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BENEFITS OF TECHNOLOGY IN ONLINE CLOTHES SHOPPING

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BACHELOR'S THESIS ABSTRACT

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BENEFITS OF TECHNOLOGY IN ONLINE CLOTHES SHOPPING

For a long while have clothing stores suffered from customers returning clothes. In a brick and mortar store most of the time it is easy to make sure the clothing is the right fit and the reasons for returning an item are usually a change of mind or a mistake in picking a size for a third party, but as online shopping is becoming more and more popular for its convenience, the downside for businesses is that a surprisingly large percentage of bought clothes online are returned because the cloth turned out to be not a good fit in real life, which results in massive losses for the business.

A modern problem most of the time requires a modern solution and this is no different. Technology has been constantly used to improve business models and increase profit. The concept of e-commerce would not be a possibility without web development, but it is in no way perfect yet and in technology, there is always room for improvement.

In this project, the aim was to reduce item returns, therefore, reducing the amount of profit being eaten away by returns as well as reducing clothes disposal. The plan was to create a complex web application to give consumers a better understanding of how suitable the item is for them. A successful implementation of this project would benefit both the consumers, and the businesses.

Web development and web applications in general have worked wonders during the 21st century. This project was implemented using the MERN-stack, which stands for MongoDB, Express, React & Node, which are all JavaScript frameworks and/or libraries. Part of the implementation also involved using artificial intelligence technology.

Artificial Intelligence, commonly shortened to AI, is an algorithm or machine that can do smarter functionalities compared to regular algorithms. In AI, the goal is often to imitate human intelligence and integrate it into an application. Due to the signed NDA, the author is not able to go into detail about the functionality of the application and AI technology that has a significant role in the implementation of the application.

At the time of writing, the implementation of the project is not yet complete and not accessible to the general public.

KEYWORDS:

Artificial intelligence, disposal, loss, program, algorithm

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TEKNOLOGIAN HYÖDYNTÄMINEN VAATEOSTOKSISSA

Jo pitkään ovat vaateliikkeet kärsineet vaatteiden palautuksista aiheutuvista tappioista ja verkossa ostelun yleistyminen ei helpottanut asiaa, vain päinvastoin. Kivijalkamyymälässä sovittaminen on helppoa, ja palautukset yleensä johtuvat mielenmuutoksista taikka sitten vaatekoon virheellisestä arvioinnista kolmannelle osapuolelle ostettaessa. Verkkosivuilta taas sovittaminen ennen ostoa ei ole mahdollista, joten asiakkaat hyödyntävät lakisääteistä palautusoikeutta palautuksiin, jos ei vaate ole syystä tai toisesta sopiva. Tämä prosessi aiheuttaa vaateliikkeille äärimmäisen paljon tappiota.

Ratkaisu tähän, kuten moneen muuhunkin moderniin ongelmaan, täytyy olla moderni myös. Teknologiaa ollaan hyödynnetty monessa alassa parantamaan liiketoimintaa ja tässä projektissa tavoite on juuri tämä. Projektin tavoitteena on huomattavasti pienentää vaatepalautuksia ja näistä johtuvat tappiot vaateliikkeille.

Tämän projektin päätavoitteena on vähentää palautuksia nettiostoksista, jolloin hävikki vähenisi ja alan yritysten häviöt pienenisivät merkittävästi. Toteutuksen ideana oli luoda kompleksi web-sovellus, jonka avulla kuluttaja pystyisi paremmin ennakoimaan vaatteen sopivuuden. Onnistunut toteutus tälle projektille olisi tuottoisaa yrityksille, ja myös parantaisi kuluttujan ostokokemuksia.

Web- ohjelmointi ja web- sovellukset ovat yleisesti olleet erittäin hyödyllisiä tämän vuosisadan aikana. Tämän projektin totetutus tehtiin käyttäen MERN-pinoa, joka on lyhenne MongoDB, Express, React ja Node teknologioiden nimistä. Nämä ovat kaikki JavaScript- kirjastoja tai kehyksiä.

Tekoälyä on toteuksessa myös hyödynnetty. Tekoäly, yleensä lyhennettynä AI (Artificial Intelligence), on algoritmi tai ohjelma, joka kykenee suorittamaan normaaleihin ohjelmoihin verrattuna älykkäimpiä toimintoja. Salassapitosopimuksen johdosta projektin toteutuksesta ei voi paljastaa yksityiskohtia sovelluksen toiminnallisuuteen liittyen, ja tekoäly on tämän sovelluksen toiminnallisuudessa hyvin keskeisessä roolissa.

Projektin toteutus ei ole vielä tähän päivään mennessä valmistunut eikä tuote ole vielä julkisesti saatavilla.

ASIASANAT:

Tekoäly, vaatehävikki, tappio, sovellus, algoritmi

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LIST OF ABBREVIATIONS

BSON	Binary encoded Javascript Object Notation
CSS	Cascading Style sheets
DOM	Document Object Model
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
JS	JavaScript
JSON	JavaScript Object Notation
JSX	JavaScript XML
MERN-stack	The combined use of MongoDB, Express, React and Node
NDA	Non-disclosure Agreement
NPM	Node Package Manager

1 INTRODUCTION

In recent years, there has been a great emphasis on how to control and limit the disposal of different items in several industries. Controlling disposal is important to keeping our planet healthy, but in some industries, this is not the only concern. In clothing businesses, especially online-based shops, there is concern about losing money and product simultaneously, and obviously, that is the worst outcome for a business, regardless of the business model.

Most successful online clothing stores offer a varying period of time where a customer can exchange or return the item if the consumer was for any reason not pleased with the item, whether if the picked size was incorrect or if the consumer just happened to change their mind after the purchase (Figure 1). In some countries, the right to return an item is mandatory in online stores for a certain period of time. While this is a great deal for a customer and most of the time it is kind of a guarantee for the customer to either be pleased with the product or receive their money back, the great drawback for businesses is the huge amount of money loss when customers choose to exercise that right. According to a study carried by Happy Returns, which is a company specialized in e-commerce item return management, customers return up to 40% of items bought online, while, compared to brick-and-mortar stores, only 10% of the purchases are returned [1]. In some cases, the online store pays for the shipping both ways, delivering the purchase and when receiving the returned item, which only adds to the huge amount of loss.

It is roughly estimated that retailers throw away 25% of the returned items for many different reasons resulting in the company not being able to resell the product, which means they lose both the product and the money. For the other estimated 75% of items not thrown away because of them being in a condition where they can resell them, it is still not lossless. Large businesses especially, where the returns are piled in the warehouses, use up considerable time and resources to organize the returned items and return them to stock. Depending on the business in question and the type of item sold, it is sometimes cheaper to throw the item away than waste resources re-organizing it, which leads to more disposal. [1]

Many modern and old problems have been solved using technology and the aim of this thesis is to capitalize on the chance to significantly reduce the amount of loss in disposal and in money.

The reason this thesis was chosen was for the importance of the topic and to raise awareness of the issue. Returning items more carefully packaged could save considerable time and resources for businesses, in addition to reducing disposal. There have been many instances where studies regarding this topic were conducted but not many solutions to the problem have been concocted.

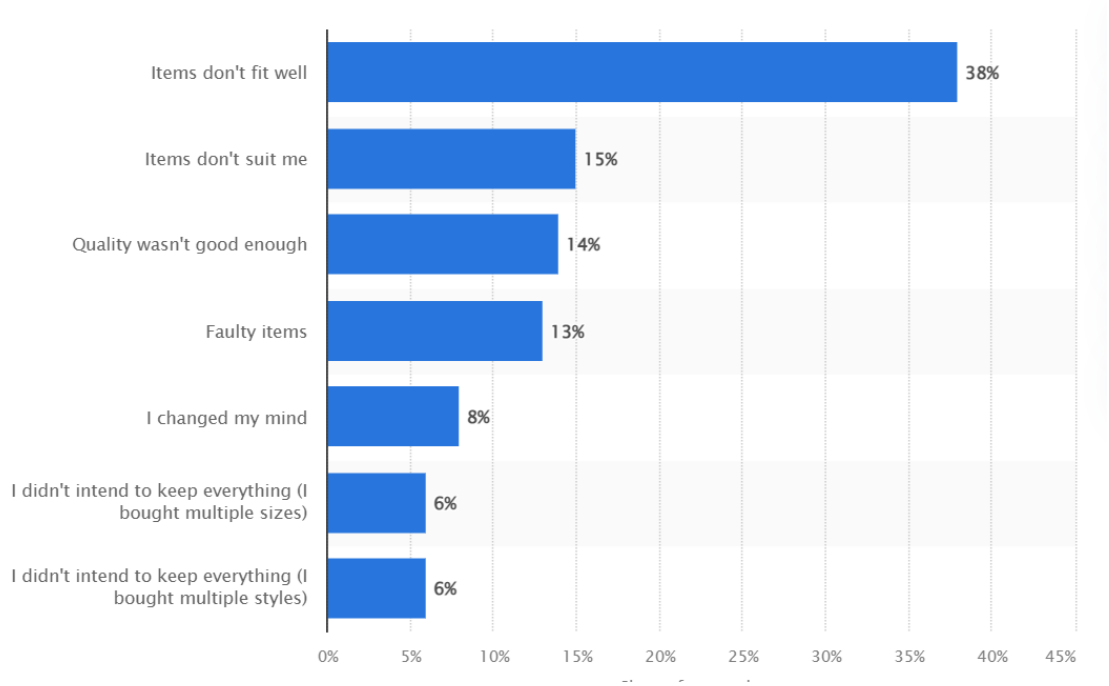


Figure 1. Most common reasons for item returning [2].

The objectives of this thesis are develop an administration page which consists of data sent to the main program and the front-end part of the tool that allows the project owners to feed information to their main program which then in turn allows it to function properly as an artificial intelligence solution. Due to NDA's and the sensitive nature of the project, the solution cannot be exposed to the general public by the author at this point.

This thesis aims to examine the challenges and benefits that were brought to the fashion industry by web technology and subsequently, e-commerce. The thesis consists of seven chapters:

- Chapter 1 gives a general overview of the subject and the objective of the thesis.
- Chapter 2 examines the challenges in the fashion industry by providing statistics and showcasing results from studies provided by various sources, showing to what extent item returns affect businesses.
- Chapter 3 describes how the World Wide Web changed the course of retail sales following the rise of Amazon and e-commerce, and how e-commerce's incline amplified the number of item returns.
- Chapter 4 concentrates on introducing the basics of web development, to gain a better understanding of what e-commerce sites are built on and what are the possibilities within web technology.
- Chapter 5 explains the structure of a web application in more detail. It elaborates on modern web development technology.
- Chapter 6 presents the technologies used in the implementation of the front-end, back-end, and database.
- Chapter 7 concludes the thesis.

2 INDUSTRY CHALLENGES

Like in many other industries, the clothing industry faces the challenge of being in constant and evergrowing competition. The clothing industry is known as highly competitive, and research estimates the global retail sales of clothes and footwear to have reached 1.9 trillion US dollars [3]. In this chapter, we'll examine some of the challenges the participants in this industry face.

2.1 Visibility

In any given industry with a competitive nature, a new aspiring business would need something to stand out, an edge over the competition to gain visibility and to create a reputation. In addition to having an edge, the business would also need to be able to match the level of offerings in such as shipping services, terms of returns et cetera.

Having an edge in the clothing industry could prove difficult, partly because it is difficult to find a clothing line or style that has not been already being sold at another established store that has already proven itself successful with a trustworthy business model. Even if the business finds a particular style that has not been fully explored yet, there is a fair chance that the receiving public could reject the attempt of creating a new trend.

2.2 Shipping and item returns

The clothing industry is a difficult one in particular since existing and new businesses have to adapt to the current standard of customer service. Part of what makes breaking into the industry challenging is the fact that in the clothing business world the terms of shipping and item returns are deemed important by many.

Some businesses have used those two previously mentioned things to create an edge over the competition. In online stores, a perfectly good example would be having free shipping for purchases from their website. According to a survey of 3000 consumers done by Forbes, approximately half of retail shoppers reported avoiding stores that do not offer free shipping, and 77% said to have changed their mind and not going through with the purchase because of not being satisfied with the options presented regarding shipping. In contrast, 84% reported that free shipping influenced them to go ahead with their purchase [4]. Of course cost of shipping is not the only variable in the shipping area, but also the speed of shipping. Some businesses combine express shipping with free shipping to attract more customers. While it does come at a great cost to the company offering that kind of service, it may bring the desired results.

While the importance of shipping variables can not be denied, there are more important contributing factors, such as the terms regarding item returns. Having the option to return an item cost-free plays a huge role in influencing a customer's purchasing decision. This is especially important in clothing purchases, since there tends to be more hesitation compared to purchasing other products online (Figure 2). This conclusion is backed by several different studies, one of them being a study conducted by Narvar 2018. The study shows that approximately 69% of shoppers are deterred by having to pay for returning an item, and 17% would not buy from a store at all without the option to return the item [5]. Being able to return the purchased items significantly reduces the risk of the consumers ending up disappointed with their purchase, as well as losing the money spent on it. Being disappointed with a purchase is especially bad for clothing stores since customers are more likely to return to stores where they've had positive experiences. It is also important to note that not all item returns are only returns. According to the previously mentioned study, 57% of the participants in the study said that they exchanged the last item for another one [5]. Being able to exchange an item the buyer was unhappy with for another one they are content with does also change the customer's experience from negative to positive, making it more likely for the customer to return to the same store again.

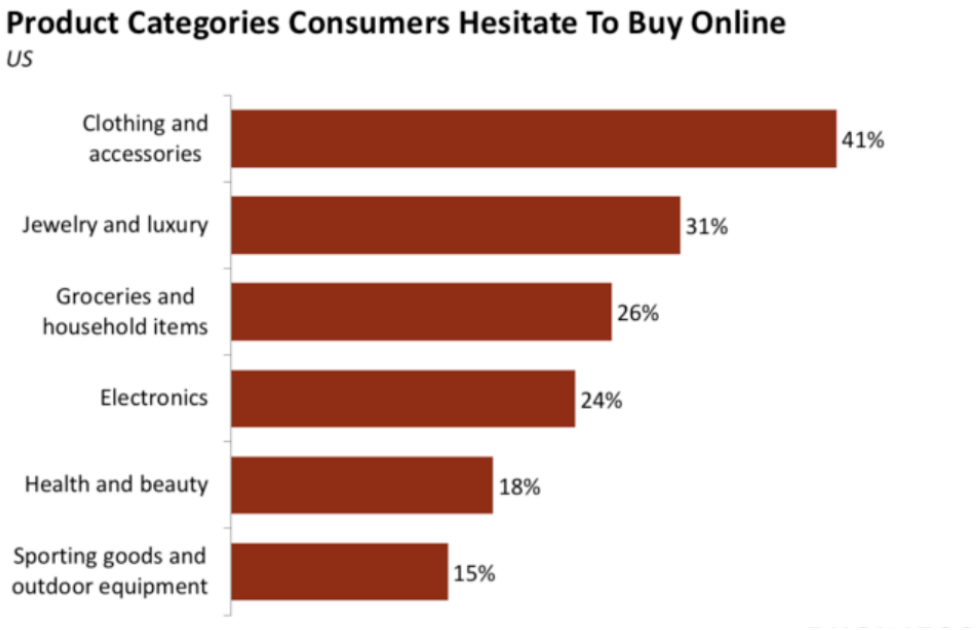


Figure 2. Results of a study by Business Insider [6].

Based on the aforementioned information, we can safely conclude that shipping options and item returns contribute positively to a clothing business' sales revenue, but sales revenue certainly is not the only thing a clothing business would need to be successful. The profit margin is reduced by the free shipping option, but more significantly the profit is cut down by item returns by consumers. As mentioned in the introduction chapter, consumers collectively return up to 40% of e-commerce

purchases, leaving the companies with a great amount of loss and disposal of clothes that are no longer in the condition of selling as new products.

3 TECHNOLOGY IN CLOTHING INDUSTRY SALES

The technology field's growth in the 21st century has been remarkable and has affected most industries in the world and the clothing industry was no exception. In addition to a widened reach in terms of marketing and exposure, the tech- industry and its progress in web development allowed clothing businesses to not completely rely on brick and mortar stores thanks to the concoction of online shopping.

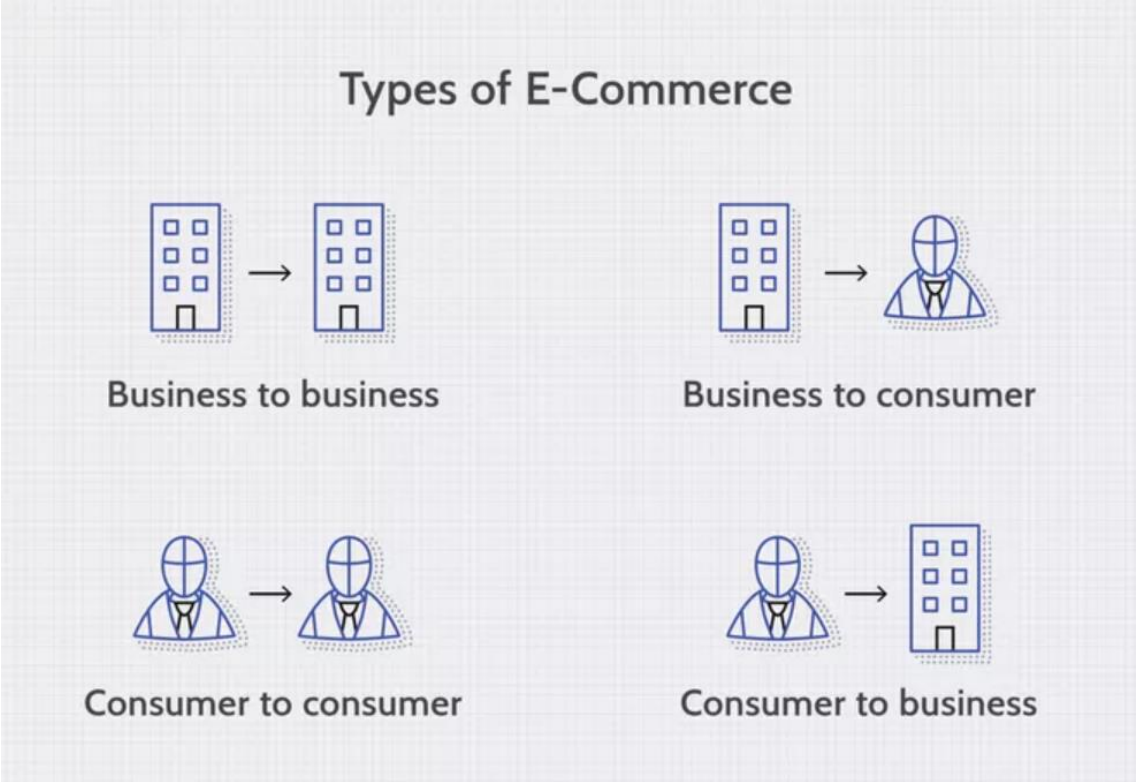
3.1 E-commerce in clothing industry

The name e-commerce refers to the act of selling or purchasing products or services over the internet. There have been many different takes on the origin of e-commerce depending on what people consider the starting point, but many believe that it was invented by Michael Aldrich in 1979 which he did by connecting a computer tasked with processing transactions to a modified TV using a telephone connection. Needless to say that during those times it wasn't the same e-commerce that we know today.

After the internet became accessible to the general public in 1991, online shopping was now a possibility. One of the pioneers of online shopping was Amazon, founded by Jeff Bezos in 1994. Amazon was initially an online marketplace for books which later then expanded to multiple product categories, earning the nickname The Everything Store. Since Amazon, thousands of businesses have opened their own e-commerce stores, with several different types of e-commerce models, and again the clothing businesses were not an exception (Picture 3).

E-commerce managed to change the way people shopped for clothes by creating numerous advantages for consumers such as access to a vastly larger selection of sellers and products, convenience, the huge amount of time saved by not going to a physical store, etc. The idea of online shopping quickly spread within the industry and was adopted by most businesses whose only channel for sales was through physical shopping.

The benefits of online shopping were not only for consumers but also for businesses. It allowed businesses to reach a significantly larger amount of potential buyers. In addition to providing an opportunity for already existing businesses to improve their turnover, online shopping was also viewed as an opportunity to create businesses that operated only online. This was a huge step forward in this field, since having an online store meant saving big quantities of money from the redundancy of having a physical store while still having a great number of potential buyers.



Picture 3. Different types of e-commerce models [7].

3.1.1 COVID-19 Pandemic

Online stores are some of the businesses that managed to benefit from the COVID-19 pandemic that originated in 2019. The effects varied of the pandemic on the businesses varied in different regions, depending on the general public's reactions to the pandemic and the restrictions set by the governments. While online shopping was already widely popular before, the COVID-19 pandemic, thanks to the restrictions of movement and people's fear of contracting the virus in public, created a notable acceleration in the rise of online shopping's popularity. For clothing businesses, that inevitably meant shifting the focus to online stores for the businesses that already had both physical and online stores [8]. While online stores gained popularity, they also increased the amplitude of the already existing shipping & returns issues.

3.2 E-Commerce structure

Stores run digitally online usually have a similar structure to each other. They usually contain a

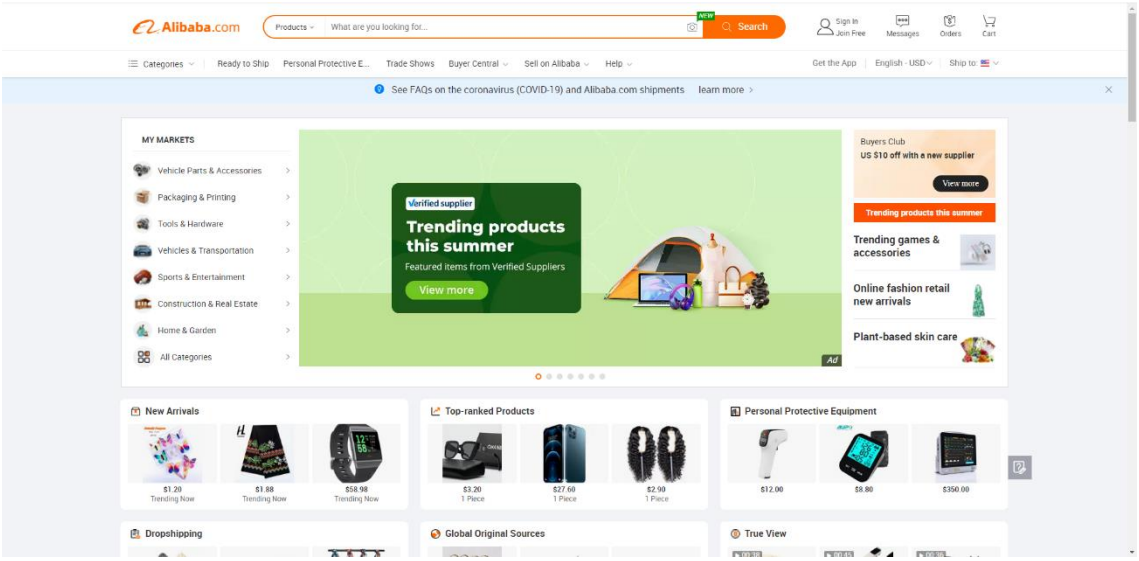
- Home page with featured products or current best deals
- Search bar to make it easier to find specific products
- Product page
- Terms & Conditions page

- Secure checkout page where you can pay using a credit card, PayPal, or similar services

This is the foundation that can be found in most online stores. The service providers then add their own touch to differentiate it from the rest, such as a unique layout and adding features that are not available in other stores (Picture 4).

Most e-commerce sites are in fact web applications and are developed by web developers and/or software engineers. Web application possibilities are practically endless, therefore allowing for every e-commerce business owner to create their own e-commerce site according to their wishes. So far, the web development field has managed to create fully functional online stores that are interactive with the customers as well as the business owners.

As in every industry, there is always room for improvement. The aforementioned issue of the extensive cost of item returns in online shopping has so far not been solved by web technology. The thesis aims to create a possible relief to this particular issue.



Picture 4. Alibaba is an elaborate example of an e-commerce store.

4 WEB PROGRAMMING 101

A British scientist named Tim Berners-Lee invented the World Wide Web (WWW) in 1989 and then shortly later HyperText Markup Language, commonly abbreviated to HTML. The initial goal was to combine data, computers, and networks to create a powerful global information system, using web pages that are browsed using web browsers [9].

In this chapter, we will go over the basics of web programming to get an understanding of how web applications are structured and the possibilities.

4.1 HTML

While HTML is an essential part of web development, it is important to note that it is not a programming language, as it cannot create any functionality. A more accurate description of HTML would be calling it a formatting system, describing how content inside an HTML file should be structured so that the web browser knows how to properly display content on the website. An HTML file is basically a text file containing the syntax displayed below, having HTML elements that consist of content surrounded by the opening- and closing tags (Picture 5).

```
<html>
  <head>
    <title>Insert title here</title>
  </head>
  <body>
    <h1>Header</h1>
    <p>
      Hello world !
    </p>
  </body>
</html>
```

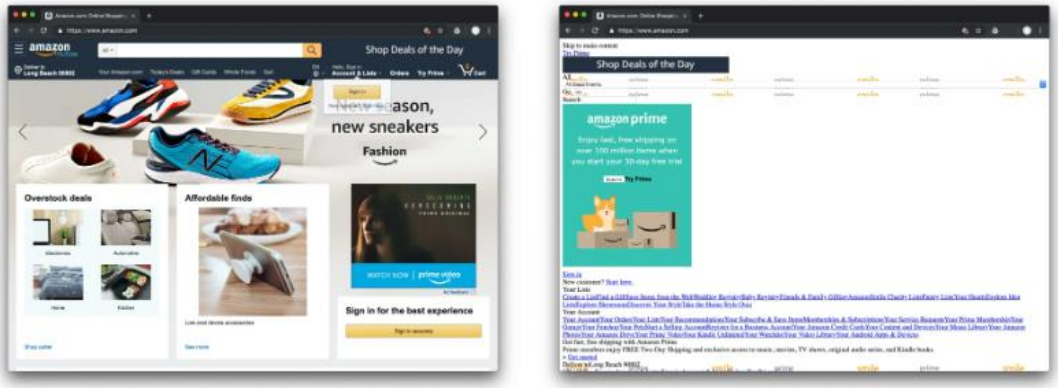
Picture 5. Example of an HTML code, showcasing its format.

A developer could type HTML code into practically any text editor, creating a basic webpage that is uploadable to the internet. This could be sufficient for super simplistic websites, created for solely informative purposes. However, if the webpage creator wants to add some style and customized layouts, they would have to add CSS into the mix.

4.2 CSS

When different layout-related tags were added to HTML in its 3.2 version release, it created quite a headache for developers, since adding for example font and color information to every individual page was inefficient and as a result, expensive as well. To solve that particular issue, the World Wide Web Consortium (W3C) in a 1996 press release issued a recommendation for web style sheets, CSS1 [9].

Cascading Style Sheets, commonly shortened to CSS, is a language used to describe the way HTML elements are supposed to be displayed on a webpage (Picture 6). That means everything style and layout related. There are huge amounts of advantages to using CSS, most notably faster loading speed, faster development, and endless customization options.



Picture 6. Amazon's website with and without CSS [10].

However, since neither HTML nor CSS are programming languages, to create actual dynamic content, animations, or other complex and interactive features, a developer would need to use JavaScript.

4.3 JavaScript

One of the most notable developments in the web development field came in 1995 when American programmer Brendan Eich and his employer NetScape introduced JavaScript to the world. JavaScript is a scripting or programming language that allows developers to create dynamic and interactive web content for applications [9]. JavaScript's formatting is unique and differs from other programming languages (Picture 7).

JavaScript's popularity is unquestionable today. Its versatility, speed and the infinite amount of possibilities in development have played their part in it becoming the most popular programming language in the world. It is estimated that 98% of all websites today are using JavaScript as the client-side programming language. That also

includes some of the most popular websites in the world such as Facebook, Twitter, Youtube, Google & eBay [11].

One of the most notable features of JavaScript is the fact that it is a web-based language. The web browser can natively understand the language, thus contributing to its execution speed. Developers have used JavaScript to create interactive websites, online games, displaying videos as well as for server-side programming purposes, further showcasing its versatility. Before JavaScript, webpages were created only using HTML and CSS, which were very well equipped to create static webpages, but not interactive.

```
const factorialOfNumber = number =>
  number < 0
    ? (() => {
      throw new TypeError('No negative numbers please');
    })()
    : number <= 1
      ? 1
      : number * factorialOfNumber(number - 1);
```

Picture 7. JavaScript function to calculate the factorial of a number [12].

4.3.1 Web applications vs desktop applications

JavaScript's rise in popularity is directly correlated to the remarkable amount of popularity Web programming has gained in the past years. Many of the application types that used to be developed to function as desktop applications, are nowadays being developed as web applications. Many of the desktop applications that are in use have now also web versions that can be viewed with ease using a web browser on any device. Contrary to desktop applications, web applications do not need to be installed locally on your computer before you can use them. Some of the other pros of creating web applications are:

- Accessibility. There are no system requirements to access a web application as you can access a web application from any device with a browser and internet connection.
- From the point of view of the end-user, updating is way less of an inconvenience, if inconvenient at all.
- Easier to fix bugs

4.3.2 JavaScript frameworks

In the programming world, more specifically in the JavaScript programming world, a framework is a programming structure and a collection of libraries with pre-written code, allowing developers to write code more efficiently. Coding in JavaScript without using a framework is called coding in vanilla JavaScript. While the use of JavaScript frameworks is not mandatory, creating a web application using vanilla JavaScript means you would sometimes have to write for every little portion, it's own code from scratch [13].

Along with the fact that JavaScript is the most widely used programming language, comes also the fact that it has the most frameworks out of all the programming languages in the world. Another reason for the vast amount of frameworks is the ability to use JavaScript for both client-side and server-side programming.

Some of the popular JavaScript frameworks for client-side programming include:

- React
- Angular
- Vue

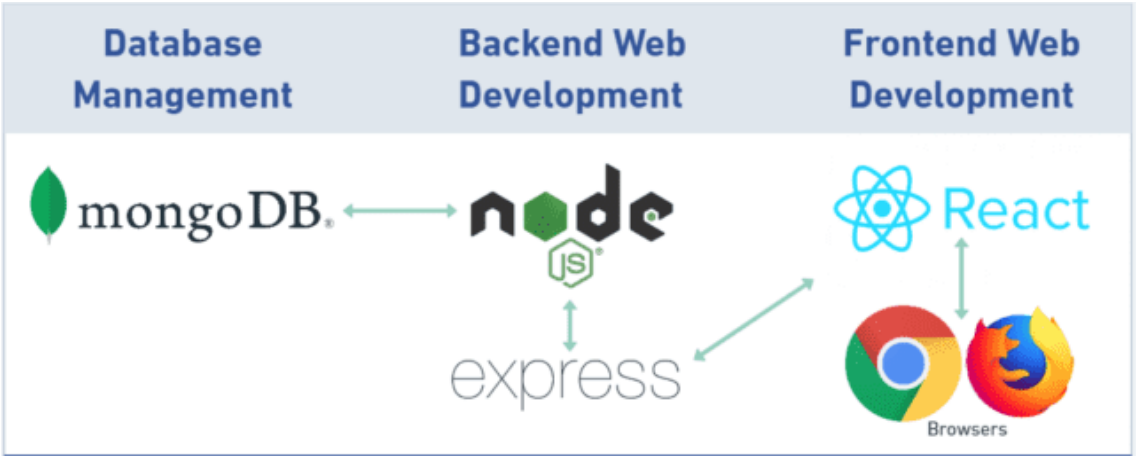
While the most popular JavaScript server-side frameworks are:

- Express
- Next

5 WEB APPLICATION STRUCTURE

One of the most common ways nowadays to create a modern client-server web application, is to have it consist of a back-end to handle the server-side operations and a front-end user interface for the users to interact with the application. The need of having a database is not present in every web application but is often a necessity for slightly more complex applications, where there is data being sent and/or retrieved.

This solution was implemented using the MERN- stack, which stands for MongoDB, Express, Node.js & React.js. The MERN- stack is a modern and highly popular technology used to develop web applications, especially single-page applications (Picture 8).



Picture 8. Visualisation of the MERN stack process [14].

5.1 MongoDB

MongoDB was founded in 2007 and has gained an immense amount of popularity since then thanks to its flexibility, ease of use, and security. It is today regarded as the most popular NoSQL database. MongoDB is an open-source document database that uses schemas for storing data. NoSQL- databases have gained popularity in general over the last years, one of the biggest reasons being the fact that it allows users to do SQL queries without actually learning SQL [15] [16].

Each entry in a MongoDB database is described in BSON, a binary representation of the JSON data. Web applications retrieve the data from the database then in JSON format. JSON stands for JavaScript Object Notation and it is a format used to represent structured data based on JavaScript syntax (Picture 9) [16].

```json
{
  "_id": 1,
  "name": {
    "first": "Ada",
    "last": "Lovelace"
  },
  "title": "The First Programmer",
  "interests": ["mathematics", "programming"]
}
```

Picture 9. An example of JSON formatted data compatible with MongoDB [16].

5.2 Node & Express

Node.js, usually shortened to Node, is an open-source runtime environment that makes it possible to develop various kinds of server-side applications using JavaScript. Node was brought up in 2009 by Ryan Dahl and the initial release supported only Linux and Mac OS X environments but later started supporting Microsoft Windows [17].

With the popularity of JavaScript on the incline, Node quickly became popular a few years after its release due to the ease of development, great performance and the fact that it is written in JavaScript makes it easier for developers to combine it with React to work on both server- and client-side code in JavaScript (Picture 10) [18].

Today, Node has an active community with lots of developers willing to help. In addition to the features mentioned earlier, the Node platform has a packager manager called NPM, short for Node Package Manager. NPM is not only a package manager, it's also the world's largest software library. Open-source developers often use NPM to share software and today it provides access to hundreds of thousands of reusable packages just by using simple terminal commands [19].

```javascript
const http = require('http');

const hostname = '127.0.0.1';
const port = 3000;

const server = http.createServer((req, res) => {
  res.statusCode = 200;
  res.setHeader('Content-Type', 'text/plain');
  res.end('Hello World');
});

server.listen(port, hostname, () => {
  console.log(`Server running at http://${hostname}:${port}/`);
});
```

Picture 10. Example of a simple node.js server code [20].

Express is a compact Node.js framework that is used to build server-side applications using the principles of Node.js (Picture 11). It is the single most popular Node framework available as of today [18].

```
const express = require('express')
const app = express()
const port = 3000

app.get('/', (req, res) => {
  res.send('Hello World!')
})

app.listen(port, () => {
  console.log(`Example app listening on port ${port}`)
})
```

Picture 11. Example of a similar code of the above picture, now using Express [18].

5.3 React

React.js, usually shortened to React, is a component-based client-side programming JavaScript library released in 2013 that is specifically designed to help developers build user interfaces, also known as UI's [21]. A user interface is a spot where a human interacts with an operating system, application, or a website. Over the years, user interfaces have seen great improvement in design, usability, and functionalities. An example of a great user interface is not only a UI with a great design, but more importantly, an effective user interface should make the user's experience require minimal effort to achieve the desired outcome. A user interface consists of a collection of on-screen menus, buttons, search bars, and everything else that a human interacts with to use the system, application, or website.

Before the introduction of React, front-end developers usually were building web application user interfaces using regular JavaScript or with React predecessors, most notably JQuery. With the introduction of React, developers were now able to significantly reduce development time, reduce bugs and errors [21].

One of the biggest attractions of using React is the possibility to create isolated and reusable components. In React, a component is a section or a piece of the user interface that can be used in many different parts of a web application. For example, creating a button in an application that you may need several times, but with a different color and size, you would be able to use the same code while just changing the color and size properties, saving a significant amount of time in comparison to re-writing the whole code. You can also use NPM to download components created by other developers and if needed, tweak their functionalities to fit your needs, or publish your own components on NPM for other users to download and utilize according to their needs [22].

Since its inception, React has had many competitors, such as Angular and Vue, but what separates React from the rest are most notably two features unique to it, JSX and Virtual DOM.

5.3.1 JSX

Every single basic web page is using HTML at its core regardless of the technologies involved in development. Web browsers read HTML- documents and display them on your device as web pages. The DOM, or Document Object Model, is the data representation of the objects, such as the structure and content of the web page. The objects represented by the DOM can be manipulated using a scripting language, usually JavaScript.

JSX, or JavaScript Extension, is a React feature that allows developers to easily modify the DOM using HTML- code mixed with JavaScript scripts (Picture 12). After the code is compiled, JSX expressions are converted to a basic JavaScript code [21].

Using JSX is not mandatory when developing with React, but it certainly makes front-end development more convenient while also having a significant effect on improving performance [23].

```
function getGreeting(user) {
  if (user) {
    return <h1>Hello, {formatName(user)}!</h1>;
  }
  return <h1>Hello, Stranger.</h1>;
}
```

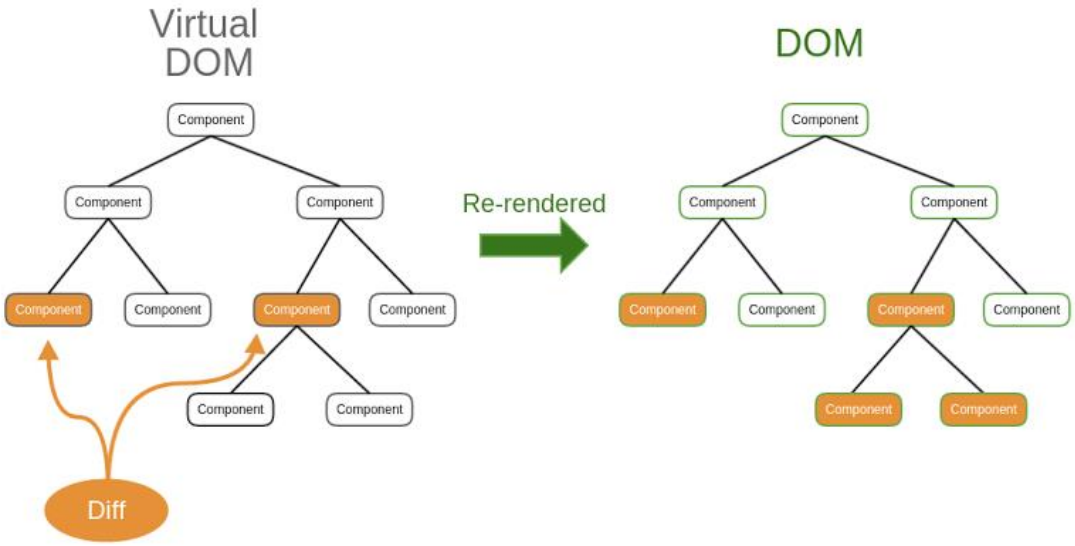
Picture 12. An example of a JavaScript function using JSX [23].

5.3.2 Virtual DOM

The Virtual DOM, sometimes referred to as VDOM, is a virtual copy of a regular DOM, which is used by React to see which portions of the regular DOM need to change in case of an event, such as a button click or submitting a comment, occurs.

Without React and VDOM, the whole DOM would have to update when a website event is triggered. In contrast, by using React, the Virtual DOM is vetted to see what changes occurred after the user action and then updates only that portion of the DOM.

Using React and its Virtual DOM exhausts less processing power and works as a performance enhancer, resulting in shorter loading times (Picture 13). The difference is easier to spot in slightly more complex websites with tons of different objects and dynamics, whereas in a simple web page it might not be as noticeable due to having a lesser amount of moving parts [24].



Picture 13. A visualization, explaining how changes in the Virtual DOM affect the actual DOM [25].

6 IMPLEMENTATION

The solution is a modern client-server web application, which consists of a back-end to handle the server-side operations, and a front-end user interface for the administrators to oversee, approve and categorize the data being forwarded to the database which then in turn stores the information collected by the program.

Due to the project's nature, sensitivity, and a non-disclosure agreement between the thesis worker and the company, including screencaps of the actual project is prohibited in this thesis in addition to over-providing details about the functionality of the program.

6.1 Front-end

Even though in this project the user interface is only visible to the administrators, making it user-friendly and simple had great importance for the project owners, and rightly so. One of the advantages of using React.js in this project was the vast amount of different options provided by the framework and third-party developed packages, which made designing the web application considerably easier. The design of the user interface was handled completely by the thesis worker in accordance with the project owners' wishes.

It was decided among the project participants to make the user interface a single page application, to promote ease of use, and avoiding unnecessary pages and complexity. The page consists of several different parts, most notably the main panel and the statistics section.

The main panel is where the magic happens. The raw data is visualized in the main panel, where the administrators go through it to categorize, filter, and forward the data to the database through the server-side program. This portion was completed with the help of a React.js package "carousel".

Statistics are often necessary addition to programs using AI for machine learning and data collection purposes [26]. The section consists of a pie chart showcasing the exact amounts of different kinds of data approved, with the ability to customize or filter the pie chart to show only certain types of data.

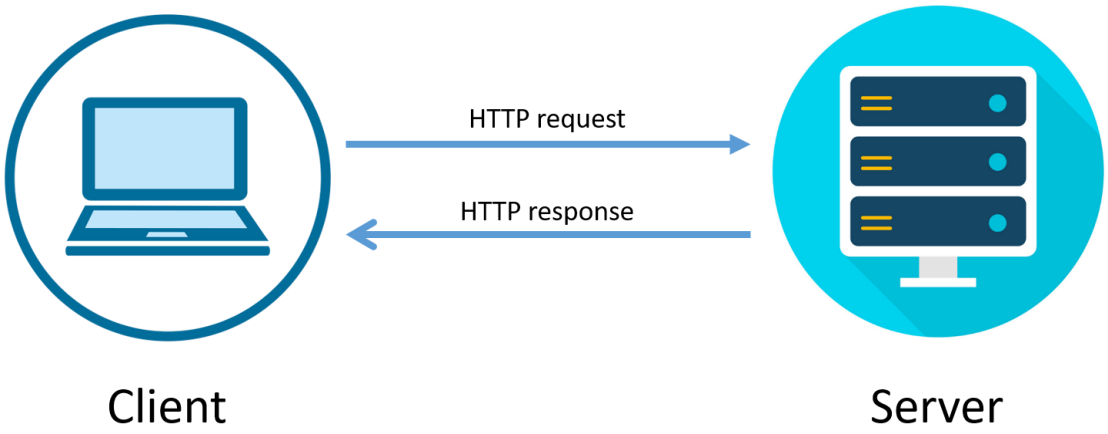
6.2 Back-end

The back-end portion of the project was constructed using Node.js, a JavaScript framework well-known for being a quick and reliable back-end platform.

Node.js was used in this project to handle server-side operations, such as when the administrator is through with handling the data in the main panel, the sorted data is then forwarded to the database using an HTTP request.

HTTP requests are an essential part of back-end programming. When an HTTP request is executed, it is often met with an HTTP response, which varies depending on the type of request used (Picture 14). For example, in a GET- request the response is usually the requested data from the server. HTTP requests allow the user to do several functions with the data such as:

- GET: Is used to request data from a specific source
- POST: Is used to send data to a server to create a resource
- PUT: Can be used to update specific data from the source
- DELETE: Is used to delete the specified resource



Picture 14. Visualisation of a HTTP Request and HTTP Response.

6.3 Artificial Intelligence

Some problems are difficult to solve using plain web development, that's when artificial intelligence usually comes in. Artificial intelligence, commonly shortened to AI, has seen notable progress over the recent years and is still continuing to do so. AI as a technology doesn't have a singular definition, but its main goal more often than not is to simulate human ways of thinking, using different kinds of algorithms. In web applications, AI technologies have been used for various different reasons such as:

- Speeding up searches
- Improving user experience. A good example of this are web chatbots
- Marketing
- Personalized experience in web applications, such as e-commerce sites.

The different possibilities and benefits of AI are near endless and will continue to improve in the future.

Database

In a project of this kind where storing and managing information is a necessity, choosing a database for data management is inevitable. We chose to work with a document-oriented database called MongoDB, for a variety of reasons, most notably its flexibility which makes it easy for programmers to store, manage and retrieve data. Our main purposes for the database were to store the raw data, retrieve it for handling by the administrators and then finally send it back to the database

The raw data stored in the database is retrieved from various different sources, such as partners of this company by varying methods, such as direct data feeding or data scraping from websites. After the data is retrieved and stored safely in the MongoDB database, it gets pulled by a GET- HTTP request to have it visible in the web application. After the GET- request is executed, the raw data is ready for the website administrators to process and categorize in the main panel of the user interface.

After the data is processed, categorized, and ready to send back to the database by the administrator, the back-end handles sending the data back using another HTTP-request, this time using a POST- request.

7 CONCLUSION

While the popularity of online shopping has seen a massive acceleration in recent years, it has also caused a rise in the number of items returned, since in online stores the customer is not able to see the product physically. Specifically in clothes that is an issue, since the material may look different in the photos and the size of the item can be sometimes unpredictable since there are no general strict guidelines for clothing sizes. This has been an issue that not many consumers pay attention to, but businesses are highly conscious of it.

After the success of early e-commerce stores, many industries such as the fashion industry began implementing their own e-commerce stores. E-commerce does not come without its flaws though. In online clothes shopping, the primary headache to businesses is caused by item returns, due to the fact that most companies offer free returns and cover the shipping in addition to some of the items returned are no longer in the prime condition to be re-sold as new. Depending on the severity of the possible damage, they either have to dispose of the item or sell it at a discounted price, affecting the profit margin. Even in the cases where there is no damage and the item could be sold again as new, there is the cost of manpower when reorganizing the items and putting them up for sale again.

Online stores are usually built as web applications by developers. With the help of web developers, entrepreneurs are able to have their own customized layouts, features, and terms of conditions within legal regulations. While there are endless opportunities and possibilities in web technology, as of today there has not been a viable solution to reduce item waste and cost of return for businesses.

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