

Inventory App

Software Development
4th Year Project

Research Manual

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Table of Contents

Introduction	3
Similar Applications	4
My Inventory Manager	4
Inventory Scanner.....	6
Barcode.....	7
Platform	9
iOS.....	9
Android.....	9
Apache Cordova/Phonegap	10
Website	10
Conclusion	10
Technologies	11
Barcode Scanner.....	11
OCR.....	11
Flask.....	12
Item Lookup.....	12
Amazon	12
eBay.....	13
Scandit.....	13
Conclusion	14
Programming Languages	15
HTML5.....	15
CSS	15
JavaScript.....	15
Python.....	15
Cloud Platforms	16
DigitalOcean.....	16
Google App Engine	16
Amazon AWS.....	16
Kinvey	16
Parse.....	17
Conclusion	17
Integrated Development Environment (IDE)	18
Eclipse	18
Xcode	18
Sublime Text 2.....	18
Conclusion	18
Conclusion	19
Features.....	19
Overview	19
References	20

Introduction

This is the research manual for my Inventory App project. In this manual I will discuss the technologies available to develop this application and provide a conclusion to which of these technologies would be best suited to implement the functionality of my application and the chosen target platform. I will also look at some similar inventory applications which are available to download on the market and provide an analysis of the functionality that these applications provide to the user.

Similar Applications

My Inventory Manager

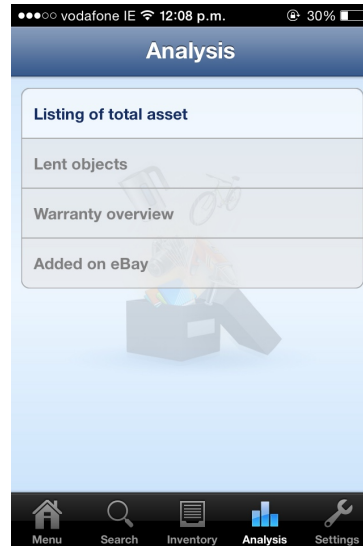
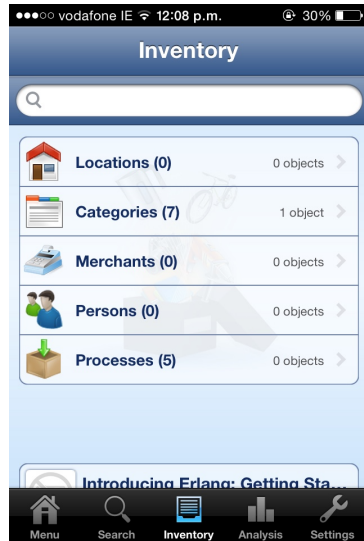
This application is very similar to the application outlined in the project specification for my inventory application. This application allows the user to scan a barcode using a built-in barcode scanner and automatically retrieves information on the item and populates fields such as title, price, author, publisher, genre, ISBN, category, etc. These fields can also be edited manually by the user. In the case where information for the barcode is not available, the user can add items to their inventory by manually filling out fields describing the object.



The application provides a very simple user interface with three main options on the landing screen.

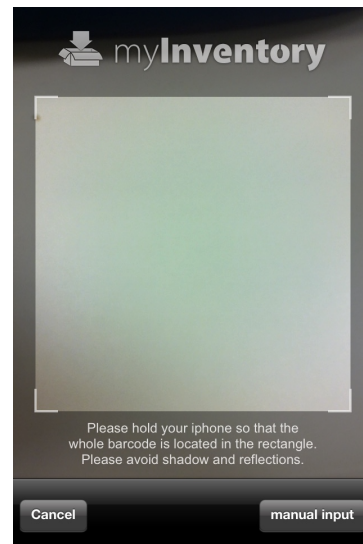
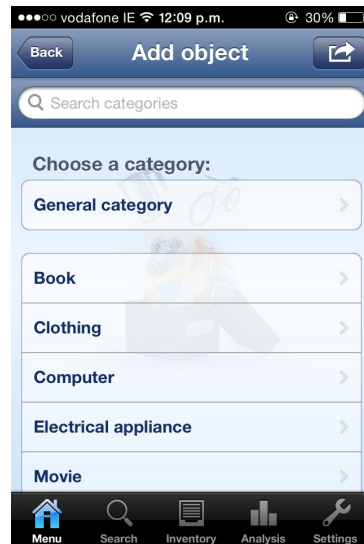
1. Show a list of items in the inventory.
2. Manually add an item to the inventory.
3. Add an item to the inventory by scanning the barcode.

A user can also search the inventory for an item by typing the name of the item into the search bar at the top of the screen.



Items can be divided into different sections depending on the type of item, location, owner. Some of the categories in the application include book, clothing, computer, electrical appliance, movie, music, etc. Categories can be edited and created.

An analysis section in the application allows the user to see a listing of total assets which will show the sum of the price for all the items. The listing of total assets can be exported as a CSV file.

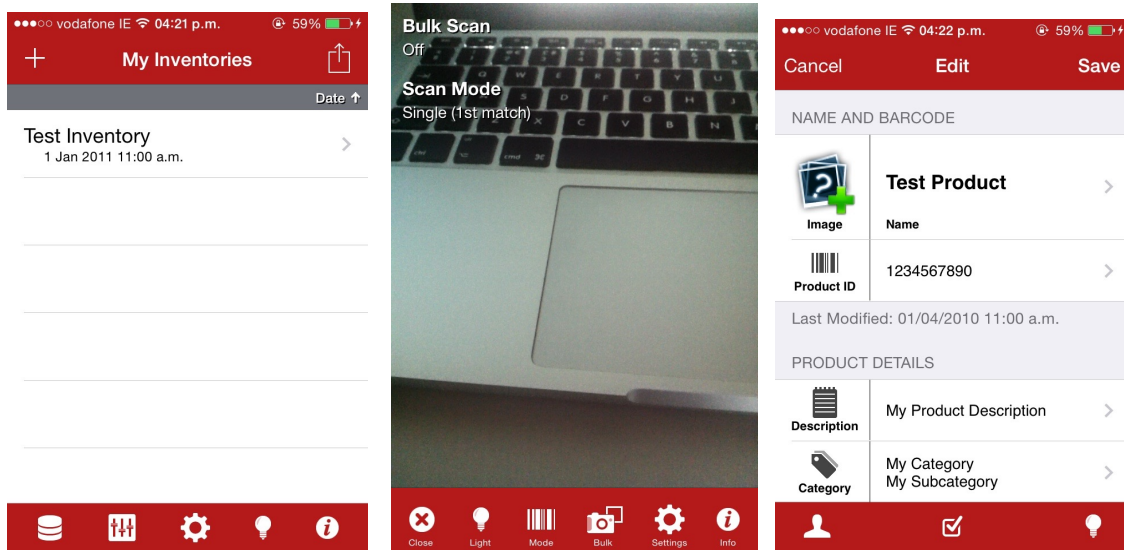


Items can be manually added to the application by selecting a category for the item and then filling out the relevant details about the item.

The barcode scanner scans the barcode and returns and displays the information to the application and gives the user the choice to add the item to the inventory or else discard the information.

Inventory Scanner

This application has some of the functionality of the application proposed in the project specification. This application is mainly targeted towards companies for keeping a record of stock rather than a general user to keep an inventory of personal items.

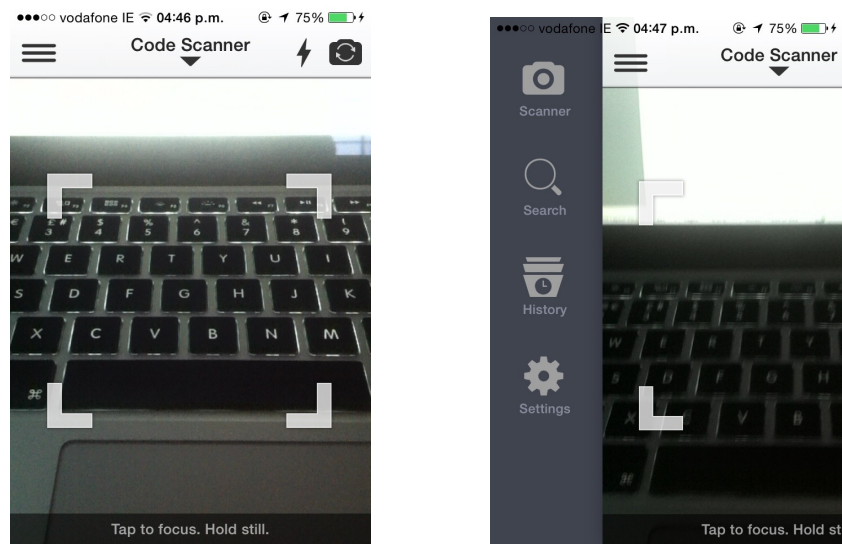


The landing page of the application provides a list of inventories. An inventory can be added by pressing the plus button in the top left corner of the screen. The menu is in tab form along the bottom of the screen but these options are not very clear as to what the different options do.

The application has a barcode scanner which provides options such as bulk scanning and configuring light settings. The scanner will return the upc number from the barcode but the application does not provide information on the scanned item and the relevant information must be filled in manually by the user.

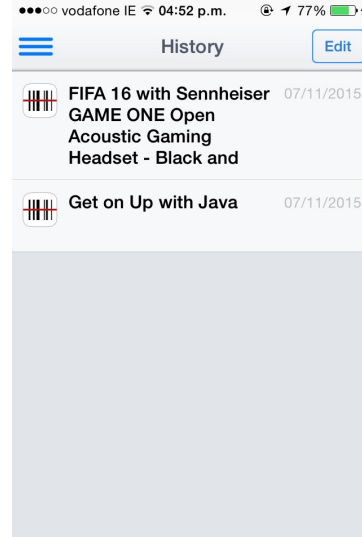
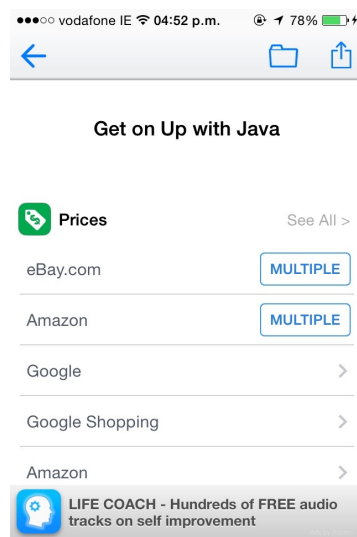
Barcode

This application is quite similar to the application outlined in the project specification for my inventory application. The main functionality of the application is to provide the user with the prices for the item from different stores by scanning the barcode of the item.



The initial screen when the application is opened is the barcode scanner. The application allows the user to use either the front facing camera or the camera on the back of the phone to scan the barcode on the item. The application menu can be accessed by pressing the icon on the top left of the screen.

The menu is a slide out menu which appears from the left hand side of the screen. The user interface is very straight forward to use and the menu icons are clearly labeled. The user can choose to scan an item, search for a previously scanned item, view a history of scanned items and an option to configure application settings.



When the barcode of an item has been scanned the application returns the the name of the item and a list of prices from the different online stores which have this item for sale. Images of the item is also returned and other information such as related products, related books, websites, etc. The scanned items can be added to a folder which the user can created to organise the items into categories.

The history option in the menu provides a list of all items that have been scanned by the user.

Platform

iOS

iOS^[1] is a mobile operating system created and developed by Apple. iOS was originally released in the year 2007. This operating system is exclusively distributed for Apple hardware. Originally this operating system was supported for the iPhone but now it also powers other Apple products such as iPod touch, iPad and Apple TV. iOS is the second most popular mobile operating system in the world behind Android.

Applications for iOS are developed using a macintosh computer and must be written and compiled using Xcode which is an integrated development environment (IDE) containing a suite of software development tools. Applications for iOS are written in the Objective-C programming language. Developers who create iPhone applications must pay a developers fee of \$99.00 before they can test their applications on a physical device or upload their applications to the App Store for release to the general public.

Android

Android^[2] is an open source mobile operating system which is developed by Google. This operating system was designed primarily for touchscreen devices such as smartphones and tablets, and is now also available for Android TV and Android wear for watches. The Android operating system was unveiled in 2007. The latest version of the operating system is Marshmallow version 6.0, which was released on 5th of October 2015.

Applications for Android are written using the Android software development kit (SDK) using the java programming language. The SDK includes a device emulator, a debugger, software libraries, documentation, tutorials and sample code. Google's supported integrated development environment (IDE) for developing applications was initially Eclipse using the Android Development Tools (ADT) plugin. Google released Android Studio in 2014, as its primary IDE for Android application development, which is based on the IntelliJ IDEA.

Apache Cordova/Phonegap

Building applications for different devices such as iPhone, Android and Windows mobile requires different frameworks and languages. Phonegap^[3] is platform independent, applications can be developed for many mobile platforms using HTML, CSS and JavaScript, instead of relying on platform specific APIs.

Phonegap applications are hybrid, meaning that they are a mixture of a native app and a web app. Layout rendering is done using web views (HTML, CSS) and not a platform specific UI framework. A hybrid application can still interact with the camera, GPS, contacts, files, storage of a device as it has access to all the native devices APIs.

Phonegap provides a build service that allows the programmer to upload their code to a cloud compiler that generates the application for every supported platform such as iOS and Android.

Website

Along with the smartphone application, a website will be available for the app user to access and manage the items in their inventory. The user will be able to modify the items in the inventory or delete the items from the inventory. The website will be built using Flask, HTML, CSS, JavaScript and Python.

Conclusion

The platform I have decided to develop for is Apache Cordova/Phonegap. Developing the application using Cordova will allow the application to run across many different platforms as it is platform independent.

Technologies

Barcode Scanner

Given that the application must be able to scan a barcode and retrieve information on the item, barcode scanning software must be integrated into the application. Since the application will be built using phonegap I started to research if there was any plugins available for barcode scanning for this platform.

BarcodeScanner^[4] is a cross-platform and an official plugin for phonegap which can be easily integrated into the application using JavaScript. This plugin can scan many different types of barcodes and get the metadata encoded in them for processing within the application.

OCR

Optical Character Recognition^[5] is the procedure of creating machine-encoded text from scanning and converting typed, handwritten or printed text. This technology is to be integrated into the application for the situation when the barcode of an item does not generate the required detailed information for it to be stored in the inventory. The user of the application will be able to scan text from the item which will be converted to machine encoded text and automatically populate a specific field for the item.

Tesseract^[6] is an open source OCR engine which is developed by Google. It can read a wide variety of image formats and convert to text in many different languages. This engine works in association with Leptonica image processing libraries. A version of this engine is available for integration with android called tess-two.^[7]

Python-tesseract^[8] is an OCR tool for the python programming language. Python-tesseract is a wrapper for Googles tesseract-OCR engine which is described above. This tool works in conjunction with the Python Imaging Library and supports image formats such as jpeg, gif, png, bmp, tiff, and others.

Flask

Flask^[9] is a micro web application framework written in Python. Flask does not force the developer to use a particular tool or library. There is no native support for accessing databases, validating forms, or other high level tasks. Flask was designed as an extensible framework which supports extensions that add features to the application.

Item Lookup

As part of the requirements for the application, when an item is scanned with the barcode scanner, the details of the item must be retrieved so that the relevant fields can be automatically populated which eliminates the need for the user to enter these details manually.

Some of the websites that provide functionality for retrieving item information are as follows:

Amazon

Amazon provides a Product Advertising API^[10] which can be used for searching for an item using an ISBN or a barcode. Amazon covers a huge range of products, would return information on the vast majority of items scanned, which would be beneficial to the project.

To use this API, you must post the item identifier(barcode) and the ItemLookup operation will return some or all the items attributes. A sample response would be as follows:

```
<Items>
  <Request>
    <IsValid>True</IsValid>
    <ItemLookupRequest>
      <ItemId>B000080E6I</ItemId>
    </ItemLookupRequest>
  </Request>
  <Item>
    <ASIN>B000080E6I</ASIN>
    <ItemAttributes>
      <Manufacturer>Canon</Manufacturer>
      <ProductGroup>Photography</ProductGroup>
      <Title>Canon PowerShot S400 4MP Digital Camera w/ 3x Optical Zoom</Title>
    </ItemAttributes>
  </Item>
</Items>
```

eBay

Ebay^[27] provides different API's such as, Finding API, Shopping API and Trading API. The Finding API suits the needs of this project as an item's barcode number can be used to query eBay's platform which contains a huge number of products. The request to the API is made by constructing a URL which contains information such as the barcode number, item condition, listing type, return format, and other filters. The item information can be returned in JSON format. An example response would be:

```
_cb_GetSingleItem({"Timestamp":"2016-04-12T16:12:04.569Z","Ack":"Success","Build":"E949_CORE_API_LW_17769283_R1","Version":"949","Item":{"ItemID":"361512863605","EndTime":"2016-04-16T00:10:52.000Z","ViewItemURLForNaturalSearch":"http://www.ebay.com/itm/NEW-Second-Half-Doyle-Roddy-Keane-Roy-Paperback-/361512863605","ListingType":"FixedPriceItem","Location":"Peacehaven","PictureURL":[],"PrimaryCategoryID":"171279","PrimaryCategoryName":"Books, Comics & Magazines:Non-Fiction:Biographies & True Stories","BidCount":0,"ConvertedCurrentPrice":{"Value":4.27,"CurrencyID":"USD"},"ListingStatus":"Active","TimeLeft":"P3DT7H58M48S","Title":"NEW The Second Half, Doyle, Roddy, Keane, Roy Paperback","ItemSpecifics":{"NameValueList":[{"Name":"Returns Accepted","Value":["Returns Accepted"]},{"Name":"After receiving the item, your buyer should cancel the purchase within","Value":["14 days"]},{"Name":"Return postage will be paid by","Value":["Buyer"]},{"Name":"Return policy details","Value":["We're happy to accept returns for any reason, within 14 days of receipt. Refunds will include all shipping costs, but we will only refund return postage for an error in the listing."]},"Name":"Author","Value":["Roy Keane","Roddy Doyle"]},"Name":"Subject","Value":["Biographies & Autobiographies"]},"Name":"Subject 2","Value":["Autobiography: Sport"]},"Name":"Publication Year","Value":["21/05/2015"]},"Name":"Format","Value":["Paperback"]},"Name":"Language","Value":["English"]},"Name":"EAN","Value":["9781780228822"]},"Name":"ISBN","Value":["9781780228822"]}},"Country":"GB","AutoPay":false,"QuantityAvailableHint":"MoreThan","QuantityThreshold":10}});
```

Scandit

Scandit^[11] is another website which provides a product API for lookup of UPCs. The scandit product database features more than 25 million UPCs. Some of the details that can be returned on the item scanned are, product names, and categories. This services does not provide a price for the scanned item.

Conclusion

The item lookup provider I initially chose to integrate with the application was the Amazon Product Advertising API. Amazon has a huge database of items and returns relevant information on each item. Amazon requires permission to use the Product Advertising API in conjunction with a mobile application which I was denied.

After being refused permission use Amazon's API's for item lookup, I decided to go with Ebay's Finding API and Shopping API which works in a very similar way to Amazon's API. Ebay also has a huge collection of items which provides all the relevant information I need for this project.

The barcode scanner for the application will be a cordova plugin which is based on the zxing barcode image processing library.

Programming Languages

HTML5

HTML5^[12] is used on the world wide web for structuring and presenting content in a web browser. HTML stands for Hyper Text Markup Language. HTML5 was published on the 28th October 2014. It is the 5th revision of the HTML standard.

CSS

CSS^[13] stand for Cascading Style Sheet. This style sheet language is a highly popular technology used by most websites used for describing the presentation of a document written in a markup language such as HTML5. CSS was designed primarily for the separation of document styling and document content. Some aspects of the styling CSS provides are layout, colour, fonts, etc.

JavaScript

JavaScript^[14], along with HTML and CSS is one of the essential technologies for content production on the world wide web. JavaScript supports object-oriented, functional and imperative programming styles. The most common use of JavaScript is for adding client-side behaviour for creating dynamic HTML pages. JavaScript can also be used in game development, creation of desktop and mobile applications. Server-side web applications can be developed using the Node.js^[15] runtime environment.

Python

Python^[16] is a high-level programming language which emphasises on code readability. Like JavaScript, Python supports object-oriented, functional and imperative programming styles. Python is free and open source. Python programs are platform independent which means they can run on any platform. Python has a very large and comprehensive standard library. This language was developed by Guido van Rossum and initially released in 1991. The latest version of this is 3.5.0 which was released on the 13th of September 2015. Python can be used as a scripting language for web applications.

Cloud Platforms

DigitalOcean

DigitalOcean^[26] is a cloud infrastructure provider of virtual servers for software developers. The company is based in New York and has data centers around the world. It was one of the first cloud hosting companies to provide SSD-based virtual machines. Pricing plans start at \$5 per month which offers 512MB of RAM, 20GB SSD, 1 CPU and 1TB transfer.

Google App Engine

Google App Engine^[17] (GAE) is a platform as a service^[18] (PaaS) for developing and hosting web applications. This service is free up to a certain level of usage. Automatic scaling is provided by this service for web applications. Additional fees are charged for extra bandwidth or instance hours that may be required by your application. Data storage, queries and transactions are provided as part of the service.

Some of the supported programming languages are Python, Java, Go and PHP. Python web frameworks such as Django and Flask can run on the Google App Engine.

Amazon AWS

Amazon Web Services^[19] is a cloud computing web service provides a large collection of services such as EC2 which provides scalable virtual servers, S3 which is Amazon's simple Storage Service, Networking, Content Delivery, Database, Deployment, Management etc.

Similar to Google App Engine AWS provides free usage up to a certain level and automatic scaling for coping with high levels of traffic.

Some of the programming languages supported are Java, PHP, Python, Ruby, Windows and .NET.

Kinvey

Kinvey^[20] is a (MBaaS) Mobile Backend as a Service^[21] that provides web and mobile application developers with a backend cloud storage, APIs and SDKs. Some of the

services provided are push notifications, file storage, user management and integration with social media networks. Kinvey is a paid service with a range of pricing packages.

Support is available for all mobile platforms such as iOS, Android, PhoneGap.

Parse

Parse^[22] is a Mobile Backend as a Service provider which was founded in June 2011 and was purchased by Facebook in 2013 for \$85 million. Provides SDKs for mobile, desktop and IoT devices.

Parse provides comprehensive documentation and API Reference for each platform. Parse provides its services for free up to a certain usage level. This free service would be more than enough for the scope of my Inventory Application.

Conclusion

The cloud platform that I initially chose for the back end of the application was Parse. The reason I choose this platform was that it was free and has comprehensive documentation and API references for all platforms. From reading through the documentation this service looked quite straight-forward to use.

In January 2016 it was announced that Facebook was closing this developer platform which it purchased in 2013. Parse will remain in operation until January 2017. As a result of this announcement, I decided to move away from using this service for the backend of the project.

I decided to use DigitalOcean to host a backend solution. DigitalOcean provide very reasonable pricing options, all plans are standard with solid state drives and boasts a 99.99% uptime. Using DigitalOcean would allow me to create a Ubuntu virtual private network to implement my own backend system for the application by deploying a python flask application on the server and creating my own API for interacting with the mobile application and sending/receiving information to/from the mysql database which will also be hosted on the virtual private network.

Integrated Development Environment (IDE)

Since PhoneGap is compiled in the cloud, a text editor could be used for writing the code for the project.

Eclipse

Eclipse^[23] is a very popular IDE which contains a base workspace and many plug-ins are available for customising the environment. Eclipse is written in Java and primarily used for developing Java applications. It can be used to develop applications in many other programming languages through the use of plugins.

Eclipse was initially released in November 2001. The latest Version of Eclipse is Mars which was released in June 2015.

Xcode

Xcode^[24] is an IDE developed by Apple that contains software development tools for developing software for iOS and OS X. It was initially released in 2003 and the current stable release is 7.1.1 which was released in November 2015. Xcode is written in C, C++ and Objective-C.

Xcode supports many programming languages such as C, C++, Objective C, Objective-C++, Java, Python, Ruby and Swift.

Sublime Text 2

Sublime Text^[25] 2 is a source code editor that has a Python API. It has syntax highlighting and supports a large collection of programming languages and markup languages. Plugins are available to extend the functionality of this code editor. This software is written in C++ and Python.

Conclusion

As the application will be developed for use on different platforms, both Xcode and Eclipse will be used to develop the application on iOS and Android. To test the application, the emulator will be used on both Xcode and Eclipse.

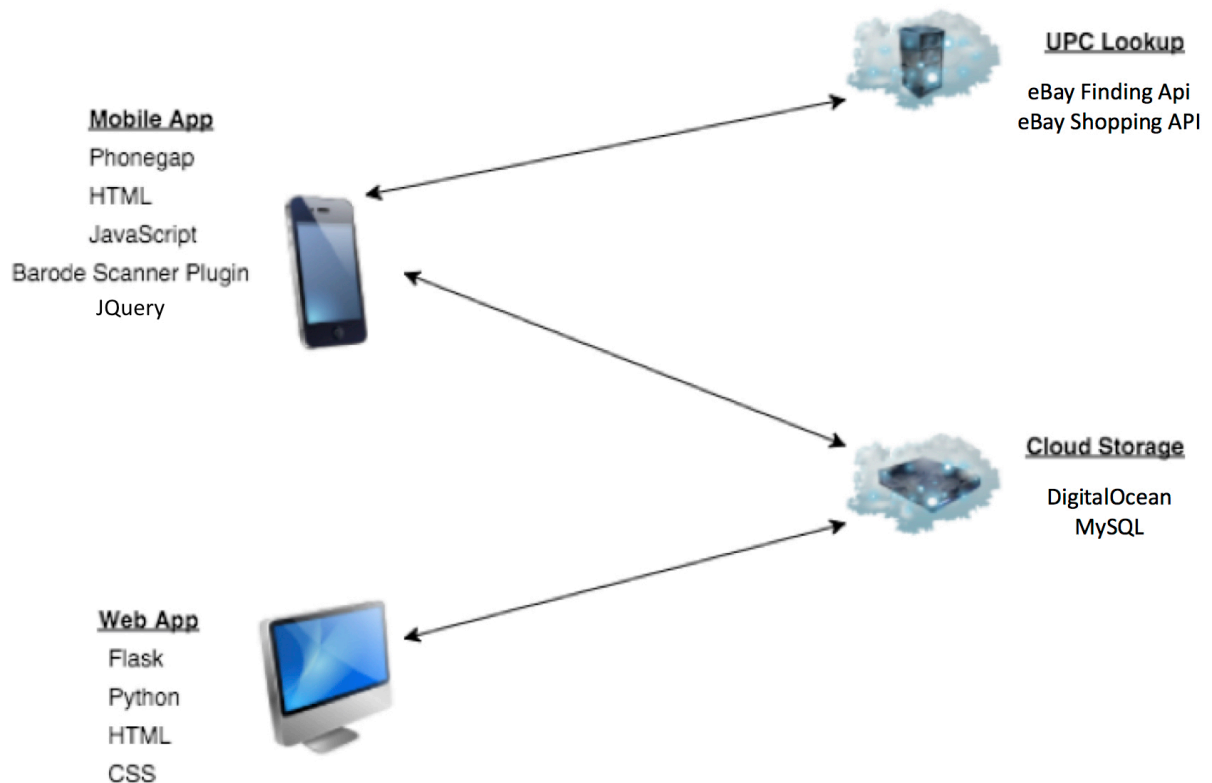
Conclusion

Features

The Inventory Application will have a number of features which will be developed using the technologies outlined in this document. Some of the features will be as follows:

- Barcode Scanner which will return the UPC of a scanned barcode.
- Automatically retrieve information on the scanned item and populate fields in a database with these details.
- In the event that the details of an item cannot be found, the user can choose to input details about the item manually or by using optical character recognition.
- Reports can be generated for all items in the inventory and then exported.

Overview



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