**Inventory Management System**

**Conor McGrath**

**Aaron Healy**

B.Sc.(Hons) in Software Development

November 7, 2018

**Final Year Project**

Advised By: Daniel Cregg

Department of Computer Science and Applied Physics

Galway-Mayo Institute of Technology (GMIT)



**Contents**

[Introduction 4](#_Toc3205397)

[Context 5](#_Toc3205398)

[2.1 Objectives 5](#_Toc3205399)

[Methodology 7](#_Toc3205400)

[3.1 Agile Development 8](#_Toc3205401)

[3.2 Version Control 10](#_Toc3205402)

[3.3 Technology Choice 11](#_Toc3205403)

[3.4 Testing 12](#_Toc3205404)

[Technology Review 13](#_Toc3205405)

[4.1 Database 13](#_Toc3205406)

[4.1.1 MySQL 13](#_Toc3205407)

[4.2 Backend 15](#_Toc3205408)

[4.2.1 Java 15](#_Toc3205409)

[4.2.2 Spring 16](#_Toc3205410)

[4.3 Frontend 17](#_Toc3205411)

[4.3.1 Angular 17](#_Toc3205412)

[4.3.2 Typescript 17](#_Toc3205413)

[4.3.3 HTML 17](#_Toc3205414)

[4.3.4 CSS 17](#_Toc3205415)

[System Design 18](#_Toc3205416)

[System Evaluation 19](#_Toc3205417)

[Conclusion 20](#_Toc3205418)

**About this project**

**Abstract** This paper aims to provide a technical understanding about computerized inventory management systems; the various implementations of, and the technologies used within these systems. Modern businesses can utilize the latest technologies for their warehouses to help:

* analyze trends or patterns through inventory flow
* reduce instances where stock is too low or high, and reduce instances where there is no stock
* increase in accuracy and fulfillment of orders with relation to picking, packing, and shipping a customer’s order
* provide a deeper understanding of customer demand for your products

The significance of this study will redound to the benefit of consumers that utilize such systems, especially since businesses are faced with the problem of getting products and services to their costumers quickly and responsively. The demand for better customer experiences, justifies the purpose to evaluate the current technologies already available. Thus, businesses that integrate these technologies and solutions can create stronger customer experiences, through the tight integration of their web platforms and enterprise resource planning systems. For the researcher(s), this study will help advance our knowledge and evaluate the approach with which to take when determining which technologies are best integrated with one another when developing inventory management systems. Thus, a new implementation or integration for these systems may be established.

**Authors**

Conor McGrath - B.Sc.(Hons) Computing in Software Development

Aaron Healy - B.Sc.(Hons) Computing in Software Development

**Chapter 1**

# Introduction

This chapter will outline the objectives of the project along with the scope which we plan to complete those objectives in. An analysis of each of the chapters found in this dissertation along with a summary Github repository containing the project can be found below. This application will aim to satisfy the standards for a Software Development Level 8 project by surpassing the expectation of Inventory Management Systems currently offered online. Inventory Management Systems are a key part to any business. They allow the business to manage and control their customers, wholesalers, orders and stock. They are essential in giving up-to-date data on movement of stock throughout the company.

The members of this group have taken it upon themselves to research and analyze existing Inventory Management Systems available, and with the knowledge gained create an application that will allow users to manage all their customers, wholesalers, orders and stock in an easy and conventional way. The frontend of the application be presented using Angular 6 which will be running off a Java Spring Boot backend. Proper authentication and login will be applied to the app to allowing users to easily assess their current stock, current and past orders, wholesalers and their current customer base. All the data will be stored in a MySql database hosted by Amazon Web Service.

**Chapter 2**

# Context

The general context of this project is an easy to use system that provides users, in particular, online sales businesses a platform to manage their inventory. It will help them keep track of all stock and alert them when they are running low on certain products. The users will be able to track their customers and view who purchases what number of products and how regularly. This will allow a business to see what sort of customer their main target for future sales is. The products section of the application will allow users to view and manage the current stock they have. This will show them what products are selling good and the profit they are making from each product. This sort of information is vital for a business to know so that they can see the good and bad sellers and order more inventory accordingly. In terms of the order side of the application, the user will be able to input orders so that they can be tracked. When these orders are completed the products and customer information will all be updated accordingly. Each user will have their own home page which will contain a variety of tables and graphs that represent their current monthly information such as “Total Sales”, “Top Selling Products” and “Top Spending Customers”.

## 2.1 Objectives

The main objective of our application is to help businesses to manage their inventory easier. We also wanted to make it easier for businesses to be able to view all the statistics for their sales information easier in one place. The following is a list of the main pages in our application along with the objectives for each page.

1. **Login/Register:** The first page the user will see is a login and/or register page. If the user is new, they will be able to create an account using the register function. If the user has already created an account, they will be able to login using their credentials. Once logged in, the user has access to all the features of the application. All users of the application have to be registered so that they can have their inventory data linked to them and only viewable by them.

2. **Home:** The objective of the homepage is that it is a base of navigation for the application while also providing the user with quick available statistics about their inventory. The homepage will display a variety of graphs and tables that will show information regarding the current month of sales information. The homepage will also provide links for the user to follow to the other pages of the application.

3. **Customers:** The customers page will provide a base for the user to view all information about their current customers. This will include information such as the products they have purchased and in what amount. Users will also be able to create, edit and delete customers on this page.

4. **Orders:** The orders page will be the location where the user will be able to manage their current orders, create new orders and look back on previously completed orders. The user will also be able to view orders from specific customers which will allow them to see what each customer is ordering and in what amount.

5. **Products:** The products page will provide a base for the user to view all information about the current products they have to offer. This will include information about the products such as cost price, sale price and the quantity in stock. This is vital information as it will allow the user to see what sort of margin they are making on products and when a re-order of a certain product is needed.

**Chapter 3**

# Methodology

This is where will be discussing the methodologies we are using in our project. We researched the different methodologies we could use in our project. After seeing the positives and negatives of each methodology, we decided to use Agile as our main methodology. We felt this was a methodology that would suit our development and it is also a methodology that is used widely in organizations around the world

## 3.1 Agile Development

Our project contained three main stages, research, design and implementation. For each of these stages we applied an Agile like approach to complete them. Agile was suited to this project as it allows for flexibility and for us to deliver software incrementally. This is what made it stand out to us as a methodology that would work well for us.

We used a Scrum like approach for our research, design and development process. Scrum is an agile framework for teams who members break their work into actions that can be completed within timed iterations, called sprints, usually around two weeks long but no longer than one month, they then track progress and re-plan in short meetings.

Our sprints involved certain parts of the development being completed. Our first sprint in the development phase was to create the database that would be used for storing our data. After this our sprints followed a pattern of developing a backend and frontend component for each part of the project.

This would mean one sprint would involve developing the users, another, the customers, the next, the products and so on.

We held weekly meetings with our project supervisor, this allowed us to have meetings before, after and during our sprints. This constant contact with our supervisor was key to making sure we were completing everything on time and to make sure the project was running smoothly. After each of these meetings we were able to note what was needed to be completed before the next one. This gave us a goal to work towards each week in our sprints.

Any issues we noted at a meeting were logged into our Github repository under the issues tab. This allowed us to track problems we had throughout the problem.

!!NEED TO INSERT IMAGE OF ISSUE LIST!!

## 3.2 Version Control

Version control is key in any project development cycle and for ours we decided to use GitHub. GitHub is a hosting service for version control which our team has experience of using on projects in the past. GitHub allows us to work on different parts of the project simultaneously using different branches. These branches are very useful for times of the project where the members are working from different locations. A couple of commands and one member can pull the changes the other member has made. We used this in our project a lot for when one member would be working on the frontend and the other on the backend.

GitHub allows us to view every commit we made to the project. This lets us see our project being created over time and lets us visit past commits before a certain part of the code was changed if necessary.

## 3.3 Technology Choice

After researching Inventory systems and what type of application we would be designing, we made our decisions about the languages and software we would be using for our project.

We decided on a MySQL database hosted on AWS for the database side of our project, Java Spring Boot for our backend and Angular 6 for our frontend. These technology choices were made based on our experience using each and the advantages they gave us over the other options. Each of these technologies will be explained in the Technology Review chapter.

!!NEED TO INSERT IMAGE OF TECHNOLOGIES!!

## 3.4 Testing

Testing is a vital part of every project. It is essential that tests are carried out on a project to make sure every aspect of it is working in the correct way. There are many types of testing which we researched for using in this project. In the end we decided to test our project using the below techniques.

!!NEED TO FINISH TESTING!!

**Chapter 4**

# Technology Review

In this section, we will review all the different technologies used in our project. We will discuss what each technology is, and what it does in our project. We will use images and code snippets to show how the technology is implemented into our project. We will split the review into three smaller sections which will be the Database, Backend and Frontend sections. We will talk about the technologies used in each section and why we chose to use each for that section.

## 4.1 Database

### 4.1.1 MySQL

MySQL is a free-to-use, open-source database that facilitates effective management of databases by connecting them to the software. It is a stable, reliable and powerful solution. The choice of using MySQL as our database for our project was easy to make. Both members of the group have used MySQL for several modules over the course of our degree. We also used MySQL in our 3rd year project. This experience gave us the confidence to use it in our project. We also felt MySQL would suit our project for several reasons, which we mention below.

MySQL is globally renowned for being the most secure and reliable database management system and is used in popular web applications including WordPress, Facebook and Twitter. This data security is essential in our project as we need to protect our user’s data. We will be storing information about the user’s business such as orders and customers. This is important data that must be stored securely.

Although our project will only have a small number of users, MySQL allows it to be expanded to a huge size without putting any strain on the database. It is designed to meet even the most demanding applications while ensuring optimum speed, full-text indexes and unique memory caches for enhanced performance. MySQL also comes with the assurance of 24×7 uptime which makes sure our project will always be accessible.

!!IMAGE OF MYSQL DATABASE!!

## 4.2 Backend

When choosing what technologies, we were going to use for our backend we had to take a few things into consideration. We had to make sure that we would be able to create a secure backend capable of connecting to our database and frontend. After researching a few different solutions, we decided to go with the technologies mentioned below.

### 4.2.1 Java

Java is a general-purpose computer-programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. We have worked with Java in every year of our degree and we both feel like it is our strongest language. We felt our skills in the language would give us an opportunity to make a high standard backend. Having used Java as a backend before we both had experience in connecting it to databases and frontends. This knowledge would benefit us greatly when it comes to connecting the separate parts of our project.

After we decided on using Java for the backend, we researched a few ways we could design the backend. We looked at previous work we had done and decided to use the Spring framework. This is discussed in the next section.

### 4.2.2 Spring

The Spring Framework is an application framework and inversion of control container for the Java platform. Some of the most important features of the spring framework are:

**Lightweight**: With respect to size and functionality, The Spring Framework is very lightweight. This is due to its Plain Old Java Object implementation, which doesn’t force it to inherit any class or implement any interfaces.

**AOP:** Aspect-Oriented Programming is used for separating cross-cutting concerns such as logging and security, from the business logic of the application.

**Dependency Injection**: This allows you to develop loosely coupled applications. Therefore, the unit testing of these loosely coupled applications becomes easier. This also allows the developer to swap out some of the modules according to its need.

**Integration with other Frameworks:** Spring doesn’t try to solve the problems that have already been solved. It just tries to integrate them with its framework, which provides a solution to greater problems. For example, this could include Hibernate, which we used in our project.

#### 4.2.2.1 Spring Boot

Spring Boot is in simple terms, an extension of the Spring framework. It eliminates the boilerplate configurations required for setting up a Spring application. Spring Boot makes it easy to create a stand-alone and production ready spring application. Spring Boot contains a comprehensive infrastructure support for when you are developing a micro service and enables you to develop enterprise-ready applications that you can basically “just run”.

!!IMAGE OF SPRING BOOT APP!!

## 4.3 Frontend

### 4.3.1 Angular

Angular is a platform that makes it easy to build web applications. Angular combines declarative templates, dependency injection, end to end tooling, and integrated best practices to solve development challenges. Angular is built with TypeScript.

Angular allows you to start making your application right away. There are directives to give HTML elements dynamic behavior. You can use FormControl to create forms and introduce various validation rules. You may easily send asynchronous HTTP requests of various types. Routing can be set up very easily. There is also much more angular can offer too with these just being an example.

Angular is mobile and desktop-ready, meaning you have one framework for multiple platforms. This empowers developers to build applications that live on the web, mobile, or the desktop.

!!IMAGE OF ANGULAR APP LAYOUT!!

### 4.3.2 TypeScript

TypeScript is an open-source programming language developed and maintained by Microsoft. We used it in our project within Angular. TypeScript is a superset of JavaScript which primarily provides optional static typing, classes and interfaces.

### 4.3.3 HTML

Hypertext Markup Language is a text-based approach that describes how content is structured within an HTML file. This markup lets the web browser know how it is supposed to display text, images and other forms of multimedia on a webpage. HTML is not a complex programming language.

Every web page is really a HTML file. Each one of these HTML files is just a plain-text file, but with an .html file extension instead of .txt. The file is made up of many HTML tags as well as the content for a web page. Most web sites will contain many html files that link to each other.

In terms of the tags used inside the HTML file, commonly used tags include <H1>, which describes a top-level heading; <H2>, which describes a second-level heading; <p> to describe a paragraph; <table>, which describes tabular data; and <img>, which describes an image.

HTML is a formal recommendation by the World Wide Web Consortium (W3C) and is generally adhered to by all major web browsers. HTML5 is the latest version of the specification.

!!IMAGE OF HTML CODE!!

### 4.3.4 CSS

**Chapter 5**

# System Design

As many pages as needed.

• Architecture, UML etc. An overview of the different components of the system. Diagrams etc... Screen shots etc.

|  |  |
| --- | --- |
| Column 1 | Column 2 |
| Rows 2.1 | Row 2.2 |

Table 5.1: A table.

**Chapter 6**

# System Evaluation

As many pages as needed.

* Prove that your software is robust. How? Testing etc.
* Use performance benchmarks (space and time) if algorithmic.
* Measure the outcomes / outputs of your system / software against the objectives from the Introduction.
* Highlight any limitations or opportuni-ties in your approach or technologies used.

**Chapter 7**

# Conclusion

About three pages.

* Briefly summarise your context and ob-jectives (a few lines).
* Highlight your findings from the evalua-tion section / chapter and any opportuni-ties identified.

**Bibliography**

[1] A. Einstein, “Zur Elektrodynamik bewegter Ko¨rper. (German) [On the electrodynamics of moving bodies],” *Annalen der Physik*, vol. 322, no. 10, pp. 891–921, 1905.