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Visual Water: An Integration of App and Web to Understand Chemical Elements

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Abstract:- This paper presents Visual Water: a novel inter- active application designed to augment chemical education and discovery. This mobile app and web version collectively provides an interactive environment for users to explore and understand chemical elements. Using vast databases and visual interfaces, Visual Water provides real-time information about various chem- ical elements, leading to a range of new, engaging and accessible learning tools for students, educators and enthusiasts. This paper provides a description of the development of this system, key features and potential impact of the Visual Water system in helping users better understand chemical reactions and their application in formal and informal educational spaces.

I. INTRODUCTION

One of the fundamental aspects of Chemistry education is the study of chemical elements, and digital tools can greatly enrich this process. Visual Water was developed as an integrated solution to bridge the gap between a mobile application and a web-based platform, to cater affordances for different trade-offs that users prefer to make.

With the increasing prevalence of technology, the digital world is ever expanding. It has become common practice for digital designs to integrate web and app versions, providing users with a versatile experience. This research paper seeks to understand the relationship that is created when web and app platforms are merged. In doing so, it explores the potential outcomes forthe resultant design.

This research investigates the technical elements of integrating web and app versions, as well as the challenges, opportunities,and innovations that emerge. By looking at the best practices and user reactions in successful case studies, it is expected that best practices should be identified and followed in order to give users the best experience across platforms.

➢ *Background*

The field of chemistry education has been facing an in- creasing need for interactive and engaging tools to enhance students' learning. Recent technologies present opportunities to create innovative educational applications that accommodatedifferent learning styles and preferences.

➢ *Objectives*

- The goal of the project was to design and develop an educational application that teaches students Chemistry Elements and encourages them to learn more about them.
- To integrate web and mobile platforms for a seamless user experience.
- The content of the app on chemistry education should be evaluated in an upcoming study to determine if it is successful in promoting such education.

II. LITERATURE REVIEW

A literature review is proposed to evaluate how technology fits into chemistry education; specifically, how critical it is to include an interactive, integrated platform. Moreover, previous research on the effects of web- and mobile-based educational tools on learning outcomes should also be considered.

The use of augmented reality in education has been widely acknowledged for its potential to bridge the gap between the- oretical concepts and practical applications. Elements 4D, in- troduced by [1] Shuxia Yang.The practicality of incorporating augmented reality into the classroom extends beyond science education. In a study by [2] Kyle N Plunkett augmented reality was successfully employed in language learning, demonstrat- ing its versatility across various disciplines.The integration of augmented reality in chemistry education has been met with enthusiasm, driven by its potential to provide immersive and interactive learning experiences. The study conducted by [3] Camalia Macariu offers valuable insights into the effective use of augmented reality for learning chemistry concepts.Several studies have delved into the impact of technology integration on student learning outcomes. For instance [4] R.E.Belfordand Tanya Gupta investigated the use of virtual laboratories in teaching chemistry concepts, reporting positive effects on students' understanding and

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engagement.The study conducted by [5] Robert E. Krebs provides a comprehensive examina- tion of the historical context and practical implications of Earth's chemical elements.The study conducted by [6] Ryan Lansangan presents a compelling argument for the integration of creative story writing in online learning environments to facilitate a deeper understanding of chemical elements.

➢ *Accessibility and Flexibility*

Various studies have emphasized the importance of accessi- bility in contemporary education. Many techniques have been developed that support the idea of inclusivity. Naturally, web- integrated versions of apps also offer the added advantage of allowing users to access educational material from a variety of internet-enabled devices. In summary, this means that studentscan keep on studying, no matter where they are.

➢ *Interactive Learning*

Integrated web features often come hand in hand with the type of interactive learning experiences that are vital to keeping a generation that grew up with the internet engaged. This is because apps have, for a long time, been designed to take advantage of the web as a platform. As far as educational apps go, this has mostly manifested in simulations or 3D models and fully functional, interactive periodic tables – you know, for instance. Learning applications, of course, have a responsibility to bring the periodic table and all of its chemical elements alive in ways that actually help students understand how they're behavior and formed.The study conducted by [7] Leonardo Vargas Hernandez provides valuable insights into thepotential of AR applications in enhancing science education for elementary school students.

III. METHODOLOGY

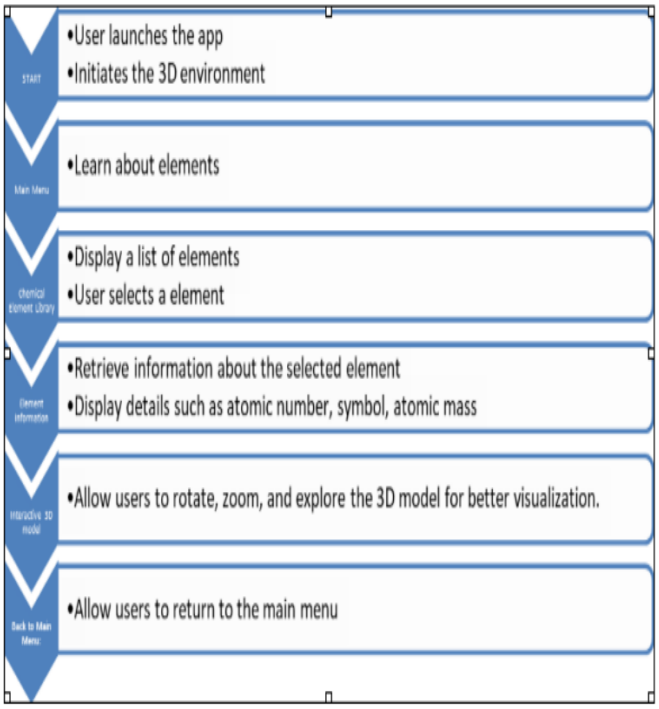

Fig 1 Flow Chart for App Version

A. Technology used for App Development

➢ *Unity 3D:*

Within Unity3D, the project's virtual en- vironment was constructed in the engine's scene editor, a visual interface for arranging and configuring 3D objects, lighting, and more, facilitating the overall design aes- thetic and functionality.

➢ *Vuforia:*

- The project's existing capabilities were then increased further with the use of Vuforia a powerful augmented reality (AR) development platform.
- Utilizing Vuforia's marker-based tracking system, the project was able to recognize and track a number of predefined markers within the physical environment.

➢ *Csharp Language:*

- One of the reasons why Csharp was chosen was be- cause it provided robust mechanisms for data handling and processing.
- The language's strong support for data structures, Lan- guage Integrated Query (LINQ), and asynchronous pro- gramming enabled the efficient manipulation, storage andretrieval of data within the project.

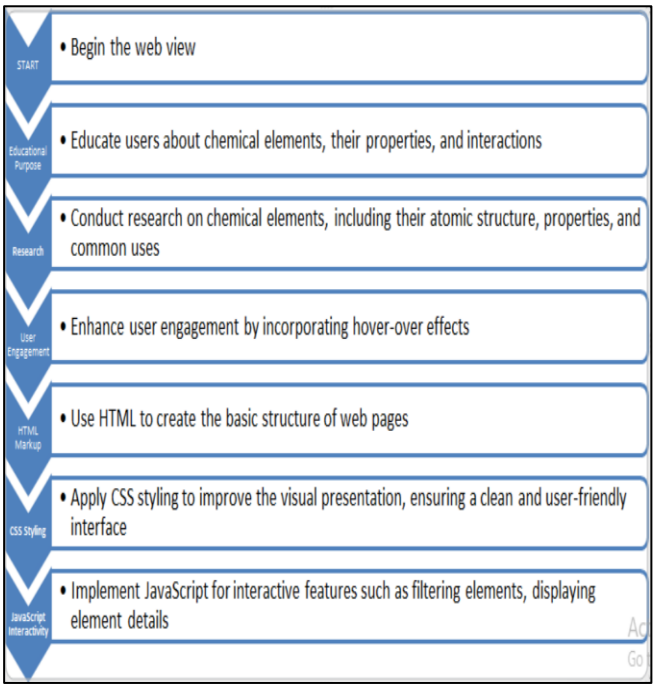

Fig 2 Flowchart for Web Development

B. Technology used for Web Development

➢ *HTML:*

As the universal language of the web, HTML was used to structure and present content in this project. HTML5 is a highly versatile markup language that is em- ployed to organize and lay out documents using elements, which are indicated by tags.

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➢ *CSS:*

CSS was used to style and format the project's HTML content. Being a stylesheet language, CSS describes the presentation of a document written in HTML. Separating the document content (HTML) from its presentation (CSS) allows the same markup to form an accessible, semantic document, while at the same time be styled into an attractive and easy to read document.

➢ *JavaScript:*

JavaScript, a dynamic and versatile program- ming language, is another technology deeply embedded in this project. JavaScript was used as a client-side scripting language,greatly enhancing the project's interactivity and overall user experience.

IV. APP FEATURES

A. Chemical Elements Visualisation

The app features an interactive and visually appealing periodic table where users explore the elements and their symbols, atomic numbers and electron configuration both in the web version and the mobile app.

Fig 3 Web Version

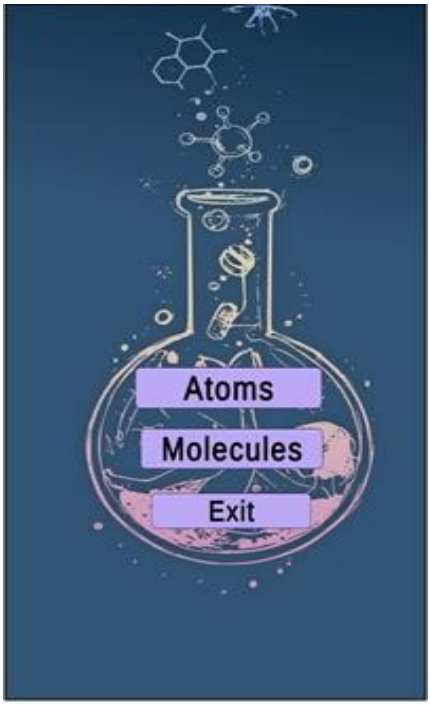

Fig 4 Begining of the App

B. Interactive 3D Models

What makes the online chemistry learning tools particularlyawesome is the interactive 3D models of selected chemical elements found in the web version and mobile app. Users can rotate, zoom in and explore these models to gain better grasp of the atomic structure of the elements.

C. Cross Platform Synchronisation

Users can seamlessly transition between the web version and the mobile app while maintaining their preferences, book- marks, and progress. Cross-platform synchronization ensures a consistent experience regardless of the device used.

➢ *User Experience*

- *Intuitive and User-Friendly Interface:*

Central to the web-integrated app is an intuitive, user-friendly interface, which ensures users can access information about chemical elements quickly and easily, even if they have no chemistry background. A clear layout, consistent design elements, and recognisable navigation options make for a positive userexperience.

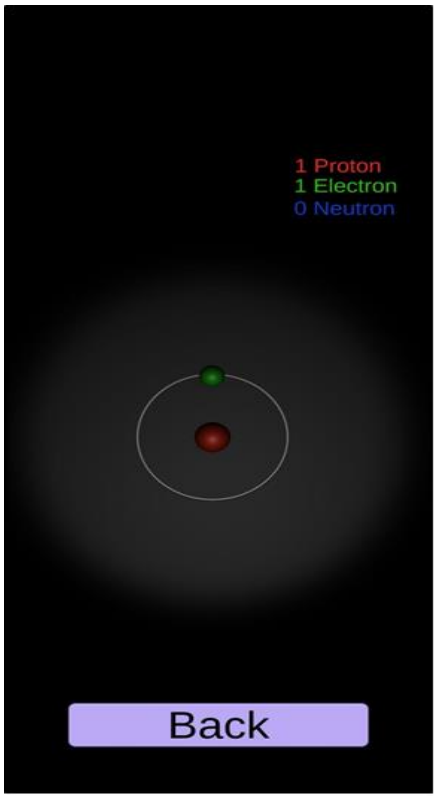

Fig 5 Orbital View

D. Interactive Chemical Elements

However, the app's success lies in its take on the chemical elements. The interactive nature of the table encourages users to hover over or tap on elements to access essential informa- tion, promoting an engaging, exploratory approach to learning. It's designed to be simple, but not too simplistic, which means that it caters to both new learners and those looking to dive into the details.

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V. IMPLEMENTATION

➢ *App Development*
➢ *Detailed steps of Implementation*

- Obtain a Vuforia License
- Add Unity Vuforia Extension
- Make a Unity Project
- Transfer in Vuforia Content
- Input a License Key
- Confirm that Vuforia is installed in your project
- Make sure that Vuforia is also installed within your project
- Fire up Unity again and open the Vuforia Configuration pane
- Test The Project
- Iterate and improve
- Publish the project

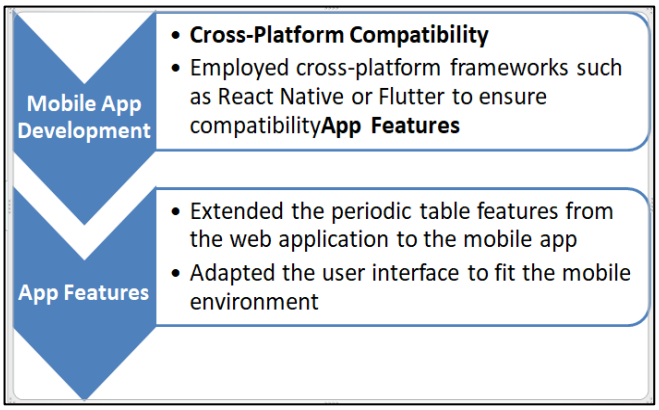

Fig 6 Flow Chart for App Development

➢ *Web Application*

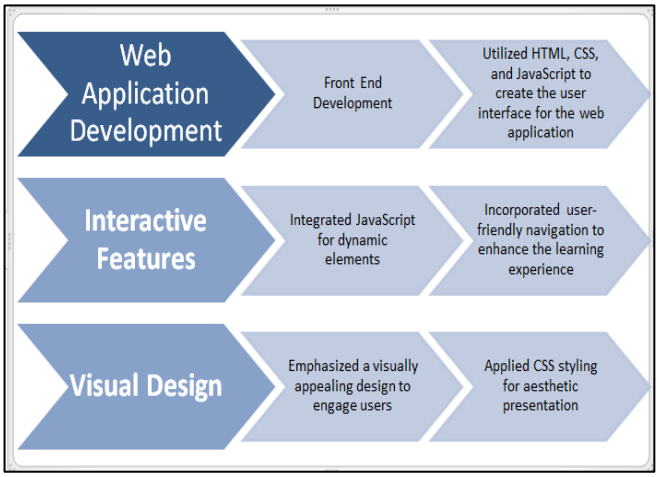

Fig 7 Flow Chart for Web Application

➢ *Educational Impact*

- *Improved Access to Learning Resources*

A web-integrated application, with which access to learning resources about the chemical elements is significantly im- proved, it comprises comprehensive information for users that include students, educators and chemistry enthusiasts, interac- tive models, and educational content that can be accessed froma device connected to the internet from anywhere, anytime.

- *Deepened Understanding Through Visualization*

Incorporating interactive, 3D models as well as augmented reality, it allows for complex atomic structures that to be visualized, facilitating the comprehension of students through a visual approach to chemical elements, rendering easier to understand the highly abstract concepts that are part of the traditional teaching of these subject.

➢ *Facilitation of Self-Paced Learning*

Students can work through the content in their own time and at their own speed. The rates of learning for people can vary massively, so this approach accommodates to all preferences and allows the learner to really understand the content in their own time, rather than rushing through to a thesis or assignment deadline.The study conducted by [8] Nadia Cuottoprovides valuable contributions to the field by exploring the potential applications of AR technology in chemistry labo- ratory settings. By incorporating virtual elements into real- world laboratory experiences, AR enhances students' ability to visualize and manipulate chemical structures, reactions, and experimental procedures. This lets the student carry on in the areas they excel, revisiting trickier topics at their own leisure and contributing to a highly personalized learning experience.The study conducted by [9] Archana Mantri sheds light on the potential of AR technology to transform tradi- tional teaching methods and make chemistry education more engaging and accessible.

VI. RESULT

The comprehensive system attracted the interest and engage-ment among uses of different age, race, and gender worlds. Features are dynamic and interactive–3D visualizations and augmented reality modules have been shown to keep interest at a sustainable level. Transitioning seamlessly from the web to mobile changed the way people learn. The learner is free to switch back and forth between devices, their work will not be lost. This facilitates easy, continuous access to educational content whenever it is convenient.

The main advantage of this that is that in this we use the API so that the user can ask for any info related to the topic.

VII. FUTURE DIMENSIONS

➢ *Enhanced Interactivity and Simulation*

Future iterations of the platform could explore richer fea- tures for interactivity and simulation. For example, integrating virtual labs or simulations could allow users to actually manipulate elements in a controlled virtual environment, pro- viding the hands-on experiences that have made MOOCs an increasingly attractive alternative.

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- *Artificial Intelligence (AI) Integration*

The integration of AI could further personalize the learning experience. For instance, AI algorithms could adapt content delivery based on individual learning styles, preferences, and performance data, enhancing the platform's ability to adapt to different users' needs.

- *Adaptive Learning Paths*

Implementing adaptive learning paths based on user per- formance and preferences is another future dimension. This would include dynamically adjusting content difficulty, sug- gesting learning modules relevant to cross-disciplinary exper- tise and providing targeted remediation.

VIII. CONCLUSION

The design and deployment of the integrated web and app platform for elemental understanding in chemistry is a step towards creating a living and breathing educational system in chemistry. In this body of research, we have considered the components of the application, the user interaction and experi- ence with the technology, as well as educational implications, challenges and future dimensions.

By combining the chemical elements with embedded 3D models, augmented reality features, and gamified learning elements, it's made the arcane exploration of the various chemical elements not only more palatable, but given as much needed injection of excitement and curiosity into the process. And it's commitment to inclusivity and accessibility – with features like text-to-speech and adjustable fonts – assures a wide array of learners can benefit from engaging with itseducational offerings.

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