

Artificial Intelligence based personal computer parts and laptops recommending assistant

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Abstract – Most of the computer and laptop users find it difficult to search for the ideal hardware component for themselves. Because there is a number of manufacturers in this sector. Thereby there are a variety of versions and brands available. This has created a need of having an online assistant to help the laptop and PC users to find the ideal hardware component matching their requirement. Another aspect that has created the need for such an assistant is the practice of assembling PCs' by people according to their requirements. This is a common practice, especially in the gaming industry. Because almost all the games demand PC specification if it needs to be played.

Considering the above aspects an online assistant to assist you in finding the hardware components is designed in this research. This research was initiated with the deployment of an online questionnaire and interviews with the local vendors (PC and Laptops). With the information gathered an online assistant is designed to suggest compatible parts matching the requirements. In order to find the ideal component customer feedback analysis along with price optimization is used. This platform will provide assistance in finding the compatible PC parts, generating PC plans matching customer's budget and analysis of customer feedback and display the results in a rating format. Laptop users are given the service to compare laptops and based on the computational power the BEST will be recommended. In order to generate compatible PC part plan and laptop recommendation, Expert Systems will be used. For customer feedback analysis Natural Language Toolkit is used along with Python Libraries. Price optimization algorithms will be utilized to generate PC part plans according to the budget. The final output of this research is a web-based application built using Java, JavaScript and Python with MongoDB as its database. Users will encounter this platform by the name "TechRing"- we make the right choices for you.

Keywords: *Computer assembly, Computer parts, Price Comparison, Web scraping, Computer games, Expert system,*

neural networks, Price optimization, Comparison, Sentiment Analysis, Laptop Comparison

I. INTRODUCTION

Computers and laptops play a major role in everyone's' life. These two devices have been capable of pushing themselves into being a need of human beings rather than just a want. Earlier building a computer was less complex comparative to today because computers were used for simple tasks. For an example used as a calculator [1]. Thus they used one computer model to satisfy the requirement. In contrast, today the computer devices are a must to solve ninety percent of human tasks. Therefore the tasks computers perform has increased and also they have become more complex. This evolution of usage made the fact that one common computer model is not enough to do the needful. Therefore based on the requirement the computer specification also differ. For instance, the computer used in the cashier might not be capable of performing the tasks used in video or photo editing. Because of these complexities of requirements, most of the users have tended to assemble their computers by themselves.

One of the most striking industry that depends on the computer, customizations are the Gaming Industry [2]. Earlier games were a method used for entertainment. But it is much more advanced than that. It has become more of an industry with high competition and can be considered as one of the highest profit earning industries prevailing in the current market. Moreover, around 70 percent of the population is involved in this industry. Earlier games were designed according to the computer but now the table has turned around. In order to play games, you need to meet the hardware

specifications of the games. Thus most people move towards assembling their Personnel Computers by themselves. Therefore the need of knowing the appropriate computer parts for your need is important.

Nowadays, with technology advancement, there are many sources when it comes to purchasing purposes. Digital platforms and physical platforms. Each source provides their own unique prices based on their costs. Therefore customers are provided with the opportunity to have a comparison for the vendors. One of the common motives of customers is that they need to buy their products both for best quality and price. Considering these aspects from customers' point of view this platform is developed to the purpose of assist customers in assembling a computer of their need and also to have the hardware products they seek for the best price and quality.

II. LITERATURE REVIEW

Development of an online assistant for recommending the best hardware solution for the customers is a combination of different concepts, theories, technologies, and methodologies. When building a PC it is not only about finding the parts that fulfill your requirements. It also needs to satisfy the compatibility of other components. Thus automating such function is risky and complex. This platform is also designed to find the best product as well. In here the authors consider "Best" as the most pocket-friendly option with the best quality. To achieve this expected automation there are several concepts and theories used in previous researches.

Web scraping will be one of the prominent technologies that will be used by the authors in order to retrieve data. Eloisa Vargiu and Mirko Urru (2012) has previously used this technology in order to extract data based on web advertisements. Another striking example that highlight the effective use of web scraping is the Russian research done by Maxim Bakaev and Tatiana Adveenko. They used web scraping to extract data about job applicants, candidates in order to manage the labor market in Novosibirsk, Russia. Apart from them for analysis Expert system and Neural Networks will be of high efficiency.

According to the Hou's Research, once the assembly sequence is fed and the expert system is trained, the expert system is capable of making any decision related to assembling sequence. In the neural network, there is an advanced extension named "Recurrent Neural Network (RNN). This concept is the repetitive use of a neural network scenario. This method enhances accuracy. This methodology is capable of conducting the same analysis on different layers. The blog, "Recurrent Neural Network for Sentiment Analysis" explains how this concept can be utilized for accurate sentiment analysis. Along with RNN using the analysis matrix will produce an overall analysis of the complete sentence since it will be considering the relationship and impact of each text has on one another.

In order to teach the supervisors and the trainees about assembly operations, Yupeng Su, Wenhua Zhu and Tao Yu

developed a Virtual Assembly Platform. For this purpose, they have utilized the VAP architecture where VAP is a set up on the graphic library. This system is adopted to optimize the stimulation scene. The platform is developed using Object-Oriented analysis (OOA) methods which adapt themselves into a hierarchical layout and the design modularization.

Considering the Udi and Nachum research there is a two-stepped standard approach to conduct a proper analysis. That is Approach C and S. Approach C is comparing based on the functionalities whereas Approach S is used in case of Approach C is not enough. Approach S will be conducting a deep analysis of the functionalities fed to the system.

The Lucene Model used by Jianxia and Huang's research is the development of a system which will use apache libraries and web crawling for an effective price and product comparison. Many experiments and test results have proven it is an effective model that give accurate results.

Since PCs' and laptops play an important role around the world having a common platform for both of them will come in handy. Many kinds of research have conducted researches on this area and they have developed similar service providing platforms. We observed that these platforms have their own limitations and none of the platforms cover all the functionalities that a customer is looking for.

III. OBJECTIVES

"TechRing" is designed and developed with the motive to provide PC and Laptop buyers with a reliable source to find the ideal solution for their hardware need. Since this platform has a variety of PC parts from vendors, both local and E-commerce sites, customers will be provided with a choice to select. This is also designed to have your own assembly plan for a PC based on the Gaming need you have entered. All the recommendations will be provided with high accuracy and reliability. Recommendation of the options that customers should go with in purchasing a PC part or Laptop will be displayed considering their prices and also by analyzing the customer reviews given for each product. Thus both budget and quality facts are considered. So that customers will be provided with the BEST solution that they should go with. For laptop recommendation, their computational powers will be considered in recommending. Also "TechRing" assures that up to date information will be produced from the platform since ninety percent of the data will be extracted real-time.

IV. METHODOLOGY

A. Research Methodology

The method that will be utilized in the software development will be "Agile" software development approach. In this requirements and their solutions evolve through a collaborative effort of self-organizing and cross-functional teams along with the help of customers. The main reason to go with this is its capability to have rapid and flexible responses to change. This supports adaptive planning,

evolutionary development, early delivery, and continual improvement. More attention is given to Scrum methodology which comes under Agile. Scrum can be considered as a lightweight agile project management framework. This supports both the iterative and incremental projects. Thus this method is well suited for smaller achievable modules which can be gradually developed. The most important aspect to select this methodology is it reduces the probability of failure to a greater extent.

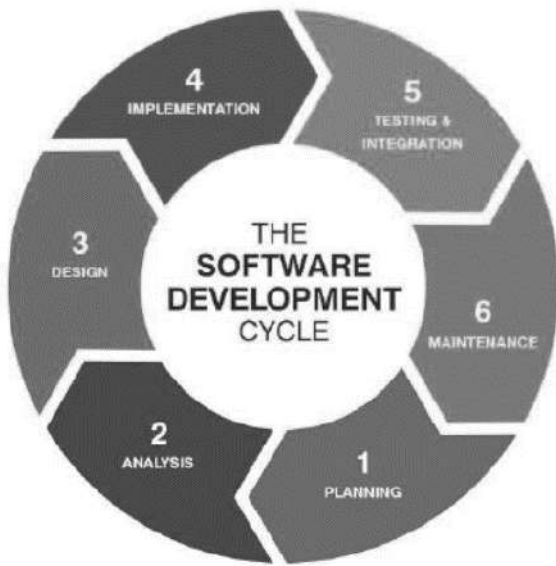


Figure 1 - Agile development Life Cycle

V. ANALYSIS AND DESIGN APPLICATION

A. Requirement Analysis

The first phase after planning in Agile is the requirement gathering phase to proceed with the analysis. In this phase, the authors conducted a requirement gathering session in order to determine the features and attributes of the platform. Requirement gathering can be conducted using questionnaires, discussions, interviews, and observations.

B. Requirement Analysis Result

Requirement gathering was conducted using a Google form. This questionnaire was developed in order to discover the interests of the potential users of our site. For this 91 respondents were involved. This consisted of 2 sections and 11 main questions. Respondents were categorized as Laptop users and PC users. Then based on each category requirements, past purchase experiences, motives, and interest were gathered.

➤ After analyzing the data authors were able to understand the below key points.

- Age range of potential users.

- The factors customers look in before purchasing a laptop or a PC.
- Main reason people tend to assemble a PC.
- The difficulties or limitation faced in assembling a PC.
- Feature customers look in before purchasing a laptop.
- The level of design complexity based on the age limitations of our users.
- Necessity to compare the local vendor prices with the International market
- Need a way to know the product by analyzing social media comments
- Requirements for assembling a PC according to the game

C. Design

By analyzing the previous works of researches it provides us guidance to the most appropriate tools, technologies and software are to be used in the implementation and development phase. In some cases, the theories, concepts, and models used by them help to detect the possible dependencies and limitations that might affect our design. Thus through their outlines the platform to be designed minimizing the risk occurrence.

The system that is proposed is a web-based platform which is marketed by the name “TechRing – We make the right decisions for you”. This is Artificial Intelligence-based PC parts and Laptops recommending assistant. The main ideology of this platform is to automate the process of recommending the hardware solutions for users based on their requirements. This concern about the keywords entered by the users and then based on the customer requirement solutions are generated or extracted and displayed.

System architecture is a web-based platform. Any user can access our platform via an internet browser and clicking on the site URL. This platform caters for both laptop and PC users. Required data of the systems will be extracted real-time from reliable websites. These extracted data will be filtered and purified. Using the cleaned data in specified algorithms accurate result are generated. The site along with the functions is hosted by a web server. Algorithms that use data extracted real-time is designed in a way they support the process and not collide one another. Algorithms are designed to make effective decision making thus making the site efficient. Also, each algorithm used should produce accurate results. In order to achieve every expectation developers should have a clear understanding of the platform and its functionalities.

There are four main functions provided by our platform. Namely,

- PC part Assembly Sequence
- Price optimization and comparison
- Product Feedback analysis
- Laptop Comparison

a. PC Part Assembly Sequence.

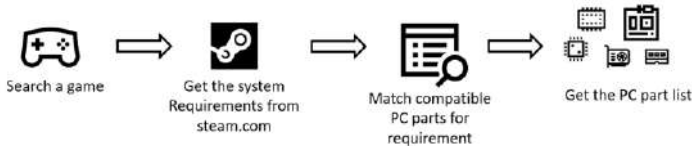


Figure 2 – Assembly sequence

This platform is focusing on building the assembly sequence according to the gaming requirements that user inputs. Once the user enters or selects the game, this platform is designed to generate the assembly plan required to play the game. For each game, there are specific requirements needed. These gaming specifications will be extracted from the gaming site steam.com. Once the user enters the game, specifications will be extracted through web scraping. The build sequence is used in order to analyze the final product (assembled PC) and check the compatibility of each component. The build sequence will analyze the final product (assembled PC) as several sub-components and match those specifications. To match the PC parts for satisfy user requirement used rule base algorithm with point machanism. This will be conducted in a stepwise approach. In building the build sequence final product is considered as a combination of four main components. That is the Processor, Motherboard, Memory, and Graphics. As mentioned earlier, the compatibility needs to check. For this processors socket compatibility is mainly considered. Base on the sockets and suggested parts compatibility is assessed and then recommended in the end.

b. Price Optimization and comparison.

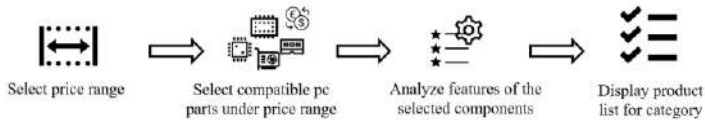


Figure 3 – Build PC for customer budget

Price optimization focus on providing the best product for customer requirement. What price optimization main concern is to find what the best is? It does not consider the most expensive one as the best one. In order to optimize the suggestions price and product features along with the results of comment analysis will be taken into consideration. Then decide on what is best for the customer. In order to display the prices of each vendor details will be extracted based on their selected mode. Some local vendors might provide details in excel sheet formats. Thus these will be scrape using scripts and save in the database. If the vendors' permission is granted to access details from their websites using web scraping required details are extracted. For e-commerce sites, the sites will be accessed using web APIs and then using web scraping data will be extracted.

In addition to the above customers are given the facility to create a budget-friendly assembling plan. User will enter their budget limitations along with the requirements. An algorithm

is designed to detect the limitations and arrange the plan according to the lowest budget. Moreover, if the product is not available for the price customer is looking, they can make a Memo in the platform. These will be saved in the database. Thus when there is a price drop for that product and if it tally with price customer is looking, a notification will be sent via an email to the customer.

c. Product Feedback Analysis.



Figure 4 – Scrape YouTube Comments

Customers place their comments expressing their experiences about the product. These comments are placed in many platforms including social media platforms like Facebook, Instagram, Twitter and YouTube. New feedbacks are added to these platforms every single minute. Considering these aspects algorithms are designed to scrape the comments in real time. For this purpose, YouTube is the platform the authors have selected. When the customer enters the search details keywords are detected and captured by the platform. These keywords are utilized to search for similar video posts on YouTube. Next, the video with the highest views will be selected automatically. After selecting the video, comments posted on that video will be extracted. These comments will be saved in a CSV file. Each time comments are extracted this CSV file will be created. These extracted comments then undergo filtering in order to remove the stop words. Then the algorithm checks for the positive and negative comments and net value for each category will be considered. The results of these comments will be displayed in rating format and also these results will be utilized in deciding the best product for the customers.

d. Laptop comparison.

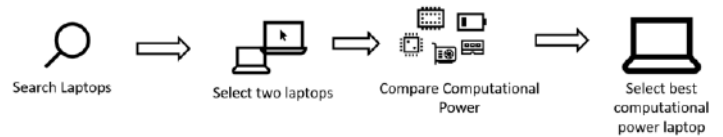


Figure 5 – laptops comparison

There are a variety of laptops in the market. Each version of the model holds its own specifications. Therefore based on their specifications a comparison will be created. When a customer checks a laptop for purchasing they get confused due to the varieties. Thus they prefer having a comparison method to conduct. Usually, CPU, RAM, Hard-Disk, Battery, and VGA are the features that consumers look in before purchasing a laptop. But the authors found that there three main aspects that need to look in before purchasing. These three factors directly affect the computational power. These components are Boost Speed, Cores and Cache. Thus the comparison algorithm is developed in a way where initial specifications are checked and value is generated. Then the

computational power is calculated by another mechanism where three unidentified features are assigned to a value. Then the sum is taken from both and the comparison will be conducted. For the time being authors allow the customer to compare two laptops at a time. Based on the results best of the two will be recommended.

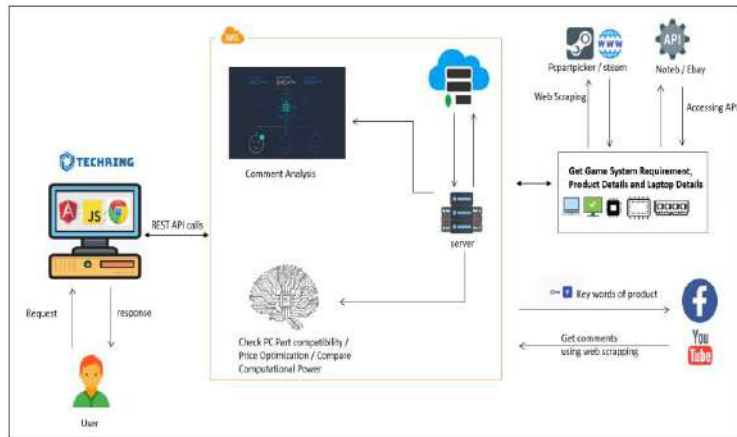


Figure 6 - High level architectural diagram

D. Implementation / Code

In this phase authors need to perform two key activities. That is data retrieval and application of the codes. In this study, the authors use web scraping to conduct data retrieval. This is a process where specified data from the web is extracted based on the matching key words. These data will be then extracted and copied to a central database for analysis. Most of the data will extract real-time. This is used because the data samples we use constantly get updated. E.g. Comments: New comments will be posted, Arrival of new games with new specifications. Since the authors need to extract comments from Facebook, they need to access Facebook first. Thus the access is gained using a Graph API. Later these extracted data needs to be cleansed before analyzing. That is the noise should be removed from the extracted data set. Python libraries are used for the cleaning process. Basically cleaning process is will result in having a database with the most relevant information.

E. Verification / Testing

In this phase author needs to verify that the platform is capable of catering to the user requirements. Thus a user acceptance test is to be conducted. In here authors plan to verify that their functions work properly and users are compelled to use this platform again in the future. For this purpose sample of potential users covering the age base of 10 -50 years will be used. 50% of the participants are to be selected from the respondents of the online questionnaire.

F. Maintenance

Maintenance is the last phase of the Agile Life cycle. In this phase, the authors need to have a plan to maintain the system

once it is deployed. They always need to be alert of what is happening around the world and also in the environment they deal with. They need to be alert of the price updates done by the local vendors. Authors need to keep in touch with their local vendors to check whether there is any price update that they failed to inform. In case there is a change that needs to be done to the design of the platform they need to be done without affecting the data analyzing and scraping process. Furthermore, if there any new updates from the gaming industry constantly keep checkups whether the platform is capable of tracking these new arrivals and it is capable to cater to these new arrivals. If there are new techniques to retrieve data in a much more efficient manner, necessary amendments need to be taken to adapt to these new technologies. These changes done should not affect the smooth functioning of the platform. In case there is an error, authors needs to reanalyze the system algorithms and data retrieval methods. Then arrange quick solutions to the problems.

VI.RESULTS & DISCUSSION

This research will be highly beneficial for all most all the industries prevailing in society. Because PC and Laptops are vital components in every industry. Depending on the requirements people either tend to purchase a preset computer or assembly their PCs, by themselves. PC assembling is a common practice, especially in the Gaming Industry. Even though the Gaming industry was for mere entertainment purpose, nowadays it is one of the highest profit earning industries. More than 60percnt of the population around the world are gamers. By analyzing the online articles, blogs, and video it was evident most of the gamers assemble their PCs' by purchasing parts based on the gaming requirement. As mentioned earlier it is now the games who demand specifications from PCs' of the gamers need to play the games. Apart from PCs' since we focus on the laptops, people find it confusing when they need to find the ideal laptop for their purpose. Because day by day new versions, models are introduced to society. Thus finding what is best for the users is complicating. Considering the above-mentioned aspects of the final outcome of this research is designed. That is the final output is an online assistant which will assist any user in finding the best hardware solution for them. This will be a web-based application which goes by the name "TechRing".

Basically, this platform will consist of two components. That is frontend and backend. Services provided by the platform is categorized into four key areas and detailed overview of these four areas in a functional perspective is given in the Methodology section.

There are similar platforms like "TechRing". But these platforms only cater to only one hardware perspective. Before the development of this platform, authors conducted a study on the functioning of the prevailing platforms. Authors' consideration mainly focused on three such platforms which either cater for PC part requirement or Laptop. The main aspect that "TechRing" stand out from the prevailing aspects

is it provides three unique aspects that none of the considered platforms provide. One aspect is the special attention given to gamers. Where users provide assembling sequences customized according to the games. Base on the game that the user enters to the platform, the required hardware specifications will be displayed. This will save the time where users have to search and find the parts. Moreover, through the observations and surveys authors conducted it was clear that not all gamers are technical experts. They find it hard to assemble the PCs' by themselves according to the gaming requirements. Thus this platform will provide solution for this aspect. Since the parts that are mentioned in the sequence is already available with the same platform users can find the outlets who sell these product for the best price. Thus the PC assembly requirements will be solved from just one platform. Since sequence will be displayed in an easy clear manner any user with average technical knowledge will easily understand the sequences.

Most of the available sites either allow the people to post their comments on the site or they will display the comments as it is extracted from a social media platform. One of the prominent aspects customers look in before purchasing a product is to look into the customer comments. But most of the time people do not have time spend on reading these comments in order to get an idea. Thus they will just skim through the most relevant comments and get an idea. Another problem that is faced is the language barrier. People find it difficult to find the comments from the language they are familiar with. Thus "TechRing" have implemented a common language to overcome these problems. That is the use of graphical representation. It provides the customer comment overview at once. Thus this saves the time plus people need not have sound knowledge about the languages. Since "TechRing" will analyse the comments and do the needful. This will be an efficient and effective method for both users and implementers. The reliability of the analysis is guaranteed since the comments will be extracted from the most famous social media platforms and reliability will be emphasized by displaying the most descriptive comments in the interfaces if users prefer a detailed overview. This whole process will be achieved using Neural Networks along with expert systems and also by using the NLP tool kit. The graphical representation will help the users to make quick decisions as to purchase or not. In an industrial perspective, this will be highly beneficial since they need to make quick yet accurate decisions when it comes to bulk purchases.

There are many online platforms for laptops. There are sites where they allow the users to conduct comparisons among two laptops. Yet none of these platforms recommend which of the two selected item is the best. Authors have looked into these aspects and designed "TechRing" for this purpose as well. Most of the laptops comparisons are conducted superficially. But this will conduct the analysis using both superficial features and also non-superficial features. Thus the users need to spend hours searching the best laptops by watching YouTube videos done on product reviews. Because once you

enter the products that you need to compare "TechRing" will compare and recommend the Best from the two. Also to build faith in customers comparison result on each product will also be displayed. To accomplish this task special algorithms are designed especially for this using Python and Expert Systems techniques.

Accordingly considering the above facts the uniqueness of the platform is built. In addition to this, there are other features where the users are provided with ample product and vendor solutions to select with. All the products are displayed in accordance with the grade they are given from the algorithms designed. Moreover another feature the authors prefer to highlight is that user is given sequences algorithms not only based on their technical requirements but also based on their budget requirements.

One of the most common platforms for customer feedback is Facebook. But the authors have selected the Youtube platform due to the hardships they faced in accessing Facebook to extract comments. Facebook comment analysis could not be conducted due to their current security regulations. As per their new rules, they have limited access for their data by a third party software. Because Facebook has taken measures to protect the privacy of Facebook users.

Thus "TechRing" will be the ideal solution for any person who is looking for a hardware component. Authors guarantee the reliability and accuracy of the recommendations given by this platform. Efficiency and effectiveness will be achieved with the use of the algorithms used and designed. Each function is designed based on the users' requirements. The front end is designed in a way where any person who has access to the internet and who is comfortable in the use of the internet can find what they want from a few clicks. Eye-catching and friendly interfaces are designed in order to attract new customers along with the motive keep the existing customers attracted to our services. All these described functionalities are proven to be capable of satisfying the user needs that are mentioned by the authors previously.

III. CONCLUSION AND FUTURE WORK

This research paper contains a detailed overview of the online assistant that is developed. This is an artificial intelligence-based PC parts and Laptop recommending assistant. This platform currently capable of catering to hardware suggestions (PC parts) to the customers based on their gaming requirements and budget limitations. When the user enters the game this platform will generate the build sequence required. The accuracy of this result is proven since the gaming specifications are extracted from a very reliable gaming website. These sequences will be generated by considering their compatibilities of one another. Thus the assembling process will satisfy the gaming need and the assembling procedure as well. Another aspect that is overlooked is the users are allowed to have a choice in a purchase. Since for

each product, multiple vendors with their prices will be displayed. Thus this also gives an opportunity for local vendors to compete with the global market and also local vendors are given the opportunity to reach the customers breaking the geographical barriers. As another aspect users look in before purchasing is the previous customer experiences when the brand or the version is not familiar. This platform gives an analyzed customer overview in a rating format since the users can have an idea at a glance. In order to satisfy the customers need to have a detailed idea of the customer experiences, a few of the most related comments will be displayed below each product. In suggesting the products, they will be arranged by considering both the price and the results of customer ratings. Apart from that laptop comparison helps the users to figure out differences between two laptop versions and recommend the better of the compared two.

In future development is expected to further customize the build sequences based on the soft wares used and editing purposes. So that the customer base will consist of a variety. Currently, comments from Youtube is utilized. Later on, to generate the rating customer reviews from other social media such as Instagram, Twitter, etc. is expected to be utilized. For advanced analysis, it is planned to generate overviews based on the blogs as well. In the future, it is anticipated to provide the facility have multiple laptop comparison simultaneously. Also to recommend laptops based on user requirements customized based on the gaming, software or editing needs.

Apart from the functionality development "TechRing" possess a long term goal. Currently, the platform's focus is on the local market. But with time and increased publicity, the authors plan to expand themselves to the global market by onboarding the foreign outlets for this platform. Through such approach, "TechRing" will be capable of being a customized service provider around the world for anyone who is looking for PC parts or a Laptop.

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