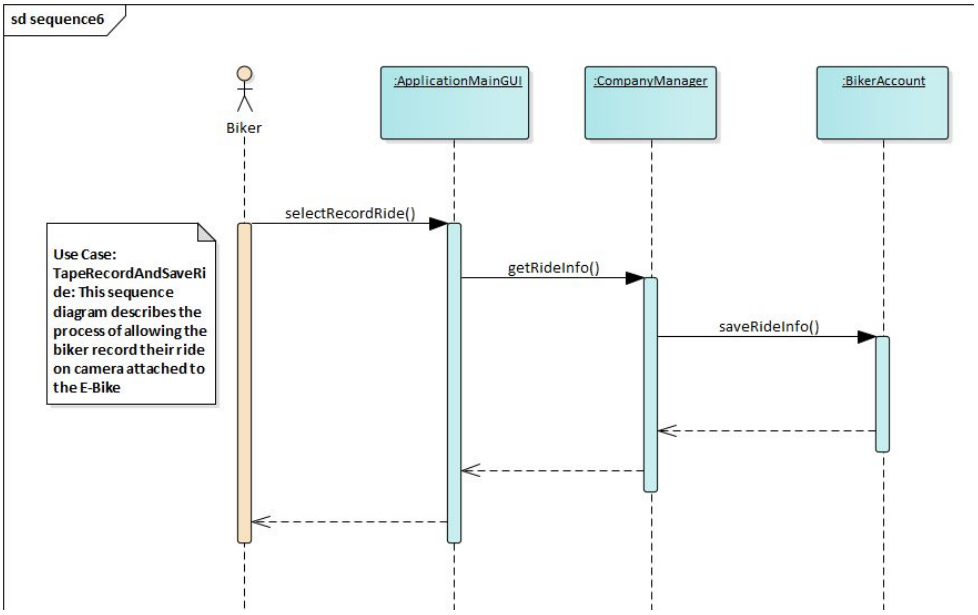
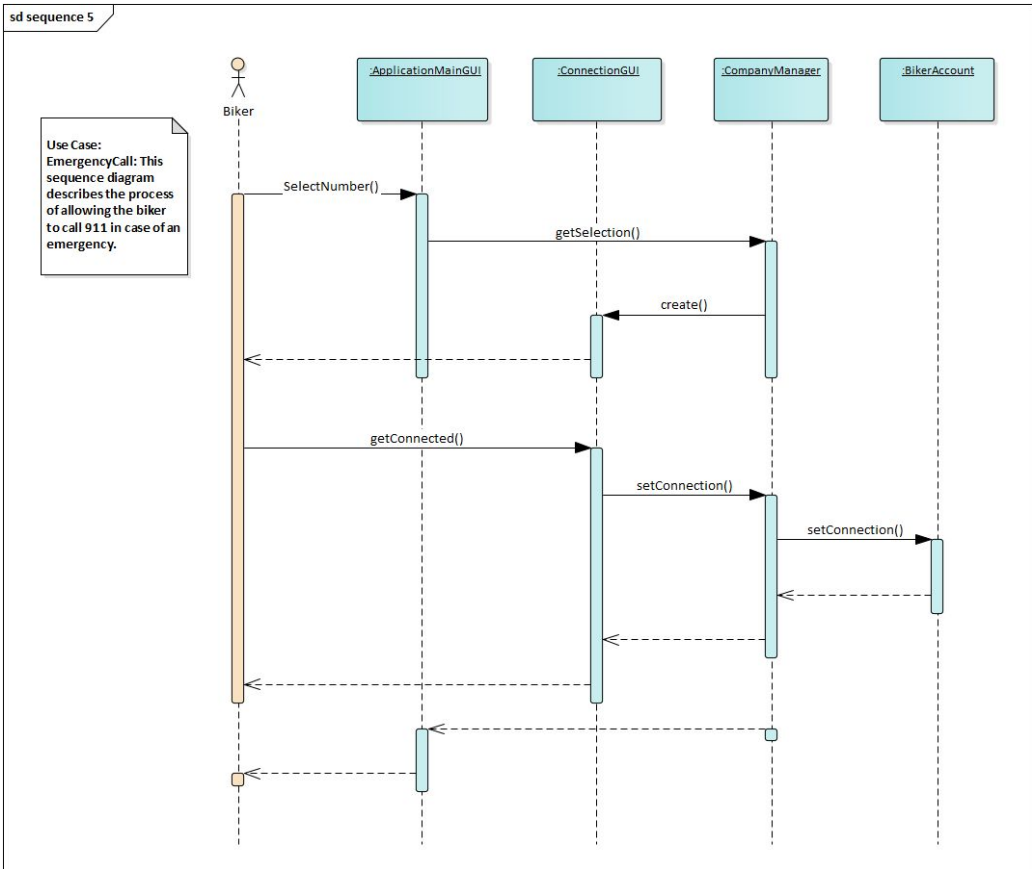
Appendix D: Design Models









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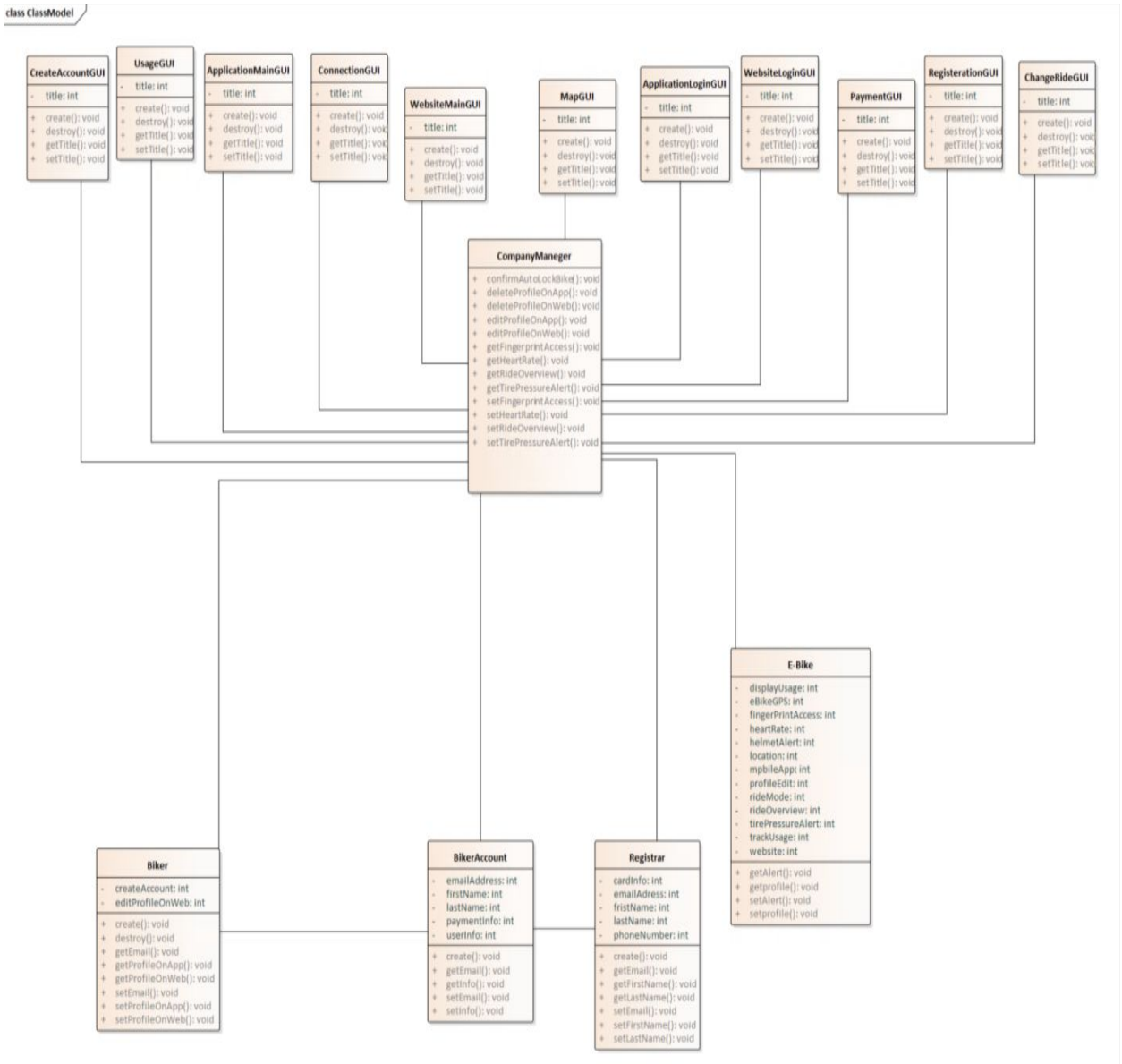

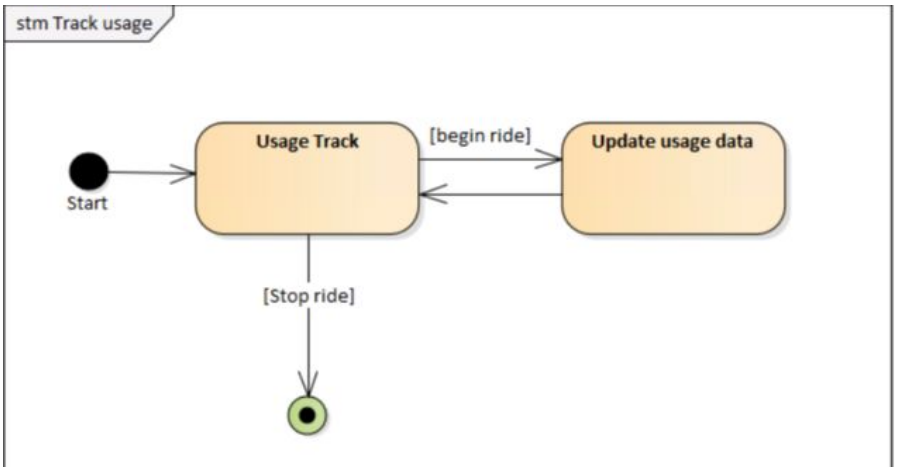

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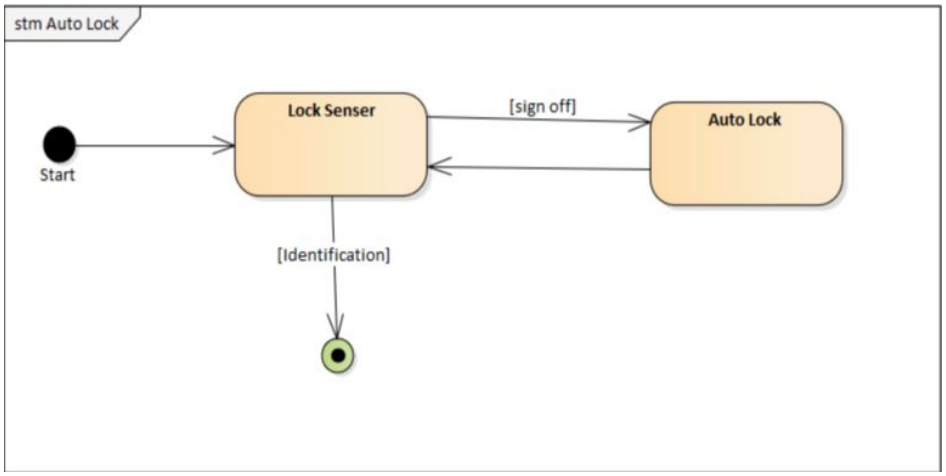

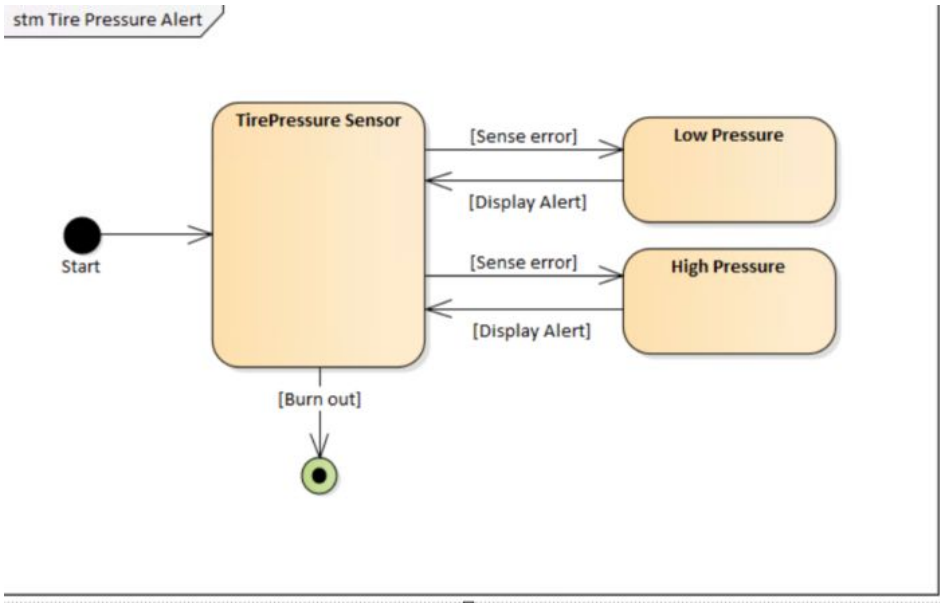

Original placement

Not Applicable

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