

# Enabling Sustainable Development with Progressions into HyperText Transmission Language HTML 5 as the New Frontier in Web Application Development

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**Abstract:** The Internet and associated web-enabled application and Information Systems has had tremendous positive impact on the worldwide societies in recent years leading towards development. And sustainability of such development in the world generally cannot be over-emphasized. Various advanced countries in different parts of the world have positively transformed their society with the use of Information Systems enabled with programming computers and related devices in the last few centuries. The net result was progress to society, increasing the standard of living with benefits related to quality of life through the development of knowledge, products, and services with the ultimate goal of sustainable development. The Internet and associated web-enabled application and Information Systems added the advantage of limiting space and time such that relevant information can be obtained from anywhere at any time. Notable areas and fields of works in which web-enabled application and Information Systems development have undoubtedly contributed towards includes e-commerce, online banking, online bookings of different services, online taxation, enabled communication systems, e-learning and virtual learning systems etc. Most of these systems are developed in advanced countries and developing countries purchase at exorbitant foreign currency-based prices. Developing such systems had traditionally been done by expert web developers using specialized programming languages. However, towards sustainability, developing countries have to get to a point where most of the needed systems are developed in-house. Such progress has evolved towards a state where some countries have leapfrogged towards development through progress in Information Systems development such that even advanced countries outsource some of their system development works to make use of the massive human talents at lower costs in developing countries. Without doubt, that would increase employment rate and should serve a goal for many other developing countries that are especially low in financial fundings, plagued with high unemployment but yet buoyant with high human capital. But such laudable goal would involve developing countries seizing such opportunities and rigorously training programmers and web developers who will become the developers of the needed Information systems. However, learning programming is a complex task and is one of the subjects that students find challenging. Some of the difficulties involve comprehending learning materials in specialized programming languages that involves meticulously manipulating specialized programming languages or codes.

The evolution of specialized programming languages for web application systems has transformed the global landscape in the above-mentioned. It all began with the inception of basic web applications using Hyper Text Markup Language (HTML) 1.0, primarily designed for delivering static web pages containing text, images, graphics, and videos that were accessible online. Subsequently, the paradigm shifted towards dynamic web pages capable of presenting real-time data retrieved from databases. For instance, databases could store hourly temperature forecasts, and when a user requested the temperature for a specific hour, the data would be extracted and displayed on the website, enabling the dissemination of continuously changing information on the web. Over time, we witnessed a progression that allowed people to create web applications with native-like functionalities that could run directly in a web browser. These advancements and enhanced features

were largely made possible through incremental improvements in HTML versions, spanning from 1.0 to 4.0. However, the introduction of HTML 5.0 marks a significant departure from its predecessors similar to the situations where word documents can simply be converted to webpages such that more and more people without technical training can develop web application. This research paper delves into the utilization of HTML 5 for developing advanced features that were traditionally the domain of native applications. Additionally, we will explore the advantages of employing features such as offline browsing and synchronization capabilities, particularly in environments with slower network connections, commonly found in developing countries.

**Keywords:** Hyper Text Markup Language (HTML), Offline Browsing, Mobile Apps, Web application development, Native Apps

### Introduction

Information Systems development as the engine of information and communication technologies (ICTs) has been known to be capable of leading to development. And development can be understood to refer to a state of improvement. Mansell and Wehn (1998, p.11) explain that the former United Nations Secretary General Kofi Annan emphasises the enormous potential of information and communication technologies (ICTs) for development in the remarks to the first meeting of the United Nations Working Group on Informatics. Every nation would love to fully actualize this enormous potential. This is a desirable state for any society. This was desirable to be achieved without incurring major social costs. An important aspiration of people is to sustain the state of development they might be, and to continue to grow more into further developmental state. Brown (2017) explains that sustainable development (SD) is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. In this regard of Information Systems development, we have to plan ahead for ways that would ensure that future Information Systems developers are able learn to do their work effectively without any compromising situation. For example, the advent of the COVID-19 pandemic in 2019 has shown the world the need to plan ahead and be able to quickly overcome any compromising situation.

As observed in a previous study, Dehinbo (2022) indicates that sustainable development has major enabling factors of which an important key is the use of Information systems and web applications to automate different aspects of societal endeavors. The development of web application systems have revolutionized the world. This began with the development of simple web application using Hyper Text Markup Language (HTML) 1.0 to convey static web pages containing online accessible texts, pictures, graphics and videos. Thereafter, it became possible to convey dynamic web pages containing online accessible data from databases. For example, temperatures expected for every hours of the day can be stored in a database and when someone request for expected temperature for any hour of the day, the information is extracted and then presented with relevant texts on the web site, making it possible to display constantly changing information online. These progressions and features have been made possible with minor improvements in versions of HTML from version 1.0 up version 4.0. However, the advent of HTML 5.0 brings significant technical difference of HTML 5.0 compared to HTML 1 to HTML 4.0 with corresponding features that made HTML 5.0 accomplish more than HTML 1 to HTML 4.0.

However, the technical differences in versions of various programming and mark up languages are one of the factors that makes programming difficult leading to low pass rate. Dehinbo (2023) further observes that even lecturers struggle to cope with rapid developments in programming and software development. While in Chemistry and Biology for example, the organisms and the chemical reactions a lecturer learnt while in university have rarely changed, but in programming and software development, most lecturers that learnt programming using Formular Translator (FORTRAN), Basic, Pascal etc. using structured programming concepts while in school, now must relearn programming languages like Java, C++, Python etc which now uses new concepts such as object-oriented programming.

Dehinbo (2023) further indicates that even within each programming language, there have been significant shifts over the years. If someone thinks he or she has mastered programming and software development tool such as Hypertext Markup Language (HTML) version 1, 2 or 3 for developing web application for example and hears of HTML version 5 and assumes that just minor differences will exist, the person is in for big surprises. This is because HTML 5 is a completely re-engineered version with different approaches. This could explain why from experience, it seems like very few professors in computing or Information Technology lecturers at senior levels still lecture programming. Some hide under the banner of “specializing only in Informatics” saying their specialization is more about investigating the impact of Information Technology on people, organization, and society, possibly using questionnaire and interviews. Some others hide under the cover of the statement that traditional universities should just lecture

programming concepts without illustrating with specific current programming languages so as not to be seen as promoting one language over another.

But the corresponding features that made HTML 5.0 to accomplish more than HTML 1 to HTML 4.0 are definitely bound to be significant to justify the high shift in technical differences from previous versions.

### **Current Trends and Applications**

The goal of this study therefore is to explicate on corresponding features that made HTML 5.0 accomplish more than HTML 1 to HTML 4.0 via a vis the significant features to justify the high shift in technical differences from previous versions. Some simple prototype systems will also be developed to further highlight the significant features to justify the high shift in technical differences of HTML 5 from previous versions. We begin by summarizing from previous experience the relevance and usefulness of HTML 5 relative to the relevance and usefulness of HTML 1 to HTML 4.0. This is then followed by the features that made HTML 5.0 to accomplish more than HTML 1 to HTML 4.0.

#### ***The Relevance and Usefulness of HTML 5***

Accessibility and Inclusivity:

*HTML5 provides substantial support for people with disabilities through features like semantic elements, ARIA roles, audio/video accessibility, form enhancements, and more. However, achieving a high level of accessibility also depends on how well web developers implement these features and follow best practices.*

Compatibility and Cross-Platform Support:

*HTML5 is designed to work across different devices and platforms. This means that websites and applications developed using HTML5 can be accessed on a variety of devices, including smartphones, tablets, and low-cost computers. This is particularly valuable in regions where access to high-end technology may be limited.*

Reduced Development Costs:

*HTML5 allows for the development of web applications that can run in web browsers, reducing the need for expensive software development and distribution. This can significantly lower the cost of developing and deploying digital solutions, making them more accessible to developing countries with limited resources.*

Offline Capabilities:

*HTML5 offers features like local storage and service workers that enable web applications to work offline or in low-connectivity environments. This is beneficial for regions with unreliable or limited internet access, as users can still access content and services when offline.*

Multimedia and Rich Content:

*HTML5 includes native support for multimedia elements like audio and video, reducing the need for third-party plugins like Flash. This allows for the creation of rich and interactive web content, which can be valuable for educational and entertainment purposes in developing countries.*

Mobile-Friendly Design:

*HTML5's responsive web design features make it easier to create websites and applications that adapt to different screen sizes and resolutions. This is particularly important in regions where mobile devices are the primary means of accessing the internet.*

Open Standards:

*HTML5 is built on open standards, which means it is not controlled by proprietary interests. This openness fosters innovation and competition, potentially leading to the development of locally relevant solutions and reducing dependence on foreign technology providers.*

#### E-Learning and Remote Education:

*HTML5 supports the development of online educational platforms and resources, making it possible to deliver remote education and training to individuals in remote or underserved areas. This can help bridge educational gaps and improve skills and knowledge in developing countries.*

#### E-Government Services:

*HTML5 can be used to create user-friendly and accessible government websites and online services. This can improve government transparency, reduce bureaucracy, and enhance access to essential public services for citizens.*

#### Entrepreneurship and Innovation:

*HTML5's accessibility and low development barriers can encourage local entrepreneurs and developers to create innovative digital solutions and services tailored to the needs of their communities, potentially driving economic growth.*

**The Technical Differences thus far.** There's been a significant improvement on HTML 5.0 from the other previous versions.

#### *New Semantic Elements:*

HTML5 introduced a range of semantic elements such as `<header>`, `<nav>`, `<section>`, `<article>`, `<aside>`, and `<footer>`. These elements make it easier to structure web content and provide more meaningful tags for specific parts of a web page.

#### *Audio and Video Support:*

HTML5 includes native support for embedding audio and video content through the `<audio>` and `<video>` elements. This eliminates the need for third-party plugins like Adobe Flash.

#### *Canvas Element:*

HTML5 introduced the `<canvas>` element, which allows for dynamic rendering of graphics, animations, and interactive content directly within the web page without relying on external plugins.

#### *Offline Storage:*

HTML5 introduced features like Local Storage and Session Storage, which allow web applications to store data locally on the user's device. This enables web apps to work offline and reduces the need for constant server interaction. This means that users can download the whole website and move to a place where there's poor to no internet connection and enjoy the full experience of the website and later sync when they have full internet connection.

#### *Web Workers:*

HTML5 introduced the concept of web workers, which are background scripts that run separately from the main browser thread. This enables multi-threading in web applications, improving performance and responsiveness.

#### *Geolocation API:*

HTML5 provides a Geolocation API, allowing websites to access the user's geographical location, which is particularly useful for location-based services and applications.

#### *Form Improvements:*

HTML5 introduced new input types (e.g., `<input type="date">`, `<input type="email">`) and attributes (e.g., the required, placeholder) to enhance form handling and validation.

#### *Drag-and-Drop:*

HTML5 introduced native support for drag-and-drop functionality, making it easier to create interactive interfaces for file uploads and other user interactions.

#### *Cross-document Messaging:*

HTML5 introduced the `postMessage` method, which enables secure cross-origin communication between windows or iframes.

#### *WebSockets:*

HTML5 includes support for WebSockets, allowing real-time, full-duplex communication between a web browser and a server over a single, long-lived connection.

#### *Responsive Web Design:*

While not exclusive to HTML5, this concept gained prominence alongside it. HTML5 includes features like media queries and the viewport meta tag, which are critical for creating responsive web designs that adapt to different screen sizes and devices.

#### *Improved Error Handling:*

HTML5 specifies how browsers should handle errors in parsing and rendering, providing consistency and better error messages for developers.

#### *Compatibility:*

HTML5 is designed with backward compatibility in mind, ensuring that older browsers can still render and display HTML5 documents, even if they don't support all the new features.

### ***HTML 5 for mobile apps***

#### *Cross-Platform Compatibility:*

One of the significant advantages of using HTML5 for mobile apps is that it allows you to create cross-platform applications. You can build a single codebase that works on multiple platforms, such as iOS, Android, and the web. This reduces development time and costs compared to building separate native apps for each platform.

#### *Cost-Effective Development:*

HTML5 mobile app development can be more cost-effective than native app development because you don't need to hire separate teams of developers for each platform. You can have a team of web developers who are proficient in HTML5, CSS, and JavaScript work on the app.

#### *Rapid Development:*

HTML5 apps can be developed more quickly than native apps because you're working with web technologies that are well-established and have a large developer community. This can be especially beneficial if you need to get your app to market quickly.

#### *Ease of Maintenance:*

Maintaining HTML5 apps is generally easier than maintaining native apps. When you need to make updates or changes, you can do so in one codebase, and those changes will be reflected on all supported platforms.

*Web-Based Content:* HTML5 apps can easily integrate web-based content, such as web pages, online videos, and web services. This can be advantageous if your app relies on content from the internet.

*Access to Device Features:* HTML5 has APIs that provide access to various device features, such as geolocation, camera, and local storage. While not as extensive as native APIs, they still allow you to build apps that utilize these features.

*Offline Functionality:* HTML5 apps can work offline by using technologies like Service Workers and local storage. This is useful for scenarios where users may not have a reliable internet connection. "Users of any data-driven mobile application should be able to read and write data without an Internet connection. When the app reconnects to the Internet, the details should be synced to the server." [17]

#### *Limitations*

However, it's important to note that HTML5 mobile apps also have some limitations and considerations:

#### *Performance:*

HTML5 apps may not perform as well as native apps, especially for resource-intensive tasks like gaming or graphics-intensive applications.

#### *Limited Access to Device Features:*

While HTML5 provides access to some device features, it may not offer the same level of access and control as native development.

#### *User Experience:*

Building a user-friendly and responsive user interface in HTML5 apps can be more challenging, and it may require additional effort to achieve a native-like look and feel.

#### *App Store Distribution:*

HTML5 apps may not have the same level of visibility and discoverability in app stores as native apps.

#### *Security:*

One of the limitations is that security concerns, such as protecting sensitive data, may require additional attention in HTML5 app development. This requires additional languages and frameworks to boost these security concerns.

### ***HTML 5 for building native applications***

HTML 5 can be used for developing native-like apps through various technologies and frameworks. While these apps are often referred to as "hybrid" or "webview-based" apps, they can provide a native app experience while leveraging web technologies.

#### *Cordova/PhoneGap:*

Apache Cordova (formerly known as PhoneGap) is a popular framework that allows developers to build mobile apps using HTML, CSS, and JavaScript. Cordova provides access to device features like the camera, geolocation, and contacts through JavaScript APIs, making it possible to create cross-platform native apps.

#### *Ionic Framework:*

Ionic is a framework built on top of Cordova that provides a library of UI components and tools for building responsive and native-like mobile apps using HTML, CSS, and JavaScript. It's particularly popular for building mobile apps with a native look and feel.

#### *React Native:*

While React Native primarily uses JavaScript and React to build native apps, it also allows embedding web views (WebView) in your app, which can contain HTML5 content. This allows you to combine native UI components with web-based content in your app.

#### *Electron:*

Although primarily used for building desktop applications, Electron allows you to package HTML5, CSS, and JavaScript code as a standalone app for Windows, macOS, and Linux. It's commonly used for creating cross-platform desktop apps.

#### *NW.js:*

Similar to Electron, NW.js (previously known as Node-Webkit) enables developers to create native desktop applications using web technologies. It provides an embedded Chromium browser and Node.js for executing JavaScript on the desktop.

#### *Progressive Web Apps (PWAs):*

PWAs are web applications that can offer a native app-like experience when accessed through a web browser. By using HTML5 features such as Service Workers for offline functionality and manifest files for app-like behavior, PWAs can be added to a user's home screen and provide an app-like experience without installation.

WebViews:

Many native mobile development platforms (e.g., Android and iOS) provide WebView components that allow you to display web-based content within a native app. You can embed HTML5 content in a WebView, creating hybrid apps that combine native features with web content.

## Methodology

The flexible Design Science Research (DSR) has proven to be an effective tool for discovering innovative solutions to complicated problems. The nature of addressing a complicated problem, according to [12], is searching for an action or collection of activities to attain the desired aim. These authors agree on the importance of identifying, gaining, and applying knowledge to solve an issue. New data and information are extracted from results in the phenomena being examined, domain expertise, existing literatures, and specialists in domains to obtain knowledge [12].

This methodology is applicable to this paper. It further gives a structure on how the research should be carried out as it contains different steps as shown in figure 1 below according to [13].

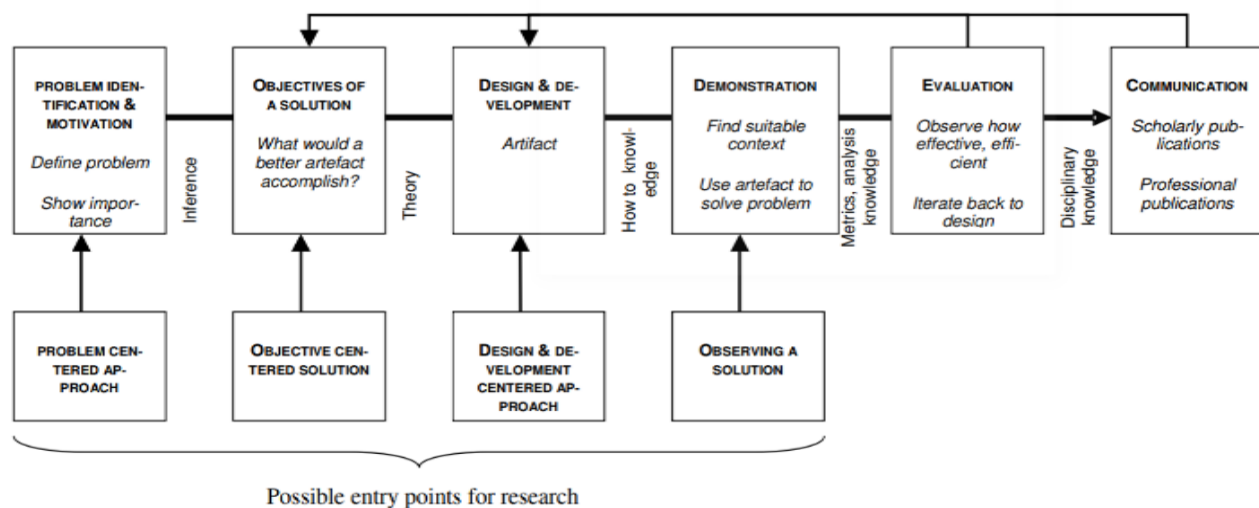


Fig. 1: Design Science Research process [13]

Design Science Research Process (DSRP)

### 1. Problem Identification and Motivation

The researchers, as well as the research audience, are motivated to accept the research conclusions when the research motive is provided, and it also aids in understanding the researcher's grasp of the problem [13].

There was a huge improvement from HTML 4 through to HTML 5. The improvement looks to improve user experience by adding a lot of powerful features for presenting data on both mobile, tablets and desktop devices. This improvement requires a huge learning curve but offers a wide range of benefits like the offline features which means users can now browse without internet access and only need internet access to sync the data created during the offline sessions.

This is a huge benefit for developing countries that do not have adequate internet connection facilities.

### 2. Objectives of a solution

A set of objectives that the solution must be achieved which will be drawn from the problem description. The aims can be quantitative, in which case the desired artefact would be better than the current ones, or qualitative, in which case the envisioned artefact is intended to solve a problem that has not been addressed previously. In this study we will demonstrate the adaptation and qualities of a HTML 5 features. This study focuses on system that demonstrates the features of HTML 5 as an adaptable front-end system. Using this solution, users can focus on the building of the backend data storage and processing infrastructure and capabilities. This is a fully adaptable solution that can be

converted to a native application using one of the native applications development options mentioned above in point number E.

### 3. Design and development

This paper looks at one of the most commonly used dashboarding templates that was developed using AdminLTE. This is a popular open source WebApp template for admin dashboards and control panels. It is a responsive HTML template that is based on the CSS framework Bootstrap 4. The system (template) is designed and developed with Bootstrap and utilizes powerful features that can be used to demonstrate data drawn from various backend applications.

### 4. Demonstration

The system is popularly known for its fully and easy utilization as a front-end design.

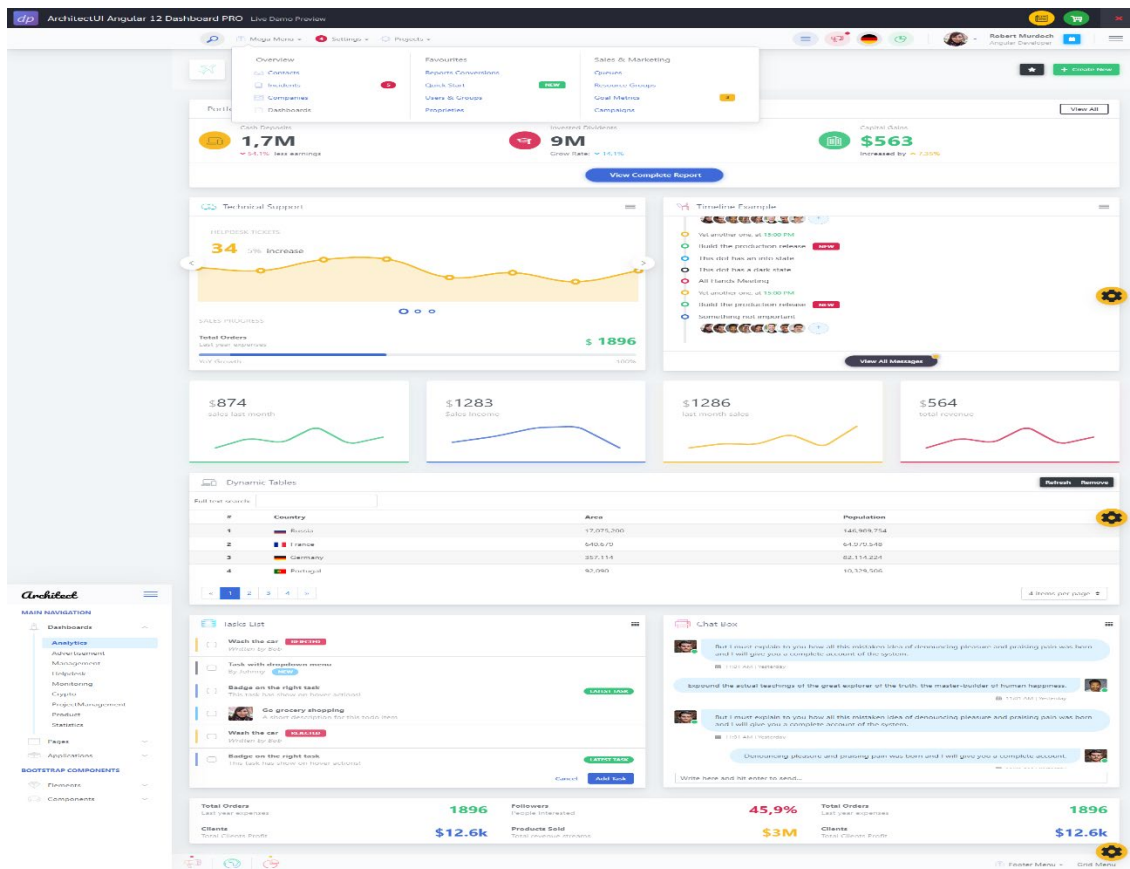


Fig. 2. Admin LTE - Architect UI Angular 12 Dashboard

The above screen demonstrates the ability to display multiple information in the different Bootstrap features. You can show information using graphs, dynamic tables, timelines, orders in sliding bars, accordions, include chat boxes for interaction with amongst staff members or with customers.

The system uses the following elements of HTML 5:

- Standard Buttons
- Pills Buttons
- Square Buttons
- Shadow Buttons
- Icons Buttons
- Dropdowns



- Icons
- Badges
- Cards
- Loading Indicators
- List Groups
- Navigation Menus
- Timeline
- Utilities

Also uses the following components of HTML 5:

- Tabs
- Accordions
- Notifications
- Modals
- Progress Bar
- Tooltips & Popovers
- Carousel
- Calendar
- Pagination
- Count Up
- Scrollable
- Maps
- Ratings
- Image Crop

Form elements already uses controls that already validates input and comes with multiple layout options.

Tables are built using Bootstrap 4 tables that are responsive as well as consist of sorting features.

### 5. Evaluation

The solution makes full use of HTML 5 features to demonstrate the points raised in the literature on this paper. It moreover shows the capability and adaptability of HTML 5 applications for use as a front end of various scenarios. This shows the huge improvement that HTML 5 shows when compared to the earlier versions.

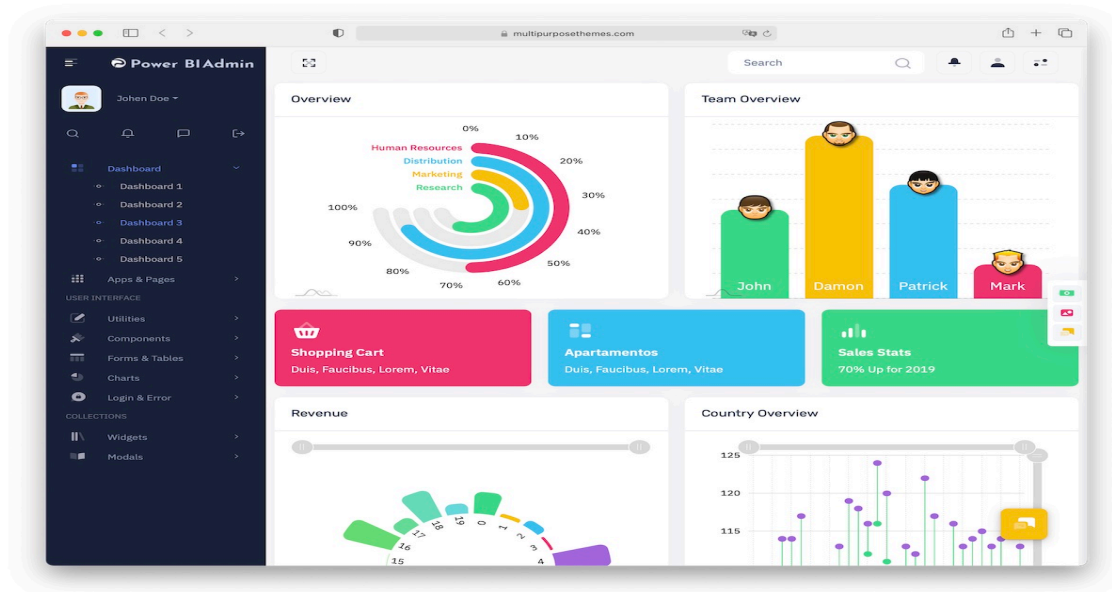


Fig. 3. Admin LTE Demo on Bootstrap 5

## Conclusion

This paper has demonstrated powerful HTML5 features that uses Bootstrap CSS features for demonstrating or presenting data. AdminLTE system template as demonstrated is fully adaptive and can be used as a front end of most backend applications. Users can focus on the creation and processing of their data and make use of the already developed data presentation features for presenting the data to various stakeholders. The system can be converted to a native application using options discussed in this paper. The paper also discusses a few concerns with regards to limitations of using HTML 5 for applications. Overall, most of the web application systems are developed in advanced countries and developing countries purchase at exorbitant foreign currency-based prices. Developing such systems had traditionally been done by expert web developers using specialized programming languages. However, towards sustainability, developing countries have to get to a point where most of the needed systems are developed in-house. Such progress has evolved towards a state where some countries have leapfrogged towards development through progress in Information Systems development such that even advanced countries outsource some of their system development works to make use of the massive human talents at lower costs in developing countries. Without doubt, that would increase employment rate and should serve a goal for many other developing countries that are especially low in financial fundings, plagued with high unemployment but yet buoyant with high human capital. Thus, such development attainable today will also enhances the development of future generations, and such goal is the ultimate aim of sustainable development.

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