

Nice PC Maker: An Online Interface to build Custom PCs

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Abstract

A custom-built PC is assembled to cater to a specific user's needs. Internationally, there are many e-stores available for users which offer them to build and order their systems as per their needs. In, 2020, Pakistan observed a covid-19 lockdown, and most international shipments are canceled due to the pandemic. This real-world situation highlighted the deficiency of the local market to fulfill the demands of custom-built PC users. In this paper, we propose and design a generic architecture of an e-store (Nice PC Maker (NPM)) to facilitate users with custom-built PC options along with other added features such as pre-build system purchasing and PC components purchasing. WooCommerce product builders (WordPress) are used to implement the architectural design. We also configured this generic architecture for a local client which helps them to increase their business and facilitates users to get their desired systems.

Keywords—custom-built PC, online PC build, PC configuration, system builder, WordPress.

1. Introduction

PC configuration is the process where components of a PC such as a processor, motherboard, GPU, RAM, ROM, power supply unit, and Case, are assembled into a working system. This process is an assembly area of the system build [1]. A PC can be assembled using different configuration methods, i.e., pre-build, self-assembled, and custom-build.

Pre-build PCs are systems that are already assembled and configured. They are assembled by using an authenticated, reliable, and balanced hardware configuration. Big organizations like Dell and HP produced them to cater to market needs. To configure a self-assembled PC, users buy PC components individually and assemble them into a working unit. These components are easily available in markets but the user needs computing skills to buy the compatible components. A custom-built PC is assembled to cater to a specific user need. These systems can be cost-effective or costly depending on the user's PC configuration requirements. If a user configures a high configuration for gaming, then definitely he needs to add a supportive graphic card which

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increases the configuration cost. Custom PC Builds always offer customization/Modification options to users so they can build the PCs according to their needs [2].

To purchase pre-built PCs, users don't need too much expertise they just need to go to an authenticated system vendor (local or international via shop or e-store) to buy their desired systems. Users have to face issues in the case of self-assembled and custom-built PC because there is no local e-store available to fulfill the local market needs. The lack of a locally available one-stop computer center or web portal prompts issues for the users of self and custom build PCs [3]. To cater to the needs of these users there is a dire need for a locally available e-store solution that can facilitate users in configuring the systems as per their needs.

Internationally, there are many portals available for users which offer them to build their systems as per their needs but most of them limit their custom-build functionality to their local users only (discussed in the next section). Moreover, custom-build functionality is available to international users and adds features such as payment issues, credit card availability, increased shipment cost, custom duty, and late delivery time. This absence of e-stores to custom-build PC also reduces the business of local vendors who offer the same system at a competent cost due to the less shipment charges.

The need for a locally available e-store equipped with a custom-built PC option highlighted the high intensity in the days of lockdown due to covid-19 when most international shipments are canceled due to the pandemic.

This real-world scenario of the unavailability of the custom-built PC motivated us to study and design a solution to cater to the needs of local computer vendors and users. To the best of our knowledge, there is no local website or portal available to fully support the custom-built PC. Some local portals are available with limited and specific functions such as custom-built PC for the game only (detailed in the Literature Review section)

In this paper, we propose and design an e-store to facilitate users with a custom-built PC option along with other added features such as pre-build system purchasing and PC components purchasing. We named this e-store Nice PC Maker (NPM). We designed a generic architecture that can be used by any computer vendor who is interested in a custom-built PC. WordPress and WooCommerce product builders are used to implement the design [4]. We mapped this generic architecture for our local client with medium scaled business. This solution helps the vendor to increase their business and facilitates users to get their cost-effective custom-built systems in time. We also acquired the user's feedback to analyze the acceptability of the NPM to the market. The positive feedback from the market motivates us to work on more local market problems in the future.

This paper is organized as follows. In Section 2, a background study is presented. Section 3 describes the literature review. In Section 4, we discuss the motivation and research objectives. Section 5 presents the architecture and design of the proposed solution. Section 6 presents a working example along with the evaluation protocol. Finally, we conclude our work in Section 7.

2. Background

2.1 Personal Computer (PC) builder

A Personal Computer (PC) can build in three different ways, i.e., pre-build, self-assembled, and custom build. Pre-build PCs are systems where all the components of PCs are already assembled or already configured for users. Here, Customization is not available. This type of PC build requires no expertise of the user because users simply go to market and buy a pre-build PC [2]. Pre-built PCs are manufactured by using reliable and balanced hardware configuration. These PCs are produced by well-known organizations such as Dell and HP. These PCs are usually available in stores and they are designed to be ready to use right out of the box.

For self-assembled PC, users buy PC components individually and self-assemble the components in a PC [2]. PC components are easily available in computer markets so self-assembled PC users just go to the markets and buy their desired computer components.

A custom-built PC is customized to meet specific consumer needs. It can be costly or cheaper depending on the user's needs. If a user builds a high configuration for gaming then definitely the user needs to add a graphics card which increases the PC cost. Custom PC Builds are always available with customization/Modification options so users can build the PCs according to their needs. For instance, if a user's preference is gaming, then he would customize the PC according to the requirement of the gaming machine. Similarly, if a user needs 3d rendering or video editing then he would customize the PC accordingly.

2.2 WordPress

WordPress is a software program designed for everyone, emphasizing accessibility, performance, security, and ease of use. It is high-quality software that needs minimal setup. The simple WordPress software program is simple and predictable so one can without problems get started. It additionally affords effective elements and agrees with democratizing publishing and the freedom that comes with open source. WordPress contributors work around the globe and have committed endless hours to constructing a device that democratizes publishing [5]. Some of the WordPress plugins are as follows [4]:

- Elementor: The Elementor Website Builder has a drag and drops web page builder, pixel-best design, cellular responsive editing, and more.
- WooCommerce Product Builder Premium: It helps to increase income by Building product

configuration for an online store. It also aids in constructing an entire product from small aspects.

- Starter Templates: Starter Templates is all in one answers for whole starter sites, single-page templates, blocks & photos.
- UpdraftPlus - Backup/Restore: It facilitates backup and restore. It takes backups locally, or backups to Amazon S3, Dropbox, Google Drive, Rackspace, FTP, WebDAV & email, on automated schedules.
- WooCommerce: An eCommerce toolkit that helps to promote anything.
- WooCommerce Cart Abandonment Recovery: It is used to recover your misplaced revenue and captures the electronic mail tackle of customers on the checkout web page and ships follow-up emails.
- WPForms Lite: It is a Beginner-friendly WordPress contact structure plugin. It uses Drag & Drops shape builder to create the WordPress varieties.

3. Literature Review

In this section, we discuss the state-of-the-art related to our research domain, i.e., custom build PC.

Singapore is developing very fast in information technology and so many people are not able to configure and build their personal computers. It is a major real-life problem. The solution to this major issue that the people of Singapore are facing is to propose a flexible and systematic framework in which we can integrate any search method for solving this difficult and real-world optimization problem. The major advantage of making such useful frameworks is that now users can flexibly add or modify their requirements at any time [6].

In [3], lacking one-stop mobile or website applications is highlighted. Issues that are faced by people in configuring their desired PC within their available budget are discussed in detail. Authors also advocate the development of such websites and mobile applications to provide users the flexibility to configure their desired PC with the compatible components of their choice. They also discuss the benefits of custom-built PC such as time-saving, high user interaction, and cost-effectiveness. In [7], the authors discuss the importance of a standard data model for PC configuration management and proposed a model to solve the problem. A need for a collaborative PDM (Product Development System) is explained in the context of a grid of systems to support the sharing of logistic data among engineers. A working prototype is also developed and tested which is compliant with ISO standards, i.e., ISO10007.

Similar to [7], [8] also highlight the importance of a standard data model for computer and electronic components which is controlled by a remote PC station. The case study of an undergraduate lab of the University of West Indies is used to explain the need for and lacking self-configured tools for the staff of CS and electronics departments. Authors, motivate the use of such automated and self-configured tools to reduce the intervention of third-party vendors. Efficient configuration

of PCs is also a potential research domain, [9] discusses and forces the introduction of new and innovative technologies to improve the overall complexity of the PC configuration process. The authors discuss the use of a modular structure which is established with a generic module to configure a PC. A model of the PC product family is generated along with the generic attributes. PC is configured from this generic model as per the given requirements of the user. This research work also avoids the configuration of PCs that are invalid or inconsistent (components with no compatibility) and promotes efficiency in the PC configuration process by introducing a self-configuration mechanism.

Similar to [9], [10] also promotes the use of innovative and new technologies to modify and configure a PC component, i.e., CPU (Central Processing Unit). The need for CPU modification is highlighted to improve work efficiency. The authors also advocate the use of automation to prevent delays in the CPU configurations.

Due to the industrial and practical nature of custom-built PC, many computer vendors are using applications/websites to facilitate their clients. The selected web-based and mobile-based works are discussed to highlight the importance of custom-built PCs. In [11], a website is designed to offer different types of pre-built PCs. This website allows users to change or customize system components as per their needs in the build. It also categorizes the PC builds as per the different minds of users. For example, Budget home/office building, basic gaming build, AMD builds, Intel builds, etc. In [12], the website offers two types of categories in the PC build section, i.e., create now and buy gaming PC. Create now button/ page offers users to make a custom machine as per their needs. The buy now button/page offers a pre-build PC for the user. It also offers/sells laptops.

In [13], website offers the same functionality ([12]). Peripheral selections/browsing product is different on this website, users can choose separate products one by one. In [14], the website has three sections, i.e., Devices, Custom Rigs, and Game Booster. On the devices page, a custom PC build type is available. When users fill these spaces, the website shows predicted PCs in the right section, this feature is good for users and helps them to ease the customization. Custom Rigs helps users in building their machines. The game Booster tab is not functioning. In [15], a website is offered to make the dream PC. Users can select components and change components as per their needs and can also see the price of the computer. The site offers tech Gadgets, computer chairs, headphones, coolers, and gaming systems. Similarly, [16] also proposed a portal to make gaming computers and laptops for users. The site divides into 3 types of Gaming machines Intel gaming pc, AMD gaming pc, and Gaming Laptops. It also offers a pre-build pc and users can select components and change components. A local website is also designed to support the custom pc build but this is limited to games only [17]. Users can visit the website which displays a list of games to select. After the game selection, the user can select the build type to support the selected game. Similarly, [18] also caters to the needs of the local market, the architecture of this website is not user-friendly and needs functionality improvements. It only takes type to start building a

custom PC. Limited existing research work and lack of a one-stop center or website to support the custom-built PC to facilitate the local vendors and users make it a potential research domain.

4. Motivation and Research Objectives

After a detailed literature review, we found a research gap, i.e., no online portal is available to fill the needs of local customers who want PC customization from a local vendor. This research gap motivated us to propose a web interface that provides users a helping hand to build a custom PC online and also provides an opportunity to order a single component of a computer such as a motherboard, GPU, Ram, power supply, etc. We divided our main objective, i.e., custom PC build, into the following sub-objectives:

- Display only compatible components when users start building a PC.
- Display only compatible components when users search for other components after selecting a component.
- Managing the building of a custom PC by adding all supportive features such as user login, storing information, and payment management.
- Show complete information on every computer component to help users in understanding the build process.

The proposed solution can be beneficial for the users and vendors of our local market. Users who want to build a custom PC or order a pre-built PC can get benefits from the solution. Similarly, vendors who want to sell pre-built PCs or custom-build PCs can employ this solution to cater to their business needs. People with less computer configuration knowledge can get more knowledge about the component's compatibility. It also helps users to update their PCs by searching for compatible components. Moreover, a user can order a single component also. Users can also visit the portal as guest users. They can view the component's compatibility and build the custom PC but they cannot place an order. For placing the order, users need registration.

5. Nice PC Maker (NPM): Results & Discussion

In this section, we discuss the results of NPM in the context of architecture & design. The web interface is based on the functionalities offered to users with different roles and responsibilities.

Figure 1 shows an abstract-level architectural view of NPM. It depicts the frontend and backend processes. The backend includes web access and web hosting components while the front shows the different types of functionalities which can be accessed by different users.

The main page is the home page which contains the system builder, search bar, accessories, social media link, about us, and account setup links. Admin has full control of the portal to manage the offered functionalities. He can add/update/delete products. Registered users can view products

and prices. They can build custom PCs online and place orders. Guest users can view products and prices and also build custom PCs online but cannot place orders. Our portal's primary function is to provide users with the functionality of online PC build and delivery of their ordered customized PC. We offer home-based delivery to our customers for safety during covid-19. Figure 2 shows the interaction of different users with NPM.

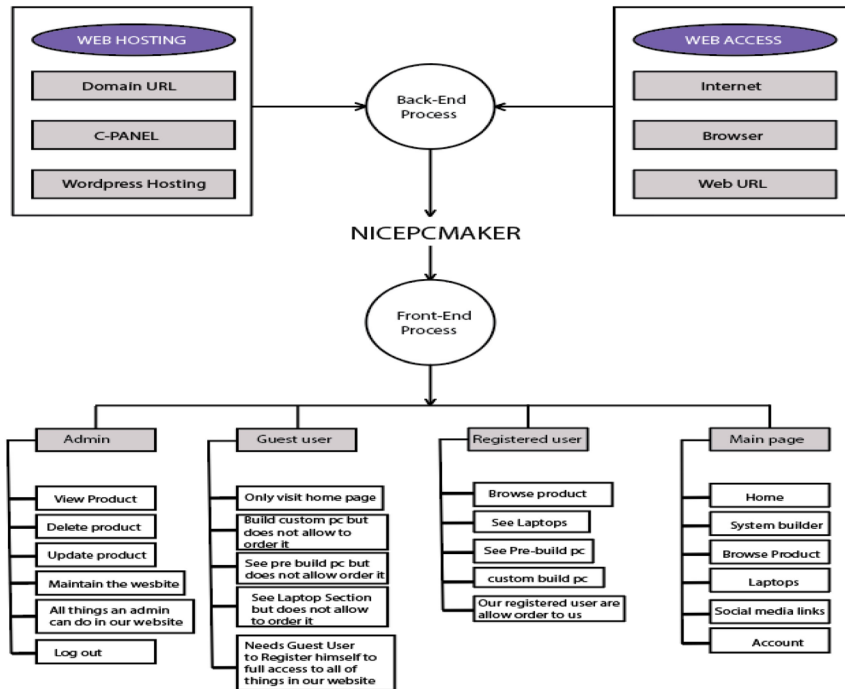


Fig. (1). An Abstract Level Architectural View of NPM

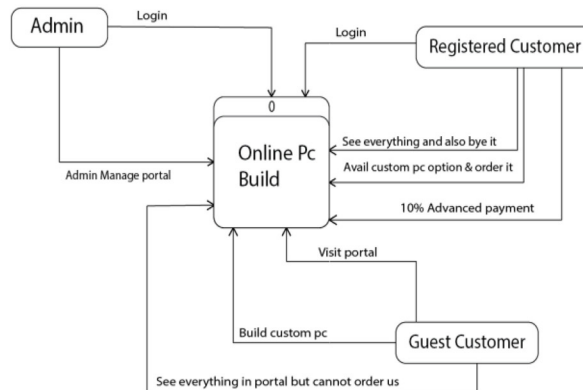


Figure 2: Interaction of different users with NPM

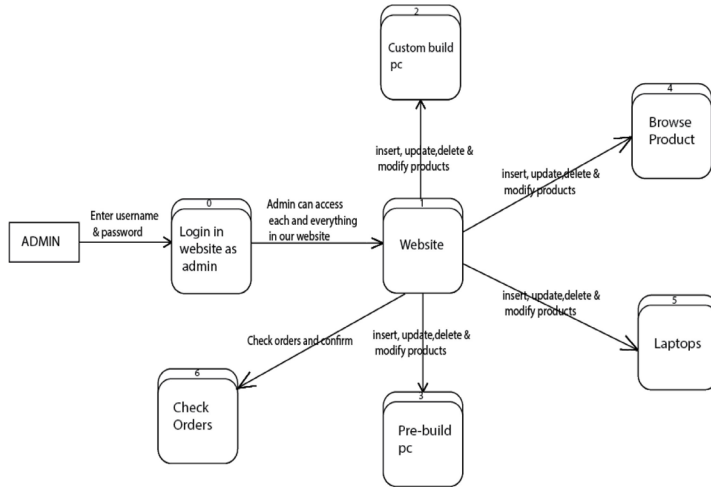


Figure 3: Flow Diagram of Admin

Figure 3 depicts the detailed working flow of the admin. He categorizes products into relevant categories. Admin can check the details of the order in the WordPress database and communicate with the user regarding confirmation/rejection of the order. He manages the portal by using a master password. He can change, update and delete products. Moreover, he controls financial matters such as product pricing and order invoice.

Figure 4 shows the detailed workflow of a guest user. Guest users can access the interface, moreover, they can build a pc online and check the pricing of their built PC but cannot make an order. To order any products, guest users have to register with the system. They can also browse products along with the price and compatibility details.

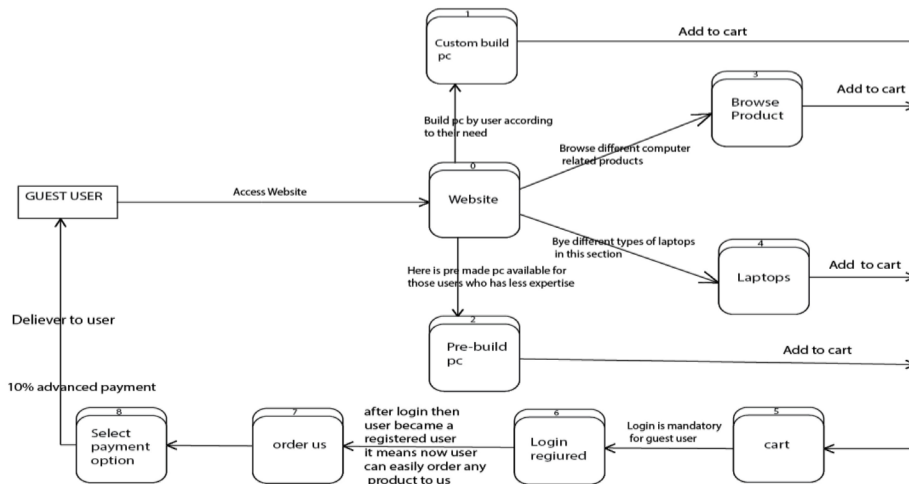


Figure 4: Flow Diagram of a Guest User

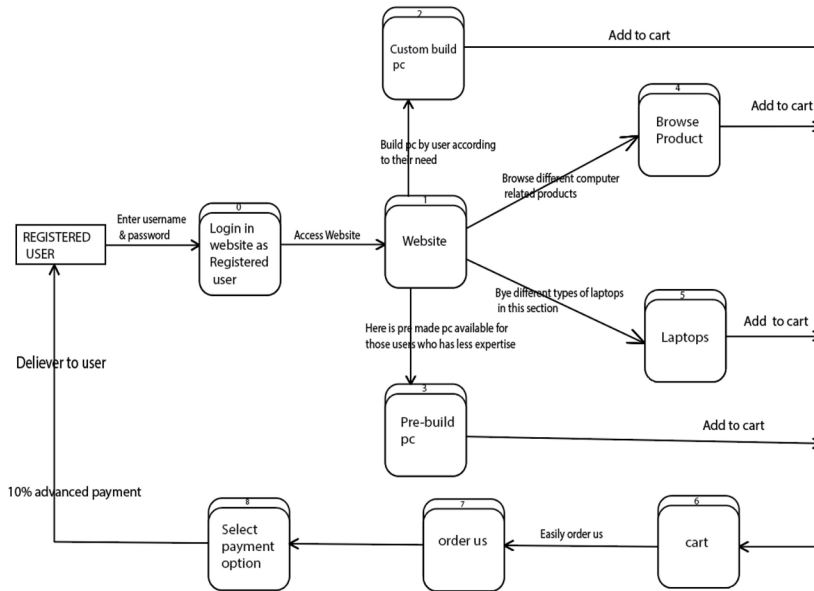


Figure 5: Flow Diagram of a Registered User

Figure 5 depicts the flow of a registered user. Registered users can access a website and browse products along with their compatibility details and price. Registered users can build pc online and can make an order for their built PC. If a registered user has less expertise about PCs, then he can use the option of rebuilding a PC. This user can also order a single component of a computer. First. They have to add an item to the cart and then select the payment options. Users have to pay 10% of their total amount of products in advance to confirm the order.

6. A WORKING EXAMPLE AND EVALUATION OF A NICE PC MAKER

In this section, we present a working example of a Nice PC maker by explaining the actual interfaces of the portal.

- HOME PAGE: Fig. 6 presents the interface of the home page. It contains some labels in the menu bar like home, system builders, all products, laptops, and accounts. On click, these labels redirect users to different pages.

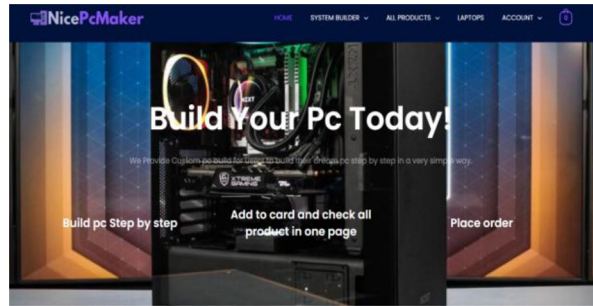


Figure 6: Home Page of NPM

- **SIGNUP OR LOGIN PAGE:** When a user wants to register on our site, he will click on the Account label (My Account) in the menu bar. A login page will be opened with two options, i.e., Register or Login. For registration, the user enters his id and a valid email address, a system-generated password is sent to the user using the given email address. Login is possible after registration. The user simply enters a valid username and password for a successful login. Figure 7 depicts the registration/login interfaces.

Figure 7: Registration & login Interfaces

- **USER DASHBOARD:** After a successful login user will be able to see his/her dashboard. Users can view recent orders, manage their shipping and billing addresses, and edit their password and account details using the dashboard. Moreover, users can also manage the dashboard, order components, and can build and order the custom pc (Figure 8).

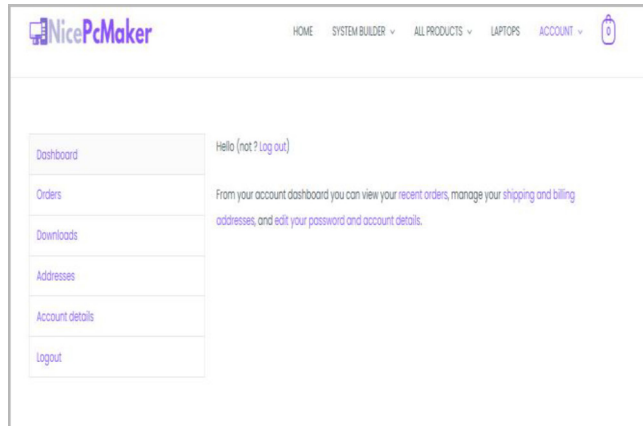


Figure 8: User Dashboard

- **PRE-BUILD PC:** Users can view the pre-built PCs using this interface. All available systems and laptops will be listed here along with their price and components details. Users can order a pre-build system(s) and initiate the payment and delivery details (Figure 9).

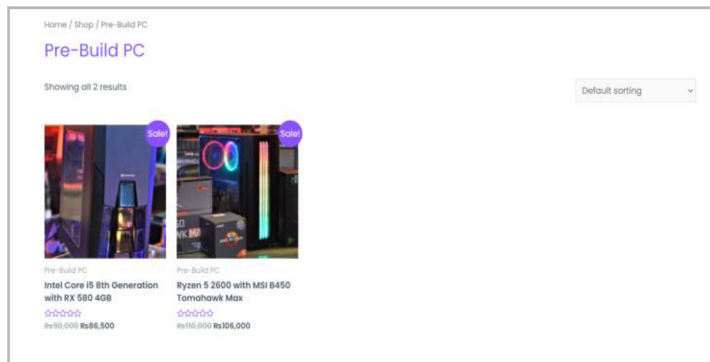


Figure 9: Pre-Build pc page

- **CUSTOM PC BUILD:** This interface facilitates users to build their custom PC by selecting compatible components. User can start the system building by picking any specific component, after the selection of a component only compatible components of the selected is shown to avoid any system configuration errors. Users can select the components such as CPU, Motherboard, and Ram. Storage Device, Graphic Card, Power Supply, and Casing type (Figure 10).

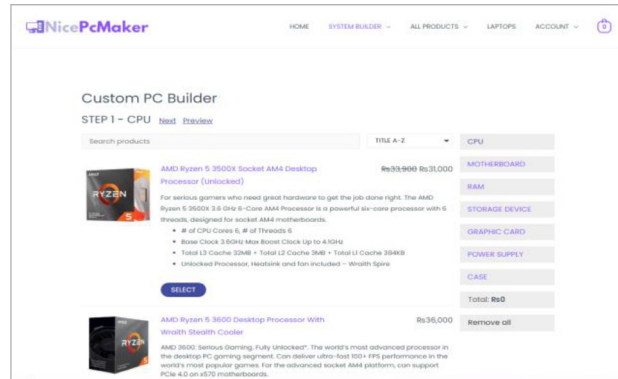


Figure 10: Custom Pc Build

- **CART:** The cart interface shows the details of all components which are added by the user for purchasing (Figure 11).

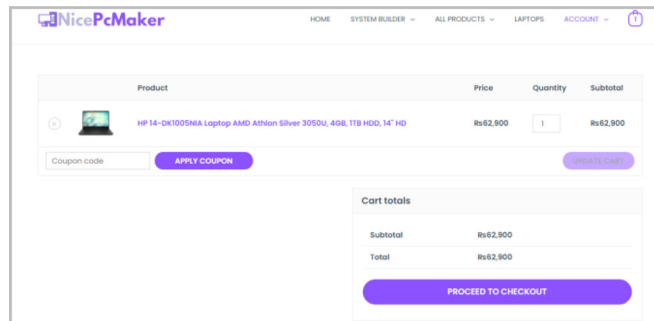


Figure11: Cart

- **CHECKOUT:** For ordering the PC or any component user needs to fill out the form available on this checkout page (Fig 12). There are many fields on this page name, address, postal code, city, country, and phone number, and also show the selected product price.

Figure 12: Checkout

6.1 Nice PC Maker: An Evaluation

The primary purpose of NPM is to provide users an opportunity to build their custom pc or desired pc. To evaluate NPM, a questionnaire is designed for acquiring user feedback. The questionnaire is developed as per the standard guidelines and in the context of acceptability, usability, effectiveness, and user satisfaction [19] (Fig 13).

We designed and distributed a Google form to get feedback. The total number of participants was 40 and feedback showed that they trusted the proposed portal to cater to their need for a custom PC build. Figure 14 shows an image from the population describing the details.

To analyze the questionnaire responses, we stored the quantitative values which were taken from participants on a scale from 1 to 5 (1 shows the extremely negative and 5 represents the extremely positive response) as-it-is. For qualitative questions we used a mapping procedure to generate the number values [20], this conversion made the responses easy to analyze and plot. For positive questions such as Q1, Q2, and Q3, we simply calculated the percentage. For negative questions such as Q7 and Q8, we calculated the percentage and subtract the value from 100 to obtain positive feedback. We used this sentiment change to analyze and plot all given questions from the same sentiment perspective.

Table 1 shows the results of the questionnaire responses. On average, Q11 obtained the highest positive response which means users liked NPM and were interested in recommending it to others. Q6 received the least positive response, i.e., 85% which means users wanted to improve the interface of NPM. Many questions such as Q2, Q3, and Q8 received full positive feedback, i.e., 5 while Q4, Q6, Q7, and Q8 received the least feedback from a user, i.e., 2. On average, all questions obtained very positive responses (>90%) which shows that NPM has useful functionalities and users are also satisfied with the working and applicability of NPM.

- Q1: Is our pricing clear?
- Q2: Custom pc build option/feature useful for you?
- Q3: Are you satisfied with our services?
- Q4: How did your experience compare to your expectations?
- Q5: Are you satisfied with our website overall performance?
- Q6: Interface of NicePcMaker is interactive?
- Q7: Are you having trouble finding anything?
- Q8: Is there anything missing on the website?
- Q9: How easy was it to use our website?
- Q10: Did you have any problem to use our website?
- Q11: Are you recommending other people to use our website?
- Q12: Give us a rating?

Figure 13: Questionnaire to evaluate NPM

S/Ns	Customer Name	Is your problem solved?	Custom pc build website features made for you?	Are you satisfied with our website?	How did your experience compare to your expectations?	Are you satisfied with our website speed performance?	Interface of NicePC Maker is attractive?	Are you satisfied with product features?	Is there anything missing on the website?	How easy was it for you to use the website?	Did you recommend other people to use our website?	Are you recommended other people to use our website?	Click to a rating	Comments (optional)?
1	Samuel Okunribido	YES	YES	YES	It's OK/Good	YES	Good	NO	Nothing	Easy to use	Yes	Yes	*****	Thankyou
2	Miles Ilesanmi	YES	YES	YES	Excellent	YES	Excellent	NO	Nothing	Easy to use	Yes	Yes	*****	Will share with the experience
3	Isaiah	YES	YES	YES	1	YES	Excellent	YES	1	Easy to use	Yes	Yes	*****	
4	Adekunle Samuel	YES	YES	YES	1	YES	Good	NO	It was ok	Nothing	Yes	Yes	*****	It's a helpful platform
5	Francis Salami	YES	YES	YES	Better than I thought	YES	Good	NO	More features available at the time of checkout	Easy to use	No	Yes	****	
6	David Ilesanmi	YES	YES	YES	It's a good, but production is a month long	YES	Good	NO	No all set	Easy to use	No	Yes	****	
7	Faibial Sheriff	YES	YES	YES	Good	YES	Good	NO	No any Comment	Easy to use	No	Maybe	*****	Nice site
8	Lachman Das	YES	YES	YES	Good	YES	Good	NO	Yes slow with some transactions	Easy to use	No	Yes	*****	YES
9	Sanjay Kumar	YES	YES	YES	Good	YES	Fair	NO	There are some things to improve	Easy to use	No	Yes	*****	Good over all
10	Kashif Iqbal	YES	YES	YES			Good	NO	No	Easy to use	Maybe	*****		
11	Ramadh Kumar	YES	YES	YES	Pretty much good	YES	Excellent	NO	No	Easy to use	no	Yes	*****	Engagement slider works like problem and if engagement value lower on product usage the session rate should also (value) increase
12	Chidera Ilesanmi	YES	YES	YES	That's good	YES	Good	NO	No at all	Easy to use	Nothing bad	Yes	****	That's amazing service
13	Kamal	YES	YES	YES	Good experience	YES	Fair	NO	No	Easy to use	Nothing	Yes	****	
14	Muhammad Farooq	YES	YES	YES		YES	Good	NO	I don't think so	Easy to use	Not yet	Maybe	*****	
15	Mohamed Ali	NO	YES	YES	Good	YES	Fair	YES	Can't share how increment and decrement values with counter that user could increase and decrease quantity and also the price increment and decrement methods are not easy either due to clicking option counter	Easy to use	No	Yes	***	Need to introduce some interactive value to differentiate it from other selling apps in the market.
16	Mohammed	YES	YES	YES	Good	YES	Excellent	NO	No according to use	Easy to use	No, it's working good	Yes	*****	Good

Figure 14: An image from users' Feedback Table

Table 1: Results of Questionnaire

	Response (+)	Maximum	Minimum
Q1	88%	4	3
Q2	95%	5	4
Q3	92%	5	3
Q4	89%	4	2
Q5	93%	4	3
Q6	85%	5	2
Q7	90%	4	2
Q8	86%	5	2
Q9	95%	5	3
Q10	91%	4	3
Q11	96%	5	4
Q12	90%	4	3
Average	90.83%	4.5	2.8

7. Conclusion

Many international e-stores are available for users to build their PCs as per their needs and requirements. The ban on international flights in 2020 affected the shipments of custom PCs. The lack of any local e-stores to fulfill the user's needs made the condition worse. In this paper, a generic architecture of an e-store (NPM: Nice PC Maker) is proposed to facilitate local users

with a custom-built PC option that displays only compatible components during a configuration of a custom-built PC. NPM also provides a single component(s) order of computer parts such as GPU, Ram, power supply, etc. NPM is also equipped with supportive features such as user login, storing information, and payment management. The proposed NPM architecture fills the gap of the unavailability of custom-built PC configurations for buyers and vendors of the local market. We also implemented this generic architecture for a local client. Positive feedback in evaluation shows the successful applicability of the NPM to the local market.

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