Artificial Intelligence based personal computer parts and laptops recommeneding assistant

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Abstract **– One of the main issues faced by both PC and laptop users is difficulty in finding the ideal hardware component matching their needs because there are a number of manufacturers in this sector. Most of the hardware components are not compatible with each other. Therefore, people find it difficult to assemble PCs due to the compatibility issues. Another aspect is, the same product available in different vendors can have different prices. People consider the price factor, when purchasing a PC part and most commonly they don't go with most expensive products. Apart from that, past user experiences are more important when finding a PC part or a laptop. Another problem people have is how to find a good laptop. Laptop comparison should be there in order to decide which laptop is the best. Mostly people consider the performance of each version or brand of laptops. Thus, having an assistant to provide guidance before purchasing a hardware component is important. Thereby, this research paper is discussing about a web-based online assistant designed to look into the PC and laptop needs of people before purchasing and providing them with suitable recommendations.**

Keywords**:** ***Computer assembly, Computer parts, Price Comparison, Web scraping, Computer games, Expert system, neural networks, Price optimization, Comparison, Sentiment Analysis, Laptop Comparison***

I. INTRODUCTION

Most of the professional gamers in the gaming industry have their PCs which are customized game-wise. Because most of the games (Especially the professional games) demand specifications if the games needed to be played with maximum performance. Nowadays, one of the most challenging aspects is assembling the PC by ourselves [1]. Because there are many limitations and barriers people have to face when assembling PCs by themselves. Firstly, they need to know the specifications and what match the specifications. Mostly, there are limited sources to identify the specifications. Secondly, limited technical knowledge [2]. Because most of the gamers will be of age starting from 15 years. Thus, having knowledge of compatibility will be not that advance. Another common limitation people face is the budget limitation. Finding the matching parts for a reasonable price. Finally, most of the buyers prefer looking into previous customer experiences before purchasing [4]. They consider this as a benchmark for the quality. For example, people will not purchase a product that has bad reviews even if the product matches their requirements and the budget. Thereby, people need a platform which will overcome all the above-mentioned limitations.

If you look deep into these problems the solutions are already available in the internet. But these data or information is dispersed and not processed. Therefore, in "TechRing", brings all these dispersed data under one platform and process these

data into useful solutions. If users have a platform to analyze the gaming specifications based on their game preference and build a sequence to generate a compatible PC parts plan, the burden of finding the parts are lifted from the gamers or users having limited technical knowledge and this will also save the time they spent on researching about the parts [2]. There are many open sources where users can post their comments or experiences of the products. But these views are everywhere. This platform will bring these views into one place and analyze them for the users. Thereby, they just need to visit the platform and summarized overview of the user experiences [4]

will be available. As the current target is the local market, authors need to consider about the budget limitations of the community and most people prefer going for the lowest price. Thus, the platform is designed to provide multiple local vendor options to each product with their listed prices. This will provide the users to have a choice in selecting a vendor from the available options.

This platform is designed to assist in finding the ideal laptop for the user. Because there are many laptop versions and brands available and each laptop models have their unique specifications [3]. A person with average technical knowledge might find it difficult to understand certain technical aspects. Thereby this platform is designed to conduct a deep analysis of Laptop specifications. From such approach, authors tend to give the users an idea about the computational power of each laptop version. Because the computational power of the laptops is considered as one of the main aspects a person needs to check before purchasing a laptop [3]. Many factors determine the computational power of a laptop. "TechRing" is designed to analyze these aspects for the consumer.

Basically, “TechRing” is a one-stop solution for hardware needs of people and “TechRing” is focusing on making the right choice for you.

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 the requirements. It also needs to satisfy the compatibility of other components. Thus, automating such functions is risky and complex. This platform is designed to find the best product. In here the authors consider “Best” as the most budget-friendly option with the best quality. To achieve this expected automation, there are several concepts and theories used in previous researches.

A software application that is similar to the functions of “TechRing” was founded in the year 1978. This was a program designed by John P. McDermottof CMU. The main task of this system was to assist the ordering of DEC’S VAX computer systems. This application has automated the computer components election based on customer requirements. System was written in OPS5 and was a production rule-based system. This system was not a successful project since the platform required the human intervention for the sales role and sale people failed to answer the critical and technical questions that were asked by the customers. A successful version of XCON was XSEL. This was able to overcome the failure factors of XCON. This has used the algorithm and Expert Systems to analyze the consumer needs and configure the VAX that is required [7].
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 highly efficient.

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 researchers have conducted on this area and they have developed similar services providing platforms. Authors observed that these platforms have their own limitations and none of the platforms cover all the functionalities that a customer is looking for before purchasing a hardware component.

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 users 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 recommendation. 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

Research Methodology

For the research methodology "Agile: software development approach is utilized. Since this iterative approach is of less risk and easy to embed the changes based on the variations [17].

V.ANALYSIS AND DESIGN APPLICATION

A. Requirement Gathering and Analysis Result

Firstly, an online questionnaire survey was held to understand the target audience and their requirements. This questionnaire consisted of two sections such as, for PC users and Laptop users. Based on the category they selected, the details are gathered. There were 91 respondents' age ranging from 10 to 60 yrs. Results were analyzed and grouped as below.

- The limitation faced in assembling a PC.
- Feature customers look in before purchasing a laptop. Peoples' interest in analyzing social media comments before a purchase.
- Percentage of people for assembling a PC according to the game

B. Design

The system design of "TechRing" is a web-based architecture and ninety percent of the data that is utilized is real-time extracted. The site and the desired functions will be hosted by a web server. There are four main key areas in this research. These four areas will be providing four different solutions and all these functions cater to one main objective. That is help user to find the ideal hardware component for themselves. Four areas are,

- Customized PC parts Assembly Sequence.
- Price optimization and comparison.
- Product Feedback analysis.
- Laptop Comparison.

a. Customized PC Part Assembly Sequence.

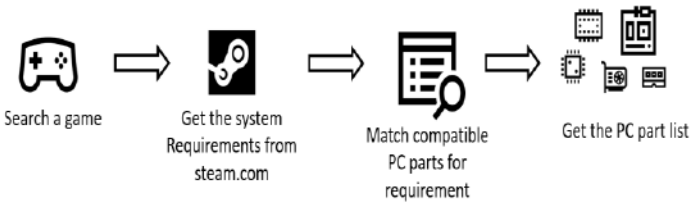

Figure 1 – Assembly sequence

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 will 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 to satisfy user requirements, rule base algorithm with point mechanism is used. 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 be checked. 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.

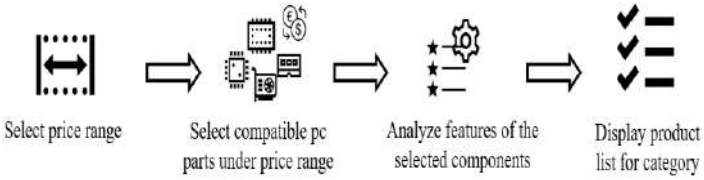

Figure 2 – Build PC for customer budget

Price optimization focuses on providing the best product for customer requirement [11]. What price optimization main concern is to find what the best option is? This 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. For that, rule based and decision tree based algorithms are used. Each and every feature contains a certain amount of points and those features are different from product to product [6]. 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 scraped using scripts and saved 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 tallies with price customer is looking, a notification will be sent via an email to the customer.

c. Product Feedback Analysis.

Figure 3 – 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 [13]. Considering this, 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 in this application, 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 and to extract the comments that are related to the product. 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.

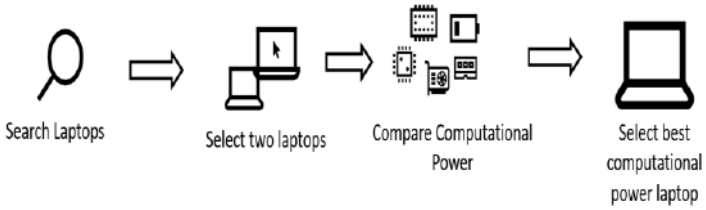

Figure 4 – laptops comparison

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 are 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.

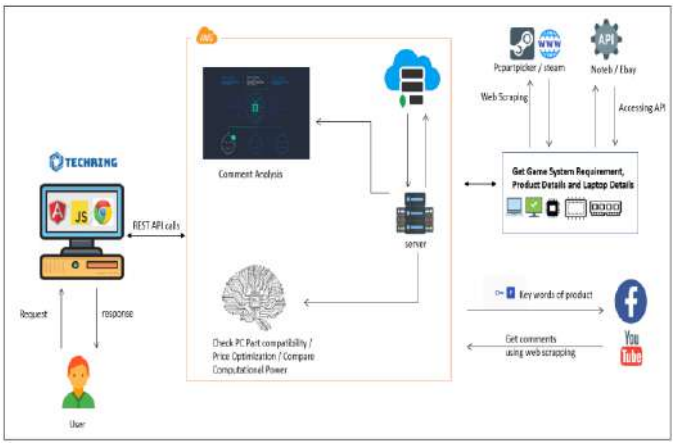

Figure 5 - *High level architectural diagram*

C. *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 keywords. These data will be then extracted and copied to a central database for analysis. Most of the data will be extracted real-time. This is used because the data samples we use constantly get updated. Later these extracted data need 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.

VI.RESULTS & DISCUSSION

For the testing purpose, we used three sets of groups. They are,

- Consumers (Gamers /Non-gamers)
- Vendors.
- Experts (Hardware components and Gamers)

For the consumer category, the age group extended from 15 to 60 yrs. Because that was the target audience and for the experts, authors used people who are more than one year of experience in this industry.

After the testing phase, analyzed the results based on the above-categorized users. Considering the consumers, authors analyzed the way they navigate in our platform. Their results were based on the

- Ease of finding required hardware component.
- Time spent by each to find what they need.
- Attractiveness of the platform.
- Satisfaction level.

Then from the vendors' perspective, authors wanted to know their opinions and suggestions when it comes to displaying their prices and products in our platform. In here, information on how they want the details to be displayed, price negotiations, benefits they will receive and the benefits they expected were gathered.

From the experts, authors gathered details about the compatibility of the parts. Especially authors considered their opinions on the results and the accuracy of these details from their knowledge perspective. For this category, gaming experts and also local hardware vendor dealer who have expertise in this area were engaged.

After conducting the user acceptance, performance testing was conducted. In this, authors measured the meantime that was used by this platform in generating the expected results. Below is a tabular representation of time consumed in the extraction and analyzing the gaming specifications.

Game Name	Time Taken (Seconds)
Far Cry 5	130
Need For Speed	145
Call of Duty	130

Time taking for comment analysis vary with the number of comments that needs to be extracted. It will take an average time of 123 seconds to extract set of comments ranging from 100 to 1000.

No. of Comments	Time Taken (Seconds)
150	64
500	125
700	180

Due to the fact that the authors have used rule based algorithms, they checked the accuracy level using the existing records and also with the expert knowledge. Thereby, the algorithm used to generate the PC part sequence shows an accuracy level of 82%. To get the best product from each category, again the authors have used the same rule-based algorithm which gives 82 percent accurate results. When browsing PC parts, the system gives the better products first in the database. That algorithm approximately gives 85 percent accurate results.

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 compatible parts. Thus, the assembling process will satisfy the gaming needs 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 user 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 software used and editing purposes. So that the customer base will consist of a variety. Currently, comments from You tube 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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