# Inf2C - Software Engineering
## Coursework 1
## Capturing requirements
## for a city bike-hire scheme

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# Contents

# CyclED

## 1  Description

The CyclED system consists of several docking stations placed at strategic positions across town and an Operations Hub which monitors all the activity happening in the docking stations. It facilitates the supervision, assistance and maintenance of the entire process of hiring bikes around the city, while keeping track of all states of the docking stations and any changes made. For further information on the details of the system you can refer to the following website.

## 2  Inputs and Outputs

### 2.1  System inputs

- Connecting to hub system: wireless data-links from the docking stations.

- Connecting to docking station: bank-card reader, touch-screen display.

- Connecting to docking point: fault button, key reader-slot, bike sensor.

### 2.2  System output

- Connecting to hub system: wall display, wireless data-links.

- Connecting to docking station : terminal display, key dispenser.

- Connecting to docking point: green OK light, red FAULT light, lock actuator.

## 3  Requirements

1. Docking station.

    (a) Docking station should have multiple docking points.
        i. Docking point shall be able to read unique ID of any bike and key.
        ii. Docking point shall lock and unlock bike.
        iii. User shall be able to press fault button.
        iv. Docking points with faulty bikes shall have a red light.
        v. Staff shall be able to use keys to unlock faulty bikes.
    (b) Docking station shall have a terminal.

      i. User shall be able to insert personal details.

     ii. Terminal shall read card upon insertion.

   iii. Terminal shall display charges and details of previous trips on user's request.

   iv. Terminal shall display map with nearby docking stations and number of free docking points.

    v. Terminal shall give a 15 minutes extension to user in order to reach alternate stations.

2. User shall be able to register at a docking station terminal

   (a) User shall be able to input personal data.

   (b) User shall be able to insert credit or debit card.

3. Users shall be able to hire bikes.

   (a) User should be issued a key.

   (b) User shall be able to insert key into key-reader slot to unlock bike.

   (c) Upon removing key from key-reader slot, bike shall be unlocked and green light should flash.

4. Users shall be able to return bikes.

   (a) Bike shall be locked into docking point upon insertion.

   (b) Upon locking the bike, the green light shall flash.

5. Charges.

   (a) Users shall be charged £1 per 30 minutes.

   (b) If the 30 minute time-frame is exceeded, users shall be charged an extra £2 per 30 minutes.

   (c) Users shall have the charges deducted from their account at midnight.

6. Hub System.

   (a) Hub System shall show status of all stations, including the locations where docking point occupancy is under 15% or over 85%, and where there are bikes with reported faults.

   (b) Personnel at hub shall coordinate the movement of bikes to docking stations where bikes are running out, and to and from a bike service centre.

   (c) Hub shall manage overall system configuration.

(d) New stations shall can be registered into the system by a Hub Operator.

(e) Upon demand, Hub System shall generate a report showing statistics of the Docking Stations.

(f) Wall screen shall display information from all docking stations.

**Non-functional requirements:**

- Overall time for a hiring operation shall not exceed 5 minutes.

- Trips should be updated immediately in the system, to provide accurate reports both to borrowers and hub operators.

- Keys should be activated immediately after being issued.

- Operation Hubs should receive updates every minute.

- Instructions on screen should be easy to follow.

# 4 Use Cases
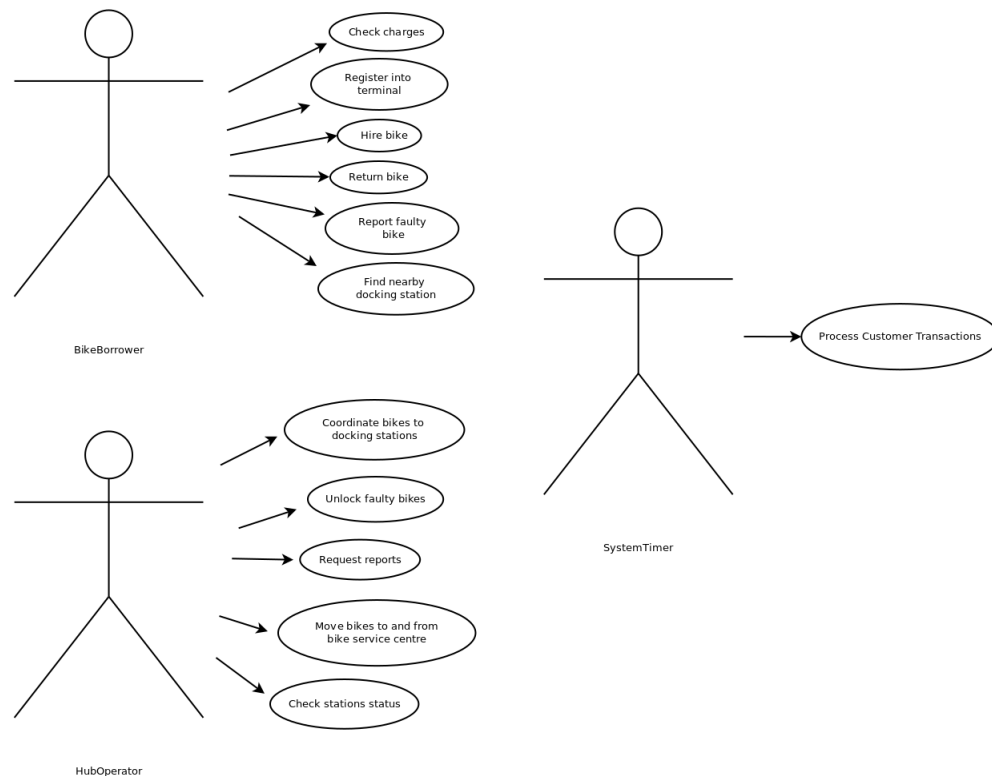
## (I) User registers

**Primary actor** Bike Borrower

**Summary** Bike Borrower wants to register into the system.

**Precondition** Terminal screen is ready to get input.

**Trigger** Bike Borrower uses terminal to register into the system.

**Guarantee** Bike borrower will have an account stored into the system.

**Main Success Scenario**

  (1) Bike Borrower inserts personal details using touch screen display.

  (2) System checks information.

  (3) Registration is complete.

**Extension 1**

  (3) Account already exists.

  (4) User returns to (1) and is requested new input.

**Notes**

- It should be discussed what information the user needs to input.
- User should be able to recover account.

**Requirements** 1.b.i, 1.b.ii, 2.a, 2.b.

## (II) User hires bike

**Primary actor** Bike Borrower

**Summary** User hires a bike from a docking point.

**Precondition** All keys are valid. Terminal screen is available.

**Trigger** Users inputs account details.

**Guarantee** Users gets bike.

**Main Success Scenario**

  (1) User inputs personal details into the terminal.

  (2) System recognizes user's account.

  (3) User inserts card.

  (4) User inserts PIN.

  (5) System checks card and PIN is valid.

  (6) User is issued an electronic key.

  (7) User inserts key at occupied docking slot and removes it.

  (8) System proceeds to unlock a bike.

(9) Green OK light flashes.

(10) Status of docking station is updated at the hub.

(11) System records start time, date and place.

**Extension 1**

(3) User inserts key at empty docking point.

(4) Nothing happens, as there is no bike to be unlocked.

(5) User moves to different occupied docking point.

**Extension 2**

(5) PIN is not valid.

(6) Screen goes back to 4.

**Extension 3**

(12) Bike borrower has already hired one bike and is trying to get a second one with the same key.

(13) System rejects operation.

**Notes**

- User should not be allowed to input wrong PIN more than three times.
- The entire hiring operation should not take more than 5 minutes.
- It should be discussed with the stakeholders whether users shall be allowed more than one key.

**Requirements** 1.a.i, 1.a.ii, 1.b.i, 1.b.ii, 2.a, 2.b, 3.a, 3.b, 3.c, 5. a, 5.c.

## (III) **User returns bike**

**Primary actor** Bike Borrower

**Summary** User returns bike to a docking station.

**Trigger** Users inserts bike into docking point.

**Guarantee** System recognises bike has been returned.

**Main Success Scenario**

(1) User inserts bike into a docking point.

(2) Bike sensors detect bike.

(3) Docking point locks bike.

(4) A green OK light flashes.

**Notes**

- Status of docking station is updated at the hub.

**Requirements** 4.a, 4.b.

## (IV) Insufficient bikes for rent

**Primary actor** Bike Borrower

**Secondary actors** Hub operator

**Summary** Bike borrower attempts to rent bike. None available, hence he is suggested the nearest docking station.

**Precondition** All keys are valid. At least one Hub Operator at the Hub Station is always available. Hub Station never down. All docking stations are registered in the Hub Station.

**Trigger** Bike Borrower goes to docking station to rent a bike.

**Guarantee** Bikes for rent will become available at the previously clear docking station.

**Main Success Scenario**

(1) Bike Borrower goes to docking station and is unable to find an available bicycle.

(2) Bike Borrower proceeds to check the terminal for the nearest docking station to rent a bike from another place.

(3) Bike Borrower arrives at the docking station and checks terminal.

(4) Terminal shows that bikes are available.

(5) Bike Borrower hires bike from the station.

(6) Hub Operator sees alert of under 15% capacity on the Hub System screen.

(7) Hub Operator proceeds to move bikes in order to load up space at the bike station without available bikes.

**Extension**

(4) Terminal shows that bikes are no longer available.

(5) Bike Borrower check map for the next nearest docking station.

**Requirements** 1.a.iv, 6.a, 6.b, 6.f.

## (V) Docking station at full capacity.

**Primary actor** Bike Borrower

**Secondary actors** Hub operator

**Summary** Bike Borrower needs to return bike, but docking station has no empty docking points.

**Precondition** All keys are valid. At least one Hub Operator at the Hub Station is always available. Hub Station never down. All docking stations are registered in the Hub Station.

**Trigger**  Bike Borrower renting session is ending.

**Guarantee**  Bike is returned to one of the available docking points and fully loaded docking station gets some docking points cleared.

**Main Success Scenario**

(1) Bike Borrower needs to return the bicycle

(2) Bike Borrower reached docking station terminal and sees that there is no available docking point.

(3) Bike Borrower checks map to find nearest docking station.

(4) Bike Borrower is given a 15 minute extension to return the bike.

(5) Bike Borrower returns bike within the time frame.

(6) Hub Operator sees alert of over 85% capacity on Hub Systems screen.

(7) Hub Operator proceeds to move bikes from the fully loaded docking station in order to create some empty docking points.

**Extension**

(5) Bike Borrower arrives to the docking station terminal and sees that this might have just become fully loaded, while Bike Borrower was cycling to it.

(6) Bike Borrower checks terminal for next nearest docking station.

**Requirements**  1.b.iv, 1.b.v, 6.a, 6.b, 6.f.

## (VI) Bike develops a fault

**Primary actor**  Bike Borrower

**Secondary actor**  Hub Operator

**Summary**  After some time, bike develops a fault and user returns it.

**Precondition**  System does not need to charge additional costs for faulty bikes.

**Trigger**  User has faulty bike, which needs to be returned.

**Guarantee**  Faulty bike is returned and hub is notified to take it to a service centre.

**Main Success Scenario**

(1) User inserts bike at the docking point.

(2) Docking point locks bike and flashed green OK light

(3) User presses fault button.

(4) Docking point flashes red light to signal faulty bike.

(5) Docking station status updates at Operation Hub.

(6) Hub operator notices faulty bike and uses key to unlock it from the docking point.

(7) Hub operator takes bike to service centre.

**Notes**

- It should be considered what happens if bike is stolen.
- Further discussion with stakeholders needed in order to determine on the charging issue with the user who reported faulty bike.

**Requirements** 1.a.ii, 1.a.iii, 1.a.iv, 1.a.v, 4.a, 4.b, 6.a, 6.f.

## (VII) User wants to check charges and trips

**Primary actor** Bike Borrower

**Summary** User requests to see details of his previous trips and he can see the time, location and charges.

**Trigger** User requests trips details.

**Guarantee** User will see details of all trips for current day.

**Main Success Scenario**

(1) User requests trip details at terminal

(2) System displays all information for trips during that day, including starting and finishing times, locations and charges.

**Notes**

- All information should be accurate (i.e. system should report trips which happened just before the request)

**Requirements** 1.b.i, 1.b.iii.

## (VIII) New docking station added to the system.

**Primary actor** Hub Operator.

**Summary** A newly built docking station need to be added to the system and monitored from the Operations Hub.

**Precondition** Operations Hub systems are available.

**Trigger** A new docking station has finished building.

**Guarantee** The docking station will be monitored from the Operations Hub.

**Main Success Scenario**

(1) Hub Operator registers the station with the hub system.

**Requirements** 6.d.

## (IX) Generate report.

**Primary actor** Hub Operator.

**Summary** Hub Operator uses the hub system to generate a report.

**Precondition** Operations Hub systems are available.

**Trigger** Hub Operator needs to check for any bikes that have not been returned in the past 24h.

**Guarantee** The system will generate the statistics.

**Main Success Scenario**

    (1) On demand from Hub Operator, the systems generate the report.

    (2) Report is printed.

- Content of reports is subject to discussion with the client.

**Requirements** 6.c,6.e.

## (X) Charging users.

**Primary actor** System Timer

**Summary** Users are charged for their past 24h hires.

**Trigger** The System Timer triggers this use case at midnight.

**Guarantee** System Timer resets at the end.

**Main Success Scenario**

    (1) System Timer processes customer transactions.

**Notes**

- It should be considered what happens if at midnight user does not have sufficient funds on card.

**Requirements** 5.a,5.b,5.c.