MINISTRY OF EDUCATION AND TRAINING

FPT UNIVERSITY

Capstone Project Document

Laptop Reviews

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Capstone Project code	LRA

-Ho Chi Minh City, 05/2015-

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Table of Contents

List of Tables

List of Figures

Definitions, Acronyms, and Abbreviations

No.	Abbreviation & Acronym	Definition
1	LRA	Laptop Reviews
2	OS	Operation System
3	Admin	Administrator
4	API	Application Programming Interface
5	HTTP	Hyper Text Transfer Protocol

A. Project Management Plan

1. Project Definition

1.1 Project Information

- Project name: **Laptop Reviews**
- Project Code: **LRA**

1.2 Problem Abstract

Today, when people want to buy a new laptop, they usually search its information though technology websites. The information like laptop's specifications, prices, outfit pictures are typically found, but lack of reviews from customer who bought that laptop. To solve that problem, we propose a solution which can help people to archive it. We will gather and classify the reviews from trusted websites so that customers can have the best advices and easily make decisions. How can we know whether the reviews are positive or negative? Our system will, therefore, help classify the reviews automatically, show them to our customers in an appropriate way.

1.3 Project Overview

1.3.1 Current Situation

In Vietnam, people tend to choose laptops base on what they hear from sellers at electronic markets or what they read on some technical forums, websites. These activities have limitations. Sellers' advices may be not accurate, some reviews may be non-sense and are not classified. Moreover, it will take lots of time for people to come to electronic markets to have laptops' information or read reviews on many forums, websites. After searching on Google, we find this page: www.buydig.com. They offer classified reviews for laptops but not all laptops. Therefore, customers will be upset when they can't find what they need. Our solution will do a better job. We will gather and classify the reviews from trusted websites so that customers can make the best decision. Moreover, customers can claim for reviews for laptops which they can't see on our system and get notification when those laptops' information is updated.

1.3.2 The Proposed System

The system is intended for use by those with a smart phone or a laptop/computer with Internet connection. The system will have the following functions:

1.3.2.1 Web Application

- Admins can manage accounts.
- System can parse product, classify review and store to database daily or on requests.
- Staff can check feedback from user, manual update dictionary.
- Users can search laptop's information, leave feedback

1.3.2.2 Mobile Application

Users can search laptops, write comments or add favourite laptops.

1.3.3 Boundaries of the System

- The system can be used by every people with a smart phone or a laptop/computer with Internet connection.
- The language of the system is English.
- The complete product includes:
  - + The website, for staff and user.
  - + All the process document involved.

1.3.4 Development Environment

1.3.4.1 Hardware Requirement

For Server

Windows	Minimum Requirements	Recommended
Internet Connection	Cable, Wifi (4 Mbps)	Cable, Wifi (8 Mbps)
Operating System	XP, Vista, 7, 8	XP, Vista, 7, 8
Computer Processor	Intel® Core 2 Duo	Intel® Core(TM) i5 CPU , M 460 @ 2.53GHz
Computer Memory	1GB RAM	3GB or more

Table 1: Hardware Requirement for Server

For Mobile Application

Android	Minimum Requirements	Recommended
Internet Connection	Wifi (4 Mbps)	Wifi (8 Mbps)
Operating System	4.1 Jelly Bean	4.3 Jelly Bean or later
Computer Processor	1.0 GHz	1.2 GHz or more
Computer Memory	512 MB RAM	1GB or more

Table 2: Hardware Requirement for Mobile Application

1.3.4.2 Software requirements

- Microsoft Windows 8.1: operating system and platform for development.
- SQL Server 2008 Express R2: used to create and manage the database for system.
- StarUML: used to create models and diagrams.
- Skype: used for communication and meeting.
- Visual Studio 2013: used to implement website and web service.
- Github.com & TortoiseSVN: used for source control.

2. Project Organization

2.1 Software Process Model

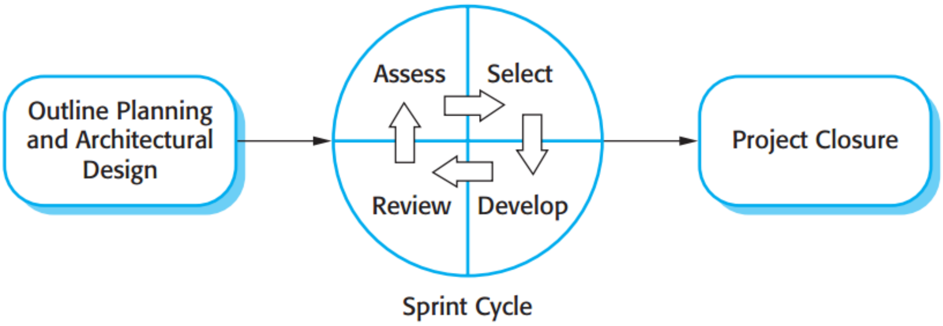


Figure 1: The Scrum Process

(Sommerville, Software Engineering, 9th Edition, 2011, Figure 3.8 page 73)

2.2 Roles and responsibilities

No	Full name	Role in Group	Responsibilities
1	Kieu Trong Khanh	Scrum Master	• Arrange daily meetings • Track the backlog of work to be done • Record decisions • Measure progress against the backlog • Communicates with customers and management outside of the team
2	Vo Thi Minh Chau	Scrum Team Member	• Design database • Clarify requirements • Prepare documents • GUI Design • Create test plan • Code • Test
3	Nguyen Van Hon	Scrum Team Member	• Design database • Clarify requirements • Prepare documents • GUI Design • Create test plan • Code • Test
4	Dinh Huu Toan	Scrum Team Member	• Design database • Clarify requirements • Prepare documents • GUI Design • Create test plan

			• Code • Test
5	Tran Manh Khuong	Scrum Team Member	• Design database • Clarify requirements • Prepare documents • GUI Design • Create test plan • Code • Test

Table 3: Roles and Responsibility Details

2.3 Tools and Techniques

- Front-end technologies: HTML5, CSS3, JavaScript, jQuery 1.10, AJAX, SignalR 2.0.
- Back-end: Website: ASP.NET MVC5 + Entity Framework 5.
- Web Server: Microsoft IIS 7.
- Database Management System: MS SQL Server 2008 Express R2.
- - Android Developer Tools: Eclipse

3. Project Management Plan

Software Development Life Cycle

Phase /Iteration	Description	Deliverables	Resource needed	Dependencies and Constrains	Risks
Outline Planning and Architectural Design	- Study similar existing systems. -Identify and clarify requirements for the system in general.	- Introduction of proposed system. - Project task plan. - Software requirement specification. - Prototypes.	20 man-days	N/A	- Missing requirement - Unclear scope of project - Lack of member share of understand
Sprint Cycle – Parser Analysis	- Analyze websites to parse data. - Choose a library for parsing HTML content.	- Websites which will be parsed date. - Library for parsing HTML content.	10 man-days	N/A	- Lack of experience.
Sprint Cycle – Training Machine Function	-Teach the system how to synchronize products' names.	N/A	20 man-days	Depends on "Data management".	- Not have a clear understanding about business process.
Sprint Cycle – Dictionary Management	- Input data manually. - Import data from excel files. - Find synonyms and antonyms form dictionary websites.	- Dictionary management service.	30 man-days	N/A	- Lack of experience. - The dictionary is not variety.

Sprint Cycle – Parser Management	- Manage parser.	- Parser management system.	20 man-days	Depend on “Sprint Cycle – Parser Analysis”.	- Lack of experience. - Not have a clear understanding about business process.
Sprint Cycle – Main User’s Functions	- Parse data. - Build algorithm to analyze comments then classify them into 3 groups: positive, negative and neutral. - Member (staff and admin) can manage profile.	- Collected data. - Classified comment system. - Main user’s functions on web.	60 man-days	Depend on “Sprint Cycle – Parser Analysis” and “Sprint Cycle - Dictionary management”.	- The implemented algorithm is not the best. - Lack of test data. - Lack of experience on analyzing sentence’s meaning.
Sprint Cycle – User Account Management	- Manage user accounts in the system.	- Account management system.	5 man-days	N/A	- Lack of experience. - Not have a clear understanding about business process.
Project Closure	- Documentation.	- Installation guide. - User manual.	3 man-days	Depend on “Sprint Cycle”	- Lack of experience.

Table 4: Software Development Life Cycle Detail

B. Software Requirement Specification

1. User Requirement Specification

1.1 Guest Requirement

Guests is a person who doesn't have access to the system. Guest can use some functions in the system. These are some functions guest can use:

Guests are normal users who don't have access to the system. Guests can use almost functions but the systems functions. Here are things guests can do with our website:

- Search products.
- View products details with all information.
- Report unsuitable comment.
- Recommend not available products and ask for notification when they are available.

1.2 Member Requirement

Member is an authorised user of the system who has some functions relating their account, such as:

- Edit profile.
- Change password
- Retrieve password.

1.3 Staff Requirement

Staff is a person whose work is maintaining the system. Staff will be able to do all Member's functions and following additional these:

- Update dictionary manually or through importing Excel file and dictionary file.
- Modify parser.
- Train the system so that it can handle some tasks such as managing duplicated products.
- Configure the system
- Force parsing data.
- Manage products.
- Parse recommend product.
- Handle reported comment.

1.4 Admin Requirement

Admin is the one who manage all accounts in the system. Beside the Member's function, Admin can be able to:

- Create account.
- Edit account.
- Activate/Deactivate account.

1.5 System Requirement

System is also an actor help run the website. System will handle these works:

- Auto parse the data

- Auto find synonyms and antonyms
- Parse recommended product if the result can be found automatically

2. System Requirement Specification

System Overview Use Case

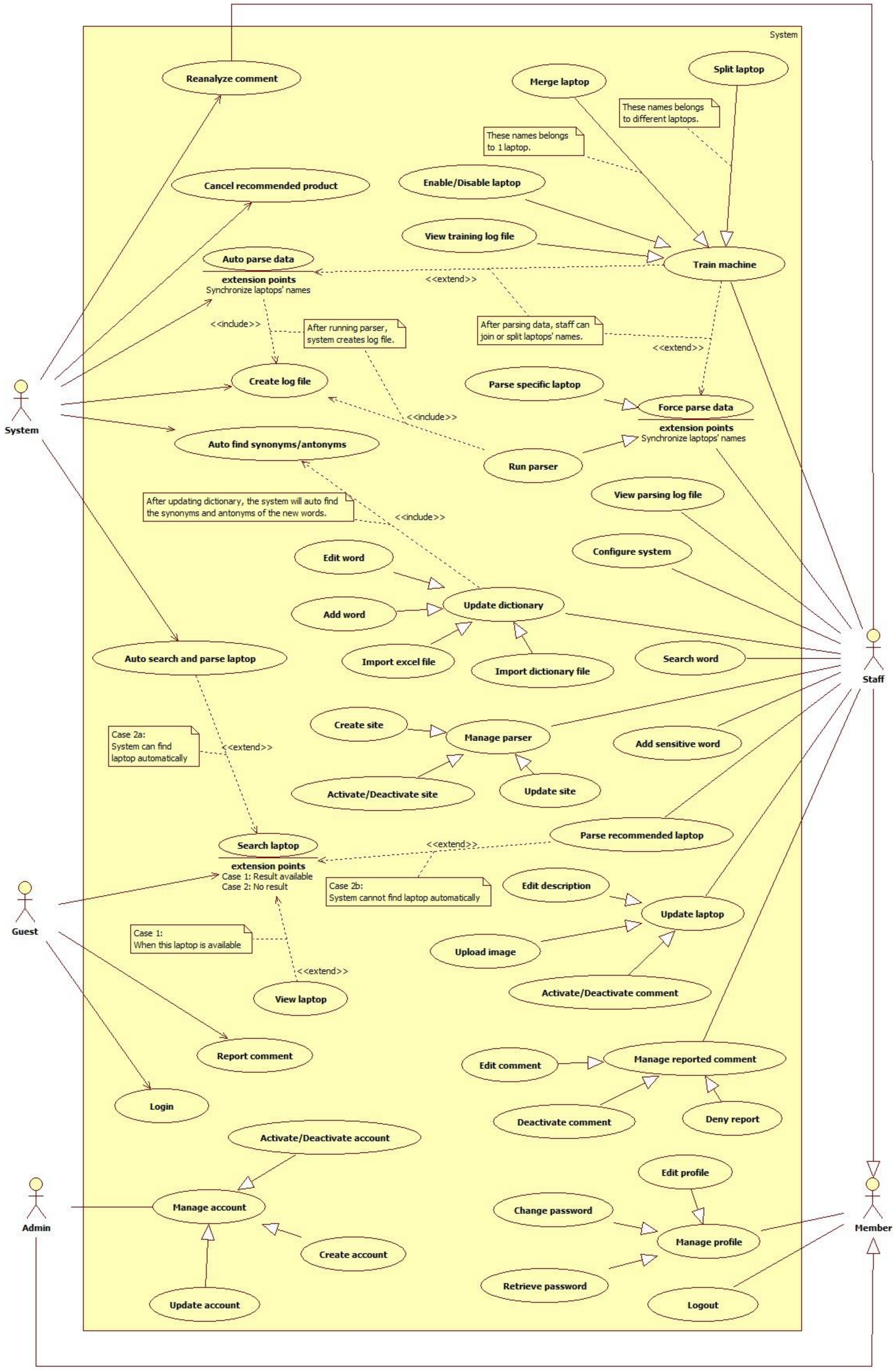


Figure 2: System Overview Use Case

3. Main Flows

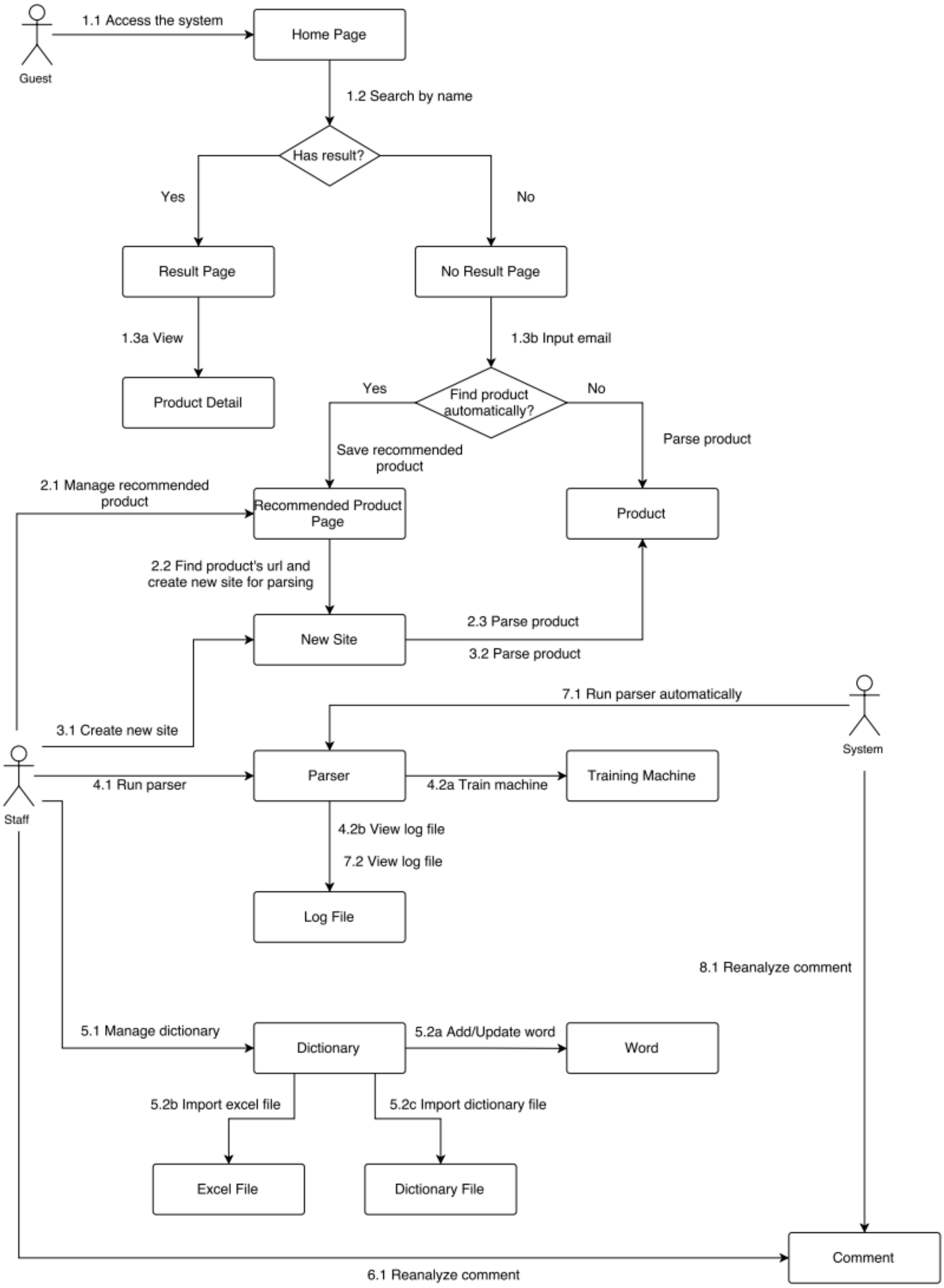


Figure 3: Main Flows

4. Entity Relationship – Conceptual

Entity Relationship Diagram (ERD)

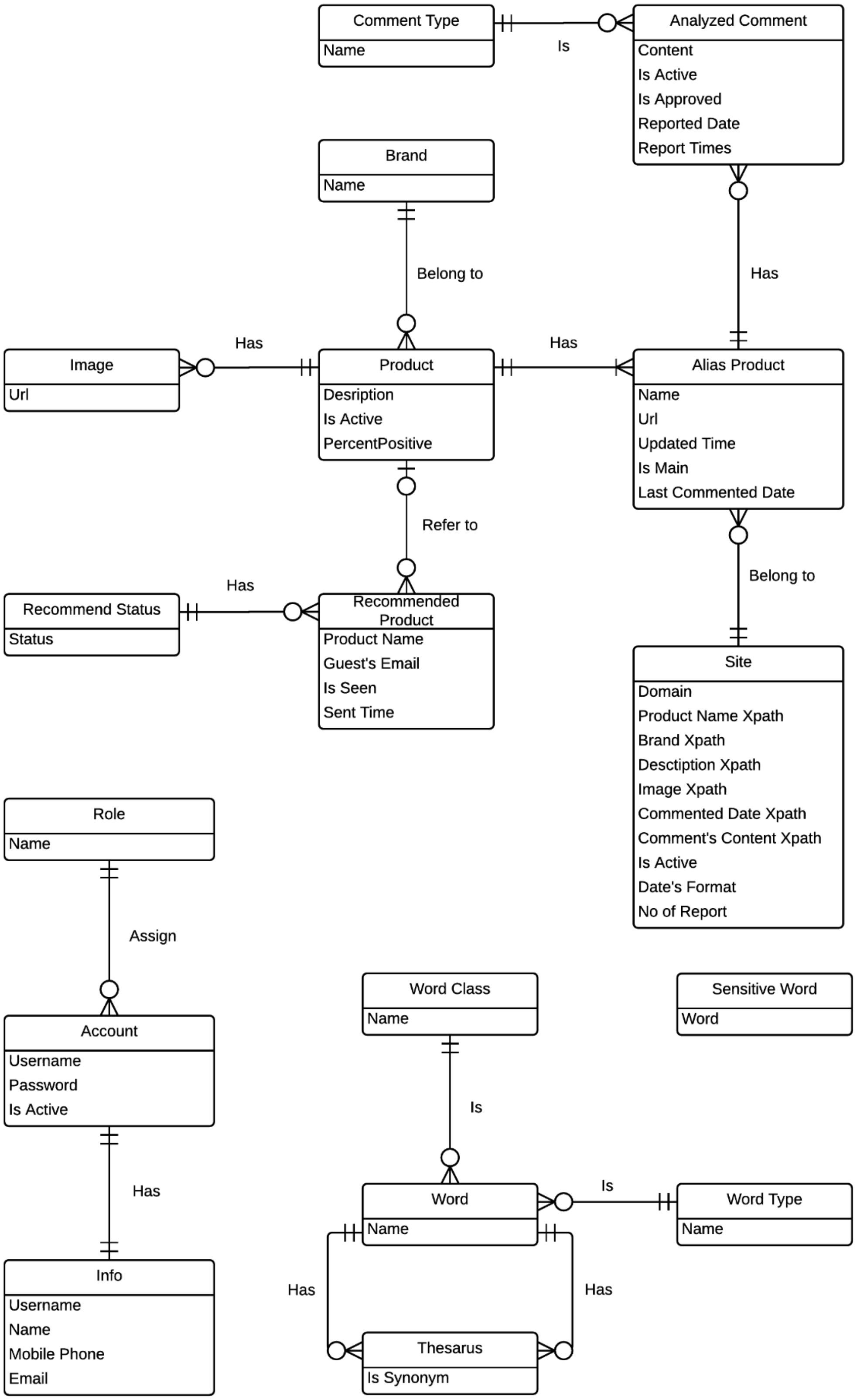


Figure 4: Entity Relationship Diagram

C. Software Design Description (SDD)

1. Design Overview

- This document describes the technical and user interface design LRA System using web. It includes the architectural design, the detailed design of common functions and business functions and the design of database model.
- The architectural design describes the overall architecture of the system and the architecture of each main component and subsystem.
- The detailed design describes static and dynamic structure for each component and functions. It includes class diagrams, class explanations and sequence diagrams for each use cases.
- The database design describes the relationships between entities and details of each entities.
- Document overview:
  - Section 2: gives an overall description of the system architecture design.
  - Section 3: gives component diagrams that describe the connection and integration of the system.
  - Section 4: gives the detail design description which includes class diagram, class explanation, and sequence diagram to details the application functions.

Section 5: describe an ERD with logical diagram

2. System Architectural Design

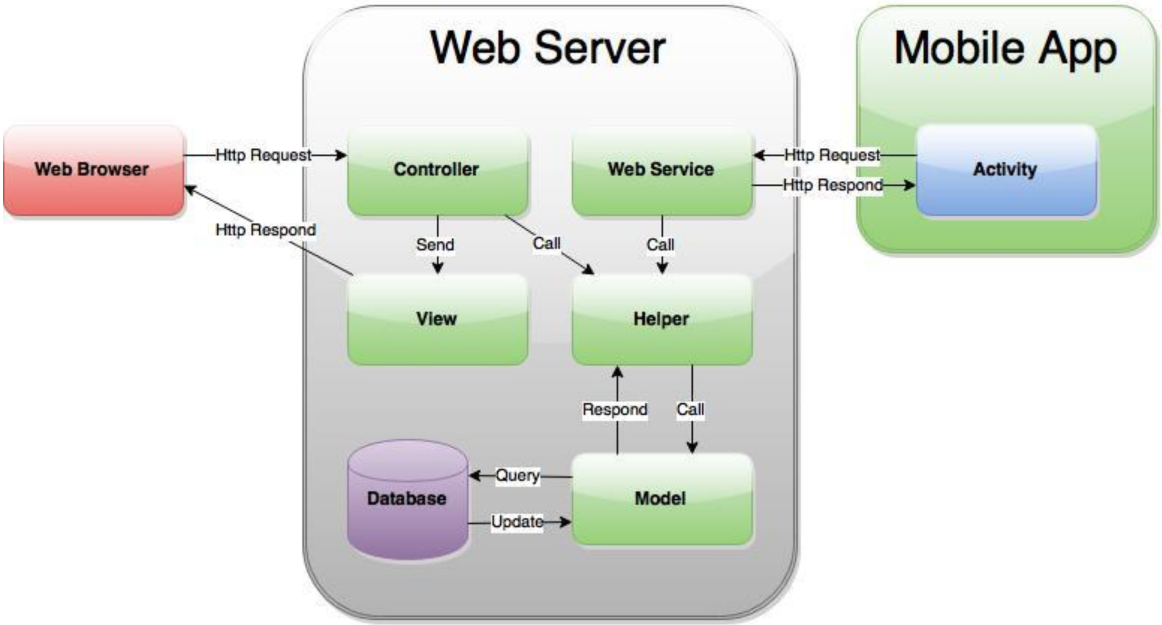


Figure 5: MVC Architecture

3. Component Diagram

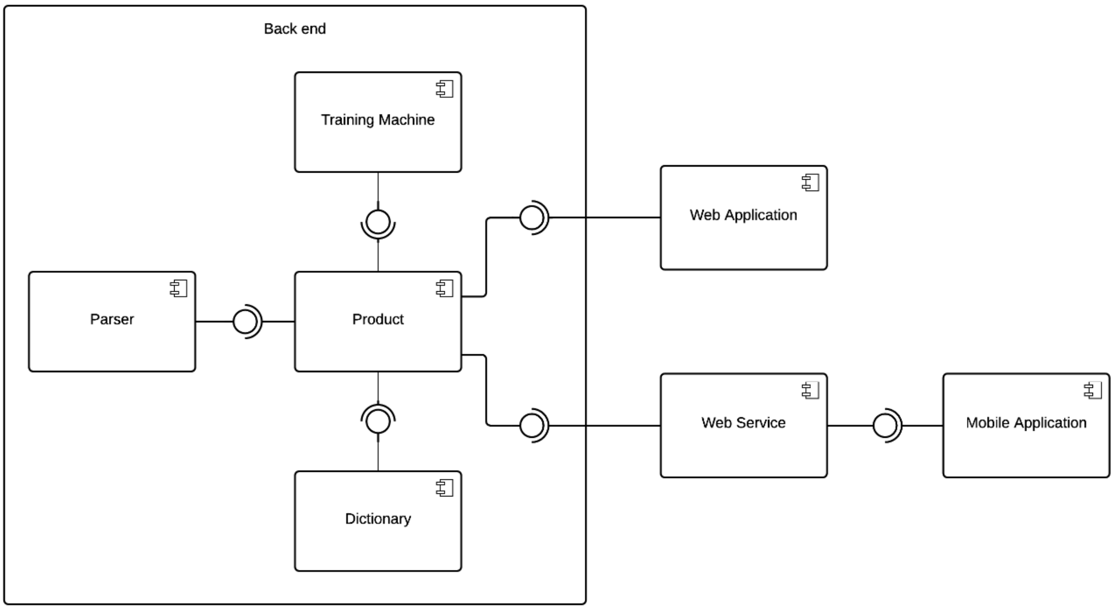


Figure 6: Component Diagram

4. Detailed Description of Components

4.1 Class Diagram

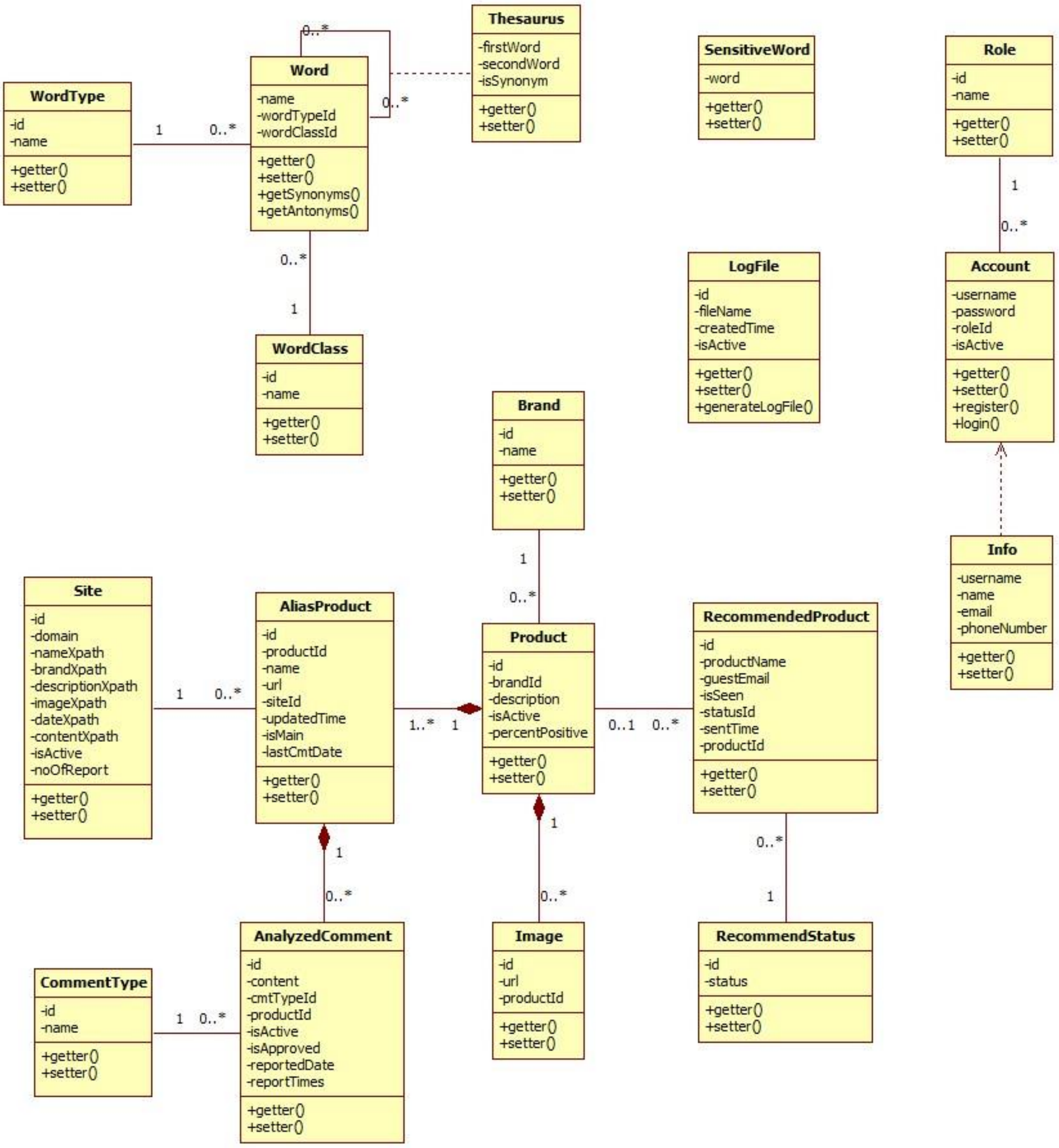


Figure 7: Class Diagram

4.2 Class Diagram Explanation

4.2.1 Site

This class contains information of website, where product information will be parsed to the system.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each site
url	string	Private	Link to the site
nameXpath	string	Private	Xpath that defines product's name location in the website
brandXpath	string	Private	Xpath that defines product's brand location in the website
descriptionXpath	string	Private	Xpath that defines product's description location in the website
imageXpath	string	Private	Xpath that defines product's image location in the website
dateXpath	string	Private	Xpath that defines product's submitted date location in the website
contentXpath	string	Private	Xpath that defines product's content location in the website
siteId	integer	Private	Id of site
isActive	boolean	Private	Status of site
noOfReport	integer	Private	Number of report

4.2.2 Alias Product

This class contains information of alias product. Same products will have a product marked as main, which contain the most information/reliable.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each alias product
productId	integer	Private	Id of product
name	string	Private	Name of alias product
url	string	Private	Link to website contains alias product
siteId	int	Private	Id of site
updatedTime	datetime	Private	Day that alias product is updated
isMain	boolean	Private	Use to check for main product
lastCmtDate	datetime	Private	Last date of comments

4.2.3 Product

This class contains information of products in the system.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each product
brandId	integer	Private	Id of brand
description	string	Private	Description of product
isActive	boolean	Private	Status of product

isReported	int	Private	State how many times the product is reported

4.2.4 Image

This class contains information of product’s image.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each image
url	string	Private	Link to website contains image
productId	integer	Private	Id of product

4.2.5 Analyzed Comment

This class contains information of comment, collect from websites or mobile user. These comment will be analyse to classify type.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each comment
content	string	Private	Content of comment
cmtTypeId	integer	Private	Id of comment type
isActive	boolean	Private	Status of comment
isApproved	boolean	Private	
reportedDate	datetime	Private	The day the comment was reported
reportTimes	int	Private	State how many times the comment is reported

4.2.6 Comment Type

This class contains information about type of comment.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each comment type
name	string	Private	Name of comment type

4.2.7 Brand

This class contains information of product’s brand in the system.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each brand
name	string	Private	Name of Brand

4.2.8 Recommended Product

This class contains information product which user recommend. These product is not existed in the system.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each recommended product
productName	string	Private	Name of recommended product
guestEmail	string	Private	Email of guest
isSeen	Boolean	Private	Indicate whether staff have seen the request or not
statusId	integer	Private	Id of status
isAdded	Boolean	Private	Indicate whether staff have executed request or not
sentTime	datetime	Private	Day the recommended product is submitted
productId	integer	Private	Id of Product

4.2.9 Recommended Status

This class contains status of user recommends.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each user recommend
status	Boolean	Private	Status of Recommend

4.2.10 Role

This class contains information of account's role.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each role
name	string	Private	Name of comment role

4.2.11 Account

This class contains basic information of account.

Attribute

Attribute	Type	Visibility	Description
username	string	Private	Unique username of each account
password	string	Private	Password used to access each account
roleId	integer	Private	Id of role
isActive	Boolean	Private	Status of account

Method

Method	Return type	Visibility	Description
register	Boolean	Public	Register new account
login	Boolean	Public	Login to the system

4.2.12 Info

This class contains extra information of accounts.

Attribute

Attribute	Type	Visibility	Description
username	string	Private	Unique username of each account
name	string	Private	Name of account owner
email	string	Private	Email of account owner
phoneNumber	string	Private	Phone number of account owner

4.2.13 Word

This class contains word which will be used as dictionary word.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each word
name	string	Private	Name of word
wordTypeId	integer	Private	Id of word type
wordClassId	integer	Private	Id of word class

Method

Method	Return type	Visibility	Description
getSynonyms	Dictionary	Public	Get word’s synonyms
getAntonyms	Dictionary	Public	Get word’s antonyms

4.2.14 WordType

This class contains information of word’s type.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each word type
name	string	Private	Name of word type

4.2.15 Thesaurus

This class contains information of word's thesaurus.

Attribute

Attribute	Type	Visibility	Description
firstWord	integer	Private	Id of word which role is main word
secondWord	integer	Private	Id of word which role is synonym or antonym of main word
isSynonym	Boolean	Private	Indicate whether the relationship of 2 words is synonym or not

4.2.16 WordClass

This class contains information of word's class.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each word class
name	string	Private	Name of word class

4.2.17 Sensitive Word

This class contains information of sensitive word. Comment contain these words will be forbidden.

Attribute

Attribute	Type	Visibility	Description
word	string	Private	name of sensitive word

4.2.18 Log File

This class contains information of log file.

Attribute

Attribute	Type	Visibility	Description
id	integer	Private	Unique identifier of each log file
filename	string	Private	Name of log file
createdTime	datetime	Private	Date the log file is created
isActive	Boolean	Private	Status of log file

Method

Method	Return type	Visibility	Description
generateLogFile	Boolean	Public	Generate log file for each time system runs parser

4.3 Algorithms

4.3.1 Parse Data

4.3.1.1 Define Problem

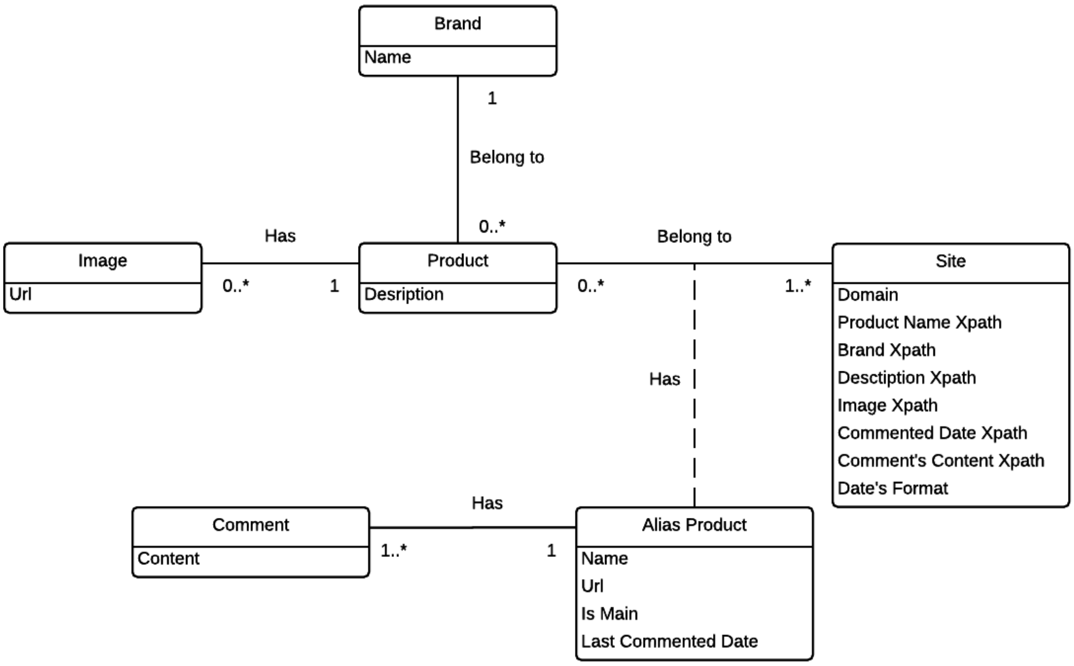
Given a laptop website then parse laptops' specification and comments.

4.3.1.2 Requirement

This website must have users' comments.

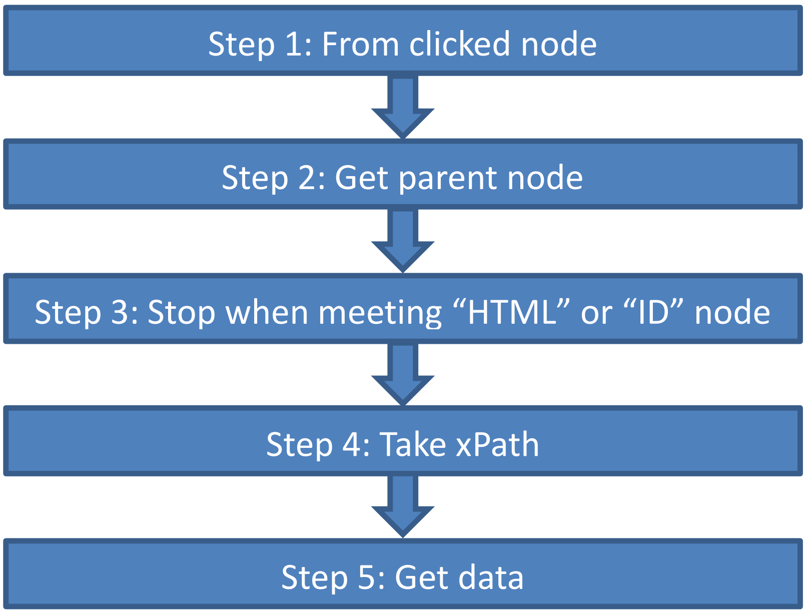
4.3.1.3 Solution

Our system will parse data from 3 websites: http://www.engadget.com/, http://www.bestbuy.com/ and http://www.walmart.com/. With each product, we need to collect name and all its comments. However, to make the source more diversity, we collect these extra information, such as: brand, description and images. We also save the last comment's date of in order to get only new comment for the next parsing time of this product. After researching from many websites, we realise that a laptop can appear in many websites with different names. We have these entities:



There are many libraries supporting parsing data and the 2 most popular are HtmlAgilityPack and Selenium. After researching 2 libraries, we decide to choose HtmlAgilityPack because during parsing process, Selenium have to create a simulator web browser to load the website's content but HtmlAgilityPack do not have. This make improve parsing speed too much.

We intend that our system will be served to people who do not need to know what xPath is, so we develop a wizard supporting user to get xPath of anything they want. The solution is:


Step 1: From clicked node
Step 2: Get parent node
Step 3: Stop when meeting “HTML” or “ID” node
Step 4: Take xPath
Step 5: Get data

After parsing 1 product, we analyse all comments and classify them into 3 types: positive, neutral and negative comments (refer algorithm 7.2). After getting all information of this product, we compare it with existed product in database to detect if this is a duplicated product (refer algorithm 7.4). With new product, it will be inserted to database. Otherwise, duplicated product will be added to xml file and staff will handle it.

4.3.2 Analyze Comment

4.3.2.1 Define Problem

Given a sentence then the system will check whether that sentence has positive or negative or neutral meaning

4.3.2.2 Requirement

All sentence must have correct grammar. They must also have sufficient length. Moreover, all sentences that contains impolite or meaningless words will not be counted.

4.3.2.3 Solution

- Manually prepare 10 lists of lower-cased words by reading first 100 comments:
  - ❖ A list contains all words which meanings are totally Pros
  - ❖ A list contains all adjectives and adverbs which meanings are Pros (these words’ positive meaning is not as strong as words in “Totally Pros” list)
  - ❖ A list contains all adjectives and adverbs which meanings are Neutral
  - ❖ A list contains all adjectives and adverbs which meanings are Cons

- ❖ A list contains all adjectives and adverbs which meanings are totally Cons (these words' negative meaning is not as strong as words in "Totally Cons" list)
- ❖ A list contains all nouns and verbs which meanings are Pros (these words' positive meaning is not as strong as words in "Totally Pros" list)
- ❖ A list contains all nouns and verbs which meanings are Neutral
- ❖ A list contains all nouns and verbs which meanings are Cons (these words' negative meaning is not as strong as words in "Totally Cons" list)
- ❖ A list contains all nouns and verbs which meanings are totally Cons
- ❖ A list of negative words such as not, no, do not, does not …

- Lower case the whole sentence and break it into a list of words, then lower case all the words.
- With a list of words, we will check how many words of that list belong to the 10 lists above, then we divide into these cases:
  - ❖ Case 1: List of words contains word(s) which belong to "Totally Pros" word list: In this case, the sentence will be Positive sentence.
  - ❖ Case 2: List of words contains word(s) which belong to "Totally Pros" word list but it also contains word(s) which belong to "Negative" word list: In this case, the sentence will be Negative sentence.
  - ❖ Case 3: We will check the adjectives and adverbs fist. So if list of words contains adjectives, adverbs and belongs to adjectives/adverbs' "Pros", "Cons" or "Neutral" lists, we will have these sub-cases:
    - ➢ If there are more "Pros" words than "Cons" words → The sentence is positive (1)
    - ➢ If there are more "Cons" words than "Pros" words → The sentence is negative (2)
    - ➢ With those 2 above sub-cases, if there are words belong to "Negative" list, then the sentence will be negative with sub-case (1) and positive with sub-case (2)
    - ➢ If the sentence contains no adjectives/adverbs that belongs to "Pros", "Cons" and has words belong to "Neutral", that sentence is neutral. If the sentence has same number of "Pros" and "Cons" adjectives/adverbs and has no "Neutral" adjectives/adverbs, we will check in Case 4.
    - ➢ If there is no "Pros", "Cons" and "Neutral" adjectives/adverbs in that sentence, we will check in Case 4.
  - ❖ Case 4: After checking for adjectives, adverbs, we will check verbs and nouns in that sentence. We have these sub-cases

    ➢ If there are more "Pros" words than "Cons" words → The sentence is positive (1)

    ➢ If there are more "Cons" words than "Pros" words → The sentence is negative (2)

➢ With those 2 above sub-cases, if there are words belong to "Negative" list, then the sentence will be negative with sub-case (1) and positive with sub-case (2)

➢ If the sentence contains no verbs/nouns that belongs to "Pros", "Cons" and has words belong to "Neutral", that sentence is neutral. Similarly, if the numbers of verbs/nouns belongs to "Pros" and "Cons" are the same, that sentence is Neutral

➢ If there is no "Pros", "Cons" and "Neutral" verbs in that sentence, it will be unidentified and will be decided later by staff

4.3.2.4 Example

Giving the sentence: "*This Mac is fast, and combined with Mavericks I am now getting some great battery life."*

- Assume that we already have "Totally Pros" words list which contains "great".
- Lower case the whole sentence:
  + This Mac is fast, and combined with Mavericks I am now getting some great battery life. → this mac is fast, and combined with mavericks i am now getting some great battery life.
- Split sentence into list words:
  + this mac is fast, and combined with mavericks i am now getting some great battery life → {this, mac, is, fast, and, combined, with, mavericks, i, am, now, getting, some, great, battery, life}
- We will check for "Totally Pros" words first. In this case, we have word "great". This word belongs to "Totally Pro" list, so this sentence is Positive.

4.3.3 String Comparison

4.3.3.1 Define Problem

Give two strings. Calculate their matching percent.

4.3.3.2 Requirement

- A robustness to changes of word order: two strings which contain the same words, but in a different order, should be recognized as being similar.
- Language independence: the algorithm should work not only in English, but in many different languages.

4.3.3.3 Solution

- If a string contains many words, break it into a list of words.
- For each word, we find out how many adjacent character pairs are contained in it.
- Create a function *pairs(s)* which returns a list of adjacent character pairs of string *s*.
- Then, we use below formula to calculate matching percent.

$$similarity(s1, s2) = \frac{|pairs(s1) \cap pairs(s2)|}{|pairs(s2)|}$$

$$similarity(s2, s1) = \frac{|pairs(s1) \cap pairs(s2)|}{|pairs(s1)|}$$

4.3.3.4 Example

Calculate the matching percent of 2 strings: MacBook Air 2015 and MacBook Air 2015 Retina.

- Upper case 2 strings:
  + MacBook Air 2015 → MACBOOK AIR 2015.
  + MacBook Air 2015 Retina → MACBOOK AIR 2015 RETINA
- Break string into list of adjacent character pairs:
  + MACBOOK AIR 2015 → $\{MA, AC, CB, BO, OO, OK, AI, IR, 20{,}01{,}15\}$
  + MACBOOK AIR 2015 RETINA→ $\{MA, AC, CB, BO, OO, OK, AI, IR, 20{,}01{,}15, RE, ET, TI, IN, NA\}$
- Calculate its matching percent.

$$similarity(\text{MACBOOK AIR 2015, MACBOOK AIR 2015 RETINA}) = \frac{|\{MA, AC, CB, BO, OO, OK, AI, IR, 20{,}01{,}15\}|}{|\{MA, AC, CB, BO, OO, OK, AI, IR, 20{,}01{,}15, RE, ET, TI, IN, NA\}|}$$

$$= \frac{11}{16} = \frac{22}{27} \approx 0.69$$

$$similarity(\text{MACBOOK AIR 2015, MACBOOK AIR 2015 RETINA}) = \frac{|\{MA, AC, CB, BO, OO, OK, AI, IR, 20{,}01{,}15\}|}{|\{MA, AC, CB, BO, OO, OK, AI, IR, 20{,}01{,}15\}|} = 1$$

4.3.4 Detect Duplicated Product

4.3.4.1 Define Problem

Give new product. Detect if it is a duplicated product.

4.3.4.2 Requirement

The product has been defined brand.

4.3.4.3 Solution

During implementation process, we discussed and improved the algorithm more times in order to improve the exactness. Here is our solution.

❖ First solution:

- Step 1: Using the String comparison in 7.3 to compare the new product’s name with each existed product’s name in the database. But the current formula to calculate matching percent has a little difference to the one in 7.3. The formula is:

$$similarity(s1, s2) = \frac{2 \times |pairs(s1) \cap pairs(s2)|}{|pairs(s1)| + |pairs(s2)|}$$

If the result is above 40%, add these existed product to a list.

- Step 2: If the list is empty, this new product is not a duplicated product. Otherwise, choose the existed product which has the biggest comparison result in the list and the new product is duplicated product with it.

With this solution, we found 9 duplicated products when parsing 50 products.

- ❖ Second solution:
  - Be improved from the 1st solution.
  - At step 1, only compare the new product's name with each existed product's name in the database which has the same brand with new product.
  - With this solution, we found 7 duplicated products when parsing 50 products – less 22% duplicated products than the 1st solution.
- ❖ Third solution:
  - ▪ Be improved from the 2nd solution.
  - ▪ Use the different formula to compare 2 products' names.

$$similarity(s1, s2) = \frac{|pairs(s1) \cap pairs(s2)|}{|pairs(s2)|}$$

$$similarity(s2, s1) = \frac{|pairs(s1) \cap pairs(s2)|}{|pairs(s1)|}$$

And the comparison result is the minimum of 2 results from above formulas.

  - With this solution, we found 2 duplicated products when parsing 50 products – less 71% duplicated products than the 2nd solution.

Finally, we decided to choose the 3rd solution to detect duplicated product.

D. Demonstration

1. Scenario 1: Search laptop and report comment

- Guest visits Laptop Reviews website and searches a laptop.
- After found this laptop, he view this laptop's detail.
- He can reports any unsuitable comment he found.
- Staff handles this report with 3 actions: Edit, Deny and Deactivate.

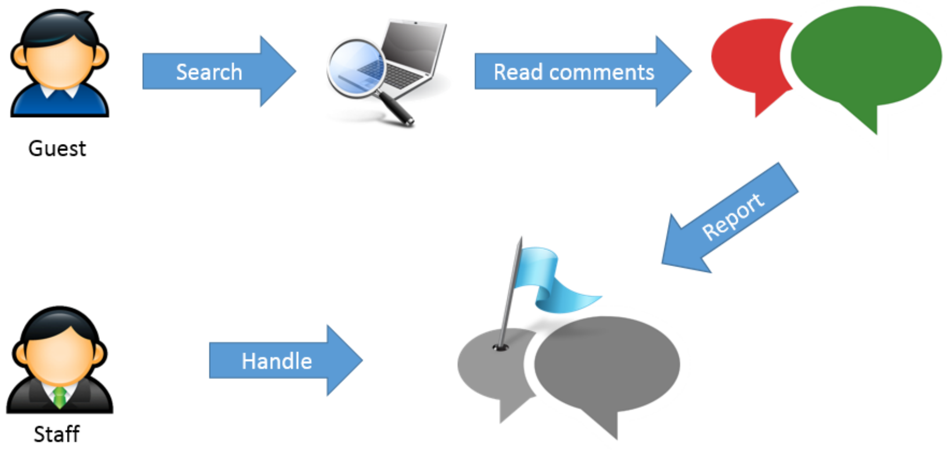


Figure 8: Scenario 1: Search laptop and report comment

2. Scenario 2: Search laptop and recommend laptop

- Guest visits Laptop Reviews website and searches a laptop but this cannot be found.
- He inputs his email to get notification when the system updates this product.
- Staff handles this recommendation if the system cannot find and parse it automatically.

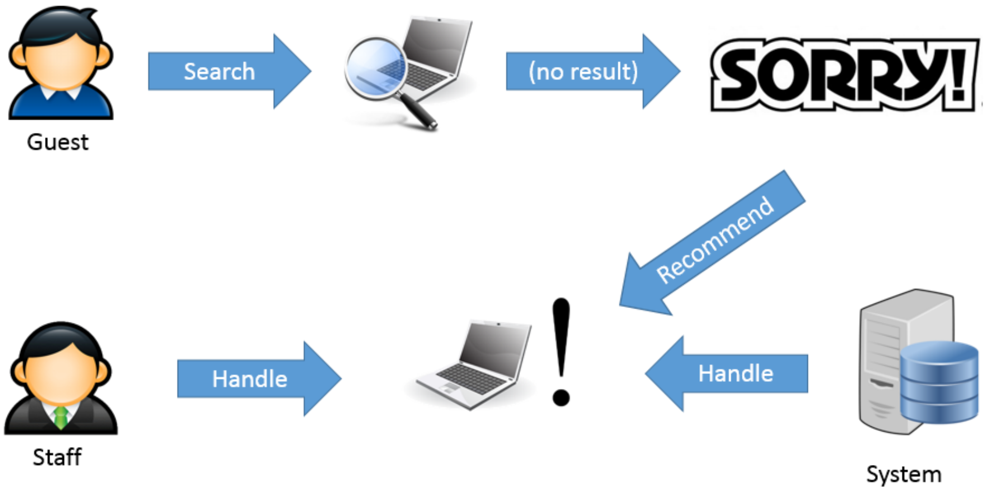


Figure 9: Scenario 2: Search laptop and recommend laptop

3. Scenario 3: Parse data and handle duplicated products

- The system parses data and staff handles duplicated products.

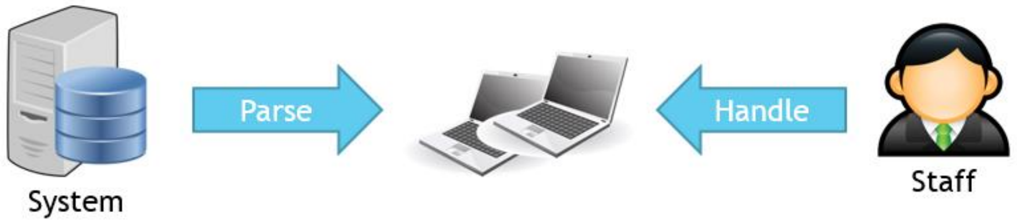


Figure 10: Scenario 3: Parse data and handle duplicated products

4. Scenario 4: Mobile Application

- Guest uses Laptop Reviews mobile application to search a laptop.
- After found this laptop, he view this laptop's detail.
- He can add this laptop to his list of favourite products.
- He also can write a comment for this laptop.

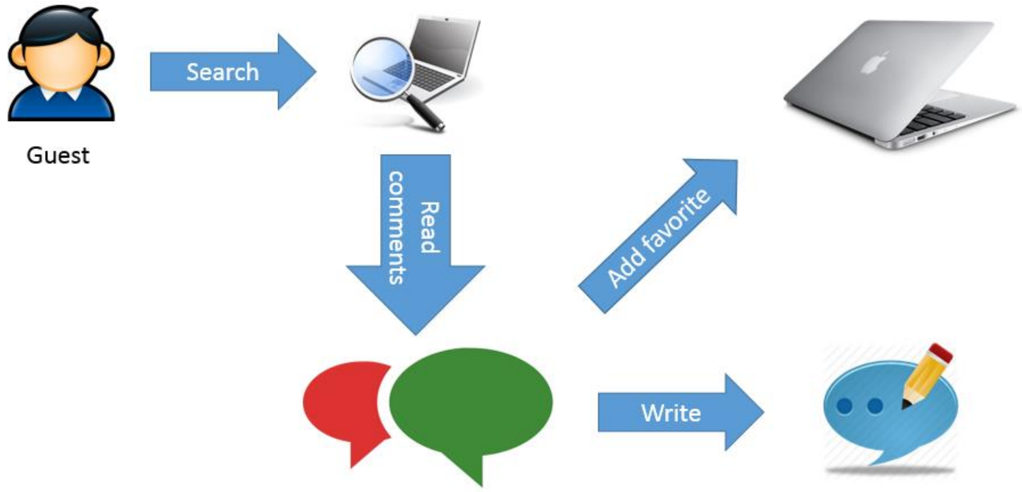


Figure 11: Scenario 4: Mobile Application