HCI : WEB DESIGN

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***Abstract*:**

Human Computer Interaction is an area which specifically deals with how users and technology communicate with each other. The use of technology and the ease with which the user can use it is the bread and butter of this research field. Along with this, cherry on cake is the look and feel of the medium. This paper particularly focuses in the area of web development. Web development should consider good design that satisfies user interaction. However, for all users, the web application interface should not lead to difficulty and frustration. Frustration not only leads to personal dissatisfaction and inefficient use, but it can also have a negative impact on the workplace. Knowledge of Human Computer Interaction (HCI) helps developers design computing technologies that are useful, easy to use, and enjoyable.

Introduction:

The design aspect of any website is the one of the most primary and important lookouts which needs to be taken care of. The application may have the best of functionalities but is not catching the attention because of its poor interface. This paper focuses on one of the latest application software types which is progressive web application built on some of the most common and widely used technologies like HTML, CSS, Javascript etc. The application is intended to work on any platform (browser) and then any device like mobile, desktop.

PWA is something that meets all the web standards and when it comes to the enhancement, should employ all the latest web development strategies. Also, some Progressive Web Apps use an architectural approach called the App Shell Model. In this model, a service worker stores a basic user interface or "skin" of a responsive web design web application in the browser's offline cache. This model allows PWAs to remain native with or without web connectivity. It provides an early static framework, layout, or architecture that can load content progressively and dynamically, thus reducing load times.

Human-computer interaction in modern design:

The intent of the HCI design is to make the interaction between the system and the user more natural. This is an interdisciplinary field of study focused on the design of computer technology. The growth of modern user experience is a byproduct of HCI research.

Human needs and goals change rapidly over time. Fifteen years ago, mice and keyboards were the primary means of interacting with electronic devices. Interaction between the system and the user can now take place in several ways. You can leverage one or more of the human senses (touch, sight, hearing, etc.) to create a basic user interface for your application.

A UX designer can improve the user experience by using a combination of elements and design system software. HCI speaks of general improvements in functionality, usability, clarity, and reliability, as well as the increasing importance of his UX in the application experience. HCI also ties in with user experience design, user interface design, and user-centered design. As Adobe XD explains, HCI is key to exploring all kinds of information technology design because it lies at the intersection of computer science, human factors engineering, cognitive science, and psychology.

Building Blocks of Human-Computer Interaction Design

The HCI design contains four major interconnected components.

User, Goal, Interface and Context.

User:

In product design, UX designers often focus on users in the form of personas. A persona contains a group of people with a common goal and a common set of attributes, needs, and pains that influence how the ultimate goal is reached. The way humans and computers interact helps the designer uncover the mystery behind the use of application.

Goal:

Users interact with applications to accomplish their goals. UX designers should focus on factors such as the complexity of the task, how long it takes to reach the goal, and whether the user will reach the end goal.

Interface:

In human-computer interaction, media or interfaces are core components. The interface is on a PC, laptop, smartphone, or other device that accepts input. When considering user interfaces, designers should focus on elements such as application layout, navigation, input and output,

colors, icons, and other graphics.

Context:

Context describes the actual conditions under which the product or service is used. The most commonly recognized contexts are physical context, temporal context, task context, social context, and technical and informational context.

Physical context deals with spatial location, functional place and space, perceived environmental attributes, movement and mobility. Temporal context focuses on duration, time of day, before and after, and time-related actions.

Task context focuses on multitasking, interruptions, and task types. Social context focuses on personas, interpersonal behaviors, and culture.

The technical and information context focuses on other systems and services, interoperability, mixed reality, information artifacts, and access.

A user uses an application or interface in a specific context. The user has no specific time or place to view or interact with the UI. UX designers should focus on the usage of interfaces in different environments and consider interface designs that support both environmental and synthetic environments.

The relationships between HCI design components are important because the number of users of a device is unlimited. UX designers can use this opportunity to analyze interactions and create efficient, user-friendly and meaningful designs, regardless of who the user is.

HCI design principles

There are two general principles of his HCI design that UX designers should consider when designing interfaces for human-computer interaction.

Information Processing

In HCI design, information processing refers to how information is processed and how quickly it is processed.

Human Information Processing

In a study from Johns Hopkins University, researchers found that humans think like computers. The brain processes, computes, and produces results, much like the central processing system of a computer. Human output can be verbal, emotional, or physical.

humans as components

HCI design recognizes humans as a fundamental element of design. All interactions revolve around humans. A UX designer's job is to understand the human mind and design the necessary interactions through computers.

Sensing

Perception varies from user to user. HCI design helps UX designers understand these perceptions and create better interactions.

Color

Color is an important element in the design of graphical user interfaces. Color psychology of human-computer interaction is a complex field of research, and color perception is based on cultural and social factors. These factors require UX designers to pay attention when creating color palettes.

Pattern

Patterns are important to his HCI design to keep the design consistent. Patterns help create mental models of user interactions. These patterns help users navigate your application easily.

Positioning

The placement of objects on the interface is important to improve the affordability,

comprehensibility, and discoverability of interactions. UX designers should always focus on making interactions easy for users. To measure user behavior, UX designers and researchers can use two of her behavioral models:

Forecast model:
Predictive models are used to compare and evaluate motor behavior when designing interfaces and systems.
Description model:
A descriptive model is a model of human movement. They are common in HCI design and ergonomics. It helps predict how long it will take a user to move from one location to another to interact with an object.
HCI design principles help designers plan their studies accurately and effectively.
Impact of HCI design on UX
Modern user experience design has evolved through the study of HCI design methodologies. Areas such as interaction design, user-centered design, and microinteractions benefit from research to find the best ways of engagement to improve usability, functionality, and user-pleasing experience. HCI design helped influence UX design methodology. Here are four design principles influenced by HCI design:

Goal-oriented design
Goal-oriented design is fundamental to HCI design. We believe that problem solving is the most important factor in product design. Goal-oriented design focuses on making the interaction between the user and the system as smooth as possible in order to achieve the end goal.
Improved usability
Available applications create a better user experience. Ease of use allows the user to interact with the application without stress by going through core components such as application learnability, efficiency, error rate and debugging. A UX designer should be familiar with the mental model of the application. This allows you to implement human-computer interface designs that make sense for your intended user group.
Positive emotional response
HCI design helps UX designers create positive emotions through color, consistent elements, UX animations, and interactions.
People first
Product designs must be designed for the right user groups in order to create meaningful interactions between computers and humans. Personas allow UX designers to create a fun experience for their users. Emotions influence designers to create better product behavior.
The importance of HCI design is understood by many UX professionals in the digital world. We interact with many products and services every day, and the interactions designers make determine the durability of their products and services. If your solution is productive and the interactions are easy to understand, you are more likely to create a pleasant experience for your users. HCI-Design makes design accessible to everyone, regardless of mental or physical ability. A UX designer's job is to combine her best practices in user experience with user research to ensure that your designs send the right message and provide an enjoyable experience for your users.

Background:

The process of interaction design involves studying the behavior and structure of interactive systems and implementing them to develop useful digital products. In short, interaction design is the relationship between users and products and services they use.

The purpose of interaction design is to create a great user experience. As such, most UI disciplines require an understanding of interaction design principles and hands-on experience. Ultimately, it's about designing the entire networked system.
Devices, Interfaces, Contexts, Environments and People. Interaction designers strive to build meaningful relationships between people and the products and services they use. This includes computers, mobile devices, gadgets, consumer electronics, etc.

Understanding UX design best practices is important when developing complex web and mobile applications. These are important factors that product designers should not ignore when creating a user interface.

Here are the 10 most important principles of interaction design:

- **UX:**

Adjust user experience and expectations

- **Consistent design:**

Maintain consistency across your application

- **Functionality:**

Follow functional minimalism

- **Understanding:**

Reduces the cognitive load/mental pressure to understand the application

- **Engagement:**

Design interactively to keep users engaged.

- **User control:**

Empower users to control, trust and explore

- **Perceptibility:**

Inviting interaction through intuition and interactive media

- **Learning possibilities:**

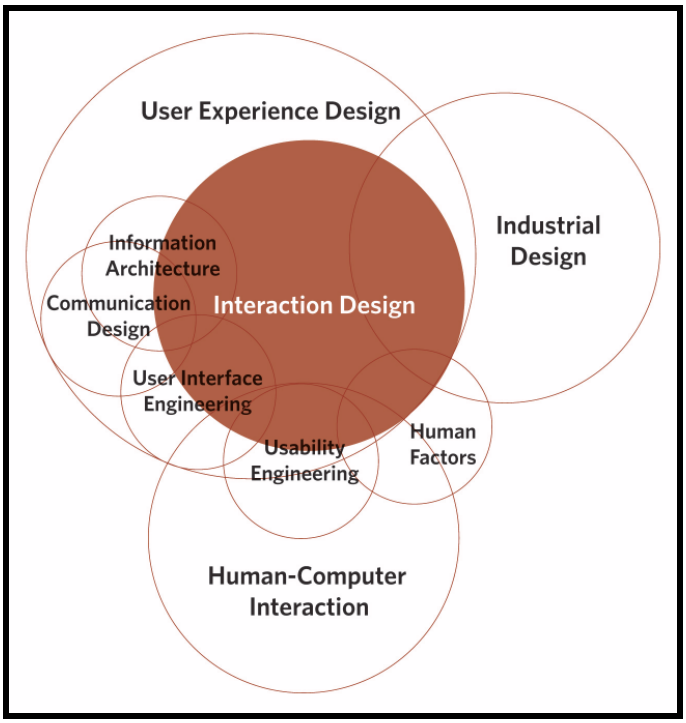
Learn and remember user interactions

- **Error handling:**

Be careful to avoid bugs when they occur, and be sure to find and fix them.

- **Affordable:**

Simulate the action, inspired by the interaction of the normal and physical worlds.
The paper and the project intended to just spread awareness of the importance of the same by creating a small application keeping in mind the principles that are followed.


User Experience Design
Industrial Design
Information Architecture
Communication Design
Interaction Design
User Interface Engineering
Usability Engineering
Human Factors
Human-Computer Interaction

Motivation:

Why did I choose this topic?
Being a full stack developer, I have aimed to create applications that eases the work of the end user but at the same time how do I make frontend and backend work in the minimal time with just the right amount of look and feel.
At the same time I am always eager to learn new technologies and tend to compare them with what I learnt in the past. To have HCI as one of my masters courses was always my plan as I could see in this course, my role suits the best and also I could enhance my skills. Hence, two of my favorite things i.e. one being web application development and other being a developer having thirst for new knowledge

Model:

The paper tells us about the model built that uses Quasar Framework, Vue JS 2 and Firebase to create an amazing Progressive Web Application (PWA)

What is Progressive Web App?

1. Enhanced Web App - much better experience for user especially on mobile for users to have native like experience.
2. Add to Home Screen - allows app to be added on home screen making the user to use it more frequently with no address bar, link
3. Improved performance and speed - storing the data on assets and not taking it every time from servers.
4. Offline Capabilities - can work offline.
5. Background Sync - Full functional offline i.e. store the post offline and if internet is returned we can send it to server.
6. Push Notifications - even if the app is close we can see notifications.
7. Native Device Features - i.e Camera, location
8. Progressive Enhancement - if a browser is not supporting any of the features of progressive app then the application will just not use it but unless otherwise work full functional.

What is the Quasar framework and why do we use it?

Quasar framework is an open source Vue-JS based framework which allows a web developer to create a responsive web app. It also saves the deployment cost to a larger amount. It is easily customizable and allows multiple options to create applications. Various inbuilt VueJS features as well.

Flowchart of how PWA Model was built

- Creating a standard web application first with frontend and backend
- Progressively enhance the made app

1. Install Quasar and Dependencies
2. Create a Quasar Project
3. Design the Layout
4. Design the Pages i.e Home Page, Camera Page
5. Native device feature integration i.e. Camera, Location
6. Cloud firestore database
7. NodeJS and Express backend
8. Integration of PWA features i.e Manifest files, App icons, App install banner, Service workers and work barriers, Precaching, Caching strategies, Background sync, Push Notification.
9. Make sure that application in working in all devices and browsers

Experimental Study:

IDE used: Visual Studio Code.
The work of Integrated Development Environment is nothing but it is a software application that helps in developing software.

Framework used: It is nothing but a User Interface.
Quasar CLI. It helps us to create a quasar application with needed dependencies.
To launch the application in progressive web application mode we need to hit command -> quasar dev -m pwa otherwise we need to hit command -> quasar dev for normal application run.

Backend used: Node JS
Node JS is a cross platform open source server environment enabling backend javascript that can run on Windows, Mac, Linux, Unix etc.

Button Icons used:
Eva-Icons are already mentioned in quasar.conf.js and then we just need to uncomment it and use it for various buttons.

Styling used:
Sass.
Font used:
The project uses google fonts which enables us to embed the style we want by pasting the link in the project style files.

Overall there is one single html page which is index.html and for global css the project makes changes in app.sass

Some unique things in the project…

1. Breakpoint for media specific display in quasar
2. Q separator api media specific
3. Media specific icons display

This app allows you to view a list of posts. Each post has an image, location, caption, and date the image was taken.
You can access the user's camera to take a photo, enter a caption, find the user's location, description and create a new post.
It has a beautiful responsive design that adapts to desktop and mobile devices.
Store all your data in the Firebase Cloud Firestore database.
Photos are stored in Firebase Storage. Create your own NodeJS & Express backend with several different endpoints for interacting with your database.
Integrates all five major PWA features.

1. Install Start Screen
2. advance cache
3. caching strategy
4. background sync

5. message

The app now works on iOS, Android, and all major desktop browsers, with a nice fallback to older browsers such as Internet Explorer.
You'll also learn about Service Workers, Workbox, Firebase Cloud Firestore Database, Firebase Storage, NodeJS & Express, and more.
After completing this course, you will be able to create your own Progressive Web App using Vue JS, Quasar Framework, Firebase, NodeJS, and Express.
Note:
This project is just compatible with Quasar V1 (with Vue 2).

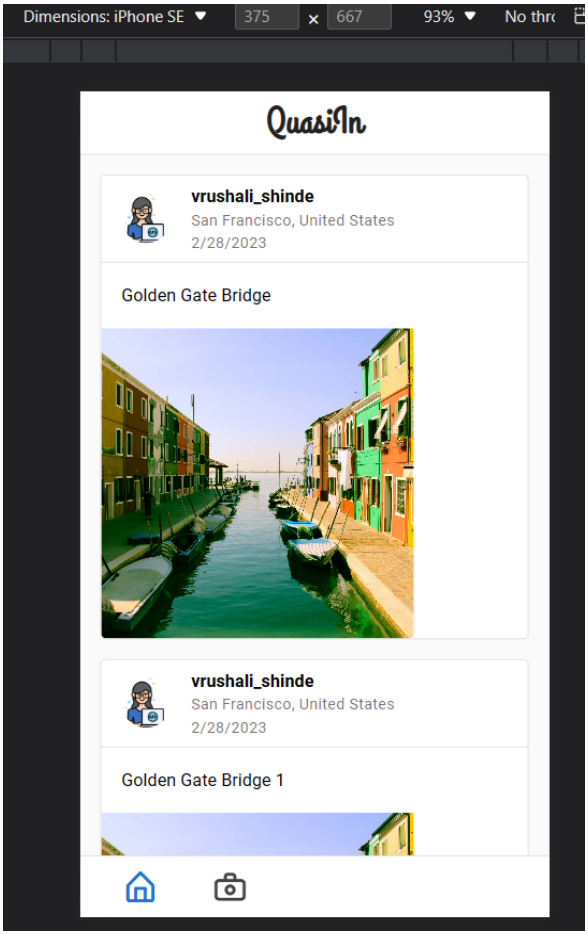
Difficulties faced so far:

1. The camera once allowed for the website and then after use it was still on even if you navigate to the home page from the camera page.
2. Sometimes the application needs to stop and rerun to reflect changes.

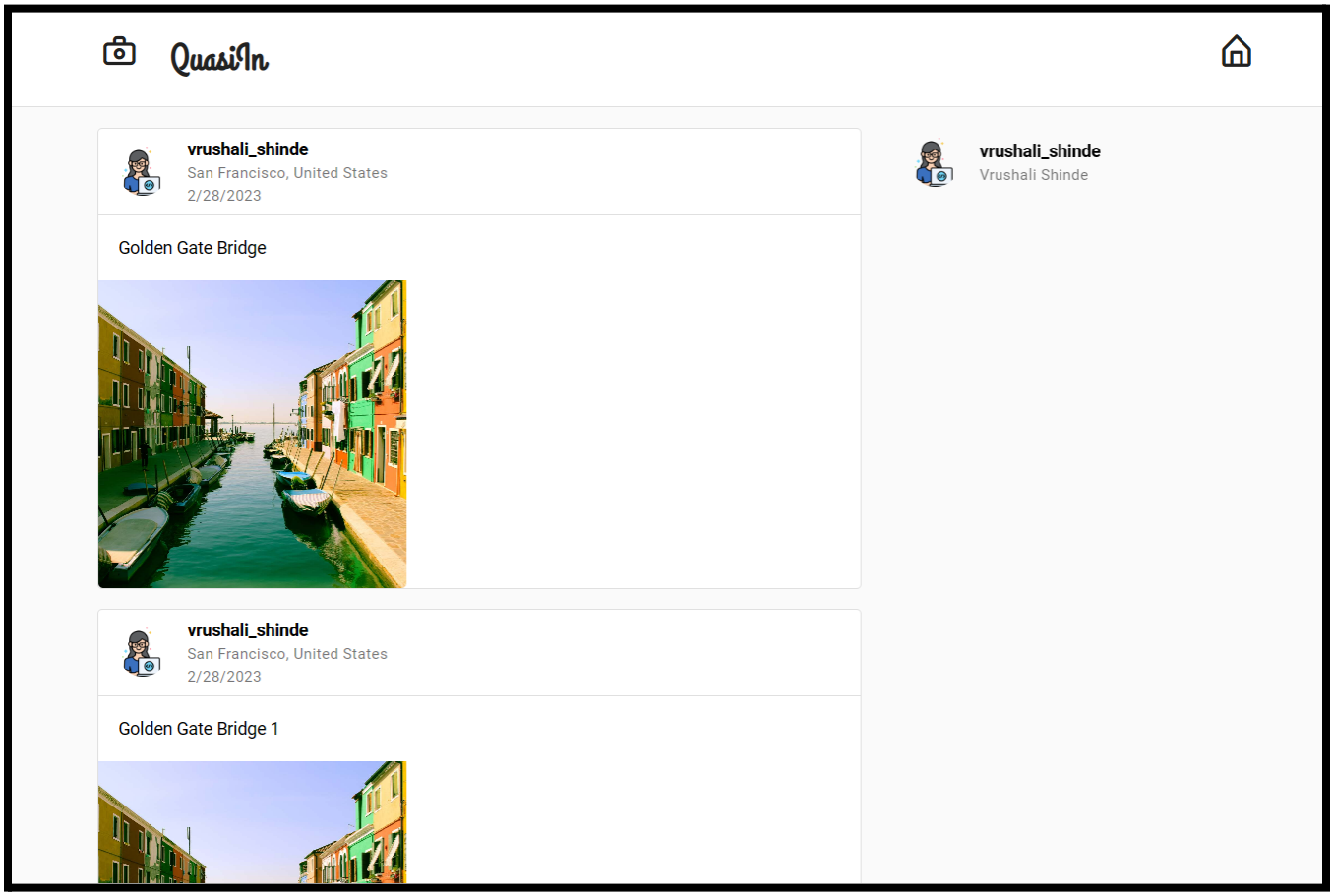
The above issues are addressed so far and the project works towards solving the same along with the completion of application.
More about application:
The application is named as QuasiIn. Regarding the background story, the summary of the user in applications like Naukri.com, LinkedIn needs to be given a careful thought and choose the best suitable one amongst all the variations. The photo needs to be most recent and perfect and professional too. But sometimes we tend to change the summary but then think that the previous one was better. So that's where the project thinks it can be useful at the very elementary level. The QuasiIn application interface is created in a way that this single page application can be used to click multiple photos and then multiple description variations. Then the user can view all the photos and descriptions at once and then decide the best one and put that on linkedin.
The interface of the application for desktop and mobile differs in a way because the screen size is different and so accordingly the user should be able to see the content

Conclusion:

The work of HCI in web design has been incredibly important in terms of user experience. The project attempts to create a progressive web application that can follow all the necessary design principles of HCI. The project does not as such address any specific issue related in this field but just attempts to make the spectators aware of certain concepts of web design by creating a small application. Making aware of how a certain website should follow rules of design so that the usability and the maintenance of the same will be handy.
Here is the mobile view of the application's home page.



Here is the desktop view of the application’s home page.



References:

1. Wikipedia
2. Quasar Documentation
3. https://xd.adobe.com/ideas/principles/human-computer-interaction/improve-hci-design-for-better-user-experience/
4. https://www.mantralabsglobal.com/blog/10-basic-principles-of-interaction-design/
5. Analyzing User Experience in Mobile Web, Native and Progressive Web Applications: A User and HCI Specialist Perspectives Authors: Giulia de Andrade Cardieri, Luciana Martinez Zaina
6. Andre Charland and Brian Leroux. 2011. Mobile Application Development: Web vs. native. Commun. ACM 54, 5 (2011), 49--53.
7. Andrew Gazdecki. 2015. Why Progressive Web Apps Will Replace Native Mobile Apps. https://www.forbes.com/sites/forbestechcouncil/2018/03/09/why-progressive-web-apps-will-replace-native-mobile-apps {Accessed: May 31st 2018}.
8. Google Developers. 2015. All showcase tagged: progressive-web-apps | Web | Google Developers. https://developers.google.com/web/showcase/tags/progressive-web-apps {Accessed: February 1st 2018)
9. Petele. 2016. Your First Progressive Web App. https://codelabs.developers.google.com/codelabs/your-first-pwapp/index.html {Accessed: Setember 26th 2017}.
10. Node JS Documentation.
11. Udemy PWA Course.