# TECHRING

# Artificial Intelligence Based Personal Computer Parts and Laptop Recommending Assistant

# Software Requirement Specification Document

Comprehensive Design & Analysis Project – 2019

B.Sc. Special (Honors) Degree in Information Technology

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# 1 Introduction

## 1.1  Purpose

This Software Requirement Specification document contains a detailed documentation of the final year research project belonging to the group 19-069 of 2019, Software Engineering and Information System Engineering Batch.

We expect to provide a detailed overview of the final product we expect to develop. Document will be focus on below aspects,

- Software Requirements.
- Project Scope.
- Project Purpose.
- Target Audience.
- Functional Requirements.
- Nonfunctional Requirements.
- Methodologies.
- References.

This document holds equal importance for both clients and development team. This will used as a verification source that is used to identify whether the final product satisfy the end users' requirements. This document will referred in each iteration of the software development lifecycle to finalize the decisions, alterations and modifications done to the system. Thus, this will be a useful key reference document to,

- Developers.
- Software testing groups.

In brief the purpose of this document is to provide an in depth insight of the Artificial Intelligence based Personnel Computer parts and Laptop recommending assistant that our team expect to build.

## 1.2  **Scope**

This document clearly state the boundaries and user requirements that will addressed in this research. Thus the document will focus on both the functional and non-functional requirements of the product.

Our final product will be introduced to the market by the name "TechRing". More precisely it will be addressed as TechRing – Artificial Intelligence based personal computer parts and laptop recommending assistant. It is a platform where any person who needs guidance in assembling, finding PC parts or recommendations in a laptop purchase

From the identified requirements we divided the main product into four components. These four components will contribute to the main aspect of recommending the best option to the customers. The components are,

- Assembling assistant
- Price comparison & optimization
- Customer review analysis
- Laptop recommender

The assembling process for personal computers is long and a complex task [1]. Assembling process has more attention than it used to have. Since majority of the people prefer assembling their PCs' by themselves. From this most of them are from the gaming industry. Thus our platform will provide assemble sequences customized for games. This assembly plan generation is currently limited only for games. But we plan to extend this service into other purposes like video editing, photo editing or based on software purposes. In finding the best product matching user requirements will be based on two data sources. One is the price and other will be the customer reviews.

Since the best product cannot be decided only by the price, we have included the next best recommending source, Customer reviews when recommending the products. Because they reveal their experiences with the product. Thus, by having an analyzed customer reviews in a rating format makes it easier for the new customers decide on their choice based on the results. Through this users will get an idea about the product prior to purchase. This document will be focusing on the customer comment analysis process done by "TechRing". These results of analysis will be used as one determining data source when recommending products to the customer.

1.2.1 Objective

Analyze the PC or Laptop requirement the user has along with their limitations such as budget and recommend the most suitable products for them by utilizing the price optimization and sentiment analysis techniques.

1.2.2 Other objectives

- Recommendations based on the customer comments posted on Facebook.
- To save user's time by providing user reviews in an analyzed format.
- To provide the users a detailed overview of the previous customer experiences through the customer comments display.
- To design a user-friendly website where the users find it easy to navigate and find what they require easily and faster.
- To provide solutions customized according to computer games (For both laptops and PC parts).
- Develop an attractive website capable of keeping the users attracted and make them use the site again.
- To develop a system which has a high
  - Accuracy.
  - Security.
  - Efficiency.
  - Understandability.
  - Flexibility where they will act as the supporting roles for the non-functional requirements.

1.2.3 Benefits.

- Empower the user to build their PC by themselves.
- Users can view analyzed overview of previous customer's experiences in a summarized format. Thus, the hassle of going through the comments is reduced.
- Saves user's time on reading the customer comments posted on different social media platforms.
- Even an average person who might have a language issues can get an idea of the previous user experiences at a glance since analyzed results are displayed in a rating format.

## 1.3 Definitions, Acronyms, and Abbreviations

| Abbreviation | Explanation |
|---|---|
| PC | Personal Computer |
| AMD | Advanced Micro Devices |
| GHz | Gigahertz |
| GB | Giga Byte |
| RAM | Random Access Memory |
| CPU | Central Processing Unit |
| IT | Information Technology |
| POS | Part of Speech |
| MVC | Model View Controller |
| AWS | Amazon Web Service |
| SRS | Software Requirements Specification |
| HTTP | Hyper Text Transfer Protocol |

*Table 1. 1- Acronyms and Abbreviations*

## 1.4 References (place this at the end of the document)

## 1.5 Overview

Main goal of "TechRing" is to provide the users a valuable and worthy service. To achieve this state we have incorporated many aspects. Thus this section will be highlighting the main goals and tasks that is to be delivered via "TechRing" and also this covers the future content of the SRS document.

**Main Goals.**

1. Become the most reliable online assistant available in finding the best PC parts and Laptops suiting the user requirements. Reliability is guaranteed through the recommendations based on price, system performances and analyzed customer reviews.
2. To build an algorithm to analyze the customer reviews to obtain accurate results and provide most suitable recommendations.

**Tasks**

1. Access Facebook using the Graph API to extract comments.
2. Extract customer comments real time through web scraping.
3. Comment categorization as positive and negative comment by analyzing the comment. Later on, a count of each category is taken.
4. Use the results of comments analysis in the comparison sequences of the products and also in finding the best product for the user.

SRS document will be mainly consisting of three sections. Each section will be considering different parts of the final product.

**Chapter 1:** This section will be explaining the core purpose of creating the SRS. This will give a detailed idea of what the final product will be capable of doing and not capable of doing in the implementation stage. Also discuss about the goals, objectives, benefits and tasks of the final output. The overview section will be demonstrating the rest of the SRS content and how the content will be organized.

**Chapter 2:** This describes the non-technical way of focusing the end users of the final product. The purpose of this section is to give the users a clear idea of what the system does. Since most of the end users might not be technically knowledgeable this section gives the idea of the final product. This includes Product Perspective which identifies the existing recommending assistants similar to the one that is being developed, Product Functions which includes details about the functions that are available in the developing system, User Characteristics describes the targeted user base, Constraints will discuss about the limitations that controls the developers options, Assumptions and Dependencies includes the assumptions utilized during the designing and implementation phase.

**Chapter 3:** This describes the technicality of the system. This describes the system in a developer's point of view. Main purpose of this section is to provide a better technical understanding for other or future developers or maintainers of the system. Thus this uses numerous technical terms that will be familiar to software engineers, developers and maintainers.

In this document the component that will be looked in to is sentiment analysis. Most of the site display the customer reviews as it is. Users find it difficult in getting an overview of the product through available sources. Thus "TechRing" will provide an analyzed overview of the comments, showing the percentages of positivity and negativity of the comments. In order to identify the nature of the comments sentiment analysis will be conducted on the extracted comments. For this NLP tool kits will be utilized along with the deep learning techniques. Comments will be accessed Real Time. Thus the comments will be extracted via the selected social media platform using Web Scraping when it's required. Users find this display of the reviews much more effective in making their purchasing decisions rather than referring to paragraphs.

## 2    Overall Descriptions

Nowadays computers play major role in almost all the industries. Initially, computers were used as a tool for calculations, but now computers help people finish many aspects in life [2]. As previously mentioned computerd have simply become  a multi tasking device. In addition to computers, laptops also come into play enhancing the portability aspect.

Earlier people prefer the purchase of PCs and laptops directly from the vendors. But with technological adavancements needs and wants of people are affected. Therefore having an option just to purchase a machine from the vendors is not enough. Considering the reasons users' deviating from the preset machines, "TechRing" is is developed based on four main sections

- Compatibility.
- Budget.
- Customer Reviews.
- Requirement.

One of the most challenging industry for PCs and Laptops is the Gaming Industry. Nowadays gaming industry is not just a field for entertainment. It is beyond limitations and it is highly changing and influencing other industries. If you consider the gaming population it is more than 50%. Earlier games were designed based on machines. But now machines need to reach certain levels to play games. Considering this aspect "TechRing" is designed for this purpose. It is designed in way once the user enters the name of the game based on the game requirements  compatible PCpart, assembling sequence or a Laptop will be recommended. This will be helping gamers with less technical knowledge plus it saves the time users have to spend on finding the compatible PC parts or the Laptop. We guarantee the reliability of the recommendation that is provided through "TechRing".

When purchasing a product irrespective of the product category any buyer refer the previous customers review on the products before purchasing. Nowadays people have abundant of sources to access customer reviews but less time to go through these comments and get an overview. Our platform provide a solution for this. "TechRing" will access the comments in mainly posted in Facebook in real time and these extracted comments will undergo an analysis procedure. Thus the end result will be that customers will be displayed of analyzed comments in a rating format based on the comments positivity and negativity. Sentiment Analysis is important in understanding the people's opinion on matter by analyzing a large amount of data [4].Thus at a glance an overview will be provided.

Since there are multiple vendors, brands and versions available for each PC part there might be price variations that is created.  Thus always the best product is neither the expensive or cheap one. It has to be decide through price optimization.  Price optimization is the use of price elasticity of demand and the enterprise manufacturing cost per unit to create economic efficiency [3]. TechRing utilize the price optimization concepts in recommending the

products for a user when they type a name of the product. Moreover through our platform vendors can reach their customers amidst of the geographical barriers. This also help them to increase theit customer base.

As previously mentioned laptops also have a similar demand like for PCs. Even in laptops have different versions and brand in the market. Thus people get confused when the want to purchase laptop. Thus "TechRing" recommends the best laptop considering the computational power and analyzed customer reviews. When the user select the two laptops they want to compare from the two best one will be recommended. This save up the user's time of researching the laptop details and analyzing them.
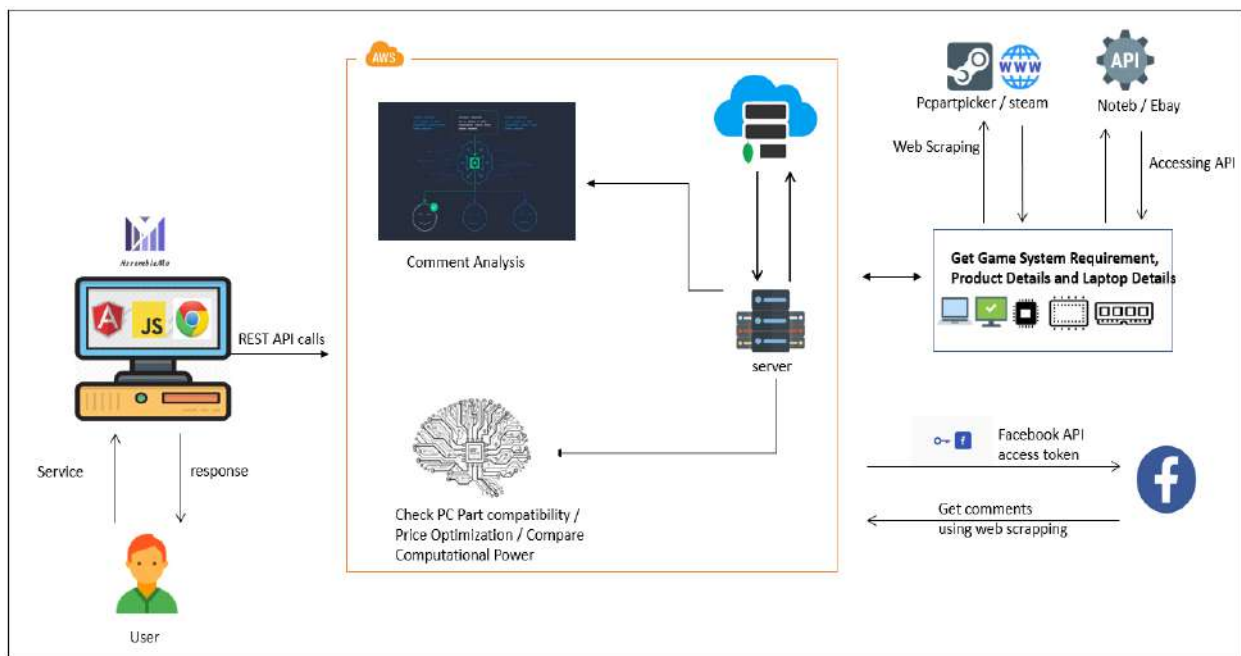


*Figure 2. 1- High Level Architecture Diagram*

## 2.1 Product perspective

By analyzing and reviewing the research articles and conducting the literature review, our attention was drawn to following noticeable platforms which cater for similar requirements.

- Pcpartpicker
- Noteb.com
- Newegg.com

Above mentioned platforms assist users in finding the PC parts and Laptops for their requirements. But these differ from one another due the availability of their functionalities. Below is a comparison we conducted among "TechRing" and the above mentioned platforms. All these mentioned features are planned to be implemented in "TechRing" in the completions of the research.

| Functions | PCPartPicker.com | NewEgg.com | Noteb.com | TechRing |
|---|---|---|---|---|
| Select Compatible PC-Parts | ✓ | | | ✓ |
| Build PC according to a System requirement Of a Game | | | | ✓ |
| Display prices and compare of different vendors | ✓ | | | ✓ |
| Analyze Comments and display rating based on that | | | | ✓ |
| Recommends assemble plan according to budget | ✓ | ✓ | | ✓ |
| Recommend the best PC part in a price range | | | | ✓ |
| Notify Price Drops to user | ✓ | ✓ | | ✓ |
| Laptop comparison | | | ✓ | ✓ |
| Recommending the best laptop | | | | ✓ |

*Table 2. 1 - Comparison of current available systems with TechRing*

Considering the results from the above Table 2.1 none of the currently functioning platforms provide a combined solution for both laptop and PC users. It is either specialized for Laptops or Parts. Thus we believe having a common platform where the users can interact with both section will be very useful. None of the above platform use customer reviews as a source for recommendation. But "TehRing" will be using this as a one of the key indicator in finding the best product.

2.1.1  System interfaces

"TechRing" will be using below mentioned interfaces.

- Spring Boot REST API
- Facebook Graph API
- Noteb REST API
- OAuth 2.0 API

2.1.2  User interfaces

The final product of "TechRing" is a web application. Detailed description of the user interfaces will be described in Section 3.1.1. Main user interfaces in "TechRing" are as follows,

- Web Application
  - Home Page
  - Register
  - Login
  - Individual PC parts page
  - System build page
    - Build for game requirement page
    - Build for budget pages
  - Laptop Comparison page
    - View Laptop details page
    - Laptop compare result page
  - User profile page
  - Vender profile page


2.1.3  Hardware interfaces

In order to run "TechRing" without any trouble there are hardware requirements that need to be available. Below are the hardware requirements we have identified that need to be available during the designing, implementation and testing phases.

- Desktop Computer / Laptop
- 64-bit (x64) Dual-core 2.4GHz or faster processor
- 2 GB RAM
- Windows 7, 8 or 10

2.1.4    Software interfaces

These software and frameworks will be used in developing the platform.

- ➢ Software
- Windows 10 Operating System
- Robo- Mongo (MongoDB)
- Spring Tool Suite 4
- Visual Studio Code
- Anaconda Navigator
- Jupiter Notebook
- Adobe Photoshop

- ➢ Frameworks
- Spring Boot
- Angular

2.1.5    Communication interfaces

- For data transmission between server and the client web app need to use internet or Wi-Fi connection to the devices.
- HTTP protocol is used to communicate web server and the client devices.

2.1.6    Memory constraints

- To deploy the web app need 2GB RAM and 10 GB space in server machine
- 1 GB RAM is recommended for the run the client app in the browser
- For client requests server machine is expected to use less than 1 GB RAM and 10 GB of HDD space.

2.1.7    Operations

- Login to the System
- Sign up
- View and edit profile
- Assemble complete PC for gamming requirement
- Get compatible PC part list for customer budget
- Compare and select best price for a product
- Analyze user comments and give final feedback of the product
- Compare computational power of a laptop and select best laptop

2.1.8    Site adaptation requirements

- From the initial user interaction, User SignUp session appropriate guidelines should be provided to assist in the user registration process.
- Prior to using "TechRing" user devices should have access to internet. This is necessary to communicate with the server.
- Platform should be designed focusing on easiness and friendliness user will experience when using "TechRing".
- User must always input accurate and valid details to the platform when using "TechRing"
- Outputs, solutions and recommendations should be displayed in a meaningful and accurate order.
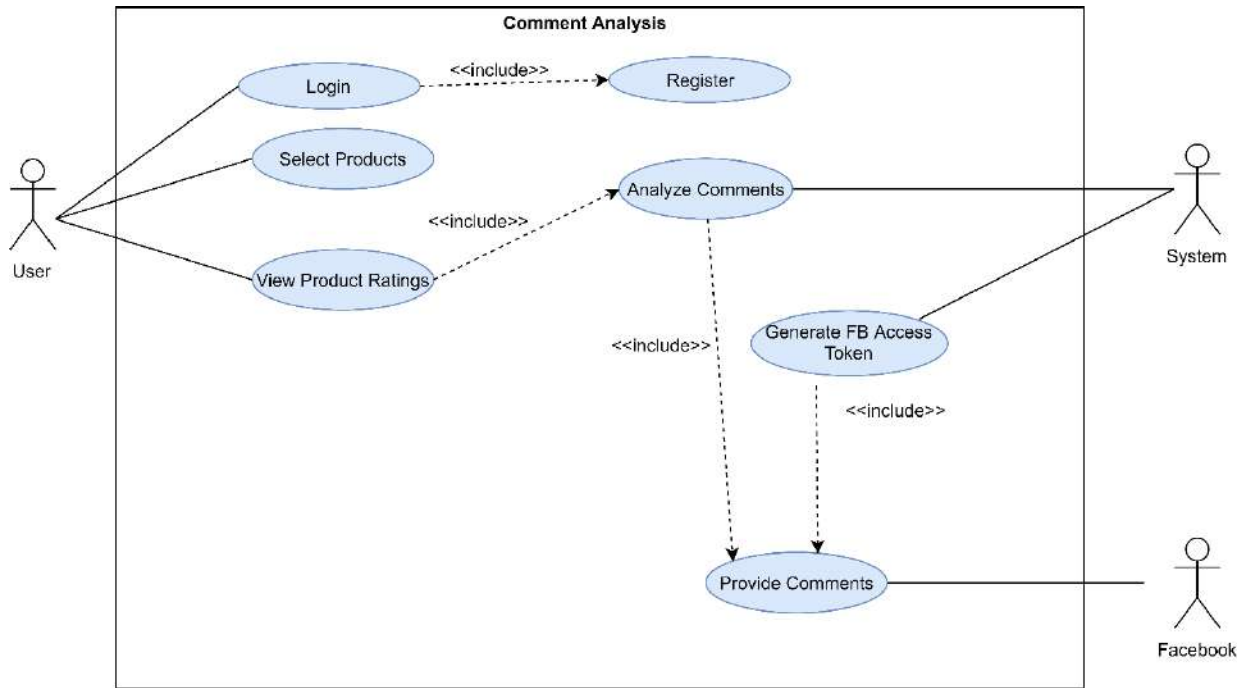
## 2.2 Product functions



Figure 2. 2- Use case Diagram

### 2.2.1 Sign Up

| Use case Name | Sign up user |
|---|---|
| Description | Sign up to "TechRing" to get more services from our platform |
| Actors | Site visitors/ users / vendors |
| Pre-conditions | Valid Email, unique username |
| Main Flow | 1. User visit the site.<br>2. Navigate to sign up page<br>3. Enter the required details<br>4. Show registration status and navigate to home page |
| Post Conditions | Display registration status and send email |
| Extensions | 3.a 1. If user enter invalid details prompt errors and attempt again to enter valid data |

*Table 2. 2- Use case Scenario: Sign Up*

### 2.2.2 Validate User(Sign in)

| Use case Name | Validate user |
|---|---|
| Description | Validate user who already signed up with "TechRing" |
| Actors | users / vendors |
| Pre-conditions | Users should have a "TechRing" account |
| Main Flow | 1. User visit the site.<br>2. Navigate to sign in page<br>3. Enter the username and password<br>4. Details verified by the system |
| Post Conditions | User log in to the account successfully |
| Extensions | 3.a 1. If user provide invalid details then prompt error messages |

*Table 2. 3 – Use Case Scenario: User Validation*

### 2.2.3 Select Products

| Use case Name | User selection of products/laptop |
|---|---|
| Description | System identify user requirements based on the user's selection |
| Actors | Site visitors/users |
| Pre-conditions | Name/ keyword that is already existing is entered by the users. |
| Main Flow | 1. User visit the site.<br>2. System allow the user to choose the option either PC part/ laptop.<br>3. System identify the key words/tags in the name entered to the system by the user.<br>4. System checks for matching record in the database.<br>    4.1 Display of matching products will be displayed to the user.<br><br>5. Step 2 will be repeated by the user until they find a product they wish. |
| Post Conditions | Display of matching product list to the users. |
| Extensions | 3.a 1. Unavailability of matching record from the database will result a notifying the customer about the unavailability or asking to reenter the name. |

*Table 2. 4- Use case scenario: Option selection*

### 2.2.4  Facebook Access

| Use case Name | Facebook Access |
|---|---|
| Description | Preparation of access requirements by the system to access Facebook. |
| Actors | System. |
| Pre-conditions | Having a Facebook access token. |
| Main Flow | 1. User selects a product.<br>2. System retrieves the key words from the selected item.<br>3. Generate the Facebook access token using the Graph API.<br>4. Comment search and extraction is conducted if the access is successful. |
| Post Conditions | Comment search for matching keywords. |
| Extensions | 4.a 1. If the access is not granted the regeneration of the access token is conducted. |

*Table 2. 5- Use case scenario: Facebook Access.*

### 2.2.5  Comment Analysis

| Use case Name | Comment Analysis. |
|---|---|
| Description | Using sentiment analysis the comment analysis will be conducted. |
| Actors | System. |
| Pre-conditions | System should have set of related comments with them.<br><br>Having sets of positive and negative word set to train the system to conduct the analysis. |
| Main Flow | 1. Collect set of comments related to the search.<br>2. Separate each word in comment.<br>3. Analyze the comments using the algorithms and training data.<br>4. Categorize each comment considering their positivity and negativity of each comment. |
| Post Conditions | Categorized set of comments as positive and negative. |
| Extensions | 4.a 1. If a comment does not fall under any category the system will ignore the comment. |

*Table 2. 6- Use case scenario: Comment Analysis.*

## 2.3   User characteristics

Our online assistant will provide the assistance to any person who is searching a PC part or a laptop. Through the questionnaire we conducted and through research article review we came to conclusion that our user base will age of an age gap 10 to 60 yrs. Reason for having such an age gap is almost everyone uses a computer or a laptop for daily functioning. Our user base can be categorized as below,

- Students.
- Gaming Society.
- Employees.
- PC parts and Laptop Vendors.
- Ordinary People.

"TechRing" will provide the service to anyone who is either an IT expert or average technical knowledge personnel.  Simply they need to have the basic knowledge of how to browse through the internet and navigate through a website.

## 2.4   Constraints

One of the common constraint for any user of this online assistant is the availability of Internet. Since the systems needs access online data apart from the data from the database and the output of the system will be provided via a web portal Internet connection for the functioning of "TechRing" is a must.

- Software Constraints. :

  'TechRing' is a web application so that using any web browser which supports relevant Javascript, should be able to access the site. Mobile devices should also be able to access the website because of the responsiveness. Python use for machine learning algorithm to analyze user comments, price optimization, Compare computational power and recommend best laptop and suggest the PC part using build sequence.

- Time Constraints

  Final product should be produced by October 2019.

- Data Constraints.

  There will be two sources of data. Set of data will be stored in the databases. Data will be stored using MongoDB. These details will be updated manually by the system administrator. Other set of data will be extracted real time since the system needs to access the updated data content.

## 2.5   Assumptions and dependencies

Assumption

- The details that are provided by the user to the system will be names and details already available in the market.

- The user device has access to the Internet before accessing "TechRing".

- Individuals who access "TechRing" possess considerable computer literacy to operate and use functionalities that are offered in the platform.

- User will input valid details to the platform.

Dependencies:

- Users' accessing devices must be connected to the Internet prior to the use of "TechRing".

- Users' should visit the site via a web browser in order to experience the services provided by "TechRing".

## 2.6    Apportioning of requirements

The first release of "TechRing" consists of the functions that are mentioned in the section 1 and 2. In section 1 and 2 more focus is given to the overall description about the system and its requirements. Section 3 is focusing on the requirements that needs to be followed in designing the final product.

It is possible to modify "TechRing" by expanding the services provided by the online assistant. Currently the PC assembling plans are built only according to the game specifications. But in future we can expand this function in to other areas like video editing, drafting, designing and more.

Moreover, we can allow the users a separate section where they can express their views about the product in "TechRing" itself. Currently user reviews in the social media will be focused. In future we can extend for comment, blogs and news articles analyzing. This can provide a more realistic result to the user.

## 3   Specific requirements
## 3.1   External interface requirements

### 3.1.1   User interfaces

User interfaces are the access points for users. The interface layout determines the friendliness of the platform. Lesser the number of interfaces more user friendlier the software will be.
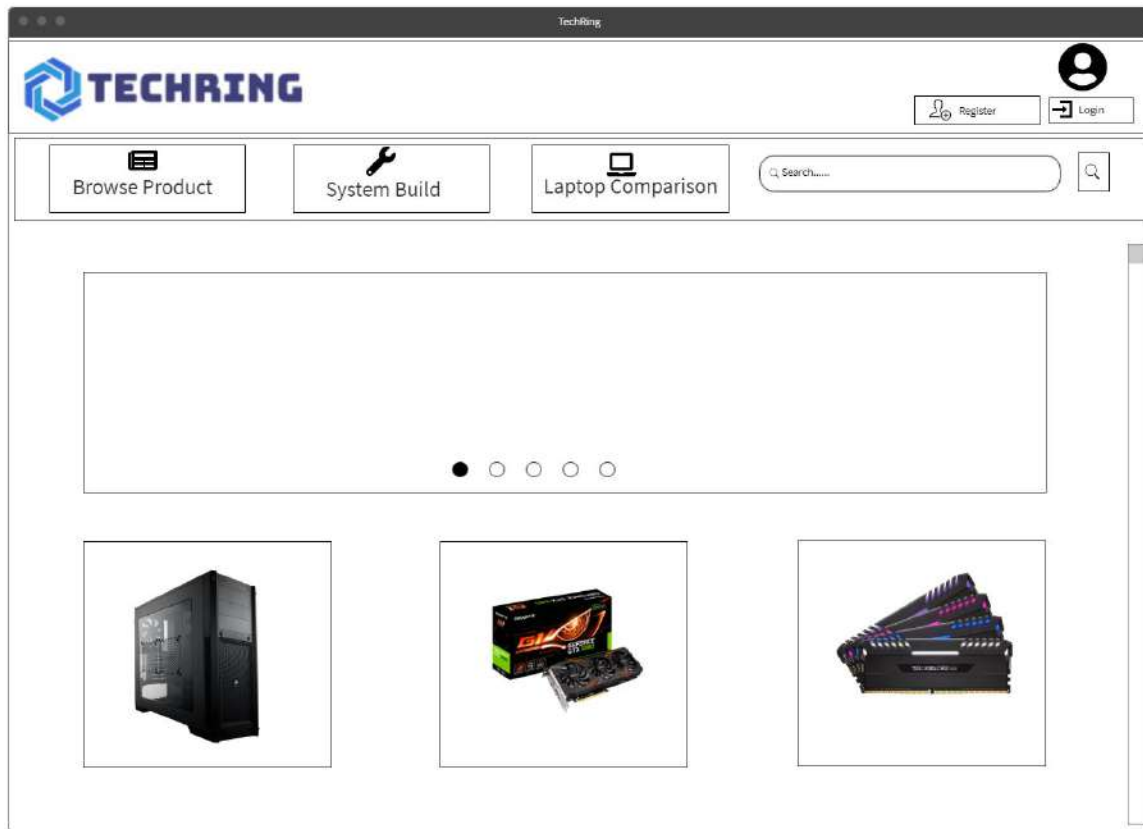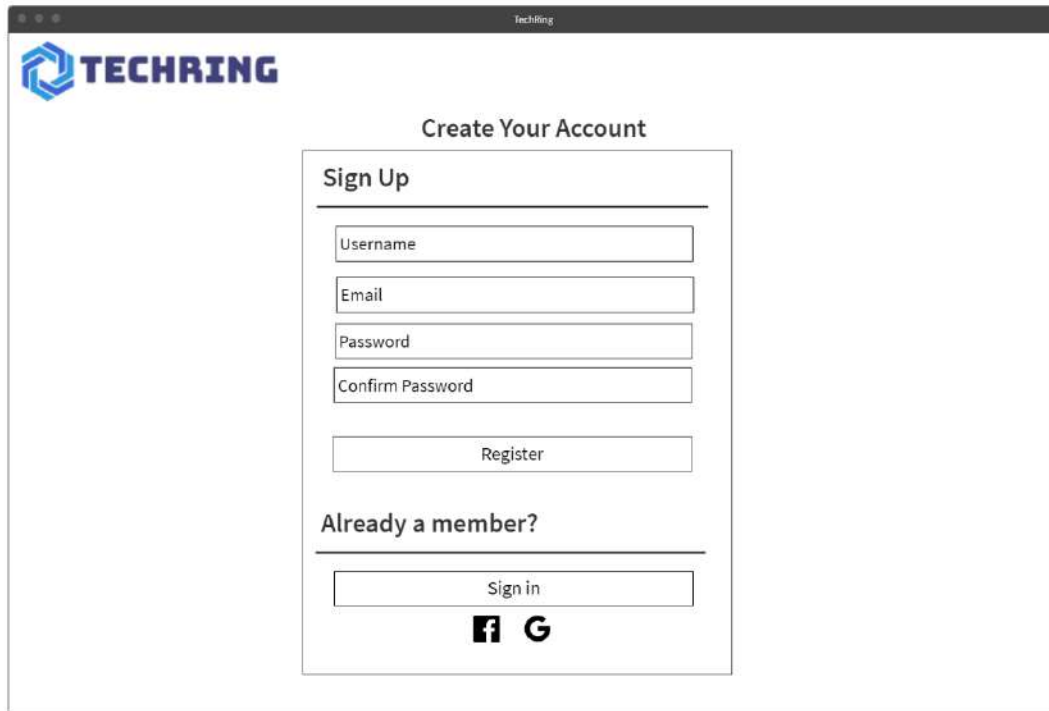


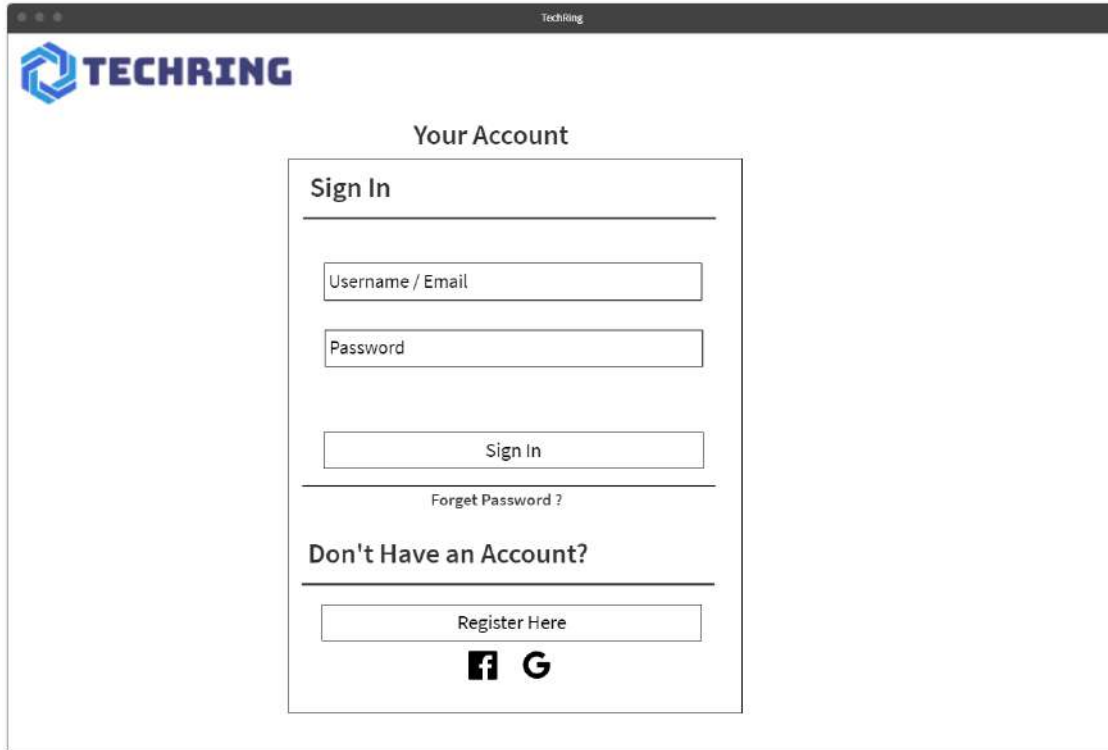*Figure 3. 1- User Interface: Home page*

When the user visit "TechRing" through a web browser the first interface they interact is displayed in Figure 3.1. This interfaces provide the user with access points which will direct them to their next step depending on their requirement.

*Figure 3. 2- User Interface: Sign Up*

This is the Register interface. Non-registered user can get registered with "TechRing" through this interface. User can register either by providing the required details to the system or they can register using their Facebook or Gmail accounts.

*Figure 3. 3- User Interface: Sign In*

Above figure is the sign in interfaces. For any registered user can enter their username and password and sign in to the platform. If the user has not registered there is option to direct the user to Register interface (Figure 3.2). If the user does not remember the password the option to reset the password is also provided.
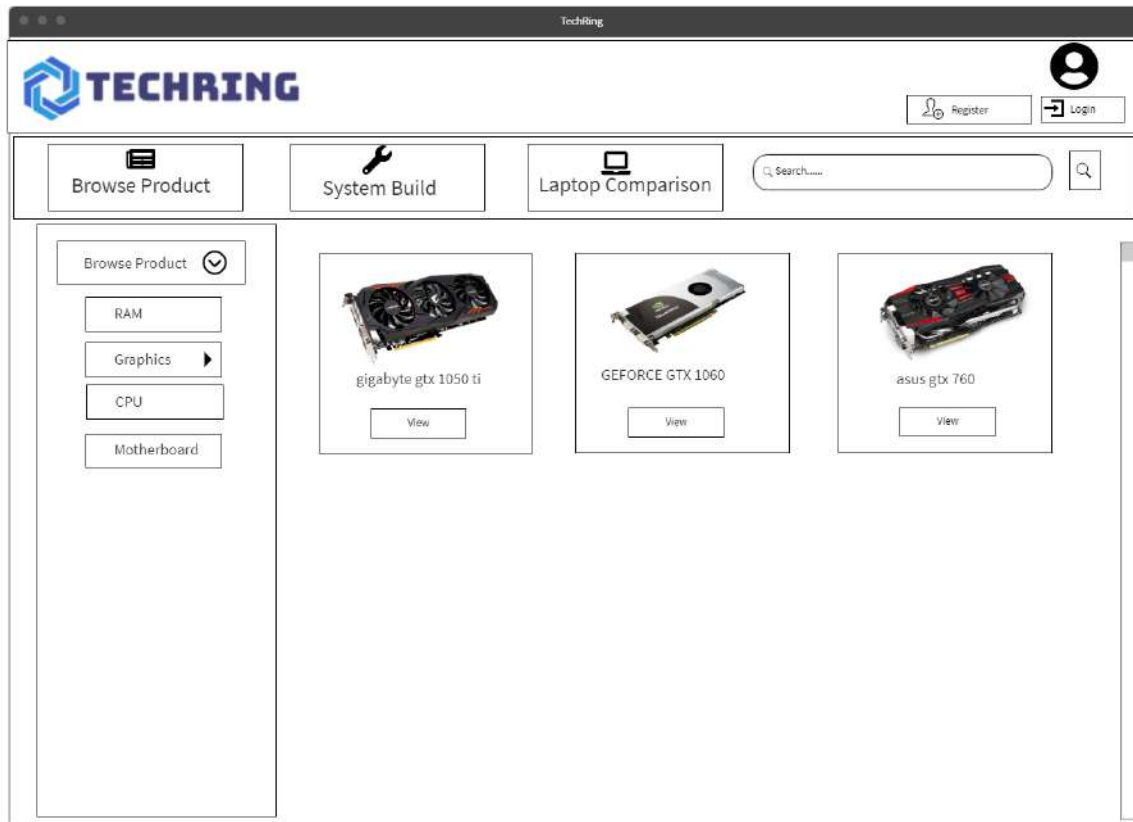
*Figure 3. 4- User Interface: Product categories browse page (Graphics)*

This is the Browse Product page in Figure 3.5.  There is an option where the user can select the product category from a drop-down list. Once user selects a category related to the product will be displayed.
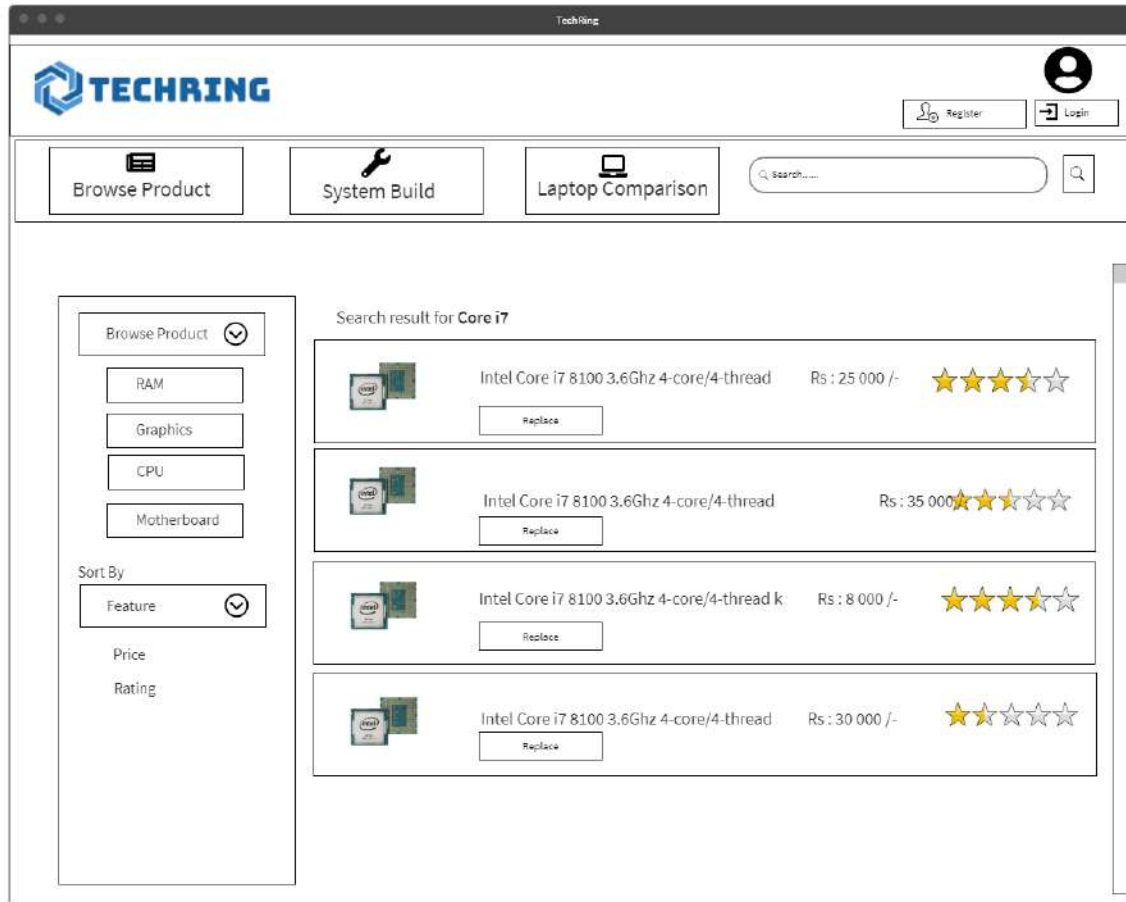
*Figure 3. 5- User Interface: Result display for the list of products based on ratings*

After user selects the Product type from Figure 3.4, they can sort the product either based on price or ratings. Once the user select ratings, above figure (Figure 3.5) will be displayed. Products are displayed in descending order of the ratings of each products.

*Figure 3. 6 User Interface: Product Overview Page with Ratings Display*

When the user click on a product this will be the interface they are directed to. In here along with the vendors who are providing this product, analyzed customer ratings will be displayed below the product. The most relevant customer comments selected from social media and pcpartpicker website will be displayed below.

## 3.2 Performance requirements

Server should contain following requirements after "TechRing" deployed. Application should be run on the server to connect clients without any distraction.

- Server should be able to response quickly to client
- Application need minimum 1 GB RAM and 20 GB hard disk space to run efficiently
- The server should handle the traffic without failing
- Server should be able to response user 24x7 to maintain reliability of the system

## 3.3 Design constraints

Responsiveness - Responsiveness is a critical feature of a website. Some people use the website on a computer or on a laptop. Some people use it on a mobile phone. Sizes of the screens are different from each other. Therefore, it is necessary to create the same website for different sizes of screens. 'TechRing' will have the ability to run on a computer as well as on a mobile phone without any confusion of the web content. When the size of the screen changes, the proposed website will change according that.

## 3.4 Software system attributes

### 3.4.1 Reliability

Reliability is measured based on the capability of a system or software's ability provide the services to the users without a failure for specified period of time. One of the major factor that affect the reliability of a system is the complexity of the system. The system developers and designers should use the appropriate model carefully. Because the best model will not be the ideal model for the situation.
The proposed platform will be developed with capability to deliver a reliable and efficient service to the end users. Algorithms used in "TechRing" will generate highly accurate results to the users. As the latest technology is used these results will be produced with in less time.
Since data handling will be done by the server there will be less crashing probability. Yet failures might occur due to server issue or connection failures.

### 3.4.2 Availability

Availability of a system should have the focus on simplicity and user's purpose. "Uptime" of the platform is the main focus under availability. In this situation "TechRing" is hosted on AWS that is ensure the availability of the system and it balance the load and the traffic by the inbuilt load balancer. So that availability of the system will increase because of the

AWS. As a result, the website will remain operational when and where the user needs it to be available.

### 3.4.3 Security

Security of the platform is the ability of the platform to withstand the unauthorized access and harmful digital threats. The system needs to be built with the appropriate security levels to ensure user's data is secure.

System has different level of user roles they have different accesses to the system those should be maintain properly otherwise some users can access to the confidential data in our system. There is a login function and when a user logs in to the system, a token is generated and it is used to identify each and every person. Therefore, the system is protected from unauthorized access.

Security mechanisms that is to be implemented will be,

- Intrusion security
- Data encryption

As mentioned, the platform development should consider the levels of security initiated considering the sensitivity of the data we collect and user level access allowed. The database should have a high level structure which could prevent a system crash or a data loss.

### 3.4.4 Maintainability

System should be developed with the capability of adapting to changes, rectify the bugs which should be done in the preventive maintenances and support future changes. The system will be developed supporting high maintainability since many improvements are will be added in to the new system in the future.

One major risk the 'TechRing' faces is the changes of web content of targeted websites. 'TechRing' gets most of the data by web scraping. When a targeted website changes the content of its site, scraped data can be false. In order to prevent from that, 'TechRing' will have modifications and be able to adapt according to the situation if it happened.

## 3.5   Other requirements

### 3.5.1   Performance

Performance is an indication of the responsiveness of the website to execute any action within a given time interval. Everyone likes to get responses quickly as possible without any problem in order to save their time. Some functions of the proposed website connect with online data and analysis of those data will be done at real time. Therefore, performance of the website would be a critical point in the website. In order to increase the performance, latest technologies are used to create the website.

### 3.5.2   Modifiability

This is the qualitative attribute of the product which will consider the cost for modifications and it focus on the ease to add modifications to the product as required.

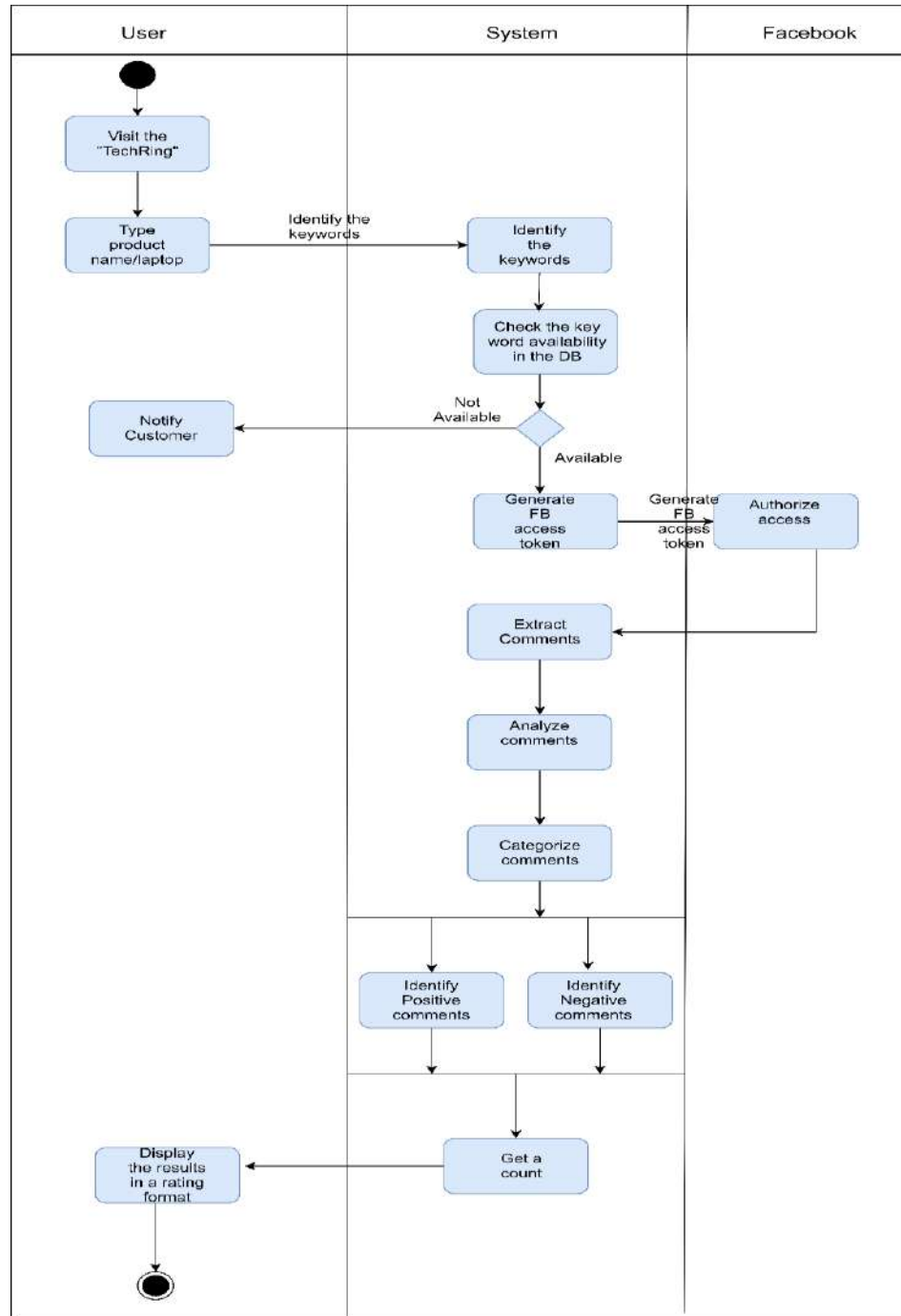# 4 Supporting information

## 4.1 Appendices



*Figure 4. 1- Activity Diagram for comment analysis.*

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