Web-based digital signage design and implementation for food and beverage industry

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Laurea University of Applied Sciences   **Abstract**
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The growth of technology and information, especially in recent years has led to an emerging phenomenon in the field of marketing, which is referred to as digital marketing. In this era, major changes have taken place in the business environment and in the marketing strategies. In order to take advantage of digital marketing in any type of business, it is necessary to create a suitable platform along with presenting new marketing strategies.

The purpose of this thesis project was to design and implement a digital signage platform with a web-based content management system to digitalize the advertainments contents and enhance the customer experience at the retail environment. The platform has been commissioned and developed for the Finnish company called Zico Oy, which operates in the food and beverage industry. The project objective was to develop a web-based stand-alone digital signage platform that can enhance the way of promoting product information (digital menu) and seasonal campaigns. The system had to be remotely accessible and user-friendly. The platform had to be compatible with Tizen and Android Tv operating systems and support multiple screens with independent contents. The project has been developed using PHP, JavaScript and HTML web programming language and designed based on the WordPress online platform. The project was successfully implemented, and all project objectives were met.

Keywords: DigiSign,Digital Signage,PHP,Web-based,Javascript,WordPress

Contents

1   Introduction

1.1   Digital Signage History

Nowadays, digital media and technologies have a significant role in our lives. The World Wide Web (www) has been around for more than 25 years, and during that time, we have seen considerable changes in digital media and marketing technology to provide new ways for businesses to connect with customers. According to Chaffey (2019) more than 3 billion people around the world regularly and dramatically use online services to find products, entertainment, and advertising.

Improving competitiveness and achieving marketing goals for business owners highlight the role of digital technologies in the retail and food and beverage industries. these technologies "increase consumer behavior and decision-making in the store and improve the collection and exchange of information." Digital signage (DS) is one of the advertising tools that have recently attracted the attention of many advertisers (Lee and Cho, 2019). The DS is a system to transmit information using a chain of electronic display devices in different locations, such as open spaces, stores, public spaces, and transportation. (Sandkuhl et al., 2018).

Digital signage is commonly used to distribute advertising, information, and entertainment for the audience on the move. With supporting real-time data delivery, Digital signage systems can get synchronized with other in-store technologies. Giant retails such as Walmart have already realized the potential of this medium and used it to enhance in-store advertising and the shopping experience and thus additional sales (Garaus & Wagner, 2019).

DS content includes audio, video, and text. Unlike traditional advertising, digital signage eliminates the cost of content distribution. In addition, it can dynamically change the content of its displays in milliseconds and sync with new content. Such flexibility allows displays to show various advertising messages according to schedule or for specific events.

Today, DS can be used to present content that exists in four distinct (but often overlapping) forms: commercial, informational, empirical, and behavioral.

•**Commercial**: Undoubtedly, commercial versions of digital signage are an essential part of this phenomenon. That includes all kinds of advertisements and content to push sales.

•**Informational**: The use of DS and displays in public places such as passenger hubs has significantly increased. With the upgrading of airports and stations, the installation of large

digital displays has become quite common. Most of these displays are limited to travel information and data up to now.

•**Experimental**: The content of digital signage affects the waiting time perceived by the customer. In practical application, the DS is being used to enhance the audience's experience while in the same environment. For instance, content includes recipes and descriptions of meals, general facts or trivia, fun quizzes, and many more. A well-positioned digital signage with relevant content can also be used to pass the time, and more importantly, to introduce other products or services nearby or at a similar location (Schaeffler, 2012).

•**Behavioral**: Visual aesthetics are enticing to human emotions. Involving digital signs at the main points of the decision can impact customer behavior due to the possibility of highlighting specific information at each step of the consumer journey.

Signs right at the entrance, for example, highlighting ongoing sales and new items will encourage consumers to come in and visit, whereas signs near the checkout highlighting limited deals may remind people of a savings opportunity to add to their cart.

Figure 1: A digital signage system

1.2 Briefly about marketing

Marketing is the science and art of discovering, creating, and presenting value in order to meet the needs of a target market while making a profit. Marketing identifies unmet needs and wants, creates the demand, and then designs and promotes appropriate products and services. According to the American Marketing Association, marketing is a set of institutions, activities, and processes related to the creation, communication, delivery, and exchange of offers.

1.3 Types of marketing and comparison

Traditional marketing: Traditional marketing is any type of marketing with content that has no presence in the online environment. Printing, broadcasting, traditional mail, phone (cold calls), and outdoor advertising such as billboards are all examples of this. This marketing method, which ranges from newspapers to radio, assists in reaching out to specific audiences. In today's world and Finland in particular, widely use traditional marketing. Finding ads in magazines and newspapers, posters, or reading billboards is still familiar to people. In most cases, this type of marketing has a local audience.

Traditional marketing has the following advantages:

- **Effective and quick to comprehension:** A visually attractive outdoor Ad (billboard) or a well-produced and colorful TV commercial is a typical sight in most people's daily lives. They are simple to understand and frequently entertaining.
- **Permanent and durable**: If the business places an ad in a local or international newspaper, it will remain until it is recycled.
- **More memorable:** According to the studies, students of different ages, from elementary school to higher education, absorb more when they read on paper rather than on screens, especially when it comes to nonfiction material. (Jill Barshay, 2019). The same rule goes for printed advertising.
- **Trustable:** It is a most important advantage of traditional marketing; because people have more confidence in printed ads.

Disadvantages of traditional marketing include:

- **Difficult to measure:** The results of ads are not easily measurable and, in many cases, are not measurable at all.
- **Usually Expensive**: Traditional marketing is usually more expensive than digital marketing.
- **Static:** Ads content is not interchangeable. once the campaign is ready, it is not changeable or editable.

- **Difficult to set target audience:** In traditional marketing, targeted advertising is difficult for a specific customer group. For instance, in a printing campaign, It is possible to focus on the location or area, but other attributes of the target customers cannot simply be specified.
- **No customer interaction:** In comparison to digital marketing, the business is mainly unaware of their audience's reaction to the marketing campaign.

In traditional marketing, it is challenging to provide complex pricing. (Todor, 2016)

Figure 2: Traditional marketing Pros & Cons

Digital Marketing: Digital marketing formerly referred to as e-marketing or internet marketing, is at the heart of digital commerce (Chaffey and Smith, 2017). Digital marketing is the use of digital media to deliver content to people in order to attract users in the digital (online) environment. Digital marketing has presented various communication methods, including Social media (Facebook, Instagram etc.),Website, Content marketing, Affiliate marketing, Inbound marketing, Email marketing (pay per click) and SEM (Search engine marketing).Social media networks offer consumers a variety of applications, such as social interaction, entertainment, information, identity and personal development, communication, leisure, and rewards. In an online environment, people can express their opinions, share their feelings, communicate, and discover the source of information or specific brand. This data provides organizations with consumer information such as demographics, psychological information, and webography data (Hanlon, 2020).

Organizations will be digitized if one of the following events occurs:

1. Big data, analytics, and artificial intelligence affect your business processes and, in addition, how your critical decisions are made.
2. Social network shapes the actions, reactions, and purchases of your customers.
3. Mobile applications and cloud computing should play an essential role in providing your services to individual and organizational customers.
4. The Internet of Things (IoT), using sensors and software, connected all products to the broader web machine and cloud space.
5. Robotics, drones, and 3D printers is the main drivers of your supply chain transformation.
6. Cognitive and robotic algorithms have influenced the way you think about recreating your business for the future (Venkatraman, 2017).

The advantages of digital marketing include:

- **Cost efficiency:** Compared to traditional marketing, digital marketing is more cost-effective, and in many cases, a simple website can generate traffic for free.
- **User interaction:** it is easy to observe what target audience thinks of the brand and marketing efforts through channels such as social media. One of the benefits of online marketing is related to its "enabling effect" Especially in small businesses because the Internet can increase market access and operational efficiency of small and medium-sized companies.
- **International audiences:** A web-based advertising (ads) can reach an audience from all over the world
- **Availability**: Information is available online for an unlimited period.
- **Dynamicity**: Digital marketing offers a wide variety of content as well as the ability to update content when needed quickly.
- **Easy to measure and monitor:** The impact of advertising can be measured more accurately than traditional marketing.
- **Tailor-made content and target audience:** Digital marketing can create suggestions and offers that can be personalized based on the consumer's profile or behavior and preferences. Also, it is possible to target a specific group of audiences based on location, age, gender, hobbies, and many more attributes.

Figure 3: Digital marketing Pros & Cons

1.4   Introduction to the current problem

The number of coffee shops is increasing, and the competition to win the customers is getting fiercer. On the other hand, in the digital age, the business environment is also evolving, and the number of companies that offer their services online or using digital marketing is expanding. Therefore, to maintain a competitive advantage in this industry, new marketing strategies must be adopted that are compatible with the new business era.

One of the highlights of digital transformation is the large number of people accessing various online contents and social networks, which is not really a problem. It is an opportunity to develop and implement appropriate digital business models.

In the case on hand, after analyzing all the sales data and other relevant information, it has been concluded that due to the lack of customer awareness about the brand and products, the business is suffering from low customer traffic. The current traditional advertising system and the unattractive style of the menu are imposing high cost and low effect in creating foot traffic.

1.5   Project scope and objectives

Digital signage technologies have been used in a wide range of business sectors. However, each industry has unique requirements for the functionality and usability of the content management system. For instance, in terms of CMS requirements, the solution used in a coffee shop to

display menus and advertisements will be vastly different from the system used in airports to display flight information.

The outcome of this project will be a web-based digital signage solution for the food and beverage industry, specifically for the client Zico Oy (Robert's Coffee Redi), that will be used to display the products menu and information on a Smart TV display inside the shop and marketing campaign (ads) on a second display at the entrance of the premises. The system is remotely manageable from the web interface. The client will have a dashboard to create, manage, and change the content. The program will generate a web address that will be compatible with any type of Smart TV. The system's most significant advantage is the stand-alone functionality that makes the need of the project for additional hardware obsolete. The project is a trial or pilot, and if it satisfies the client's expectations, they will decide to use it permanently and offer it to the franchise headquarters to use it in all 67 stores worldwide. The initial language of the platform will be English, but it will be translated to Finnish upon request.

2   Brand and product awareness

If organizations are to compete with their competitors, they must have a large number of loyal customers for their products and services (Shabbir et al., 2017). In the marketing context, companies focus on informing consumers to create the desired responses from the audience. Consumer awareness of the company or brand can be one of the basic steps in customer acquisition (Foroudi, 2019). Kotler, the father of modern marketing, defined the term brand in marketing as a set of specific features, benefits, and services that sellers provide to buyers over time. A *brand* is an invisible asset that brings added value and credit to the brand owner. A brand is a name, term, symbol, code, or design and combination that are used to differentiate it from the products or services of other competitors (Guo, 2018). Branding is part of the strategy of building long-term value-based relationships with customers (Tran et al., 2020). Brands vary in the amount of power and value they have in the market. On the one hand, some brands are not known to most consumers; on the other hand, there are brands that buyers are relatively aware of. Awareness shows the strength of the brand presence in the minds of the target market, and the ability of customers to identify the brand under various conditions shows their level of brand awareness.

Brand awareness is the potential buyer's ability to recognize and remember that a brand is part of a particular product category (Alfian et al., 2019). In general, customers who are aware of a particular brand are always significantly more attracted to products and show more loyalty than customers who are not familiar with the brand (Shabbir, 2017). Brand awareness is expressed as a combination of brand recognition and brand reminder; Brand recognition is the ability of customers to recognize in different situations, and brand reminder is the ability of customers to remember the brand when faced with the need for a product or service category. Research shows that brand awareness is the subject of many consumer-oriented branding issues, and the customer pays more attention to familiar brands (Vasileva, 2017). Studies on the effectiveness of DS on brand awareness have shown that brand awareness has increased among consumers (Alfian et al., 2019).

2.1   Brand awareness and increasing customer traffic

Brand awareness is an essential indicator of consumer knowledge about a brand and a brand's presence in the consumer mind retrieving that knowledge. Customer loyalty is a measure of a consumer's faith in a particular brand over time that emphasizes the ongoing and continuous repurchase of that brand. Customer loyalty creates an emotional attachment to the brand, which is basically due to commitment and interest, and the consumer becomes interested in the brand as a companion. Today's market is full of a wide range of product brands. Organizations develop brands with the primary goal of attracting and retaining consumers. Loyal customers are important because such customers often spend more, buy more regularly,

are motivated to seek information, are more resistant to competitors' ads, and are more likely to spread word of mouth.

Increasing consumer awareness has led consumers to buy their familiar and desirable brand. Therefore, if businesses want to beat their competitors, they must apply creative solutions to attract consumers to buy their products and brands. Macdonald and Sharp pointed out that even if consumers are familiar with a product and want to buy it, brand awareness is still an essential factor influencing purchasing decisions. When consumers want to buy a product, and a brand immediately comes to mind, the business have achieved higher brand awareness. Therefore, products with higher brand awareness will have more market share and better-quality evaluation. In addition, consumers more often choose a product, which cares about brand image and awareness. Businesses need to increase brand loyalty. Because some studies show that the cost of attracting a new customer is five times higher than retaining a loyal customer. (Macdonald and Sharp)

2.2   Related works

Studies have shown that DS has a significant effect on customer behavior, shopping time, goods purchased, the likelihood of repurchasing, and the number of re-visits the business (Roggeveen et al., 2016). Using DS, stores gain various benefits, including increased customer satisfaction, sales volume, and customers on average spend 30% more time in stores. (Cho, 2019) By analyzing research into the effectiveness of DS in marketing at public places, it offers options for improving consumer interaction with digital signage (DS), which is recognized as an essential communication tool for business or public affairs. According to the results, DS smart advertising content leads to positive buyer behaviors and make a right impression of shopping environment.

There has been some research that has evaluated the right location to display digital signage. For example (Wang et al., 2020; and Xie et al., 2018) provided an accurate pattern for selecting digital signage locations that integrate spatial location features and multifunctional agent data and combines experimental location models with machine learning techniques to recommend the best spot for digital signage. The waiting experience in any environment is influenced by the physical characteristics of the same environment. In healthcare, little is known about the "waiting experience" for the use of DS as a communication and technology platform. (Cordero, 2020) evaluated the waiting situation in real life and discovered the experience of waiting in a clinic equipped with DST. A field study and a survey questionnaire were conducted to collect data from visitors to obtain information on their participation, attention, and understanding of the "experience" and "DST" of a clinic waiting area in Edmonton. Using qualitative descriptions, the findings and analyses revealed that DST improves the visitor waiting experience, reduces visitor waiting anxiety, and impacts visitor education.

(Garaus and Wagner) evaluated the effect of installing a digital sign in a payment section of the store on customers and their experience. This field experiment indicated that digital sign installed in the payment section of a grocery store affects the customers' overall satisfaction by distracting them from paying attention to queue time and engaging with the DS content. Having a digital signage system reduces the waiting time and creates the desired waiting experience, simultaneously. (Garaus et al., 2021) have evaluated the effectiveness of emotional targeting using digital signage and face recognition systems at the point of sale. Digital signage systems that use face-reading software and sensors detect not only the age and gender of buyers, but also their mood. Findings from a lab and online experiment show that emotional targeting increases buying intent, understanding product quality and willingness to pay. In addition, matching the extra content with the product group reinforces the positive effects.

(Wibotzki et al., 2017) evaluated ads based on user preferences in digital signage. This screen, which is installed on the elevator door, investigates and displays the most relevant content for users. (Van de Sande et al) evaluated that how does the location and content of digital billboard ads in the store affect customer behavior? The results show that customers, who go shopping without purpose and planning, are more affected by advertising messages and have a more favorable attitude towards the product and a higher purchase intention. On the other hand, customers who enter the store with the intention of buying a particular product, remember the relevant ads to that specific product more. In terms of digital sign location, the screens at cash register has had the greatest impact on customers.

In another study, (Roggeveen et al., 2016) evaluated the effect of digital signage in different stores on sales. The results show that sales in hypermarkets increases when digital monitors are on. However, in smeller supermarkets or grocery stores, having digital monitors has the least effect on sales, and in smaller retail spaces, digital signs have a negative effect on sales. (Abraham and Kennedy, 2018) proposed an intelligent digital signage system for higher customer engagement. This system has been designed to broadcast ads on a digital signage system based on demographic characteristics such as gender.

(Turov et al., 2019) In their research, they examined media personalization through viewer analysis. Identifying emotions and interests, predicting by mood, as well as using modern 3D cameras to capture distance from viewers are some of the factors that have been explored to personalize digital signage.

2.3   Possible solution

After studying all the data and gathering information, it has been decided to solve the problem on hand, use a digital signage system as a pilot project to attract more potential customers, and enhance our regular customer experience. To achieve this goal client has decided to install

and use two separate screens in two strategic locations of the retail space. The first and main screen will be installed at the top of the counter to be used as digital products menu, product information point, and advertisements. The screen would replace the existing traditional menu at the same place. The second screen will be installed at the side of the entrance in order to run seasonal advertisements based on content scheduling. This screen will be able to show appropriate content at a pre-scheduled time. For instance, from 9.00 am to 11.00 show breakfast offers and after 11.00 shows lunch and evening offers. The primary purpose of the second screen would be to attract the passing customer and change their "Window Shopping" behavior to actual purchase. To manage content and displays, using a CMS or content management system that can dynamically display the contents on both screens or any additional screens in the future was necessary. Achieving this task was possible by evaluating two possible options:

2.4   Available solutions in the market

Many companies in the market are providing total solutions for digital marketing and digital content CMS. Each company has its own style, services, and price tags. According to the client's budget and preferences, most of the solutions, including extra hardware or special screens, would be unacceptable. That would eliminate most Finnish suppliers even though their language options would be preferable. However, the professional display and media player hardware have better quality and durability. The other solution was to subscribe to an online CMS system and use their server and online resources to create content. In this kind of server, for a monthly or annual fee of subscription, subscriber will have a personal dashboard and editor system to create and update content. The price range for these services will start from 20$ to 100$ per month depends on the level of service and dedicated space on the provider server. This solution is easy and reliable, but it has its disadvantages as well.

- The client would not own the server or space.
- Monthly membership.
- The client had to rely on third-party customer service in case of any technical issues.
- The language was primarily English and not interchangeable.
- The providers were mainly in different time zone, and that would make the communication difficult.
- Need of extra hardware or equipment

After considering all of the disadvantages of the premade solutions, the second option has been evaluated.

2.5   Custom-made option

The second option was to create a CMS system from scratch based on the client's needs and preferences. The project's budget was minimal; therefore, the solution to develop the whole platform, had to be based on a minimum budget and the best outcome possible. To achieve this goal, by referring to BIT courses and online research, adequate tools to make the projects possible has been identified and gathered.

3   Methods and Methodology

3.1   Research methods

The project planning started with gathering the data about the current sales information and patterns. After that, a field research to observe customer behavior and questions while making the purchase decision has been conducted. Also, a brief research about customer foot traffic around the shop entrance and analyze their reaction to other stores outdoor advertisement took place. Next a quick survey in two groups with regular customers and a group of random customers arranged. Among other information there were three questions to evaluate the level of customer information about the brand and knowing their opinion about visual changes.

1-Where does Robert's coffee brand come from?

2-Can you Name a seasonal drink from this brand?

3-What do you think visually should change in the shop?

For the first question, 50% of regular customers knew the answer, and 90% of the random customers did not know or answered incorrectly. That made it obvious that even our regular customer is unaware of fundamental information about the brand. For the second question, 100% of the regular customers could name a seasonal drink, but 70% of the random could not name any, or the name was wrong (competitor's drinks name). It showed that although they are our customers and purchasing our products but none of them could remember the names. To answer the third question, there was multiple choice answers provided, including " menu", " outdoor advertisement," and "decoration". 70% of the regular customers and 90% of the random choose all 3. That made it clear that consumers care about visuals in the shopping retail. further investigation showed that the elements that has been used to decorate the shop doesn't give a "cozy" feeling and there is not enough information on the menu for the customers to make a firm decision. "Finns don't like to ask questions and would like to find out about things without asking" one of the customers explained. In the next phase, social media data and insight related to customer engagement and attributes, including age, gender and location collected.
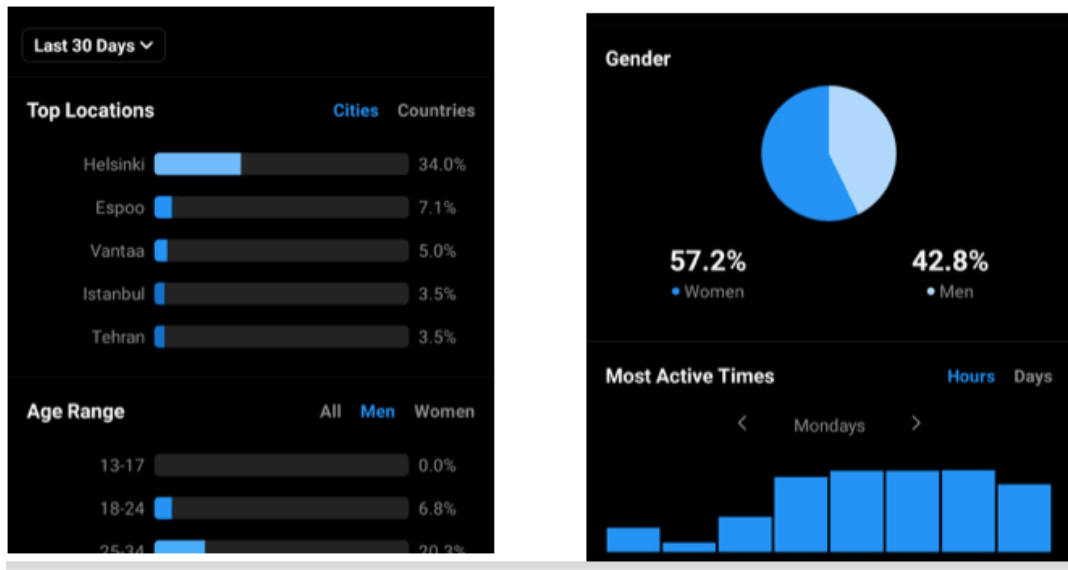
Figure 4: Social Media Analysis

At last, level of brand awareness and popularity by searching the brand on google trends and observe the pattern by matching the data with specific dates evaluated.
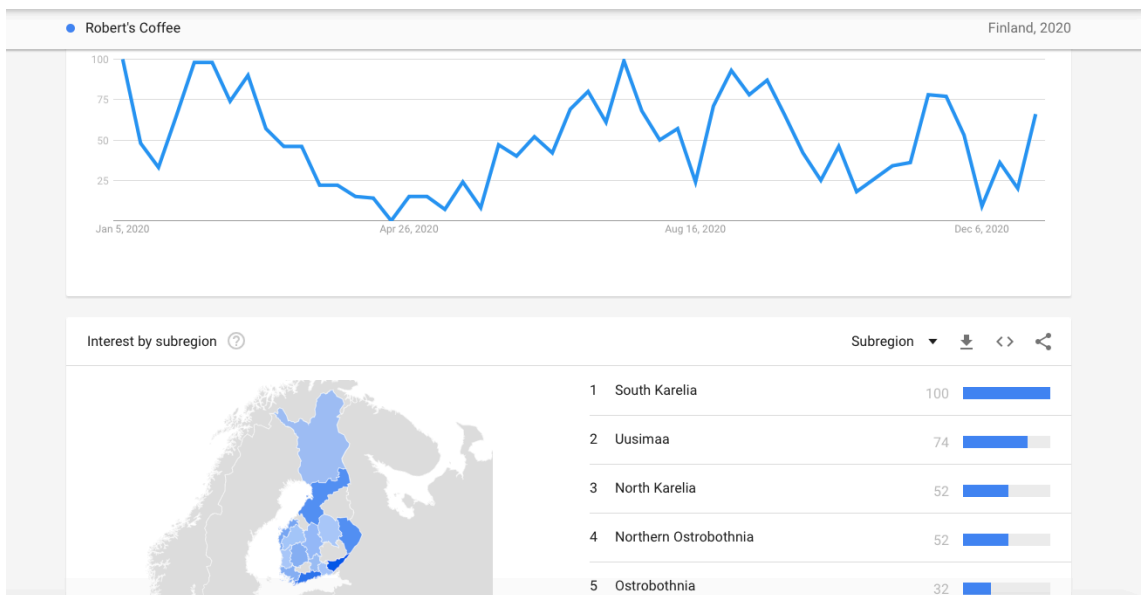

Figure 5: Google Trends Result

3.2   Development tools

In developing this project, there are various tools used that, in this chapter, will be introduced and explained briefly.

3.3   General requirement and tools

3.3.1   Introduction on Smart TV OS

Smart TVs are entertainment computers connected to the Internet that can be connected wirelessly to many devices. The TV operating system uses certain programs to connect to websites such as YouTube, Netflix, Hulu or Vimeo. Web browsers can access social networking sites such as Facebook and Twitter and other types of websites. Users can sync a wireless keyboard, smartphone or tablet with the TV, making it almost as user-friendly as the PC for web browsing. The operating system is one of the key options in choosing a smart TV. In simpler language, the OS allows the user to interact with the computer without knowing the language. The most important component of intelligent capabilities (Internet connectivity and easy access to applications and web pages and virtual use of the TV) is the operating system. TVs have different smart features depending on the manufacturer and TV model.

3.3.2   Types of Smart TV OS

Samsung TIZEN operating system: Tizen OS is a Linux-based operating system developed by the Linux Foundation. This operating system in only available on Samsung devices. TIZEN is present in all of the company's products, including TVs, cameras, stoves and air conditioners. The main feature of Samsung smart TVs is part of the operating system, the Smart Hub screen interface that allows the user to easily watch movies, browse TV shows, browse the Internet, browse Samsung apps, chat with friends, and search for a variety of new interactive TV content using Samsung Smart View .

Visually, the operating system is good. Clearly many design cues are taken from WebOS. There is a horizontal bar at the bottom of the page. However, the problem with this operating system is twofold. First, it is not as smart as some of the other operating systems on this list. For example, while Roku learns what user love and offers new content from all the apps that have been installed on it, Tizen OS only offers apps that user haven't opened in a while. Second, it faces charges of oversimplification.

LG WebOS operating system: WebOS is LG's smart TV operating system, which finally emerged as the top smart TV operating system in 2014 thanks to its soft and easy user interface. Since 2014, LG has been constantly refining and updating the operating system, and now this system can be found in refrigerators as well as projectors. Recently, the biggest update has been made on 2021 TVs, and these TVs will be released with this operating system in version 6.0. WebOS

is Bluetooth compatible, which means it is easy to connect keyboards, mice and other essentials. Also, compatible with Miracast. (Miracast is the HDMI wireless version!). Other notable features, including live streaming, 360-degree VR360 video playback, and image gallery mode, can also connect to other smart home devices and interact with all devices via voice assistants connected to Google Home or Amazon Alexa

ANDROID operating system: Perhaps the name of the most familiar operating systems is Android. This platform is managed by Google, and like mobile phones, different brands widely use the operating system on TV. Many reputable brands use the operating system for their TVs, Sony is connected to Android TV to present its smart platform, with some very attractive features and many options for content and games. The user interface is beautiful and quite simple.

If user is a Google fan, they may get the purest experience of Google Smart TVs. With both Google Chromecast and Google Voice Assistant, it makes it easy to share content across devices and search for everything from specific shows and movies to online content. For example, vast information about things like the weather, sports competitions, is reachable and user can search for style or actor content. It is also possible to take some smart steps such as monitoring smart devices, ordering products or booking an Uber car.

Amazon Company: Fire OS is the operating system that runs Fire TV and Amazon tablets. Fire OS is a branch of Android, so if the app runs on Android, it may also run on Amazon Fire devices. one can quickly check the compatibility of their application with Amazon through the application service. Fire TV Edition also grant access to Amazon Alexa. Like Google Assistant, it can control smart home, keep up to date with news and weather, and connect with other apps that has been used throughout the day. In terms of content, user is limited to the apps available in the Amazon App store. Even if Fire TV is Android-based, user will not be able to access the Google Play Store. Nevertheless, most major applications are available.

Hisense Vidaa operating system: Hisense uses Vidaa operating system in its TVs. The operating system recently used by Hisense, like other operating systems, has high speed, quality and performance, which means that any expectation of this operating system is applicable. Vidaa operating system is extremely fast and the program installs well on them, on the other hand, the variety of programs and their availability is acceptable. Features like Voice Assistant or Google Assistant are implemented on them. The Vidaa operating system is known for its high speed, in which the program runs in 3 seconds.

Based on above information can be suggested that LG WebOS operating system is the most user-friendly, Tizen and Vidaa operating systems are the fastest, and ANDROID operating system is the most possible software available to users.

3.3.3 Project environment

To start this project has been decided to use a multifunctional and easy to use web-based platform called WordPress. Below the history of the platform will be explained and abilities and short comes will be evaluated.

History of WordPress: The WordPress journey began in 2003 when two developers, Mullenweg and Mike Little, began building a new blogging platform on top of a bundled piece of software called b2 / cafeblog. Shortly after the project was abandoned, they decided to seize it and continue development as they saw fit.

They released the first version of WordPress (WordPress 1.0) in January 2004. The project was completely different from the rich content management system known as WordPress these days. However, this version already has most of the key features developers still use, such as the WordPress editor, a simple installation process, a beautiful unique link, a user management system, editing capabilities, and more.

Since 2004, WordPress has undergone an incredible transformation. Today, the WordPress project is developed, managed and maintained by a dedicated, open source community of thousands of members worldwide. They work remotely, many of them volunteering and attending a distributed WordPress conference called WordCamp.

WordPress is still growing fast and a new version is released every 2 or 3 months. Each version adds new features and security updates to the operating system.

In general, a content management system (CMS) is a web application that allows website owners, editors, and writers to manage their website and publish content without any programming knowledge.

WordPress uses PHP and MySQL, which almost all web hosts support. CMSs are commonly used for blogging, but a WordPress site can easily become an e-commerce store, portfolio, news website, or any type of project with dynamic content such as digital signage. One of the best things about WordPress is that it comes with an intuitive and user-friendly interface which makes it perfect for us in this project.

WordPress has several advantages, and this is the best solution for anyone who wants to manage their website without any programming knowledge. In addition, it is a good choice for programmers, as it is a highly customizable tool. However, everything has its pros and cons, and WordPress has its drawbacks

Advantages:

- **Very low cost:** WordPress software, many plugins and templates are free. In addition, the very low cost of setting up the site, will help user to no longer seek outsource help for any changes.
- **Easy installation and updating steps:** WordPress is known as a 5-minute installation and unlike many content management systems it is updated with one click
- **Easy to manage:** User doesn't need any programming knowledge to do everyday tasks such as writing and editing posts, uploading and editing images, managing users, adding menus and installing plugins and themes.
- **Custom Design:** With thousands of WordPress templates ready to use, user can launch a site in any field with any design.
- **Custom Features:** Use of plugins is to extend the default WordPress features. Basically, from search engine optimization to event booking, it's possible to find plugins for any specific task.
- **Useful Community:** WordPress has a global community and an extremely useful support community.
- **WordPress Security:** WordPress security is very high, but only if the platform kept updated.
- **Top SEO:** WordPress is coded in a completely standard way, and all web standards are given importance, which makes the web site SEO high and get a high position in Google results.

Disadvantages:

- **Security Concerns:** Since WordPress has the largest share of sites globally it is often targeted by hackers. It is possible to reduce the risk with timely updates.
- **Page loading speed:** If variety of plugins have been used, it may cause the site to slow down. It's obvious, that installing a WordPress cache plugin can solve this problem.

Templates and plugins are the biggest asset for the popularity and power of WordPress, which in order to have a better understanding of them ,will be explained.

WordPress Theme and Templates: WordPress template, WordPress shell or WordPress theme that all give the same meaning, is used to design the site (site design) and determine the layout of various elements in the web page. WordPress templates are ready for free and commercially. Extensive in different types and designs are available to public that can be used depending on the type of site and tailored to different type of business. After downloading or purchasing the desired template, user can add it to their website with just a few simple clicks. In this project templates have been designed and exported to make them easy to edit and change.

WordPress Plugin: WordPress plugins or plugins are small software that add features to the WordPress content management system and increase its performance, which means it's possible to add any feature desired to WordPress and eliminate bugs. For example, one can build a store using the WooCommerce plugin. Installing plugins is possible with just a few clicks and is also one of the reasons why WordPress plugins are so popular because there are more than 55,000 WordPress plugins in the WordPress repository for free to use. To implement this project the user dashboard part of the program had been designed and code as a plugin compatible with WordPress and here and after called DigiSign.

3.3.4   Project host environment

To install and run any type of application online or offline presence of an operating system is required. As previously in the scope of project mentioned, one of the objectives was to manage the content via web. For installing WordPress as the foundation of this project, an online server which is compatible with the platform requirement is the key.

Before doing a full review of suitable WordPress hosts, its necessary to understand what kind of server and interpreters the WordPress content management system needs in order to execute properly. For example, Windows hosts certainly is a wrong choice, they haven't design to work with PHP programming language, but with a series of complex tasks it may be useable which is not recommended. WordPress needs to run and process huge amount of information that is going to be stored and added to the database day by day and this is possible by using:

- PHP version 5.2 and above
- MySQL database version 5.0 or higher or MariaDB database version 10 or higher
- Apache Linux server, Nginx

Therefore, almost all Linux servers provide capabilities to install and run WordPress.

3.3.5   Content editor environment

In this project, we had to find a user-friendly and advanced tool to give the user the ability and freedom to design and create multimedia content for their digital menu or advertisement. After consideration of different tools, we have decided to use a powerful plugin for WordPress called Elementor.

The Elementor is the name of a WordPress plugin that falls into the category of page builders. Using the Elementor plugin, the site administrator can design different parts of his site content without a single coding line. Just take a few minutes and design and modify all the different parts of the WordPress site using the plugin's features. Elementor plugin has many outstanding advantages which have caused the installation statistics of this WordPress plugin to reach more

than two million official installations in the WordPress repository. Not every plugin can reach this number of installations and must have many capabilities. Here are some of the key benefits of this plugin:

- **Easy and instant editor:** As mentioned above, the user interface of the Elementor plugin is very comfortable and user-friendly. This allows the user to design their own page in the shortest time and easily.

- **Page builder by dragging and dropping:** It's possible to just to use drag and drop to move the widgets and reach the desired design. This feature makes it easy for even novice users to work with this plugin.

- **Possibility to change the page size with Elementor plugin:** Elementor plugin allows the user to change the size of all parts of the page and increase their width and length to their liking.

- **Creating templates:** In this project, it was necessary to create menu and advertisements templates to make it easier to edit. With Elementor developer can save all the pages created in this plugin and import them into other WordPress sites. This way it's no longer necessary to spend a lot of time designing and creating different pages.

- **Fully responsive and responsive design:** All parts created and edited by the Elementor plugin are fully responsive. that means all parts are displayed well and completely without any problem on screens such as TV, computer, tablet, smartphone.

The user does not need to be a professional web developer to make changes to Elementor plugin. If they are familiar with CSS code, they can easily customize this plugin to better fit the content template. The CSS will be discussed in program tools section.

High loading speed: Loading speed and refreshing rate is the essential part of online content design. All parts made with the mentor have a high loading speed and the user will not feel any noticeable reduction in speed on the page.

Undoubtedly, no plugin is complete and has disadvantages. However, some plugins, such as Elementor, have many advantages over disadvantages, and their shortcomings can be ignored.

3.4   Programming tools

3.4.1   PHP

PHP (recursive acronym for PHP: Hypertext Pre-processor) is a popular open source general-purpose scripting language that is ideal for web development and can be embedded in HTML.PHP is a server-side language. That means the code is executed on the server and generating HTML that is sent to the client. The client would receive the results of that script's

execution but would be unaware of the underlying code. Using PHP it is possible to configure a web server to process all HTML files on the server with no evidence of the code on client side. The best thing about using PHP is that it is extremely simple for a beginner while also offering many advanced features for a professional programmer. its good to mention that PHP is the scripting language used to create WordPress. PHP, like WordPress, is an open source project.(https://en.wikipedia.org/wiki/PHP, 2021)

3.4.2   HTML

HTML, or Hyper Text Markup Language, is the standard markup language for documents intended to display in a web browser. It can be enhanced and combined by technologies like Cascading Style Sheets (CSS) and scripting languages like JavaScript. Web browsers receive HTML documents from a web server or local storage and convert them to multimedia web pages. HTML semantically describes the structure of a web page and originally included cues for the document's appearance. (https://en.wikipedia.org/wiki/HTML , 2021)

3.4.3   JavaScript

JavaScript (JS) is a first-class and lightweight programming language that can interpret or compiled. While it is best known as a scripting language for Web pages, it uses in many non-browser environments such as Node.js, Apache CouchDB, and Adobe Acrobat. JavaScript is a prototype-based, single-threaded, multi-paradigm dynamic language that supports object-oriented, essential, object-oriented, and expressive programming styles. (https://en.wikipedia.org/wiki/JavaScript,2021)

3.4.4   CSS

CSS is a language for characterizing the appearance of Web pages, such as color schemes, structure, and fonts. It enables the presentation to be adapted to different types of devices. CSS is a dependent language and can be used in conjunction with any XML-based markup language.(https://en.wikipedia.org/wiki/CSS, 2021)

4   Design and Development

4.1   User Dashboard (DIGISIGN plugin)

User dashboard is the main part of this project. The next section will introduce and clarify different parts of this development.

4.1.1   Design and coding for DIGISIGN plugin

Digisignplugin.php

First part of creating any plugin is to create the first php file that contains the basic information of that plugin. As the project called DigiSign the first php file called "digisignplugin.php" with below parameters has been created:

- Name of the plugin
- Plugin URI
- Description
- Version (based of number of changes)
- Author URI
- License


```php
digisignplugin.php
1  <?php
2  /*
3  Plugin Name: DigiSign Plugins
4  Plugin URI: babak.roodsari@student.laurea.fi
5  description: DigiSign Plugins
6  Version: 1.0.3
7  Author: Babak Roodsari.
8  Author URI: babak.roodsari@student.laurea.fi
9  License: GPL2
10 */
```

Figure 6: digisignphp code lines 1-10

In the next part of the code the constants that in necessary for the entire plugin will be defined. A constant is very similar with variable with the difference of the value of the constants can't change after it is set and use of $ sign in their name is irelevent.in this part of the code debug, root path and URL address of the plugin has been defined.

Also, format of the log files to be based on year, month and day is clarified.

```
11   define('DIGISIGN_PLUGIN_ONE_VERSION','1.0.3.1');
12   define('DIGISIGN_DEBUG', false);
13   define('DIGISIGN_PLUGIN_FILE',__FILE__ );
14   define('DIGISIGN_PLUGIN_ROOT_PATH',plugin_dir_path( __FILE__ ));
15   define('DIGISIGN_PLUGIN_ROOT_URL',plugin_dir_url( __FILE__ ));
16   //define('DEFAULT_TEMPLATE_SLUG', 'DIGISIGN-default-screen-template');
17   //define('DEFAULT_NEW_SCREEN_NAME', 'new-screen');
18   define('DEFAULT_USER_SCREEN_CATEGORY_SLUG', 'digisign-user-screens');
19   define('DIGISIGN_IS_USER_SCREEN_TERM_KEY', 'is_digisign_user_screen');
20   define('DIGISIGN_LOG_PATH', DIGISIGN_PLUGIN_ROOT_PATH.sprintf('digisign.%s.log',date("Y-m-d")));
21   define('DIGISIGN_LOG_PREFIX', DIGISIGN_PLUGIN_ROOT_PATH.sprintf('digisign.%s',date("Y-m-d")));
```

Figure 7: digisignphp code lines 11-21

After defining the constants it's time to introduce main files of the plugin and give the path to access them. The main files in this plugin are as below:

1. Shortcodes.php
2. Ajax.php
3. Filters.php
4. Templates.php

This is the key part of the main code and to embed php code from another file" require_once" command has been used. If the file in any case is not accessible it will return a fatal error and program stops.

```
24   require_once __DIR__.'/include/shortcodes.php';
25   require_once __DIR__.'/include/ajax.php';
26   require_once __DIR__.'/include/filters.php';
27   require_once __DIR__.'/include/templates.php';
```

Figure 8: digisignphp code lines 24-27

Now that our main files introduced, the usage and structure of each file will be discussed.

Shortcodes.php

Shortcode is a small piece of code (snippet) that will allow developer to run a function. For instance, if the content had been designed with any type of plugin, in order to display that content, the short code of the plugin has to be embedded into the same page. The only limitation will be that it has to be embed in the site body or a widget.

AddScreefromTemplate: when user clicks on the "+" button on the templates in dashboard, it will create a new "screen" to be displayed on the TV. Furthermore, user has the ability to modify the content of that screen to desirable design.

```
5    add_shortcode('AddScreenFromTemplate', 'digisignAddScreenFromTemplate' );
```

Figure 9: shortcodes.php code line 5

UserScreens: It will show the added screens on the dashboard

```
8    add_shortcode('UserScreens', 'digisignListUserScreensShortcode' );
```

Figure 10: shortcodes.php code line 8

ScreenTemplates:it will show the list of templates that user can choose from to design their content.

```
16   add_shortcode('ScreenTemplates', 'digisignListScreenTemplatesShortcode' );
```

Figure 11: shortcodes.php code line 16

Digisign-notice: it will create and show notification after different actions. for instance, it will show "Screen successfully added" after screen created from template.

```
25   add_shortcode('digisign-notice', 'digisignNoticeCalledFromShortCode' );
```

Figure 12: shortcodes.php code line 25

GetPost: it will give the system the ability to create a post inside a post.

```
27   add_shortcode('GetPost', 'digisignGetPost');
```

Figure 13: shortcodes.php code line 27

Ajax.php:

Ajax enables web pages to be constantly updated no simultaneously by interacting with a web server behind the scenes.

From line 3 to 25 of "ajax.php" will create a screen from a template. Which means it will duplicate the template and add is as editable screen. To clarify templates in this system is a preset design that user can view, and screen is editable version of that template which user can modify and change.

```
3    function digisignAJAXCreateScreen() {
4
5      // Check the nonce
6      check_ajax_referer( 'digisign_ajax_file_nonce', 'security' );
7
8      // Get variables
9      $template_id  = $_POST['template_id'];
10
11     // Duplicate the post
12     $duplicate_id = digisignDuplicatePost( $template_id );
13
```

Figure 14: ajax.php code line 3-13

```
13
14     if(empty($duplicate_id)){
15       $duplicate_id = new WP_Error('empty', __("Screen creation function returned null!", "digisign_plugin_one"));
16     }
17     if(!is_wp_error($duplicate_id)){
18       wp_send_json_success($duplicate_id);
19     }else{
20       wp_send_json_error($duplicate_id);
21     }
22
23     die(); // this is required to return a proper result
24   }
25   add_action( 'wp_ajax_digisign_create_screen_from_template', 'digisignAJAXCreateScreen' );
```

Figure 15: ajax.php code line 14-25

When user creates a screen and they don't want to keep it, then need a button to remove that screen. This function is possible with adding line 26 to 47 to "ajax.php".

```
26   function digisignAJAXRemoveScreen() {
27
28     // Check the nonce
29     check_ajax_referer( 'digisign_ajax_file_nonce', 'security' );
30
31     // Get variables
32     $screenId  = $_POST['screen_id'];
33
34     // Duplicate the post
35     $removedScreen = wp_delete_post( $screenId );
36     if(empty($removedScreen)){
37       $removedScreen = new WP_Error('empty', __("Screen removal function returned null!", "digisign_plugin_one"));
38     }
39
40     if(!is_wp_error($removedScreen)){
41       wp_send_json_success($removedScreen->ID);
42     }else{
43       wp_send_json_error($removedScreen);
44     }
45     die(); // this is required to return a proper result
46   }
47   add_action( 'wp_ajax_digisign_remove_screen', 'digisignAJAXRemoveScreen' );
```

Figure 16: ajax.php code line 26-47

Line 48 to 68 will register and activate the debug function in case of any error occur. The author will be able to check the log and identify the issue.

```
48  if(DIGISIGN_DEBUG){
49      add_action('wp_ajax_nopriv_digisign_logger', 'digisignLogger');
50      add_action('wp_ajax_digisign_logger', 'digisignLogger');
51      function digisignLogger(){
52          $logMessage = $_POST['logMessage'];
53          if(@$_POST['logCategory']!='renderedCSS') {
54              bLog($logMessage, 'AJAX(' . @$_POST['user_ID'] . '@' . @$_POST['post_ID'] . ')' . $_POST['logCategory']);
55          }else{
56              $logPath = DIGISIGN_LOG_PREFIX.".(U".@$_POST['user_ID']."P". @$_POST['post_ID'] ."@".date("H-m-s").").renderedCSS";
57              file_put_contents($logPath, $logMessage);
58          }
59      }
```

Figure 17: ajax.php code line 48-59

```
60      wp_enqueue_script( 'digisign-debug', DIGISIGN_PLUGIN_ROOT_URL . 'assets/digisignDebug.js', array('jquery') );
61      wp_localize_script( 'digisign-debug', 'digisign',
62          array(
63              'ajax_url' => admin_url( 'admin-ajax.php' ),
64              'user_ID' => get_current_user_id(),
65              'post_ID' => get_the_ID()
66          )
67      );
68  }
```

Figure 18: ajax.php code line 60-68

Filters.php

The php filters are designed to check and validate the user input. It will make the user input verification more efficient and simpler.

The beginning of the code designed to make sure the default content editor of the WordPress will be replaced with Elementor. As mentioned in chapter 3, Elementor is a plugin that will be used to edit the digital signage content.

```
         filters.php              ●
1   <?php
2   add_filter('get_edit_post_link', 'digisign_make_elementor_default_edit_link', 10, 3 );
3   function digisign_make_elementor_default_edit_link($link, $post_id, $context) {
4       if(function_exists('get_current_screen')) {
```

Figure 19: filters.php code line 1-4

Below code will check the status of the screen and its parameter.

```
5       // Get current screen parameters
6       $screen = get_current_screen();
7   }
8   if(empty($screen)){
9       $screen = get_post($post_id);
10  }
```

Figure 20: filters.php code line 5-10

It will check the screen is object otherwise the user may be on admin page.

```
11    //check if $screen is object otherwise we may be on an admin page where get_current_screen isn't defined
12    if( !is_object($screen) )
13      return;
14
```

Figure 21: filters.php code line 11-14

Line 15 to 20 of "filters.php" will make sure that all the pages and post uses Elementor as the default editor instead of WordPress built-in editor.

```
15    // Post Types to Edit with Elementor
16    $post_types_for_elementor = array(
17      'page',
18      'post',
19      'elementor_library',
20    );
21
```

Figure 22: filters.php code line 11-14

Below code will add the "edit with Elementor" link to the admin panel. User don't have direct access to the admin panel but with admin credentials user can use this link to edit all the pages and templates.

```
25    // Build the Elementor editor link
26    $elementor_editor_link = admin_url( 'post.php?post=' . $post_id . '&action=elementor' );
27
28    return $elementor_editor_link;
29  } else {
30    return $link;
31  }
32 }
```

Figure 23: filters.php code line 25-32

In every post or page in WordPress there is an author which in this case will be the subscriber or registered user of the platform. Below codes will define the roles on the subscriber to interact with the system. Below permissions has been enabled:

- Read
- Edit pages
- Delete pages
- Publish pages
- Edit published pages
- Delete published pages

```
55  function digisignActivatePlugin(){
56      // Gets the simple_role role object.
57      $authorRole = get_role( 'author' );
58
59      // Add a new capability.
60      $authorRole->add_cap( 'read', true );
61      $authorRole->add_cap( 'edit_pages', true );
62      $authorRole->add_cap( 'delete_pages', true );
63      $authorRole->add_cap( 'publish_pages', true );
64      $authorRole->add_cap( 'edit_published_pages', true );
65      $authorRole->add_cap( 'delete_published_pages', true );
66  }
```

Figure 24: filters.php code line 55-66

Line 68 to 79 will limit the access of subscriber to admin menu. With this option the user will not be able to see the admin menus hens can do changes that may cause damage.

```
68  add_action( 'admin_menu', 'removeAdminMenus' );
69  function removeAdminMenus(){
70      global $menu;
71      $author = wp_get_current_user();
72  //    $tmp = array_search('author', $author->roles);
73      if(array_search('author', $author->roles)!==false){
74          foreach ($menu as $menuItem){
75              if(is_array($menuItem) && array_key_exists(2, $menuItem))
76                  remove_menu_page($menuItem[2]);
77          }
78      }
79  }
```

Figure 25: filters.php code line 68-79

Below code will any recognize requests to admin panel or admin feature, and it will bounce and redirect it to the user dashboard area.

```
81  add_action( 'admin_init', 'redirectAuthorsFromAdminDashboard' );
82  function redirectAuthorsFromAdminDashboard() {
83      if (
84          !current_user_can( 'manage_options' )
85          && ('/wp-admin/admin-ajax.php' != $_SERVER['PHP_SELF'])
86          && ('/wp-admin/async-upload.php' != $_SERVER['PHP_SELF'])
87      ) {
88          preg_match("/^\/wp-admin\/post\.php\?post=([0-9]+)&action=elementor/", $_SERVER['REQUEST_URI'], $matches);
89          if(is_array($matches) && array_key_exists(1, $matches)){
90              $postId =$matches[1];
91              $post = get_post($postId);
92          }
93          if (empty($post) || $post->post_author != get_current_user_id()) {
94              bLog("Admin access blocked! REQUEST_URI=".$_SERVER['REQUEST_URI']."<br>\r
95  _SERVER:<br>\n".var_export($_SERVER,true)."#####END-OF-_SERVER<br>\r
96  _POST:<br>\n".var_export($_POST,true)."#####END-OF-_POST<br>\r
97  _COOKIE:<br>\n".var_export($_COOKIE,true)."#####END-OF-_COOKIE<br>\r
98  _REQUEST:<br>\n".var_export($_REQUEST,true)."#####END-OF-_REQUEST<br>\r
99  ");
100             wp_redirect(home_url());
101             exit;
102         }
103     }
104 }
```

Figure 26: filters.php code line 81-104

And finally, our style files or CSS from 2 separate files called digisignScreenControl.css and digisignScreenControl.js will be addressed.

```
121         wp_enqueue_style('digisignScreenControl.style', DIGISIGN_PLUGIN_ROOT_URL.'assets/digisignScreenControl.css', array(), DIGISIGN_PLUGIN_ONE_VERSION);
122         wp_enqueue_script('digisignScreenControl.script', DIGISIGN_PLUGIN_ROOT_URL.'assets/digisignScreenControl.js', array(), DIGISIGN_PLUGIN_ONE_VERSION);
123    }
124  }
125  add_action( 'wp_enqueue_style', 'digisignRegisterScreenControl', 10, 0);
126  add_action( 'wp_enqueue_scripts', 'digisignRegisterScreenControl', 10, 0);
```

Figure 27: filters.php code line 121-126

Templates.php

In this file the dashboard page added as a template to appear in the home page. To clarify with below codes "Digisign Landing" will be added as a selectable template in WordPress. There are different types for each page and this template will be considered as our home page type.

```
     templates.php                    ●
1  <?php
2  DEFINE('DIGISIGN_HOME_PAGE_TEMPLATE_FILE_NAME','digisign_home_page_template.php');
3  function digisignRegisterTemplateInList( $page_template )
4  {
5    $page_template[DIGISIGN_HOME_PAGE_TEMPLATE_FILE_NAME] = 'Digisign Landing';
6
7    return $page_template;
8  }
9  add_filter( "theme_page_templates", 'digisignRegisterTemplateInList', 10, 4 );
10
```

Figure 28: templates.php code line 1-10

After selecting "Digisign Landing" as the template of our home page, Lines 11 to 23 will render the template from digisign_home_page_template.php and will return the result on the screen.

```
11  add_filter( 'template_include', 'digisignRenderTemplate', 99 );
12  function digisignRenderTemplate( $template ) {
13
14    global $post;
15    $page_template_slug    = get_page_template_slug( $post->ID );
16
17    if( $page_template_slug == DIGISIGN_HOME_PAGE_TEMPLATE_FILE_NAME ){
18      return DIGISIGN_PLUGIN_ROOT_PATH.'templates/'. DIGISIGN_HOME_PAGE_TEMPLATE_FILE_NAME;
19    }
20
21    return $template;
22
23  }
```

Figure 29: templates.php code line 11-23

Functionss.php

In the following parts the remaining filed that has been used to develop the plugin will be discussed.

In functions.php. This file contains 5 different functions:

The first function which is from line 2 to 59, includes procedure to add a screen on user request from preset template. The code below has been shown partially.

```php
2  function digisignAddScreenFromTemplate($args){
3      $output = "";
4      if(empty(get_current_user_id()))
5          return "(".__LINE__.")Function call restricted to logged-in users. <script type='text/javascript'>
6  setTimeout(function(){window.location='".home_url()."';}, 3000)</script>";
7      $sourceTemplateSlug = "";
8      if(!empty($args) && array_key_exists('template_name', $args)){
9          $sourceTemplateSlug = sanitize_text_field(filter_block_kses_value($args['template_name'], FILTER_SANITIZE_STRING ));
10     }else if(array_key_exists('t', $_GET)){
11         $sourceTemplateSlug = sanitize_text_field(filter_input( INPUT_GET, 't', FILTER_SANITIZE_STRING ));
12     }else if(array_key_exists('t', $_POST)){
13         $sourceTemplateSlug = sanitize_text_field(filter_input( INPUT_POST, 't', FILTER_SANITIZE_STRING ));
14     }
15     $sourceTemplateSlug = trim($sourceTemplateSlug);
16     if(empty($sourceTemplateSlug))
17         return "Source template named/slugged shall be supplied as argument(template_name), or parameter but not found!";
18     $sourceTemplateSlug = 152;
19     if(is_numeric($sourceTemplateSlug)) {
20         $sourceTemplateID = $sourceTemplateSlug;
21     }else {
22         $sourceTemplateID = url_to_postid( site_url( $sourceTemplateSlug ) );
23     }
24     $post_id = digisign_duplicate_post( $sourceTemplateID);
25     if($post_id){
```

Figure 30: functions.php code line 2-25 (code continues to 59)

The second function will show the list of screens which users added from each template. The code is from line 60 to 155. The code below has been shown partially.

```php
60  function digisignListUserScreens(){
61      if(empty(get_current_user_id()))
62          return "(".__LINE__.")Function call restricted to logged-in users.<script type='text/javascript'>
63  setTimeout(function(){window.location='".home_url()."';}, 3000)</script>";
64
65      $stylesheetLink = DIGISIGN_PLUGIN_ROOT_URL.'assets/digisignDashboard.css';
66      wp_enqueue_style(
67          'digisign-template-style',
68          $stylesheetLink,
69          null,
70          DIGISIGN_PLUGIN_ONE_VERSION
71      );
72      wp_enqueue_style( 'load-fa', 'https://use.fontawesome.com/releases/v5.5.0/css/all.css' );
73
74      $screenPosts = get_posts(array(
75      'post_type' => 'page',
76      'post_status' => 'publish',
77      'meta_key' => DIGISIGN_IS_USER_SCREEN_TERM_KEY,
78      'author' => get_current_user_id(),
79      'meta_value' => true,
80          'numberposts' => -1
81      ));
```

Figure 31: functions.php code line 60-81 (code continues to 155)

Next function will show the available preset templates on the user dashboard. As mentioned before , only the user with admin credentials can add or remove templates.

```php
156  function digisignListScreenTemplates(){
157      $stylesheetLink = DIGISIGN_PLUGIN_ROOT_URL.'assets/digisignDashboard.css';
158      wp_enqueue_style(
159          'digisign-template-style',
160          $stylesheetLink,
161          null,
162          DIGISIGN_PLUGIN_ONE_VERSION
163      );
```

Figure 32: functions.php code line 156-163 (code continues to 239)

lines 255 to 405 added the option to create post inside an existing post, regardless of relevancy. As discussed before most of showable content in WordPress is in the form of posts. The code below has been shown partially

```php
255  function digisignDuplicatePost($templateId, $args=array(), $do_action=true ) {
256    if(empty(get_current_user_id()))
257      return "(".__LINE__.")Function call restricted to logged-in users.<script type='text/javascript'>
258  setTimeout(function(){window.location='".home_url()."';}, 3000)</script>";
259
260    // Get access to the database
261    global $wpdb;
262
263    // Get the post as an array
264    $newScreen = get_post( $templateId, 'ARRAY_A' );
265
```

Figure 33: functions.php code line 255-264 (code continues to 405)

And finally, a simple code to debug the process and return any possible issues to the log file.

```php
240  function bLog($message, $reference = null):void{
241      if(empty($reference)){
242          $stackTrace = debug_backtrace(null, 2);
243          $reference = sprintf("%s(%d):",abstractedPath($stackTrace[0]['file']),$stackTrace[0]['line']);
244      }
245      $message = trim($message,"\r\n")."\n";
246      $timeStamp ="[".date("Y-m-d.H:i:s")."]";
247      file_put_contents(DIGISIGN_LOG_PATH, $timeStamp.$reference.$message, FILE_APPEND);
248  }
249  function abstractedPath($path): string {
250      $path = trim($path, "/\\");
251      $path = str_replace(rtrim(DIGISIGN_PLUGIN_ROOT_PATH, "/\\"), "", $path);
252      $path = trim($path, "/\\");
253      return $path;
254  }
```

Figure 34: functions.php code line 240-254

Views.php

This file will creat the necessary html codes for the buttons on the dashboard page. To add a screen from a template user will see a "+" button. Below code will create that button.

```php
views.php
1  <?php
2  function digisignScreenCreatorSubmitButton( $post ) {
3    if( $post->post_status == 'publish' ) {
4      $nonce = wp_create_nonce( 'digisign_ajax_file_nonce' );
5      $output = <<<TAG
6            <a class="icon-button digisign_create_screen_from_template" rel="$nonce" href="#" data-postid="$post->ID"><i class="fas fa-plus"></i></a><s
7  TAG;
8    }else{
9      $output  = <<<TAG
10       <div class='debug' style="display: none">Post as object is required by digisignScreenCreatorSubmitButton and post status shall be publish!</div
11  TAG;
12   }
13   return $output;
14 }
```

Figure 35: views.php code line 1-15 (screenshot redacted)

Finally line 16 to 49 is responsible for to show notifications after each action such as add or remove screens that has been made from any templates.

```php
17  function digisignNotice($return = false) {
18    $output = "";
19    $duplicated_id = isset($_GET['screen_created']) ? htmlspecialchars($_GET['screen_created'], ENT_QUOTES, 'UTF-8') : '';
20    $removed_id = isset($_GET['screen_removed']) ? htmlspecialchars($_GET['screen_removed'], ENT_QUOTES, 'UTF-8') : '';
21    if( !empty($duplicated_id)) {
22      $link = '<a href="'.get_edit_post_link($duplicated_id).'">'.__('here', 'digisign_plugin_one').'</a>';
23      $label = sprintf( __( 'Screen successfully created! You can edit your new screen: %s.', 'digisign_plugin_one' ), $link );
24      $output .= <<<TAG
25          <div class="updated">
26              <p>$label</p>
27          </div>
28  TAG;
29
30    }
```

Figure 36: views.php code line 17-30 (code continues to 49)

digisign_home_page_template.php

digisign_home_page_template.php is one of the files that has been called in template.php. this file is responsible for running or calling the style file digisigndashboard.css also reading the header to use on the same page. Second part of the code will define which page to be loaded before and after user login. Also it will read the footer and use it on the same page.

```php
2   $stylesheetLink = DIGISIGN_PLUGIN_ROOT_URL.'assets/digisignDashboard.css';
3   wp_enqueue_style(
4     'digisign-template-style',
5     $stylesheetLink,
6     null,
7     DIGISIGN_PLUGIN_ONE_VERSION
8   );
9   get_header();
10  ?>
11  <div class = 'content-body'>
12  <?php
```

Figure 37: digisign_home_page_template.php code line 2-12

```
13    if(is_user_logged_in()){
14
15      echo digisignGetPost(array('slug'=>'dashboard'));
16    }else{
17      echo do_action('digisign-guest-intro-before-login-form');
18      echo digisignGetPost(array('slug'=>'login'));
19      echo do_action('digisign-guest-intro-after-login-form');
20    }
21  ?>
22  </div>
23  <?php
24  get_footer();
```

Figure 38: digisign_home_page_template.php code line 13-24

DigisignDashboard.js which is responsible to create the function to add or remove custom screen from preset template, send the appropriate request to webserver and handle the server response.

Digisigndebug.js is handling all the requests related to debug to be sent to server and get the respond back.

Digisignscreencontrol.js is creating a widget to give the user the possibility that after playing the content on TV, they will have a auto hid menu which they can use to go back to dashboard or reload the content.

4.2   User access and registration

As a part of client request, the platform had to be designed in a way that it will accept multiple users and each user can register themselves to the system. To achieve this goal, it was possible to write a user profile and membership program from the scratch, or to use a ready-made plugin to get the task done. Due to the limited time and resources it has been decided to use a plugin call "Ultimate Member".

With this plugin we were able to add below features to the project:

- User profiles
- Account management
- User registration
- User login
- User roles
- Content restriction
- User emails

Figure 39: Digisign login page

Figure 40: Digisign user register page

4.3   Content Editor plugins

To use Elementor as the content editor plugins we needed to add some special widgets and features which was not available in the main plugin. In order to add those features we had to add 2 more additional plugins to enable these widgets for us. For instance, Elementor pro helped us to create the menu texts in a form that will be compatible on any type of TV with different sizes and Elementor pack assist us to add Weather and current time widget. It's good to mention that in order to show the weather forecast we had to fetch the API form weather stack app. Below is the list of our additional plugins.

- Elementor pro

- Elementor pack

4.4 Design Templates

To design the template, we had to understand the need of the client and check their requirements. After understanding the task, we realized that we need 2 screens. One horizontal and one vertical. Each template should contain below parameters:

Horizontal template:

- Animated background
- Full text menu
- Video advertisement
- Image slideshow
- Current local time
- Weather forecast
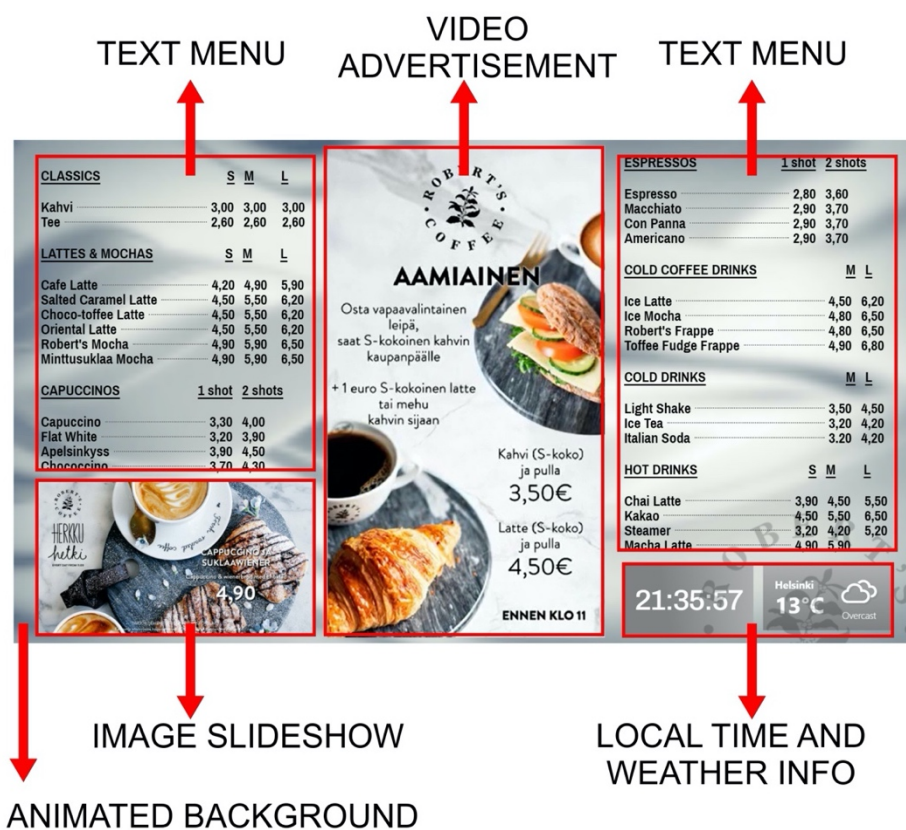
Figure 41: Digisign horizontal template

Vertical template:

- Animated background
- Video advertisement
- Local time

Figure 42: Digisign vertical template

5   Test and demonstration

5.1   Install the WordPress and required plugins

In the process of implementing the project, in order to be able to install the WordPress and install our plugin on it a domain and host has been registered. After installing the WordPress, below plugins has been installed:

- Elementor, Elementor pro and Elementor pack to run the editor
- Ultimate member to activate the user profile and membership
- DigiSign plugin to activate the digital signage environment
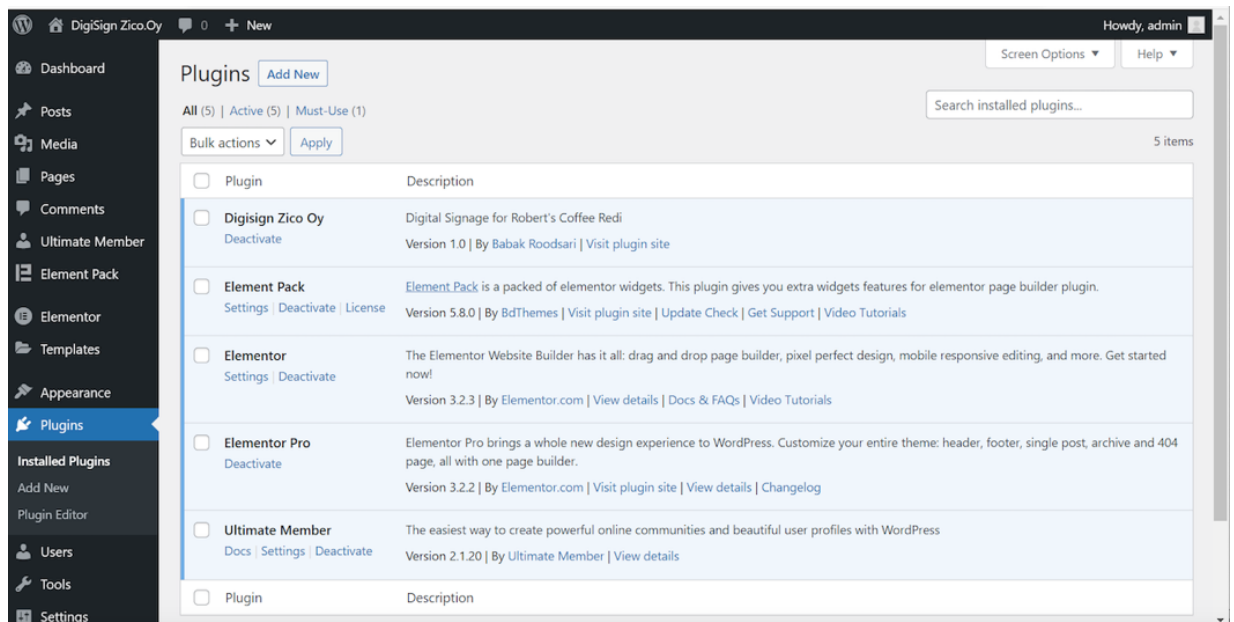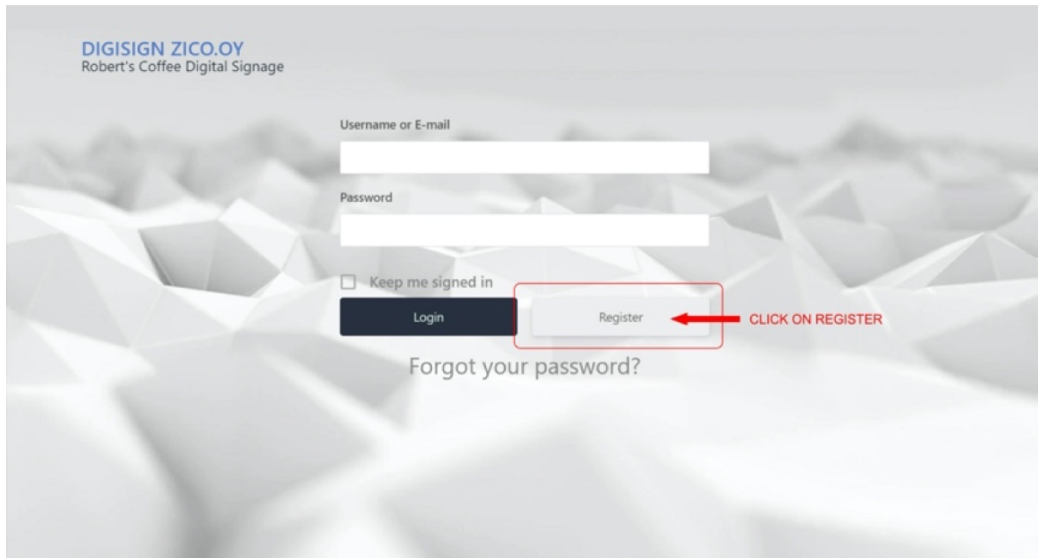
Figure 43: WordPress plugins installation

5.2   Register and Login

Now it's possible to simply execute the link or go to homepage and it will take the user to the first page of the platform which is our login/registration page. On this page the new user is able to register their profile and activate their username and password.

Figure 44: DigiSign homepage/login page

Figure 45: DigiSign registration form

After registration the system will send two simultaneous email to both user and administrator in order to inform them about the new profile.

DigiSign Zico.Oy

Aso Aziz has just created an account on
DigiSign Zico.Oy.

To view their profile click here: http://www.gelatofactory.fi/
digisign/user/aso.aziz/

Here is the submitted registration form:

Date Submitted: 17 May 2021 20:26

Form: Default Registration - Form ID#: 451

Username: Zico

First Name: Aso

Last Name: Aziz

E-mail Address: aso@zico.fi

Thank you!
The DigiSign Zico.Oy Team

Figure 46: DigiSign email confirmation to admin

Below is the email that will be sent to the user to confirm the profile creation with the access link to the profile.

DigiSign Zico.Oy

Thank you for signing up!
Your account is now active.

Login to our site

If you have any problems, please contact us at
babak.pmr@gmail.com

Thank you!
The DigiSign Zico.Oy Team
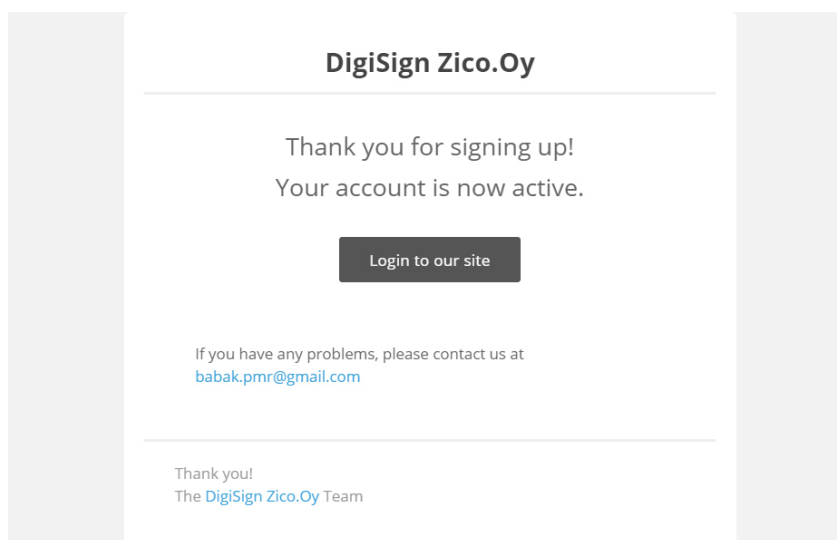
Figure 47 DigiSign email confirmation to user

5.3   Dashboard

After landing on the dashboard page, the user will be able to see 2 preset templates for the CMS. First template is the horizontal template to use for the menu at the counter and second template is to use on vertical screen for outside of the shop screen or any other vertical screen. There are 2 buttons defined on each template "+" and "l>". The plus button will add a template as customizable screen to modify or use as it is. The play button will show a preview of the page on the screen.
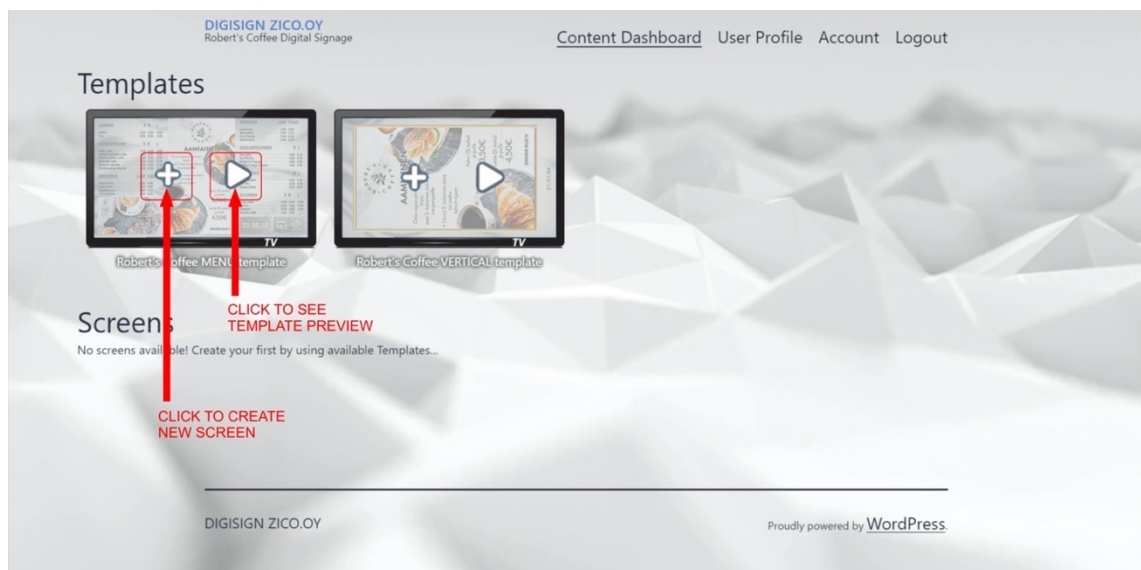
Figure 48: DigiSign dashboard-Template

After adding the screen, user will have 3 options to use.

- Edit the screen
- Preview the screen
- Delete the screen
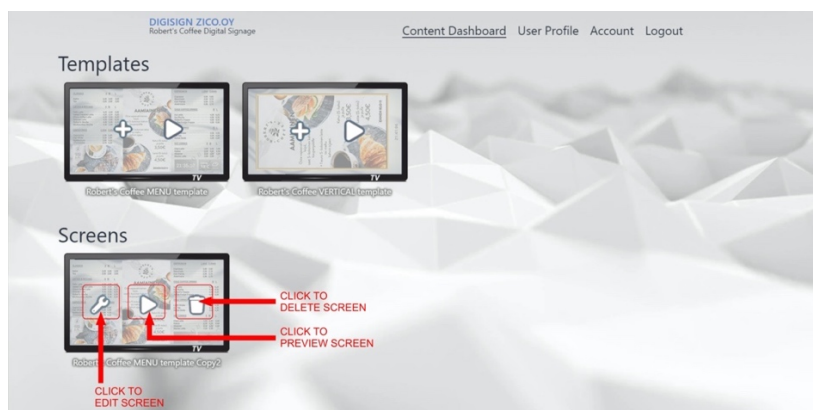
Figure 49: DigiSign dashboard-Screen

5.4   Content editor

When user decided to edit the screen, the program will redirect them to Elementor which has been used as the content editor for this project. On the left side of the screen user will have all the necessary tools and widgets to edit the content. The elements that has been used in this template including plain text, video, slider, weather and time widget and gif animated file as background. Regarding the videos, user has the option to upload the video to server or use a YouTube link to play the video online. Also, they are able to upload any type of image to their media library.

Figure 50: DigiSign content editor

After user is ready with the modification of the design, they will publish the new screen by clicking on the update button and the program will redirect them back to dashboard. From dashboard by clicking on "play" button they can display the content on the screen. Below are the outcome of the project on Samsung 55 and Samsung 43 inch TVs. Bigger screen will be placed as the main menu and smaller one as the entrance signage.

Figure 51: DigiSign horizontal test on Samsung 55"

Figure 52: DigiSign vertical test on Samsung 43"

5.5   Issues and conflicts

The first issue has been occurred during designing the content. The problem was related to the short come of web browser running on TIZEN OS for Samsung TVs. Samsung web browser doesn't have the ability to render 2 videos on the same page simultaneously. If the user upload 2 videos on the same page only one of them will play and second one will be black screen. To solve this issue, one of the videos which used as background converted to gif animated image and the video in the foreground remained as its original format.

Second issue was to find a way to change the orientation of the screen to create the content in vertical mode. With rotating the videos still web browser of the tv would play either a part of the rotated video or playing it in the normal mode. To solve the problem, has been embedded inside the Elementor to rotate the object.

6 Conclusion

In this project, a web-based digital signage platform is presented to enhance the level of service in digital marketing for coffee shops. The general results of this research are summarized below:

- In order to implement the platform, a detailed study of industry marketing technics, customers behavior and interactions leading to purchase decision, the amount of daily foot traffic and customer reaction towards retail outdoor advertisements has been conducted.
- By presenting a questionnaire with three key questions to two groups of customers, including regular and random, concluded that on average knowledge of both group about the brand and its products is not on satisfactory level.
- According to the author research on the customers behavior of other competitors, customers are able to make easier purchase decision when they are presented with detail information and visual example of the products. On the other hand, It was found that customers who do not have enough information of the product will choose a familiar option rather than trying the unknown.
- The tools that have been used to implement this project, including smart TV operating system and various programming software tools such as PHP, HTML, JavaScript and CSS.
- In order to create a suitable platform for the client to design and create multimedia content for the digital menu, Elementor plugin, which has easy editing, responsive, different advertising patterns, and high loading speed capabilities has been used.
- To adopt with the client's need of multiple displays, two different horizontal and vertical templates are designed.

In conclusion, digital signage has a wide range of applications and appears to be an important step toward better understanding customer needs, particularly in the foundation of retail business or offices. It has been observed to be remarkably effective in improving customer traffic, generating demands, improving brand awareness, minimizing perceived wait times, improving service quality, and, most importantly, making store/office visits a wonderful experience. Design and implementing the software being the main objective of this project, all the test and demonstration has been done successfully. The client was able to test different parts of the software and validate the outcome to match the scope of the project. As this project will be used as a pilot, the client expected to report their sales figures and analysis with in 3 month of running the platform and help to improve and possibility of expanding to other franchises possible.

6.1   Future Works

Considering that the platform's design in this research has not been evaluated in practice on different coffee shops, this platform can be implemented simultaneously in several other locations and Its impact on the sales of products can be analyzed. With having access to the data, it is possible to improve the project and resolve the issues. Furthermore as current project is designed to be used only as part of advertising and product information center for the customer, the overall structure of the platform can be improved to increase user convenience so that the user has the ability to pay for the product.

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Figures