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Bootstrap WordPress Web Development

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Bachelor of Engineering

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Thesis

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Expertise
and insight
for the future

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Developing websites and hosting them for business have become popular now. The demand of developing website has increased over the years. Websites developed not only need to be fast and visually good but also need to be secure. To develop all these features, it would take a lot of time and effort. This also would rise the development price. Bootstrap solves the frontend problems with easy to use components and utilities. WordPress is an open source content management tool for rapidly developing dynamic websites. Theme for WordPress has been developed in this project. This theme can be used by any WordPress users with not much technical knowledge. First, static theme was developed using Bootstrap. This bootstrap site was slowly transformed to provide dynamic functionalities. To add additional functionalities, WordPress plugins were used. Even custom plugin was developed to provide functionalities to meet customer's need. The theme developed provided an easy solution for anyone who want to develop their website easily and quickly

Keywords	WordPress, Bootstrap, HTML, JavaScript, Grid System

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Contents

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Abbreviations

HTML   Hypertext Markup Language

JS   JavaScript

CSS   Cascading Style Sheets

CMS   Content Management System

PHP   Hypertext Preprocessor
SQL   Structured Query Language

WP   WordPress

1   Introduction

In this information age, websites have become an indivisible part of human culture. With over 1.8 billion websites, we can say that there is at least a website for very five people in the world. If we had to make websites from scratch to that number, it would be daunting task. [1]

The content management system CMS solves that issue by providing framework or some base for developing websites. People with least technological knowledge could easily setup site in minutes. This would reduce the cost, manpower and re-inviting the wheel. Moreover, people with technological knowledge can further customize CMS for their further use.

Among many CMS out there, WordPress has been dominating since its launch. Now empowering more than 60% of the world's website, it's not only fast or easy but also secure and reliable. [1]

With the increase in mobile and tablet devices, people surfing the web from these devices has also increased. This created a problem for web developers to make the site equally look good in these devices as well the computer. Hence, the concept of responsiveness was introduced and implement. Frameworks were written for this purpose. Bootstrap is one of those.

Now bootstrap on top of WordPress can create stunning websites with high functionality.

We will be making a static responsive website template for a fictional business company using bootstrap which will be our frontend. We will be adding dynamic functionality to the website by integrating it with the WordPress. The result of this process would be a bootstrap WordPress theme. This theme is reusable for and fully customizable, so business company can use the same theme in their own way.

2   WordPress and Bootstrap in detail

2.1   Content Management System

A Content Management System, CMS, is a system designed to create, manage and publish various information. It is crucial to the websites where their content changes frequently. For example, in news website, the news gets updated often. It is very difficult to update the website by editing the html via ourselves. Not all the people who want to update their website may have technical information about web development. Even if you know about it, changing the code via ourselves may also result in malfunctioning of the website. The design and the layout of the website may be distorted. Moreover, it is difficult to keep track of content of website. We also won't have any track of the content in the past week or year., Address these problems, CMS not only provide solutions to these problems but also make it management of our website easier. CMS handles the lifecycle of the pages our site. It delivers the tools to create content, help us publish and also manage archive in an orderly way so that we can search and retrieve these contents anytime.

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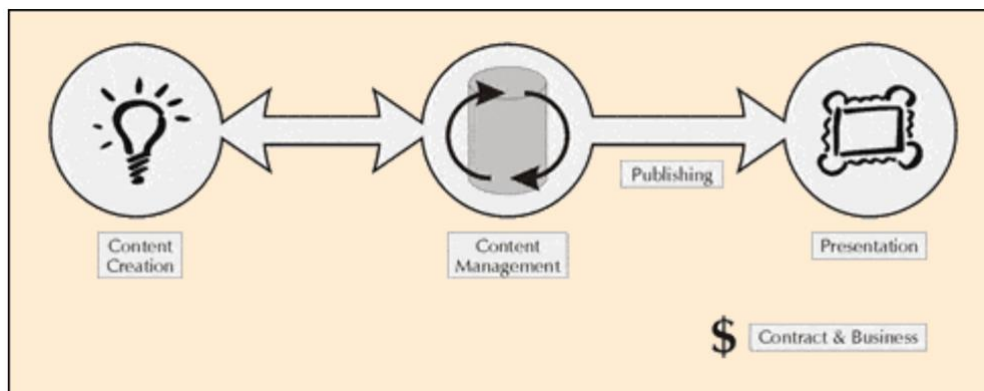
2.1.1   Anatomy of a CMS

Figure 1: Anatomy of CMS

The functionalities of a CMS can be broadly divided into four categories.

- Content Creation
- Management of Content
- Publishing Page
- Presentation of Content

2.1.1.1   Content Creation

Content is crucial for any website. CMS provides a user interface to create content. This UI is very easy to use. Even with few clicks of buttons, the content of our website can be created. This offers a way that even a non-technical personal can create new pages or content without the knowledge of any HTML.

The structure of the website also can be managed using the CMS. We can manage pages and their links together. The development of CMS has evolved over time. Now many CMS even provide drag and drop features where the layout of the website can be manged using simple drag and drops.

Web based authoring environment is provided by most of the content management system now. This further help us the implementation. The content of the website also can be updated remotely.

This user interface for managing content help us delegate to manage the content of our website to respective branches of an origination. For example, products can be published to your website by production team and different vacancies can be announced via website by Human Resource department.

2.1.1.2   Management of Content

In this stage of a CMS, all the contents and the pages of the website are stored in a central repository. All other supporting details of the pages such as author name, published date, attachments are also saved in this repository.

This central repository provides many features.
It stores the information about the versions of a page as well as the name of the author who changed it and the timestamp when it was changed.
It checks if the content being changed have the necessary permissions to change the content. Integration with the available data sources and systems.

Most significantly, CMS offers an array of workflow capabilities. For example, when a page has been created by the user, it directed towards the manager automatically. The manager checks and approves the page to the central web team for review. Then it is sent to legal team. After they approve the page is published in the website.

In every phase, the CMS recognizes the status of the page, giving information to the targeted people.

Thus, the workflow capabilities accept more authors to be involved in the administration of the site, it keeps the quality of the website excellent by providing accurate and consistent information.

2.1.1.3   Publishing Page

After the content has been stored in the central repository, the website is ready to go live.

CMS ships with built in robust engine that automatically applies the design and provides layout to the pages when they are published. This engine also provides some hooks so that the developers and designers can hook their custom code like CSS and JavaScript into the engine so that the layout and design can be tweaked easily. The content creators can just focus on their content without worrying the layout of the page.

2.1.1.4   Presentation of Content

The quality and effectiveness of the website can be enriched more by the features provided by CMS. For example, the navigation of the website is built according to the contents in the repository. CMS support different browsers and even helps users with accessibility issues. [2]

2.2   Introduction to WordPress

WordPress is a content management system which is open source. It is written in PHP and MySQL is the database used. It is free and easy to use for beginners. Released in 2003, it was used as a blogging tool. But now it has evolved as a technology.

History of WordPress

The history of WordPress is really an example to show how software or technology can be developed through community work without compromising software freedom. Being totally open source project, it is developed by dedicated developers and enthusiasts in the community. WordPress was initially developed as blogging software named b2/cafelpog. Later, the support was withdrawn by the developers. In 2003, Matt Mullenweg and Mike Little, tow enthusiast of b2/cafelog were interested to develop a new platform based on b2/cafelog.

The initial version was announced by Matt on May 27,2003. It was well acknowledged by the community. This version contained new admin panel, new templated and generated XTML1.1 template. The post editor is shown below.
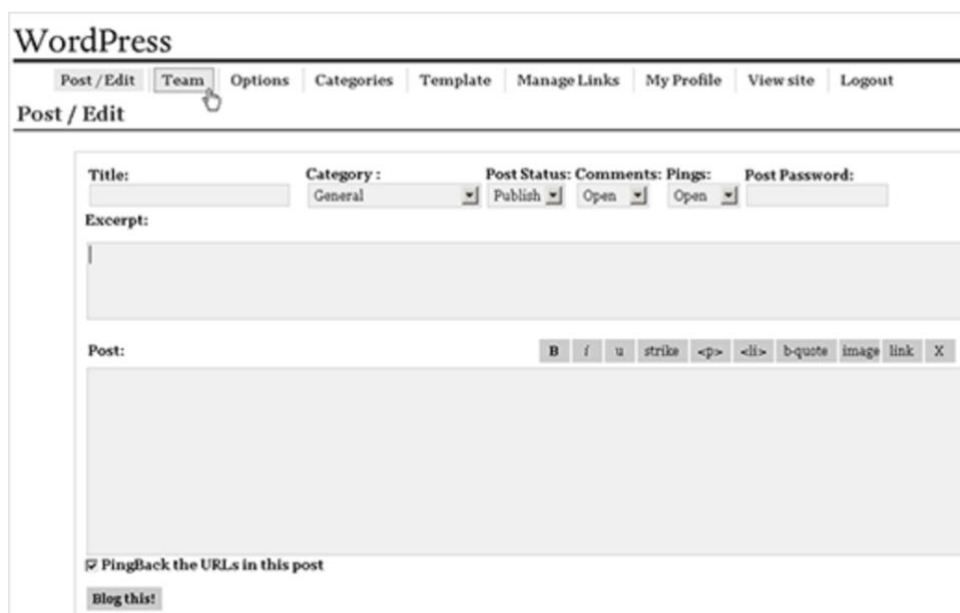
Figure 2: Post Editor Screen in WordPress 1.0

In May 2004, version 1.2 of WordPress was rolled out. It supported plugin architecture. It was huge improvement in WordPress as it allowed users to increase the functionality of WordPress by writing own scripts called plugins. These plugins could be shared online and can be used by other users.

Later in February 2005, WordPress was made more advanced. It started to support pages and comment tools. The idea of themes in WordPress was also introduced in this version. It shipped with default theme called Kubrick.

In December 2005, WordPress 2.0 was introduced with a new admin dashboard Previous to this version users had to load a page each time to do simple tasks. This issue was solved by using JavaScript and DHTML making it a better user interface. Users could easily add categories and tags to their respective posts without exiting the editor screen. They could also delete comments without entering comments page .
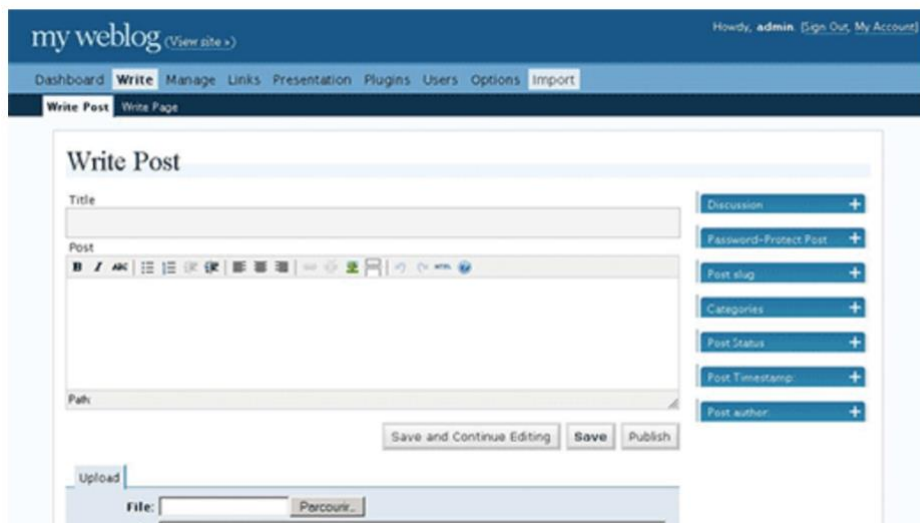
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Figure 3: Post Editor Screen in WordPress 2.0

This release also shipped with Akismet pre-installed. It is a comment spam filtering service. The common word press theme file functions.php was also introduced in this version.

Finally, on March 1, 2006 trademark registration and logo of WordPress were filed by Automattic, which was the company founded by WordPress co-founder Matt Mullenweg. Later in June of 2010, the ownership was transferred to WordPress Foundation. It was huge for WordPress because it allowed WordPress to grow more.

WordPress 3.0 rolled out later on June 17, 2010. This version of WordPress shipped with several features such as custom post type and taxonomies, custom backgrounds, menu etc. The tradition of developing default theme named starting with twenty started in this version of WordPress which was twenty ten.

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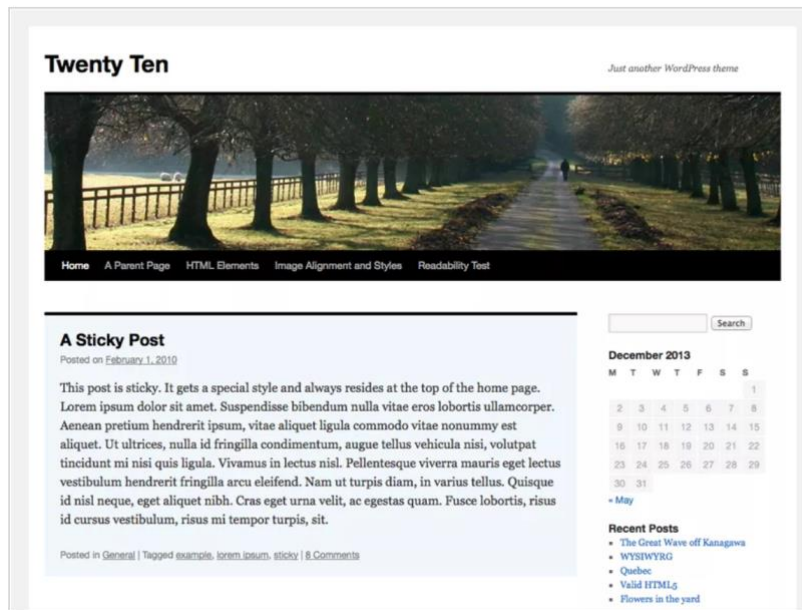University of Applied Sciences

Figure 4: Twenty Ten Theme

In 2012, WordPress added theme customizer, media manager and theme previews. New users could easily create image galleries and also can preview a theme before pushing it. Automatic update features were later rolled in WordPress 3.7 in 2013 that automatically update the WordPress.

In April 2014 WordPress 3.9 rolled out heavily focusing on WordPress visual post editor. With this editor images can easily be added to the post using drag and drop interface. Moreover, users can also edit images in the editor and instantly see the preview.

Later in 2014, WordPress 4.2, 4.3 and 4.4 were released. It supported emoji, theme customizer and lay the foundations of WordPress REST API. The same year later WordPress stated supporting Woo Commerce via ecommerce plugin.

The WordPress developed continued over the time. Earlier in 2018, WordPress 5.0 was released with a brand-new block editor project which was named as Gutenberg.

WordPress being one of the most post content management system has been evolving over the years. The open source project and this continued development has helped millions of web users across the world. [3]

2.3   Comparison of CMS

Like WordPress there are many other CMS. Among them Joomla and Drupal are the most popular. To make a proper decision on choosing one of them for our use we need to know about them as well.

Joomla

Joomla was created in 2005. It was actually the fork of another CMS named Mambo. The name comes from a Swahili word Joomla, which mean "all together". This indicated the open source nature of the project. Being the second most popular CMS on the web, it shares 6.4 percent of all CMS market and being download more than 93 million times. Joomla is similar to WordPress. It is also based on PHP and MySQL technology.

Drupal

Drupal was first released in 2001. It is now the third most popular CMS. It shares 2.2 percent of the market share. Like Joomla and WordPress, PHP and MySQL lies beneath its engine. It is a bit more advanced than Joomla and WordPress.

Let's make a comparison between WordPress, Drupal and WordPress in different aspects such as cost, ease of use etc. so that we can chose one of these according to our needs.

2.3.1   Cost and Expenses

WordPress

Although WordPress is totally free to use, adding more features to WordPress may cost you. As WordPress is open source and widely used, there are a lot of plugins and theme files that you can buy and use it according to your need. It makes send to spend some money if you are operating a professional website. For example, Woo commerce, the

ecommerce solution for WordPress is free but payment gateway extensions may cost you from $29 to $299. If you want to implement complex functionality you may want to hire a professional which might cost, you. It might cost you a bit more to host WordPress site because WordPress takes more resources than Joomla and Drupal.

Joomla

Like WordPress Joomla also has many premium templates and extensions that users can buy. Joomla being a little more advanced than WordPress and the fact that less people using it result in scarcity of Joomla professionals. This make Joomla extension a little bit more expensive.

Drupal

Drupal is the fastest on the ground of performance among its CMS competitors. Hence, it required little less for hosting online. Premium themes and plugins cost about the same as other platforms.

It is more complex than its competitor's CMS. Hence you need to be a developer to build websites on Drupal. This increases the development cost of your website.

2.3.2   Ease of use and Beginner Friendliness

WordPress
One of the main reasons behind WordPress success is the ease of use. 5-minute install, as called by WordPress, signifies its ease and easy to setup.
Many webhosting companies also offer one click install option for word press. The WordPress user interface is very easy to understand. for beginners.

To create advanced layouts, page builders are available now. Users can easily create the layout of the pages without having the knowledge of HTML or CSS. Clients can be easily educated about this.

Joomla

Joomla is a bit more advanced than WordPress but easier than Drupal. The installation process is similar to WordPress. Joomla users can easily add articles, manage media, add extensions and change the settings using graphical interface.
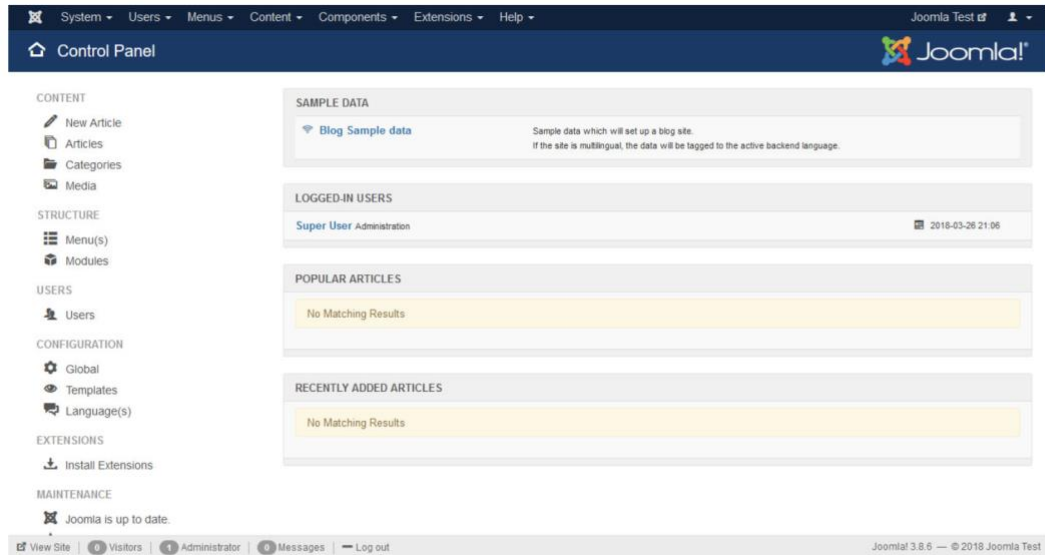

Figure 5 : Joomla Admin Area

Like WordPress, Joomla also has page builders for rapid layout development. Joomla can also be easily updated.

Drupal

Drupal can be installed in the similar way to WordPress and Joomla. It also offers distributions. These distributions are Drupal version of pre-installed extensions and modules which help us build our website easily. Drupal user interface provides settings and customizations for your website.
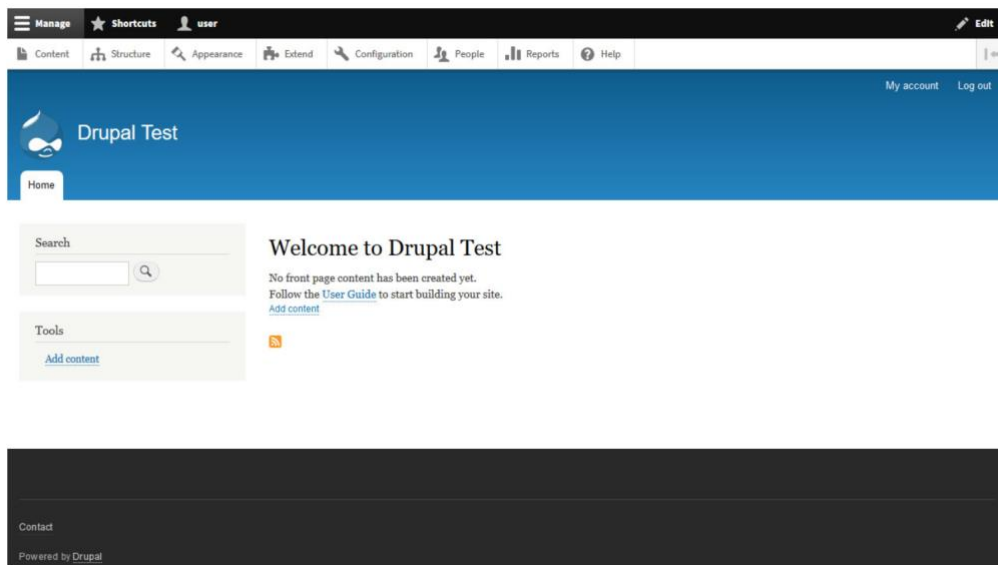
Figure 6 Drupal Admin Area

Being technically advanced CMS, it requires knowledge of HTML, CSS and JS to run website efficiently. Consequently, it has a steep learning curve making it less friendly for beginners.

2.3.3   Support Architecture

WordPress

Being one of the most popular CMS, there is obviously big community of users who use WordPress. So, chances of being supported when bug arises is high. The official support forum is frequently updated by the users. The documentation of WordPress is rich in the form of WordPress Codex, handbooks and developer documentation.

Aside from that, managed web hosting for WordPress, host maintains all the technical parts, so we can just focus on marketing. The WordPress platform is regularly updated every three to four months. This not only keep WordPress clean and away from bugs but also brings new improvements and features.

Joomla

Being the second largest open source CMS, the support for Joomla is satisfactory. Although the official help portal is not as big as WordPress, but we can still get quick replies on our problems.

In addition, we can visit the official documentation page, subscribe to the mailing list and also dive into dedicated IRC chatroom. Speaking of the technical maintenance, Joomla is update more often than WordPress.

Drupal

The update of Drupal is also very often. There is also plenty of resources to debug our applications. Like other CMS, Drupal has documentations, support forums and user groups to help with the issues.

2.3.4   Site Customizability

WordPress

Almost everything in WordPress is customizable. WordPress comes with built in tweaking tools for easy customization. We can change the admin panel's color, add our own custom header images and background images. Apart from these there are more than 55,000 plugins and thousands of themes to provide extra functionality to WordPress. If you are still not satisfied with these, there are premium themes and plugins to accomplish the task. We can modify our site in a safe way by using child themes.

Joomla

Like WordPress, Joomla also ships with its own user interface for customizing the website. It also has extensions to extend functionality of the website. Joomla unlike WordPress does not have its central repository for hosting themes. So, users need to find themes in their own way. But the official repository contains more than 8000 plugins.

Drupal

The main focus of Drupal is to make site more customizable. Hence, it ships with many built in customization options. We can directly edit our files and customize them to our need. Like WordPress and Joomla, Drupal also has a lot of resources. It has more than 40,000 plugins and more than 2600 themes. The enforced coding standards make these plugins always function. This may not be true for WordPress and Joomla plugins.

2.3.5   Site Performance

Site performance is key to success for any website. Though your website may be good looking with exciting design, it may not be regarded successful unless it loads fast. The number of mobile web surfers have grown over the years, so we might want to make these websites load fast in mobile devices as well.

WordPress

One of the negative aspects of WordPress is its performance. This is because WordPress provides backward compatibility supporting old versions. But WordPress managed hosting helps this issue by taking care of caching and site updates. Also, proper site maintenance can make our website load quickly.

Joomla

Joomla is known for its decent performance. The built-in performance boosting functionality plays a vital role for its performance. Caching and Gzip compression can be handled from the dashboard itself. Apart from this, we can optimize our site for better performance by minimizing plugins usage, HTTP requests and optimizing images.

Drupal

Drupal stands out other CMS on the matter of performance. This is because Drupal system takes less resources on the server. Supporting pages, plugins and simultaneous visitors is easier. Drupal is highly scalable meaning we can build large websites on it. It also comes with extensions to add caching to make website load even faster.

2.3.6   Web Security

Spams and hackings are being attempted on daily basis. So, there is high chance to ruin the website. That's why security plays an important role in web development.

WordPress

WordPress being popular CMS is also highly vulnerable to regular attacks from hackers. But now WordPress sites running version 3.7 and above automatically are updated to apply security and maintenance features. The current security problems do come from the third-party plugin.

Another weak spot of WordPress security is the user. The main two reasons for website being hacked are insecure login data and the outdated sites. So, it is very important to get information about new technologies and quickly update our site to https.

Joomla

Joomla like WordPress also have security features that keep our websites safe. But unlike WordPress the updates are not applied automatically but rather have to be done from the backend. Moreover, official Joomla documentation offers security checklist for further securing your website. Some extensions also help increase the security of the website.

☑ Security Checklist Articles
- Getting Started
- Hosting and Server Setup
- Learn about file permissions
- Testing and Development
- Joomla Setup
- Site Administration
- Site Recovery
- You have been hacked or defaced

Figure 7: Security Checklist in Joomla

Drupal

Drupal is one of the safest CMS its competitors. Security patches are delivered as soon as the bugs are found. Like Joomla, Drupal also has its extensions for providing extra

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security. There is also a module that generates security reports in the backend.

Figure 8: Drupal Security Report

2.3.7 Search Engiene Optimization

SEO is one of the most important factors for generating traffic. Regardless of what CMS we used, the google search engine needs to understand our website in the form of SEO terms.

WordPress

WordPress is designed to support SEO out of the box. It has custom URLs and SEO friendly mark up. Plugins like Yeast SEO provides control over different aspects of the SEO. Every theme in the WordPress directory needs to be compatible to mobile devices. Google Accelerated Mobile pages are also supported by some plugins.

Joomla

Joomla has solid features likes meta descriptions, title tag optimization, URL rewrite etc. to support SEO. But it is more difficult to implement SEO features like WordPress especially for beginners. There are also extensions for better SEO implementations.

Drupal

SEO supports for Drupal are built into WordPress. For loading page fast, Drupal even has its own built in caching system. Drupal provides more extensions for better SEO, for example there is an SEO checklist or XML sitemap module. There is even a Drupal version of SEO Yeast plugin.

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2.3.8   Translation and Localization

Websites are being surfed all around the world by the people of different communities and background. It is therefore very important to have the website in different languages. The capacity to localize and translate your website based on different zones is an important feature of any CMS.

WordPress

Measures like global translation day, has made the WordPress platform available in different zones. The language of backend of the WordPress can be selected on the basis of the user's preference. WordPress also has plugins that help us to translate our website into different languages.
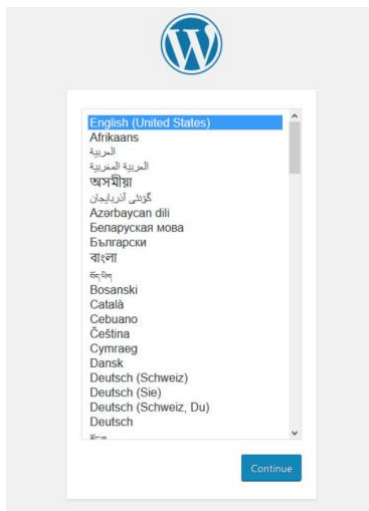

Figure 9: WordPress Installation

Joomla

Joomla shines in localization of website and translating to different languages. Translation packs are available for many languages. Also, language extensions help us to translate the admin area to desired language.

Drupal

Drupal also has been translated into many languages. The translation of content of the Drupal site is achieved without using any external plugins. [4]

2.4   Web Application Overview

We can abstract any web applications mainly into three components. They are

1.   The Presentation Layer
1.   The Application Layer
2.   The Database Layer

The front end of the website where the content is rendered, and users can react is usually the presentation layer. It contains HTML, CSS and JS code that help us to render the website.
The presentation layer makes contact with the Application layer.

The Application layer transport the information from browser to the database. This layer is also responsible for writing data from the form field to the database, retrieving user's account information and reading information from the database. This application layer is made up of different types of components. These components are some systems that are needed for retrieving and updating information to the database, cleaning information and making these data secure.

All of our data is stored in the Database layer. This layer may be composed of a MySQL database. Sometimes the data can be stored in the cloud such as Amazon s3. [5]

2.4.1   User Roles in WordPress

In WordPress, there are different roles available. According to these roles a specific user gets his own permissions to do certain things in website. Having a good understanding of user roles and permissions are crucial to WordPress site management. WordPress provides a handful of user roles for its management.

WordPress by default support five different user roles.

2.4.1.1 Administrator

Administrator is the most powerful user in WordPress. Administrator has access to almost all the data in WordPress. They can add new post, edit or delete post by any users on the website. Administrators are accessed to install, edit or delete plugins or themes. The most import capability of administrators is the access to create other user to the site. They can change data about the other users such as their passwords or email. Usually, administrative roles are provided to owners of the site so that they can control their site.

2.4.1.2 Editor

Editors in WordPress can control the contents of the website. They can add, edit, update any posts or page written by any other users. But editors do not have permissions to add or delete another user. They also cannot do website related tasks such as handling themes or plugins.

2.4.1.3 Author

Author can write, update and delete only their posts. But, authors cannot create their own categories. However, they can use the existing categories. Authors can view comments on their post but cannot approve or delete any comments.

2.4.1.4 Contributor

In WordPress, Contributors are given access to add or edit their posts but cannot publish them. Like Author they cannot create their own categories but can add existing categories to their post. One of the biggest disadvantage for users with contributor access is that they cannot upload any files. They also don't have any access to theme and plugins settings.

2.4.1.5 Subscriber

Subscriber in WordPress can login to WordPress site and update their profile. They can manage their account information such as passwords, username, address etc. but they don't have any access to admin panel preventing them to access any other information.

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Usually, subscriber user groups are useful when your website accepts comments from logged-in users only.[6]

2.4.2   Database Schema

Database Schema

By default, WordPress has 11 tables. Lightness being one of the characteristics of WordPress, the foundation lies on this. The minimal database is yet flexible to develop applications.
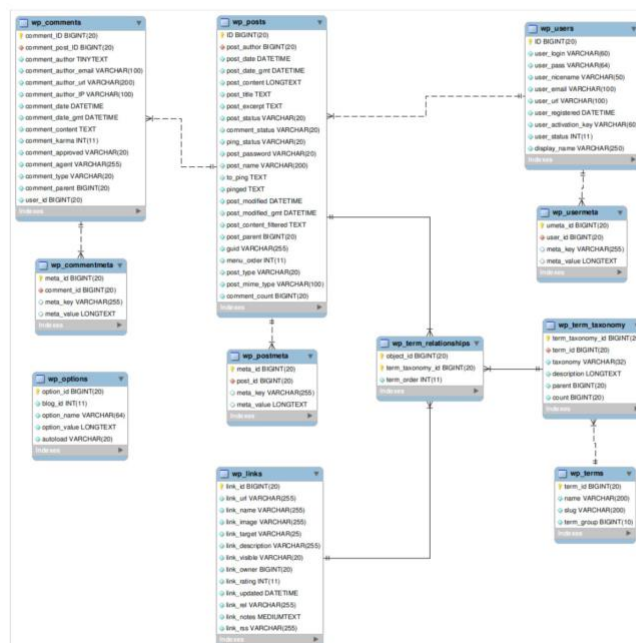

Figure 10: Tables in WordPress

Details of WordPress Tables

wp_comments: This table holds all the comment in the WordPress

wp_commentmeta: This table contain all the metadata (extra information) about the comments.

wp_links: All the links in the website are accumulated in this table.

wp_options: This table stores all the plugin and theme options.

wp_posts: It can be considered as one of the biggest table in WordPress. It holds all the post, page, media, record and revisions.

wp_postmeta: Contains all post metadata.

wp_terms: This table holds all the taxonomy terms in our website.

wp_term_taxonomy: This table holds information about taxonomy to which each term is assigned.

wp_term_relationships: This table contains the relationships between taxonomies and the pages they relate to.

wp_users: This table contains all the users that has been created on our website.

wp_usermeta: This table contains all meta data about the users. [7]

3   Technology used

3.1   HTML

HTML stands for Hypertext Markup Language which was developed by Tim Berners-Lee in 1993. W3C, an organization, led by Tim has continuously updated, developed and evolved html during the years resulting in the latest HTML5. HTML is the backbone of any website which gives structure to the webpage. This mark-up helps the web browser to display various contents like text, image and other multimedia in a webpage.
[8]

3.2   CSS

CSS which stands for Cascading Style Sheets was developed by Håkon Wium which later in 1997 became an official recommendation by W3C. CSS adds styles to the different elements of a webpage.

CSS can be included into a webpage in three different ways:

- External: CSS can be written in its own separate file having extension .css.

- Internal: Some webpage may want to include the CSS in the same file.

- Inline: Inline CSS change the style of the element with which it has been included inside as shown below.

3.3 JS

Javas script is one of the most popular programming languages of 2019. [9]
It is a scripting language that helps to make website more dynamic by adding functionalities such as updating content, controlling multimedia and more.
JS was created by Brendan Each in 1995. It like other programming languages evolved over years and today the latest version of JS is ECMAScript 2018 [10]. JavaScript being one of the powerful programming languages, frameworks were written. The most popular frameworks are

React

It was developed by Facebook in 2012 to manage Facebook ads. One can design simple autonomous view for each part in the application React will efficiently update and render just the right components when the data changes. On top of all these features, react can also be used on server using node. Moreover, mobile apps also can be made using React Native. [11]

AngularJS

AngularJS is an open source framework developed by google. Angular js expands the html making it more expressive. It is cross platform. We can build progressive web applications based on angular that provide app like experience without installing. [12]
Moreover, Mobile apps and desktop apps can be made using Cordova, Ionic, or Native Script. Turning our angular template into optimized code that is processed fast by modern browsers, it increases speed and productivity. Testing angular apps is relatively

easy with karma for unit tests. Animations also can be made easily using Angular's intuitive API. [13]

3.4   Bootstrap

Bootstrap is an amazing frontend framework for creating websites. Developed using HTML, CSS and JS, this framework can accelerate the development of websites. Bootstrap ships with built in components, utilities and extensions and much more.

Bootstrap grid System

Bootstrap uses flex-box grid to build the layout of webpages utilizing twelve column systems. It uses sequences of containers, row and columns to build the layout and align the elements. Containers help us to center the content within it and horizontally pad the contents. The columns must be wrapped by row and columns can only be the immediate child of row. Each column comes with a spacing called gutter by default. Layout can be made using the required number of columns. These columns must give a sum of 12 within a row. Columns can be created using. col classes which generally comes with a number indicating how many columns is needed.

For example, to create layout divided equally into two parts, two columns with. col-6 class can be included into a row. Similarly, three equal columns can be made using three elements with col-4 class attached to them within a row.
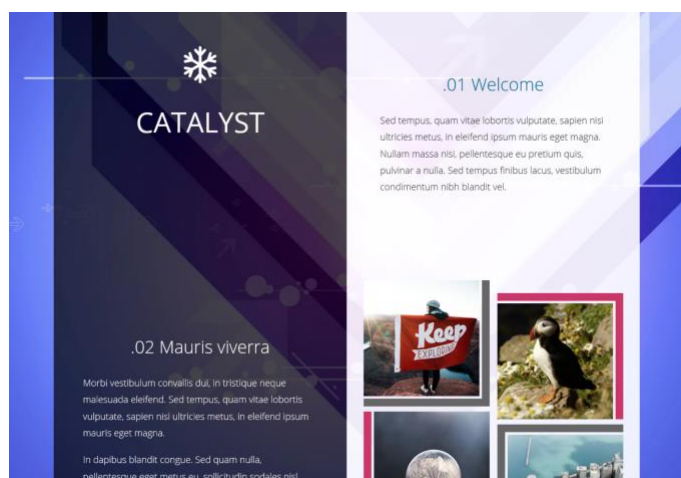

Figure 11 2 Columns Boostrap Layout

Navbar

With bootstrap, powerful and responsive navigational menu can be created. To create a menu one need to wrap menu code with bootstrap class "navbar". Navigational menu can be collapsed if the screen size is small using bootstrap classes. These menus are fluid by default meaning the proportions of the menu items will stay the same even if the screen size changes.

Forms

Forms are vital to any website. Bootstrap comes with built in form components for rending forms across various platform browsers. The basic technique to use form properly is by provide form-control class for input groups with appropriate type and bundle them within an element with a class of form-control.

Utilities class

Bootstrap comes with many small utilities classes for fixing small stuffs. Different color classes can be used for styling the webpage. Bootstrap float-left and float-right classes can float an element to left or right making the traditional floating easier.

3.5   MAMP

WordPress actually lives in the server. To develop WordPress sites, it is not always optimum to upload the website each time to the remote server. To solve this issue, a local development server was developed. There are many developmental servers available for different platforms. As this development is done in mackintosh computer, MAMP is used.

MAMP is the collection of software components to manage a local web server. The initials of the software components make the acronym for MAMP. MAMP can be represented as

- **M**ac OS X as the operating system
- **A**pache 2 as web server software

- **M**ySQL as the database management system
- **P**HP as the script language

Using MAMP users can easily setup local development server. Apartment from this, MAMP also container PHP accelerators such as Xcache or accelerator which improves the execution of script. MAMP is presented with a solid user interface for stepping ports or starting the database. [14]

3.6   Visual Studio Code

Visual Studio code which is a free and open source code editor from Microsoft is used in this project. This code editor is fast and available on almost all the platforms. Bracket-matching, box-selection, syntax highlighting, auto-indentation, snippets etc. are the features of VS Code. Moreover, there are many extensions available for enhancing the code editor. [15]

3.7   MySQL

MySQL is the relational database which is based on client server model. Database usually consists of tables which holds data related to the website such as username and password. These tables can be related to one another. Hence, called relational database.

These relational databases are stored in the server. Whenever the client request for the data, the server sends back the data to the client computer.
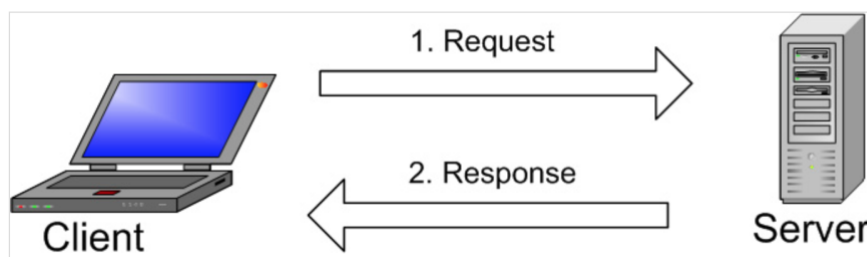

Figure 12: Client Server Model

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phpMyAdmin is a software tool that is written in PHP to handle MYSQL database from a browser. [16]

3.8   PHP

PHP is "HTML embedded scripting language" to create dynamic websites.   Since PHP can be inserted within the HTML, dynamic content can be rendered on the webpage easily. Running PHP code requires PHP pre-processor.

 Syntax influenced from C, Java and Perl, PHP is an open source technology running on all platforms. It is written in C programming language by Rasmus Lerdorf in 1994 to monitor his personal website. Hence, the initially PHP stood for "Personal Home Page". Later two programmers, Zeev Suraski and Andi Gutmans changed PHP's core in 1997, The acronym was also changed to Hypertext Pre-processor. [17]

4   Implementation

The project is carried out in two different phases. A static bootstrap website was developed initially which was later modified into a fully functional dynamic website using WordPress and Bootstrap.

4.1   Static Website Development

Static theme is the layout of the website without any functionality. It is optimal to create static website first and later convert it into dynamic website

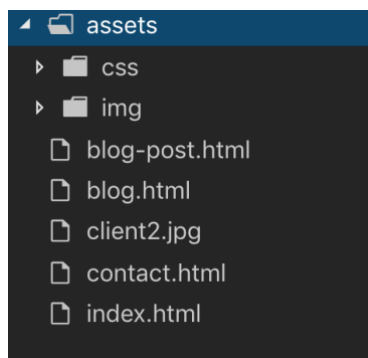The static website will be mainly consisting of three pages. Homepage, Blog page and contact page.

Figure 13: Project Structure

Project Structure

The assets folder contains CSS folder for storing stylesheet files and image folder for storing images. The other html files create the pages in the website.

Homepage

Homepage is the face of the website which will be called index.html. It is the home of all the contents that the website holds further. The homepage is further divided into smaller sections.
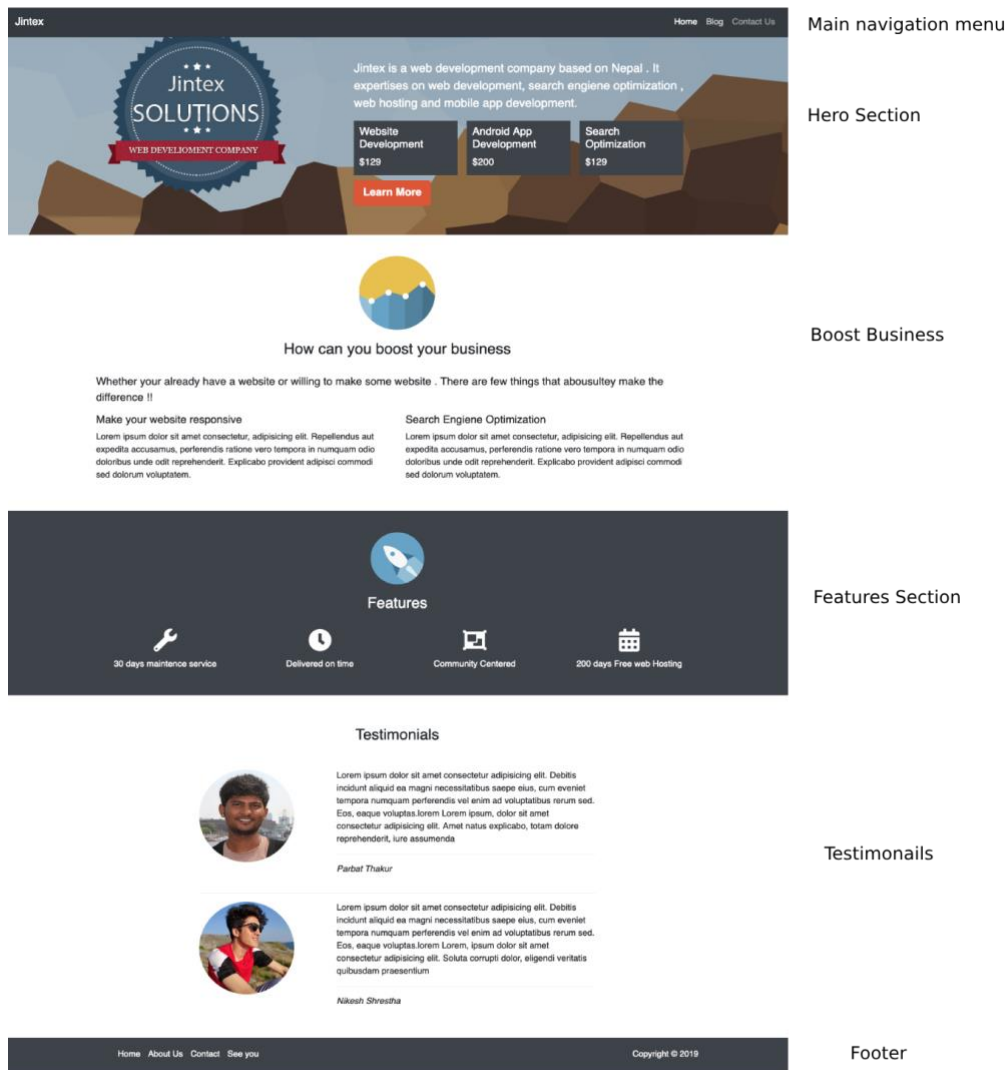
Figure 14: Landing Page

Header

Header is the main navigation for website.
Bootstrap navbar component was used to make the navigational menu.

Hero

Hero section is right beneath the header which on the left holds the website logo and, on the right, has prices information. Responsive layouts can be made utilizing bootstrap grid system. In this section, 5 columns hold the logo while the rest 7 columns hold the prices

Boost Business

Boost Business is the promotional content of the website suggesting users what they can get from the company. This section is mainly divided into two equal sections using bootstrap grid system with heading and image on the top.

Features

 Features provides the visual representation of company's features using icons and text. The icons used here are provided free by font awesome. [18]

Testimonials

This section is divided into 4 columns on left containing the user image and 8 columns on the right containing user feedback and name.

Footer

Footer consists of the left container holding navigational menu and right container holding Copyright information.

Blog page

Blog page displays the recent blog posts. The header and footer are same as in homepage. It is divided into two sections using bootstrap grid. The left consists of recent blog post and the right consists of many other small sections.

The other small sections include search bar for searching the website, about section for displaying information about the website, Recent post to display recent posts, and categories section for displaying the categories
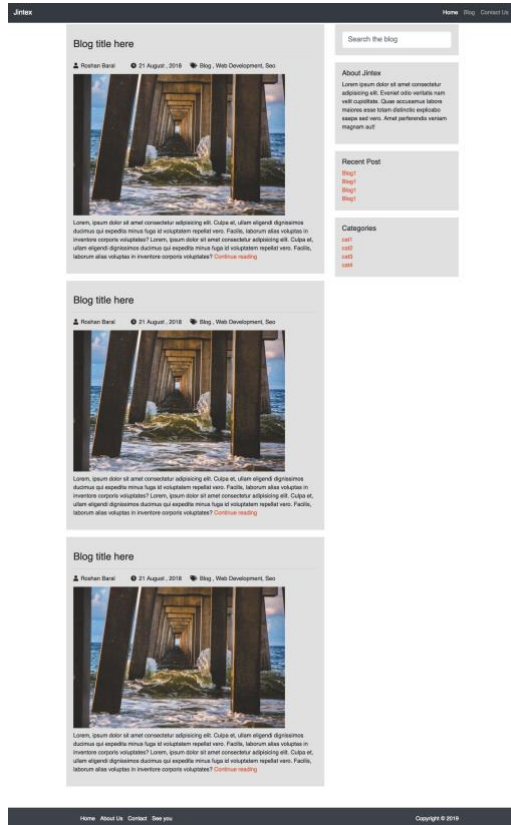
Figure 15: Blog Page

Contact Page

Contact page provides a form so that the users can contact to the admin of the website. In this section, the layout is separated into two equal parts using col-6 classes. The left column contains the name and email input fields with submit button whereas the right columns contains a text area where users can type their message.

Figure 16: Contact Form

4.2   Dynamic Website Development

A WordPress theme compromises of template files and stylesheets that collaboratively work to provide structure and appearance to the website. Basically, the theme converts raw data into HTML using various template files. Each theme file is unique that provides options for site owners to change the design of website. WordPress take advantage of template, template tags and loop to generate the content on the site. For special site features, one can build own template files. Moreover, style of the site can be switched easily.

The theme files are packed on its own folder so whenever WordPress is updated, the theme files are untouched providing the same visual appearance. While creating theme there are few standards that needs to be followed. First of all, the theme files should be well structured. There should not be any error on PHP and HTML. Next the CSS must be clean and the site design and layout must be follow design guidelines.

4.2.1   Anatomy of a theme

WordPress theme reside under WordPress theme directory(wp-content/themes) by default. WordPress theme file consists of mainly three types of files. Style.css which is a stylesheet file responsible for providing styles to the website. WordPress template files which generate the WordPress pages and also convert database information into HTML and CSS. Functions.php file which provides functionality and control some settings for our site.

Theme Stylesheet.
This style.css in addition to providing styles for the website gives some vital information about the theme itself. This is accomplished in the form of comment headers.

```
/*
Theme Name: Twenty Thirteen
Theme URI: http://wordpress.org/themes/twentythirteen
Author: the WordPress team
Author URI: http://wordpress.org/
Description: The 2013 theme for WordPress takes us back to the blog, featuring a full range of post
formats, each displayed beautifully in their own unique way. Design details abound, starting with a
vibrant color scheme and matching header images, beautiful typography and icons, and a flexible layout
that looks great on any device, big or small.
Version: 1.0
License: GNU General Public License v2 or later
License URI: http://www.gnu.org/licenses/gpl-2.0.html
Tags: black, brown, orange, tan, white, yellow, light, one-column, two-columns, right-sidebar,
flexible-width, custom-header, custom-menu, editor-style, featured-images, microformats, post-formats,
rtl-language-support, sticky-post, translation-ready
Text Domain: twentythirteen

This theme, like WordPress, is licensed under the GPL.
Use it to make something cool, have fun, and share what you've learned with others.
*/
```

Figure 17 :Style.css file

Details about the theme like theme name, theme URL, author, descriptions and licensing information are provided in the comments. This comment header makes the theme recognizable by WordPress system.

Functions File

The functions.php file live in theme subdirectory. This file is loaded automatically when WordPress initialize both for admin page and external pages. This file is usually used to load theme stylesheets and JavaScript using wp_enqueue_scripts. By default, WordPress does not enable all the theme features to make it less bulky. Additional WordPress features can be enabled in this file. These theme features may be activating the sidebar, creating navigational menu, supporting different type of post types and much more. Custom functions can be defined and used in template files. Different options of the site like colour and style could be setup in this file.

Template Files

Template are combination of HTML, PHP, and WordPress tags to generate pages when requested by the users. Separate template files can be created render various page types. WordPress Template Hierarchy, choses which template to generate in particular theme.

Common WordPress Template Files

style.css: This is the main stylesheet file which also provides information about our theme.

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rtl.css: If the website text direction is right to left, this stylesheet will be automatically added, The rtl stylesheet. This will be included automatically if the website's text direction is right-to-left. This can be generated using the RTLer plugin.

index.php**:** This is the main template file.

comments.php: This page is responsible for generating comments.

front-page.php**:** The template for front page.

single.php**:** This template file is used for generating page dedicated to a single post or page.

single-{post-type}. php**:** This template is used when retrieving custom post type page. For example, single-bag.php is used when displaying posts from custom post type called "bag".

page.php**:** When an individual page needs to be loaded, this template file is used.

category.php**:** Use to load categories page.

tag.php**:** When a certain tag is queried this page is triggered.

taxonomy.php**:** This template is used when a term in a custom taxonomy is queried.

author.php**:** This template is responsible for loading author page.

date.php**:** When date or time is queried this template is loaded.

archive.php**:** This template creates an archive of content based on post, authors, date etc.

search.php**:** When user searches anything on the site, search.php template is used.

attachment.php**:** When one wants to view an attachment such as image or video, this template is used.

image.php**:** This template file is dedicated to display the image. If this fie is not available, attachment.php is loaded.

404.php**:** When a page or page is not found, this template is loaded. [19]

4.2.2   Template hierarchy

Template hierarchy is important concept for theme developers because it decides the template file which need to use at a particular time.

When certain URL of the website is requested, WordPress determines the content being requested. In this process, most specific template matches the criteria is loaded first. If this criterion is not found, WordPress falls to more general template. This system works well, in that it is responsible understanding these template files and always falling back to index.php. It is extremely powerful because for specific situations custom templates can be developed.

Thus, more specific template files which are on the left of the diagram are given higher priority to load. If these specific template files are not found, WordPress falls back to right to general template ultimately falling back to index.php [20]
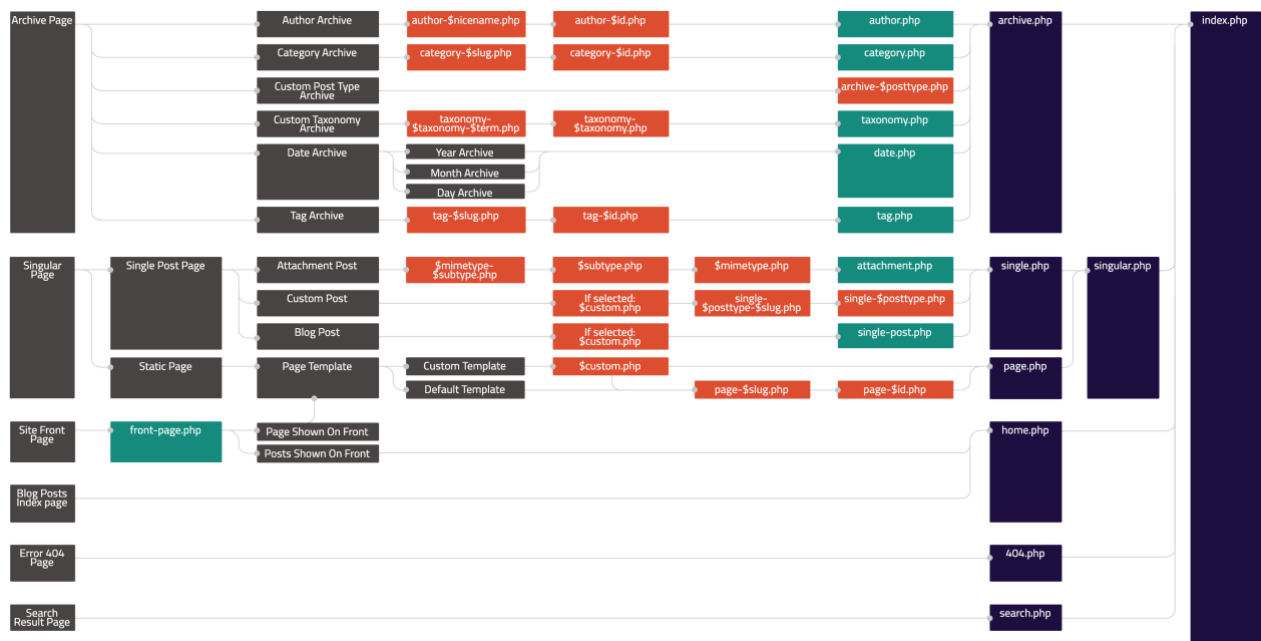
Figure 18 Template Hierarchy

4.2.3 Template tags

Template tags are built-in WordPress functions to display specific data about the website. There are many tags available for use in WordPress. Some template tags should be placed inside the loop to work properly whereas other can reside everywhere on the site. The most used template tags are listed below. These tags are usually used inside the loop.

the_permalink(): It is used to displays the URL of your post.

 the_title(): It is used to display the title of the post.

the_ID(): It shows unique ID for the post .

the_content(): This tag actually display the content including text , images and other attachments.

the_time(): It displays the date and time when the post was published.

the_author(): It displays the author of the post.

the_tags(): It displays all the tags related to the certain post .

the_category(): The categories assigned to the post are displayed using this tag.

Tag Parameters

Many tags also support tag parameters. Additional information can be supplied to the tags.

For example, the content() tag supports two parameters. The first of these parameters creates Read More feature. So, whenever a <!--more--> tag is found in post , it automatically adds the text that have been passed as parameter and link to the blog post. The second parameter decides whether to display the teaser paragraph again when the blog post is viewed. The default value is false which shows teaser in both cases.

<?php the_content('Read more', false); ?> [21]

4.2.4   Loop in WordPress

The loop can be considered as the heart of any WordPress theme. Loop in WordPress is used to retrieve different data from the database. When something is accessed via browser, URL is matched against existing files and directories in WordPress . If the file is found, it is loaded by the server. However, if the URL does not load up the file, it needs to be parsed to load the content. For example, when viewing http://example.cseom/product/bag , WordPress understands that "bag" under custom post type called "product" is viewed. Hence WordPress will try to render single-product.php . If not found, it will fall back to index.php. This translation of URL to content is done by parse_query() method. WordPress parses the URL into set of query parameters. Finally, these query parameters are converted into MySQL queries to retrieve the content. In a general template file, the WordPress loop is used to display the posts or pages.
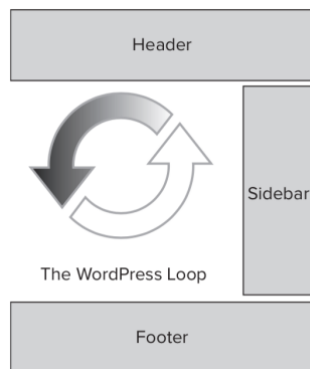
Figure 19 Loop usage

Flow of the loop

The loop uses conditional statement to decide what content to load, First , if statement is used to check if any post exists because sometimes there might not be any post or page. If there is content, while loop is used to initialize the loop and cycle through all posts or pages to display the content. Finally, the_post() function retrieves different information about the current post such as author, date and the post content itself. In background, $wp_query variable which is instance of WP_Query is referenced by all the functions in the loop.

```php
<?php
if ( have_posts() ) :
   while ( have_posts() ) :
      the_post();
      //loop content (template tags, html, etc)
   endwhile;
endif;
?>
```

Figure 20 Loop in WordPress

4.2.5   Hooks and Filters

In WordPress, hooks provide a way to insert code into the WordPress system. When a hook is creating , developers of WordPress can add additional functionality to this location. Plugins interact with our content in WordPress using hooks. Hooks are basically PHP functions with parameter .Each hook has its own name such as wp_head. Following is an example of hook usage .

function jintex_enque_styles() {

```
wp_enqueue_style('bootstrap','//maxcdn.bootstrapcdn.com/bootstrap/4.0.0/css/bootstra
p.min.css' );
// this will add the stylesheet from it's default theme location if your theme doesn't already
wp_enqueue_style( 'my-style', get_template_directory_uri() . '/style.css');}
add_action('wp_enqueue_scripts', 'jintex_enque_styles');
```

Here 'jintex_enque_styles' function is added to the hook wp_enque_scripts. This hook is triggered when WordPress loads its scripts. Custom function later on define functionality to add stylesheet functions using wp_enque_script function.

In WordPress, there are two kinds of hooks : actions and filters. Actions hooks are triggered by some kind of events in WordPress. For example, when the admin section is loaded certain hooks are triggered. Filter hooks are used to modify the content. This is done usually before pushing something or saving it to the database.

Popular Action Hooks

Some of the more common Action hooks are:

publish_post — It is triggered when some user publishes new post.

create_category – Whenever a new category is added, this hook is triggered.

switch_theme — When themes are switched , it is triggered.

admin_head — It is triggered in the <head> section of the admin dashboard.

wp_head – Like admin_admin, it is triggered in the head section of the theme.

wp_footer – It is triggered before the <body> tag .

Popular Filter Hooks

Some of the more common Filter hooks are:

the_content — It is applied before the content is published.

the_title – It is applied to the title of the post or page before it is published.

comment_text — It is applied to the comment.

the_permalink — It is applied to the permalink URL

4.2.6   Custom Post Type and Custom Fields

Custom filed

Custom Fields are the additional information supplied in the post. This information is stored as meta data. Later on, users can display this meta data using template tags in WordPress.

Custom fields can be added into WordPress using name value pair. Later this value can be retrieved using WordPress function get_post_meta().

Figure 21: Custom Field

4.2.7 Plugins and Widgets

4.2.7.1 Plugins

Plugins are packages of code that extend the core functionality of WordPress. WordPress plugins are made up of PHP code and other assets such as images, CSS, and JavaScript.

WordPress, Plugin extend the functionality of WordPress. PHP code and other assets like CSS, image and JavaScript collaboratively make a plugin. WordPress provides hooks and APIs for developers to facilitate the plugin development process. There are plenty of plugins available for customizing WordPress but one still chose to develop their plugins as needed.

4.2.7.2 Widgets

In WordPress, widgets are chunks of code that provide some functionality. Widgets can be placed in the areas where that are registered as widget friendly areas. These widgets can be easily dragged and dropped in widget areas from the Theme customizer or Widgets section under Appearance in WordPress Admin menu.

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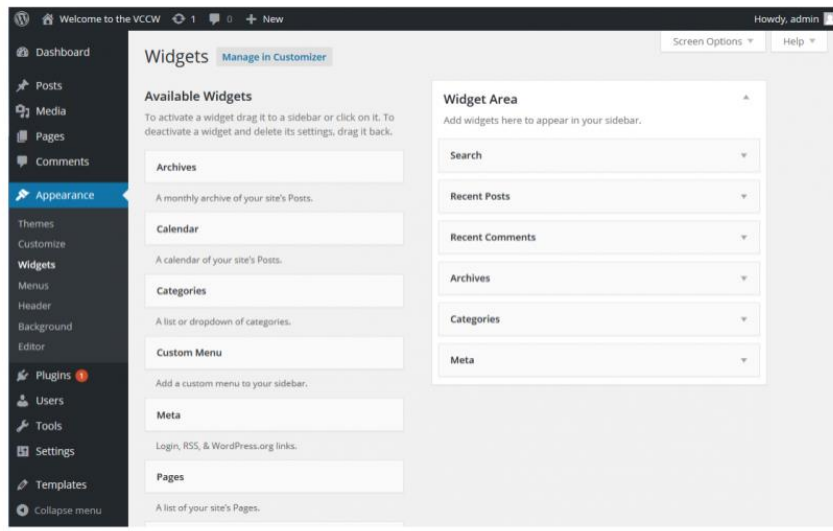
Typically, a WordPress widget consists of two areas. Title area for displaying the title of the widget and options area or setting up necessary options for widget.

A widget form in the admin area.
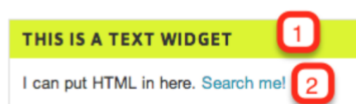
A widget as it appears to a site visitor.

Figure 22: Widgets in Backend and Frontend

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WordPress comes with default widgets such as search, recent posts , recent comments etc. . Widgets can be developed easily extending the standard WordPress Widget Class.

 For a complete widget development and setup, widget itself need to be developed by extending standard WordPress Widget Class. Next this widget needs to be registered to WordPress engine for recognition. Later, the widget could be displayed in the "widgetized" area.

Creating widget

Extending Standard WordPress Widget to develop own widget can be accomplished by extending standard widget class and implementing the necessary methods.

```php
<?php

class My_Widget extends WP_Widget {

    public function __construct() {
        // actual widget processes
    }

    public function widget( $args, $instance ) {
        // outputs the content of the widget
    }

    public function form( $instance ) {
        // outputs the options form in the admin
    }

    public function update( $new_instance, $old_instance ) {
        // processes widget options to be saved
    }
}
```

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construct: . This function basically setups the widget providing its name, description etc.

widget: This function is responsible for displaying the widget in the front-end. HTML is passed as $args parameter for rending widget title and content.

form: It renders the form in the backend for setting options for the widget.

update: It saves the options that were set in the form in the WordPress database.

Registering the widget

To notify WordPress about this newly created widget, it is necessary to register to WordPress. This can be achieved by hooking register_widget() into widgets_init hook in the following ways.

```php
<?php

add_action( 'widgets_init', 'wpdocs_register_widgets' );

 function wpdocs_register_widgets() {

register_widget( 'My_Widget' );

}
```

4.2.7.3   Project Plugins

4.2.7.3.1 Advanced Custom Fields

Advanced custom filed is the most popular plugin for adding custom fields. It supports a lot of field likes text , maps , date picker etc. These fields can be quickly retrieved using the_field() function .

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In the example client name as a custom field is created which can be retrieved later using the_field() function.

```php
<?php echo the_field('client_name'); ?>
```

4.2.7.3.2 Contact Form 7

Contact form 7 is another popular plugin for creating contact form for website. Forms can be created in the backend easily and later displayed in the frontend using shortcodes.

```php
<?php

echo do_shortcode('[contact-form-7 id="79" title="Contact form 1"]');

?>
```

Contact form allows to edit the form using tags.

[text your-name 20/40 id:foo class:bar "Enter your name"]
  Type   Name   Options   Value

[select* your-pet "Dog" "Pig" "Bison"]
  Type   Name   Values

Figure 23: Contact Form 7 usage

This tag will be replaced into HTML elements to render the form. There are many components of a form tag

Type: It is the most important tag. The type tag defines which HTML element to render to.

Name: It is used to identify these types giving them a name.

Options: It is used to give some behaviour and appearance to the elements such as giving them id and classes.

Values: They are used to provide default values to these field. They are optional.

Figure 24: Backend Form

4.2.8 Project
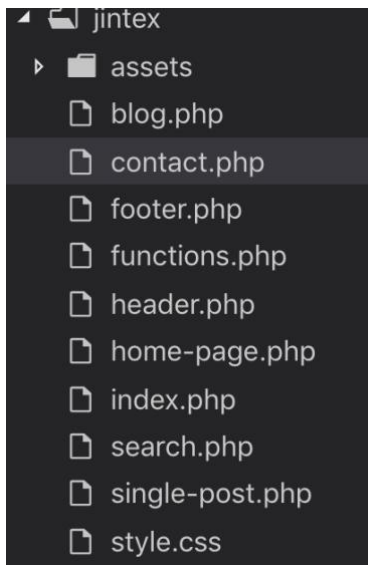
After downloading and installing the WordPress and setting up the server theme file is ready to develop. A basic theme consists of style.css page and index.php.
(landing page)

```
1    /*!
2    Theme Name: jintex
3    Author: Rosha Baral
4    Description: Description
5    Version: 1.0.0
6    License: GNU General Public License v2 or later
7    License URI: LICENSE
8    Tags: Corporate theme , easy setup |
9
10   Jintex is a theme made for small corparate companies .
11   */
```

Figure 25: Style.css

The second step is to break our static theme files into relevant WordPress files. Other pages are focused first than the blog page.

Menu

By default, WordPress does not support all the functionality. Additional functionalities can be added to the theme support. For instance, to add support for menu

```
add_theme_support( 'menus' );
```

. The second step is to register the menu and display it appropriate

Home-page.php will be template for our homepage.

Home page consists of mainly three parts.

Header, main content and footer.

Header will be included by using php function get_header() and footer by get_footer() in appropriate places .

Home page mainly consists of chunks of sections that have their own functionality.

The first section hero consists of some price information about the post which can be made dynamic using custom fields.

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WordPress by default support custom fields.

Figure 26: Custom Fields

These custom values added to the page now can be retrieved using WordPress function

```
get_post_meta ($post_id, $key, $single);
```

 When implemented

```
<div class="price">
    <h5>Website Development </h5>
    <span><?php echo "$". get_post_meta(get_the_ID(),'website_development',true); ?></span>
</div>
```

The second part is to make the theme logo dynamic. This can be done first by adding support to the theme and displaying it in the appropriate WordPress functions.

```
add_theme_support( 'custom-logo' );
```

The second step as usual is to display it on the front-end. This can be done by

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```php
<?php
    $custom_logo_id = get_theme_mod( 'custom_logo' );
    $image = wp_get_attachment_image_src( $custom_logo_id , 'full' );
?>

    <img src="<?php echo $image[0]; ?>" alt="">
```

Boost business

In this section usage of plugins in wordless is demonstrated.

Earlier custom fields were to site. This can be done more easily by using a plugin called Advanced Custom Fields. These advanced custom field supports a variety of data types from text, images to even tabs and groups. [22]

After downloading, installing and activating the plugin, the plugin is ready to use.

Figure 27: Advanced Custom Fields

As usual the appropriate custom fields need to be displayed in appropriate places using plugin functions with php.

```php
$boost_image=get_field('featured_image');
```

The get_field() retrieves the custom field type from the backend. In similar way, all the values can be displayed on the frontend.

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Custom post types

Custom post types can be done by registering the custom post type to WordPress.
<?php register_post_type($post_type, $args); ?>

where $post_type is the name of the post type and $args is the necessary arguments for the post type.

Features

To hold the features of the website, custom post type is used. By default, custom post type supports title and editor fields. To remove the editor field, remove_post_type_support () function is used.

<?php remove_post_type_support($post_type, $supports) ?>
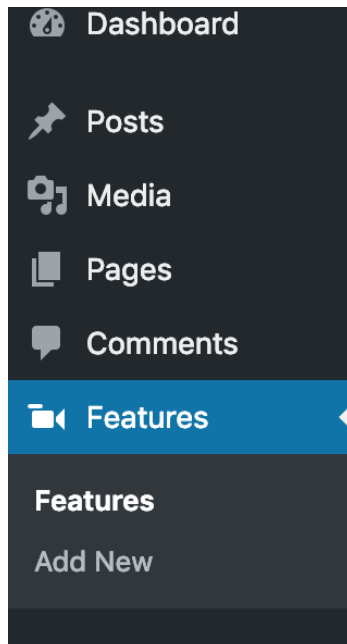
A new tab called features with a TV icon is added on the dashboard.

Add New Post

Features ⚙ ▲

Fontawesome link

features text

After the features have been added, it is time to display these features. Now we have many features to be displayed on the frontend. This can be done easily using WordPress loop.

```php
// WP_Query arguments
$args = array (
    'post_type'            => 'features',
);

$services = new WP_Query( $args );
    if ( $services->have_posts() ) {
        while ( $services->have_posts() ) {
            $services->the_post();
        ?>

    <div class="col-sm-3">
        <?php echo get_field('fontawesome_link');?>
        <h6><?php echo get_field('features_text');?></h6>
    </div>

    <?php
    }
    } else {
    echo("nothing found ");
        }
    wp_reset_postdata();

?>
```

Testimonials

Testimonials section being similar to features section, custom post type called "testimonials" is created and implemented.

Contact Page

A simple contact page has been created allowing the visitors of the website to contact the owner of website. Contact form 7 plugin has been installed and setup up for its functionality.

Blog page

Blog page
Blog page consists of recent blog posts on the left and other useful widgets on the right.

Posts

Loop is used to get the most recent blog posts with their metadata. First wp_query() function is used to get the post types that are only posts. When these posts are returned, a loop is run through each of them to get the excerpt, the author of the post, date it was published, thumbnail of the post and the link to the whole post.   Only the excerpt of a post is shown in the blog page, which when clicked on "continue reading" reveals the whole post.

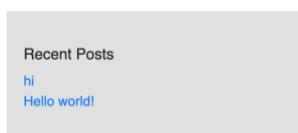Widgets

Widgets on the right provide different functionality.

Search Widget
Comes with default WordPress installation, search widget provides an input field for entering search text and a button for submitting the data. It sends data to search.php template. This template has been edited to show the search results as needed.
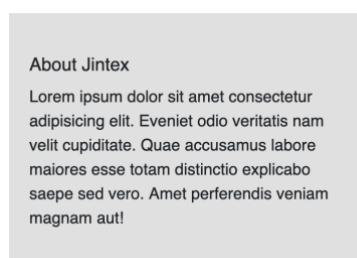
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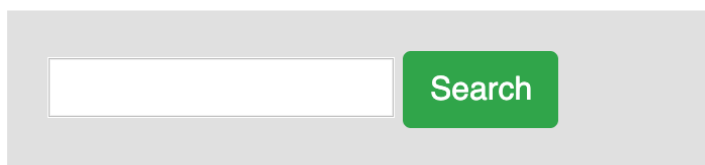
Recent post and Categories

Recent posts display the five latest post whereas categories display the name of the categories.

About

This widget simply displays some text in the frontend.

Social Links

Social Links is a custom widget developed for displaying social links for website.

5   Result and Evaluation

After downloading , installing and setting up local development server , a corporate WordPress theme was developed.

The Corporate WordPress development was carried out in two phases. Initially, a static template was developed using Bootstrap . Later , this static template was made dynamic using WordPress. To provide extra functionality , plugins were downloaded and configured from WordPress Community. Even custom plugin was developed to create a social widget. Owners of the Corporate theme , can customize the website .Prices of services, website logo , testimonials , menu etc. can be updated according to need. The theme was hosted on free hosting service. https://jintex.000webhostapp.com/

6   Conclusion

The main goal of the thesis was to develop corporate WordPress website. A thorough study was carried out on the topic. CMS, WordPress and Bootstrap where different components were analysed in the project.

Bootstrap was easy to install and use following its rich documentation. It expedited the website development process using grid system for website layout and other utilizes and components for rending different elements that were responsive across all platforms.

CMS, being the most popular technology to build websites, not only WordPress but its other competitor such as Joomla and Drupal were thoroughly examined. Installing and configuring WordPress was easy. A rich WordPress Developer's community helped to add more functionality to WordPress by providing plugins and also coping with the bugs.

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7 References

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Metropolia
University of Applied Sciences

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