

Inf2C - Software Engineering Coursework

Requirements Engineering Report

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Stakeholders

List of potential stakeholders

- Tourists
- Tourism Board
- Bike shops
- Delivery Drivers
- Other tourism services providers
- Environmentalists
- Bike Manufacturers
- Local People

Reasons for interest

Tourists

- Tourists will be affected by the system as it will allow them to more easily organise and carry out bike rental. Especially bike rental covering multiple days and major distances. It will also allow the tourists to compare prices and get a good deal.

Local People

- Locals will also be affected by the system as it will also allow them to hire bikes similarly to tourists with better comparison between shops and for longer distance travel.
- Locals around bike shops will also be affected as there may well be an increase in bike usage. This may reduce the number of cars which will be beneficial to the air/noise quality and reduce congestion/car parking, but it may also introduce a larger number of inexperienced non-local cyclists into the local roads which may cause traffic issues.
- Additionally the use by customers of the ability to leave bikes at partner locations and have shipped may result in night time deliveries to bike shops causing noise to locals.

Delivery Drivers/Companies

- The possible extra demand required for the overnight shipping of bikes from one bike location to another will require additional capacity in overnight delivery. This may increase the number of delivery drivers required or the hours they may work.
- There will also need to be additional working for delivering bikes to customers who don't want to pick them up in-store.
- Regardless of how the deliveries are managed more drivers will be needed.

Environmentalists

- Environmentalists will be keen for the system to be implemented well. Reducing the number of cars on the road and uptake in cycling will please them.
- They might however be less pleased with plans to move the bikes between partner locations by delivery which will cause pollution.

Bike manufacturers

- This system could well increase demand for bike hire and bike shops may expand their operations or open additional locations which would require new bikes to be purchased.
- More riding will put more maintenance requirements for stores increasing the need for spare parts and possible.
- There may also be an increase in replacement bikes needed.
- The demand will likely be affected by location (more mountain bikes in mountain areas)

Tourism Board

- The tourism board's job is to promote and improve tourism within Scotland, and if the scheme is successful it will likely encourage tourism, as well as enabling wider travel by tourists. They will clearly then be interested in it succeeding.
- The tourism board could also use the system as a way to promote tourist sites, by placing advertisements for them in the system - even basing these on where tourists are hiring bikes from. This would allow them to better manage tourism within the country.
- They are also the ones behind the system, so they have a vested interest in it being successful in order to prove that they are competent.

Bike Shops

- If the system is successful, it will make the hiring of bikes much more convenient for tourists, and so will increase bike hiring rates as a whole. Bike shops will benefit from this increase in revenue and so will be interested in the scheme succeeding.
- A successful system may lead to them having to change how they operate. They might have to hire more staff in order to accommodate increased hiring rates, and they might also have to operate later/earlier in order to receive/send out deliveries of bikes from/to their partner shops.
- They may wish to open more stores, or even small venues specifically for bike rental, in new locations in order to capture more of the market.

Other tourism service providers

- Many businesses will benefit from the increase in tourists that a successful scheme would encourage - they would clearly, then, be interested in it succeeding
- These businesses could include; Cafes, hotels, and other businesses that will sell directly to consumers; Tourist sites that are non-profit but interested regardless in increasing visitors; Train companies operating trains to and around, who would see a large increase in customers if having access to a car was no longer a necessity for travel.
- Service providers may also wish to install bike racks outside of their properties if bike becomes a more popular method of travel.

Possible Conflicts

Environmentalists vs Shop Owners

- In this scheme the plan to move the bikes back to their original shop from partner shops by delivery might be opposed by environmentalists. They might suggest that the bikes should move more freely within the system rather than being tethered to their original shop so the extra pollution by delivery is avoided.
- They might suggest the system be more similar to the bike hire schemes in London or Edinburgh where the bikes have no 'home' and just flow around, only moved to rebalance the system when necessary.

Locals vs shop owners/tourists

- As previously mentioned, locals may be inconvenienced by an increase in bike traffic, and may also be disturbed by delivery drivers operating late at night/early in the morning.

System State

The following is a general description of what information the system will need to keep track of for different possible elements. It treats each 'customer', for example, as a specific entity, and then has the unique information for that entity identified by indentation below it.

System state description

1. Customers
 - a. Unique customer number/identifier
 - b. Name (First, Last)
 - c. Email Address
 - d. Phone number
 - e. Address
 - f. Login Details
 - g. Associated Bookings
 - i. Future
 - ii. Present
 - iii. Past
 - h. Saved payment details
2. Bikes: Each individual bike will be tracked by the system, and will include information about that specific bike:
 - a. A unique identifier
 - b. The provider that the bike is tied to (see ambiguity 2)
 - c. The model of the bike (see ambiguity 3)
 - d. The daily price to hire of the specific bike(usually depends on bike type, but may vary - see extensions)
 - e. The replacement cost of the bike (this will usually just depend on the model of the bike, but may vary under certain circumstances - see the extensions section)
 - f. Unavailabilities - dates where the bike is not available for hire
3. The system is also supposed to keep track of a bike models in a kind of dictionary that providers can access. In our plan this would include:
 - a. A unique identifier
 - b. The specific model of bike (For example, Crossbike offroader 2013)
 - c. The broad type this bike falls under (see ambiguity 3)
 - d. A baseline cost to replace for this type of bike

4. Booking

- a. A unique identifier
- b. Associated customer
- c. Associated provider/store
- d. Associated bikes
- e. Whether the bikes are being collected or delivered
- f. Delivery address (if different from customer's home address)
- g. The dates of the hire
- h. Total Cost
- i. Total deposit required
- j. Booking status

5. Bike Providers

- a. A unique identifier
- b. Email address
- c. Address
- d. Name of Company
- e. Deposit Rate
- f. Bikes associated with the provider
- g. Opening times

Use Cases

1. Get quotes

Goal: Get some quotes for bike hire

Summary: The customer would want to find out if there were bikes to hire when they wanted to and the cost of those bikes

Stakeholders: Customer (They want to get a quote), bike provider (has their selection of bikes viewed by the customer and wants the user to book their bikes)

Primary Actor: Customer

Trigger: Customer accesses the site

Pre-conditions: User has already accessed the site

Guarantees

- Success:
 - The user is informed about bikes available on or around the dates provided
- Failure:
 - The user is sent to an error screen and asked to try again

Main Success Scenario:

1. User enters some details about their interest
 - Location (Required)
 - Dates (Required)
 - Number of bikes (Required)
 - Type of bikes (Required)
2. System takes details and returns a list of bikes available on the given dates along with their price, deposit and details about the bike provider (like their address).

Extensions:

- 2a. System takes details and cannot find any bikes available on the given dates and instead returns a list of any bikes available for the same duration 3 days either side of the given dates
- 2b. System takes details and cannot find any bikes available on the given dates or any 3 days either side so shows a message informing the user

2.Book quote

Goal: Book and pay for a quote provided by the system

Summary: The customer has selected a quote and now wishes to book and pay for it). They will be prompted to either create an account (see use case 7) to record details, or to log in, and will then pay for the bikes.

Stakeholders: Bike providers and customers have a mutual interest in this being easy to do, as bike providers want the business and customers want to get bikes.

Primary actor: The customer

Trigger: The customer pressing the 'book this quote' button for a specific quote

Pre-conditions: We assume that the quote that the customer is booking provides necessary details such as price, time and duration, and provider

Guarantees

- Success guarantees:
 - The booking is recorded by the system
 - Money is transferred from the customer to the provider
 - The provider is notified of the booking
- Failure guarantees
 - The booking is not uploaded
 - No money is sent
 - The customer is told there was an issue, and is given the option to book the quote again
 - The provider is not notified

Main success scenario

1. The customer selects the "book this quote" option
2. The customer logs in and this provides the system with their information
3. The customer reviews their order, and presses the "pay for order" button, money is transferred
4. The customer enters payment information
5. The booking is added to the system with all necessary information
6. The bikes are marked as unavailable for the specified duration
7. The customer receives a confirmation by email including order number, booking id, order summary, total price, delivery, and return information

Extensions:

- 2a. The customer has already logged in
 - 1. Step 2 is skipped altogether
- 2b. The customer does not have an account
 - 1. The “customer creates an account” use case is triggered
 - 2. Once the account is created, the use case continues as normal
- 3a. The customer wants delivery to their account address
 - 1. They will select the “Deliver to my account address” option
 - 2. option before pressing “pay for order” as long as their account address is deliverable to from the provider (see ambiguity 7)
- 3b. The customer wants delivery to an alternative address
 - 1. The customer selects the “Deliver to alternative address” option, and enter the relevant details
 - 2. If the address they have entered is deliverable to (see ambiguity 7), they move on to step 4, if not they are given an error message
- 4a. The customer has their payment information saved on the site
 - 1. The information would already be filled in, if this is the information they wish to use then the use case proceeds to step 5
 - 2. If they want to use alternate payment info then step 4 occurs as normal
- 4b. The customer wants to save their payment information
 - 1. The customer selects the “save payment information” option, then use case proceeds as normal

3. Record bike return to original provider

Goal : Record a bike returned to the original provider

Summary : For the bike provider to record one of their bikes that has been returned from a rental and can then be listed available for hire

Stakeholders : Customer (want to return their bike swiftly and easily), Bike provider (want to keep track of their bikes and ensure they are available to be hired again quickly)

Primary actor : Bike provider

Trigger : Bike provider enters the booking ID into the system in order to mark that booking as returned

Pre-conditions: The bike provider has logged onto the system and has entered the page for recording bookings as returned

Guarantees:

- Success: The bike is marked as returned and is then available
- Failure: The bike remains as 'out for hire' and an error message is shown

Main Success Scenario

1. The system marks the bike as returned
2. The bike provider is shown how much deposit is required to be returned

4. Record bike return to partner

Goal : Record a bike returned to a partner

Summary : For the bike provider to record one of their bikes that has been returned from a rental to a partner and then has to be shipped back

Stakeholders : Customer (want to return their bike swiftly and easily), Bike provider (want to keep track of their bikes, have their bikes delivered back and ensure they are available to be hired again quickly), Partner provider (wants to uphold their end of the partnership)

Primary actor : Provider's Partner

Supporting actor: Bike provider

Trigger : The partner enters the section of the system that allows them to accept a bike belonging to a partner provider.

Pre-conditions: The partner has logged into the system and has navigated to the page that allows the to accept a bike belonging to a partner. The customer is returning the bike to a partner provider.

Guarantees

- Success: The bike is marked as 'awaiting delivery from partner'
- Failure: The bike remains as 'out for hire' and an error message is shown

Main Success Scenario

1. The partner provider enters the booking ID into the page and is shown the details of the hire
2. The partner updates the status of the booking to "returned"
3. The partner is shown how much deposit they need to return to the customer
4. The original bike provider is informed that the bikes have been returned and the deposit paid by the partner (See ambiguity 5), and confirms this with the system
5. Bike has its state set to 'awaiting delivery from partner'

5. Add new bike

Goal: Add new bike

Summary: Allows bike providers to add new individual bikes to the system

Stakeholders: Bike providers (they want to add more stock and get more hires), customers (they want to use the bikes and new bikes are great)

Primary actor: Bike provider

Trigger: The provider selects the "add new bike" option on the website

Preconditions : The provider is logged in, the bike model is in the system

Guarantees

- Success: The new bike is added to the system with a unique ID
- Failure: No bike is added

Main Success Scenario

1. The provider selects the "add new bike" option on the website
2. The provider enters the relevant details about the bike like type and model which can be picked from a list. The price to hire, replacement cost and its current state (available, currently hired)

3. This information is added to the system and it displays to the provider the unique ID of the bike for them to make a note of and possibly add to the bike.

6. Add new bike model

Goal: A bike provider wishes to add a new bike model to the system

Summary: A bike provider presses the “add new bike model” button, and are prompted to add relevant information about the model (name, type, replacement cost etc.). The system will check if there are any bikes with similar names to the one being entered (to try and prevent duplicates being added to the system). Once the provider is finished the bike is recorded by the system with a randomly generated unique ID.

Stakeholders:

- Bike providers, as they want this to be an easy process;
- Customers, as they want the information they’re getting about bikes to be accurate.

Primary actor: Some bike provider

Trigger: The provider pressing the “add new bike model”

Pre-conditions: The provider is logged in.

Guarantees

- Success:
 - The bike is added to the system
- Failure:
 - The system is not updated

Main success scenario

1. The provider presses the “add new bike model” button
2. The provider is prompted to enter all relevant information about the bike model, including name, type (which they will select from a drop-down menu), and replacement cost
3. The provider presses the “add model to system” button to finalise creation of the model
4. The bike is recorded in the system with a randomly created unique id

Extensions:

- 2a. The system detects an already entered bike model with a similar name
 1. It alerts the provider that they may be attempting to enter a duplicate model
 2. The provider is able to see details about that model

7. Make customer account

Goal : Customer Creates an Account

Summary: The customer can create an account and enter their details

Stakeholders: Customer

Primary Actor: Customer

Trigger: Customer selects the “create an account” option

Guarantees:

- Success: Customer account is created securely
- Failure: No account is created and the details given are not stored

Main Success Scenario

1. The user is prompted to enter the following details
 - a. First Name
 - b. Last Name
 - c. Address
 - d. Email address
 - e. Phone number
2. Some validation is carried out
3. The user is returned to the page on which they were previously on

Extension

- 2a. Validation fails
 1. The customer is asked to re-enter details

8. Make provider account

Goal: The Scottish Tourism board wants to set up an account for a specific provider

Summary: An employee for the Scottish Tourism Board, logged into an admin account, creates a new account for a specific bike provider. They enter all relevant details, and an email is automatically sent to the provider containing a temporary password.

Stakeholders: Providers, as they want to be able to get accounts in order to rent out bikes;
Tourism board employees, as they want to be able to create accounts easily.

Primary actor: The employee

Trigger: The employee selects the “set up new provider” option

Pre-conditions: The employee is logged in on an admin account, and already has access to the necessary information for the provider (the provider will have emailed/phoned beforehand to request account set up etc)

Guarantees

- Success guarantees:
 - The provider is added to the system
 - An email with a password is sent to the provider
- Failure guarantees:
 - No new provider is logged with the system
 - No email is sent

Main success scenario:

1. They are prompted to enter all relevant information
2. They press the “create provider” button to finalise creation
3. The provider account is added to the system with a temporary random password
4. An email containing the temporary password, and all account information, is sent to the provider

9. Cancel Existing Booking

Goal: Cancel an Existing Booking

Summary: Allows the user to cancel a booking that they have made and get a refund.

Stakeholders: Customer (Want to get their money back), Bike provider (don't really want to cancel the hire but equally want to get the bike available again)

Primary Actor: Customer

Supporting actor: Provider

Trigger: Customer selects the “cancel booking” option

Pre-Conditions: User is logged in and on the booking screen, see use case 10.

Guarantees

- Success: The booking is removed from the system and the customer has their money refunded
- Failure: The booking remains on the system, no money is transferred and no emails sent:

Main success Scenario:

1. The user is presented with a screen confirming they want to cancel
2. The user clicks cancel
3. The system refunds the money that the customer spent
4. The system informs the provider that the booking has been cancelled
5. The system sends the user an email confirming they have cancelled their booking
6. The booking is removed from the system
7. The are re marked as available for the duration of the booking

10. View Existing Booking

Goal : To view existing booking

Summary : To allow the customer to view the details of their booking

Stakeholders: Customer (Wants to view their booking), provider (want for the customer to get the details of their booking).

Primary Actor: Customer

Trigger: Customer access the 'My Bookings' section of their account

Pre-Conditions: The customer is logged in

Guarantees

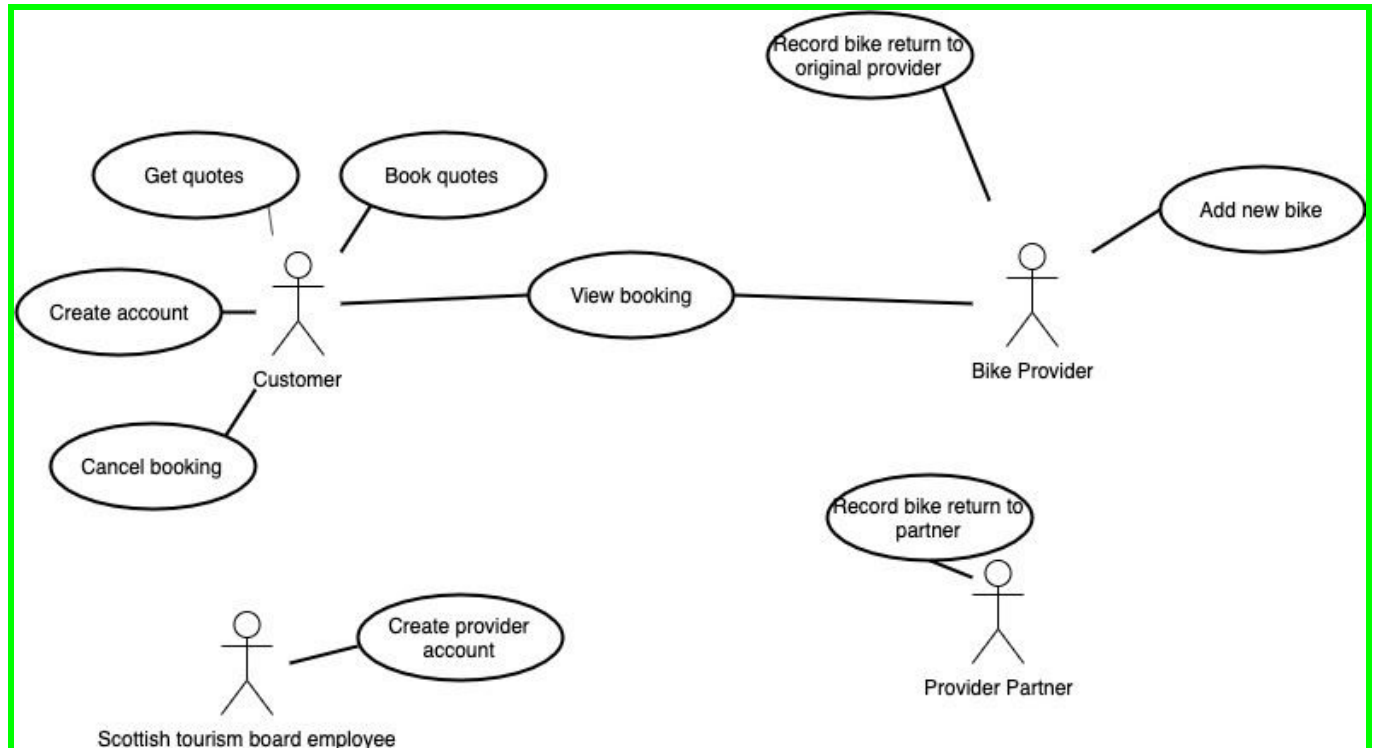
- Success guarantees: The customer is shown all associated bookings
- Failure: No bookings are shown and the customer is notified of a failure

Main Success Scenario:

1. The system gathers all booking associated with the customers account
2. The gathered bookings are displayed with dates, location for pickup/delivery, deposit to pay and an option to cancel them

Use Case Diagram

The following UML use case diagram summarises the use cases we identified, and the actors associated that they are associated with



Description of non-functional requirements

Security

The information the customers enter should not be accessible to actors other than that customer. There are exceptions, the bike provider will need access to the customers name in order to confirm the booking when the customer arrives. They will also need the delivery address if relevant. Even the customer should not be able to access the whole of their payment details, maybe only the last 4 digits of their card number. Even those at the scottish tourism board should not have access to the customers payment details but access to the customers basic details (name, address, contact details).

Bike providers should also ensure that their machines that are accessing the system have adequate security and are up to date.

Employees of the Scottish Tourism board that also access the system should be trusted employees and the machines accessing it should also be secure.

The entire system should be encrypted to modern security standards.

Testing: We would consult with a security expert to make sure that our systems are adequate

Accessibility

Accessibility to services is guaranteed in law (Equality Act 2010) so they system must abide by its wording as conditions covered by the act include visual impairment.

As the system is belonging to a group closely associated with the government of scotland it must be accessible to anyone. It should follow similar guidelines to the scottish government.

This means that it should be compatible with the following technology:

- Screen readers
- Speech recognition software
- Operating system accessibility tools such as screen magnifiers
- Browser tools such as screen zoom and keyboard navigation

The websites should also be developed with the following ideas in mind:

- Clear headings
- Clear and simple menus
- Colours that are contrasting

- Consistent style across the website

Testing:

- Run focus groups with people with impairments, we only consider this test passed if none of them have impairment related issues that are solvable, and that we have not solved.
- The system must be compatible with the list of technology mentioned earlier to be considered as passing the test
- We would consult with a legal expert to ensure that the system is compliant with the Equality Act 2010

Performance

The website in general should aim to run quickly and effectively, otherwise it will become frustrating to use and may turn potential customers away. The main area of focus will have to be on the search system, as this is where issues of slowdown and inaccuracy may be the most intense.

The system should be built such that:

- Search times are kept to a minimum
- It can keep up with seasonal increases in demand, especially over the summer when tourism increases.
 - This could be achieved using cloud computing methods, as they are easily scalable.
- The search system gives good responses - we should focus on recall over accuracy for two reasons.
 - Firstly, there will not be that many bike providers in any specific area, so it will not be too much of a burden on customers to view them all.
 - Secondly, bike providers may not use the system if they feel that they are being ignored by searches.

Testing: We would test the system under a simulated full load, it should not take more than 5 seconds to return results in order to pass

Privacy

The system does gather and store data about its users as they book hires and enter their details. This data should both be kept secure (see security) and should not be used outside of the system, keeping it private.

GDPR will also have to be taken into account. With roles such as 'Data Controller' assigned. It is likely that the Scottish tourism board already has employees that manage GDPR and they

should be consulted to ensure the system fits GDPR regulations and the organization's management of data regulation.

Testing: Again, consult with a legal expert to ensure GDPR compliance

Ambiguities, Subtleties, and Incompleteness

We identified the following ambiguous points, and have suggested some solutions, as well as outlining any assumptions we made while writing this document. They are sorted by number for easy referencing from elsewhere in the document.

1. There is in the requirements document the section describing what the customer should give when booking “personal information (first name, surname, address, post code, phone number)”. The issue here being that tourists from outside the UK would potentially not have a UK address so could not give a postcode. Making this a requirement could prevent tourists from using the system. We assume that we could simply allow for international postcode formats to be used instead.
2. The specification suggests that bikes are tied to a single physical location/shop. This is suggested when discussing that a bike would be shipped back there if handed to a partner location. This does not take into account if the bike belonged to a company with several locations where they would be fine if it floated around their shops. That however would be hard to implement so it would be easier to leave it tied to a specific location, and this is what we have assumed.
3. Ambiguity about bike type
 - The system description is ambiguous in its description of “types of bikes”
 - As an example, it gives broad, generic types such as “road bike”, or “mountain bikes”, and this makes sense within the context of customers wanting to search by specific bike type - for example, someone wanting to cycle by road will obviously want to narrow down to places selling road bikes.
 - The description also says, however, that a type should include its “cost to replace”; Including a cost to replace for a generic type of bike doesn’t make sense, as there will be many models of bike that fit under a generic category, and their prices will vary widely.
 - For the purposes of this document, we will use the idea of a bike model to refer to a specific make of bike by a specific manufacturer. Each bike model will have its own replacement cost, and will belong to some generic bike ‘type’ (road bike, or mountain bike, for example) - this list of types will be set beforehand in the system, and providers will only be able to add new models, not new types.

4. Bikes may be damaged

- Aside from a comment in 3.2 “whether or not a bike is currently in the shop” which we assume to literally mean “if a bike is in the shop that rents it out” but could also interpreted as meaning “currently under repairs” there is no thought given to the idea that a bike could be damaged.
- If a bike is damaged, it would clearly need to be repaired and this repair time may cause conflicts with bookings already in the system. There is also the possibility that bikes are returned in a condition beyond repair, in which case all future bookings would be disrupted.
- With the potential of having to cancel bookings, we get issues such as holidays being disrupted or refunds being necessary.
- This issue is clearly something that requires additional consultation, as any issues could reflect badly on the Scottish tourism board, on bikes shops, or on the software engineers responsible for the system.
- With that in mind, this document is written ignoring the possibility of damage, and additional detail would be added after consultation with the Scottish tourism board.

5. Deposits and Partner

- If the hired bike is returned to the same shop as it was hired for then the provider is implied to be dealing with the deposit themselves outside of the system
- However for partners it makes specific reference that the partner returns the deposit to the customer not the original provider thereby leaving the partner out of pocket. The system description does not reference how to deal with this, whether the system should be involved in the deposit system at all.
- Therefore we assume that the partners will handle the reimbursement of deposits themselves outside of the system.

6. Email Address

- The system description does not specifically mention taking a customers email address but since using a customers email address has become a ubiquitous standard online we will include it also.

7. Delivery Range

- It is not specifically mentioned that a shop has a delivery range
- It is assumed that the bikes are all being used within Scotland so no deliveries to England but even within Scotland it is not reasonable for a shop in Aberdeen to deliver bikes to Shetland over a morning
- For now we will just say that a delivery can be made if it is within ‘deliverable range’

8. Provider Accounts

- It would make sense for a customer to sign themselves up to the system but not a provider
- There would need to be proof that provider exists and runs a shop, as the scotish tourism board are marketing this to tourists they may want to vet or check possible providers to make sure they come up to a specific standard. They would also likely to be able to enforce this as it would drive much business to the providers
- Therefore it would be sensible that the Scottish Tourism Board would create the accounts and enter the necessary details

Self Assessment

Q 3.1 Identify stakeholders 15%

- Identify core stakeholders of the system 5%

I believe we should receive 5% as we identified the key stakeholders well.

- Identify additional stakeholders 5%

I believe we should get 4% as we have identified a good range of additional stakeholders

- Describe how the system affects each stakeholder 5%

I believe we should receive 4% as we have identified for all stakeholders how they are at least affected on the surface sometimes deeper issues caused.

Q 3.2 Describe system state 10%

- Include state essential to the operation of the system 5%

We have identified all of the essential details for the system therefore 5%

- Include additional state mentioned in the description 5%

We have identified a variety of additional aspects that the system will need so 4%

Q 3.3 Describe use cases 40%

- Identify use cases 10%

9% as we have identified 10 use cases covering a wide range of usage of the system

- Describe use cases using the appropriate templates 30%

We think that 27% is adequate as we have covered all with the template and in several have covered extensions and alternative success scenarios

Q 3.4 Use case diagram 15%

- Correctly use UML use case notation 5%

5% as the notation was used correctly within our document

- Include key actors and use cases 5%

All actors and use cases from our use cases are included and correct so 5%

- Identify connections between actors and use cases 5%

5% as we identified all the connections between actors and their use cases

Q 3.5 Describe non-functional requirements 10%

- Identify non-functional requirements within the context of the system 7%

5% as we have identified a range of non-functional requirements across the system.

- Provide means for assessing non-functional requirements 3%
2% as we have given several clear metrics including legislation that can be easily tested to ensure they are followed.

Q 3.6Ambiguities and subtleties 5%

- Identify some ambiguities in system description 3%
3% we have identified many ambiguities within the system.

- Discuss potential options for resolution of ambiguities 2%
2% we have discussed issues for several of the more complex ambiguities and have made assumptions that may allow later for different options to be implemented.

Q 3.7Self-assessment 5%

- Attempt a reflective self-assessment linked to the assessment criteria 5%
3% we have attempted a fair assessment based on the criteria laid out.