

**NinjaTypers Web Application
Research Manual
By
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NINJATYPERS WEB APPLICATION RESEARCH MANAUL

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Abstract

Areas covered in research manual:

- **NinjaTypers:** Research into the existing NinjaTypers Club that is currently in operation.
- **Web Technologies:** Research front and back end technologies, the front end being the part of the application that the user interacts with, the back end being the area of the application that is running in the background on the server side. Areas covered in these sections were what kind of programming languages were available to use and also what kind of frameworks could be used with these languages. The framework is software that supports the development of applications by having many built in functionalities so the developer does not have to do it all from scratch.
- **Version Control:** Research into different version control systems. What this refers to is an online repository to store code as the project is being developed.
- **Storage:** Research into areas of storage like servers and cloud. The cloud is a computing platform that offers a wide range of somebody who is availing of the cloud service. Research into different available cloud solutions available today that would support the application and also into what databases are available that would manage data storage of application and user data.
- **Similar Applications:** Research into similar applications that are available today both free and paid. Done this by researching reviews on applications and by testing some applications.
- **Meetings:** Information obtained by meeting with the owner and administrator of NinjaTypers.

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1. Introduction

This research document is a report of all the areas that I researched and some of the conclusions I made upon this research. All of my technical research for the project was web based. By technical research I mean areas like front and back end technology where I looked into what kind of languages were the most commonly used and best fitted for the type of web application that I want to develop. I also had to research the different frameworks that would best suit the chosen programming language and also best suit the application. Cloud Platforms this was another technical area that I had to research because I needed to find the best suited platform that would be able to host the application and store all relevant data of any user that will be using the application. Yet another technical area was Version Control, I had to find out which site would be the best for me to use as a repository for my code as I was developing my project. After researching all the areas that I felt I should, I have come to conclusions on most areas of my research and explained why I have come to these conclusions.

Another area of my research was to see what similar typing applications and software are available. This was achieved by researching reviews on the applications and software. I also tested some of the more widely used web applications for typing. This was very important because I got to compare some of the different features that each application has and some common familiarities that they share. It put me into the mind-set of somebody that was using the application to develop their typing skills which I felt was vital for me to experience.

I attended a NinjaTyper class one morning in Fairgreen to see what kind of system is in place and to see the structure of how the course works. It was a massive benefit to my research because I got to see first-hand what goes on at the club and was talking to some of the children there about their typing skills. I also had a couple of meetings with Keith Lennon who is the owner and administrator of NinjaTypers and exchanged regular emails with regards to areas of my research and my project.

2. NinjaTypers

NinjaTypers was established in 2012 by Keith Lennon. The academy teaches kids as young as 7 how to touch type. The academy is on-going in a number of different locations every week. 10 children can take the class at the one time. Each child is temporarily given their own iPad for each lesson. Each 1 hour long lesson is separated into two time slots, the first 45 minutes is allocated for typing lessons and the remaining 15 minutes the children are allowed to play the applications installed on the iPad. There is a specific grading structure in place that allows each child to receive a different certificate for each stage of the course they complete. There is 8 of these certificates in place with white being the easiest and gold being the most difficult. The final certificate given to a member of the academy is a gold certificate and also a unique t-shirt that says "I'm a Ninja Typer". The main mission for Keith is to equip a child with this skill for *"technological atmosphere of their future employment"*.

Academy Times & Location:

- o Carlow: 11-12pm every Saturday morning in the Fairgreen Shopping Centre.
- o Kildare (Naas): 6:15-7:15pm every Thursday evening at Naas Community Centre.
- o Dublin (Dundrum): 6:30-7:30pm every Wednesday at Taney Church.

3. Web Technologies

3.1. Front End Technology (Client-Side)

3.1.1. What is a Front End Technology?

Front end technology is the technology that is running on the client side of the web technology being used. The front is the user interface to the application being used.

3.1.2. Solutions to Front End Technologies

3.1.2.1. JavaScript

JavaScript (JS) is a lightweight interpreted programming language that is embedded into the computer's web browser. It is a scripting language which means that it can support programs called "Scripts" which are a list of commands that can be executed with no interaction from the user. The main purpose of this language is to make web pages interactive. Although it is the most widely used language for front end technology JavaScript can also be used for back-end programming. The implementation of the language for this is called Server Side JavaScript (SSJS). The language was created by an American computer programmer Brendan Eich. The language was influenced using different aspects from a number of different programming.

Influences:

- **Layout:** The visual layout and use of tags is taken from HTML a language used to creating web pages.
- **Syntax:** The syntax for JavaScript is influenced by C which is thought to be the fundamental computer programming language.
- **Naming Conventions:** Most of the naming conventions and names that JavaScript uses in the language have been directly copied from Java. Java is one of the most popular object orientated computer languages in the world today.
- **Design Principles:** The design principals including first-class functions and prototyping have been taken from the Script, an “*an object-orientated programming language based on the concept of prototypes*” and Scheme, “*a functional programming language and one of the two main dialect of the programming language Lisp*” JavaScript first appeared in 1995.

JavaScript is supported by most web browsers so one of the biggest advantages of the language is that it is platform independent. Some of the biggest I.T companies in the world including FaceBook, YouTube, Yahoo, Google, Twitter and Wikepedia use JavaScript. Google alone receives more than 3 billion visitors per month. JavaScript is comes in tenth place on the TIOBE Index with a rating of 2.050% There is a wide range of libraries available for JavaScript. Some of the more popular libraries are jQuery and MooTools. jQuery is the most popular library “*used by over 65% of the 10,000 most visited websites*”

The syntax for the “Hello World” program in JavaScript is

```
<!DOCTYPE html>
<html>
<head>
<script>
function myFunction()
{
alert("Hello World!");
}
</script>
</head>

<body>
<button onclick="myFunction()">Try it</button>
</body>
</html>
```

3.1.2.2. HTML5 & CSS

HTML is the acronym for HyperText Markup Language. The language was developed to create web pages and specify the structure of documents on the Internet. HTML uses html elements. The elements are usually made up of three things: a start tag, an end tag and an attribute can be placed within the tag. The closing tag must contain a forward slash (<title>Sample Title</title>). This example is of one element.

There have been many revisions of the language and currently HTML it is in the fifth revision hence the name HTML5. Some of the newer features of the fifth revision include new elements to support video, canvas and audio to handle newer plugins for

multimedia and graphical content. The first release of HTML was November 24th 1995.

CSS is the acronym for Cascading Style Sheets. CSS is a styling language that defines the layout of HTML documents on the internet. The language is *“used for describing the presentation semantics (the look and formatting) of a document written in a markup language”*. Style sheets in general first appeared in the 1980’s. This language is more concerned with the formatting of the web page rather than the structure. One of the main advantages of using CSS is that present the same data on a web page differently on different device technology. This is known as responsive web design and basically means that the content of the web page will be displayed determined by the device it is being displayed on. CSS specifies a priority scheme to determine which style rules apply if more than one rule matches against an element in to current HTML document.

A single rule for CSS is made up of two parts: a selector and one or more declarations. The selector is the HTML document that the styling will take place on. A declaration is made up a property and a value. The property is the style attribute. Each property has a corresponding value e.g. {colour: green}. A style sheet is a made up of one or more of these rules. The CSS style information can be provided from a number of sources. It can be in the form of a separate document or it can be embedded into the HTML. A number of style sheets can be imported at the same time. The display is controlled by the style sheet with the highest priority.

The syntax for the “Hello World” program is HTML5 is

```
<!DOCTYPE html>
<html>
  <head>
    <title>This is the title for Hello World</title>
  </head>
  <body>
    <p>Hello World!</p>
  </body>
</html>
```

3.1.3. Conclusions on Front End Technologies

After covering a lot of areas and looking into some of the more widely used languages in client-side of web applications I think that the best language to pick for the project would be JavaScript. It seems to be the best technology available for interactive web pages like the typing page in my project and it can be integrated with HTML5 and CSS. There is also a lot of

information available online and in the JavaScript community for problems that may be encountered when using the language.

3.2. Back End Technology (Server-Side)

3.2.1. What is a Back End Technology?

A back end technology is a technology that runs on the server-side of an application. The back-end usually supports the front end technology.

3.2.2. Solutions to Back End Technology

3.2.2.1. Java

Java is the one of the most widely used object-orientated computer language in the I.T industry today. Java incorporated “write once, run anywhere” (WORA) into the language so that there will not be a need to recompile code when it is trying to run on a different platform.

It was designed by James Gosling and Sun Microsystems and then developed by Oracle Corporation. The first time Java was seen publicly was in 1995. Some of the bigger companies that use Java are SAP, eBay, Amazon and Facebook. It is the most used computer programming language in the development of business applications and is used in back end systems for a vast number of financial institutions. According to TIOBE Software Java is the second most used language world as of November 2013 with a rating of 16.521%.

Java is also very popular among developers who create android mobile applications. A java application compiled the code into bytecode. The bytecode has the ability to work on any Java Virtual Machine (JVM); this is a huge advantage when it comes to portability. It enables the application to run with similar characteristics on different platforms and operating systems. There are some issues with java worth noting, programs have a reputation for running slower than programs written in other object-orientated languages and programs also require a lot of memory.

“The Oracle implementation is packaged into two different distributions: The Java Runtime Environment (JRE) which contains the parts of the Java SE platform required to run Java programs and is intended for end-users, and the Java Development Kit (JDK), which is intended for software developers and includes development tools such as the Java compiler, Javadoc, Jar, and a debugger”

Some of the key features that make Java such a good language with a great reputation are:

- Platform Independence: Compiling the program and converting to byte code means that it is highly portable and can run on most operating systems/platforms.
- Object Orientation: Everything in Java is built using objects which have the ability to communicate and interact with each other.
- Garbage Collection: Java provides automatic garbage collection which means there is no need to free dynamically allocated memory, this makes developing an app less prone to errors.
- Standard Library: Java has one of the best standard libraries associated with any programming language. It contains hundreds of methods and classes in areas like Networking, Input/Output, Language Support, Utility, Abstract Window Toolkit and Applet.
- Similar Syntax: Java syntax is very similar to C++ which means that developers who know the syntax of the language can pick up Java with relative ease.

The language also supports functionalities like “Polymorphism” and “Inheritance”. Polymorphism refers to how a method behaves depending on the method signature and the parameters passed to the method. Inheritance refers to how a class can inherit attributes and methods from parent class. There are 3 types of comments in the Java language. Single line comments start with a double backslash “\”, multi-line comment start with a backslash followed by a start and end the same way “* comment *\” and documentation comments. Syntax for Java is taken from C++ with a number of similarities between the two languages. The syntax for the “Hello World” program in Java is

```
public class HelloWorld
{
    public static void main(String[] args)
    {
        System.out.println("Hello World!");
    }
}
```

3.2.2.2. Python

Python is a general purpose dynamic programming language. It is a high level language meaning that there is a strong abstraction from the details of the computer. It was designed by a Dutch computer programmer named Guido van Rossum in 1989. Python is growing in popularity among web developers. Some of the more notable companies using Python for back-end development are Google, Dropbox, Yahoo Maps and NASA. It is currently ranked 8th in the list of the most widely used programming languages in the world today in the TIOBE index with a rating of 3.110%.

The TIOBE Programming Community set up this index to monitor the uses of programming languages. The results are calculated on a monthly basis by using results from the more popular search engines like Google, Bing and Yahoo. The phrase

“batteries included” is often associated with Python to describe the vast range that the standard built in library covers. *“Python is a multi-paradigm programming language: object-oriented programming and structured programming are fully supported”* (Python (programming language), 2013).

This means that Python supports a number of styles of computer programming. Style refers to the way the program is built using structure and elements.

Python has the ability to run on most operating systems including Windows, Linux/Unix and Mac OS X but recently has also been ported to Java and .NET virtual machines. The same source code runs unchanged on all platforms.

An implementation of Python called “Jython” has been created to access Java libraries when using the Java Virtual Machine (JVM). Similarly for .NET an implementation has been created called “IronPython”. It can also be integrated with objects in .NET, COBRA and COM. The Python community is very strong on the internet and there is an extensive amount of support available for anybody looking to learn the language.

Some of the key features of using this language are:

- Syntax is very readable: Python is a very clear easy language to read even for a novice computer programmer.
- Object-Orientated: Everything in Python is an object which improves the ability to communicate amongst objects.
- Error Handling: Python uses exceptions to try catching an error in the source code.
- Extensive Standard Library: The built in library that Python has can be used for just about any task.
- It’s free: The language is freely available even for commercial use because the implementation of Python is open source.

The syntax for the “Hello World” program in Python is one of the easiest examples of the program that anybody is likely to encounter.

```
print(“Hello, World!”)
```

3.2.2.3. PHP

The name PHP originally stood for “Personal Home Page” but has since been changed to “PHP Hypertext Preprocessor”. It is a scripting language that can be used for general purpose programming but the main reason the language was designed was for web development. The main use for the language now is for server-side scripting. *“Originally created by Rasmus Lerdorf in 1995, the reference implementation of PHP is now produced by The PHP Group”*.

A PHP file can contain many things like text, JavaScript, HTML, CSS and PHP code. It is compatible with all types of servers used today and supports a range of databases. Some companies that are currently using PHP are Google and Yahoo.

PHP is ranked 5th on the TIOBE index table with a rating of 5.379%.

The code is usually executed by the PHP runtime. It can also be used for command line scripting. *“As of April 2007, over 20 million Internet domains had web services*

hosted on servers with PHP installed". 75% of all websites using a server-side language are using PHP. There have been some disadvantages associated with the language. There are security flaws due to unknown vulnerabilities in the implementation of PHP. On the National Vulnerability Database in America *"On the whole database, about 29% of vulnerabilities (CVE) are related to PHP, although about 18% of products (CPE) are related to PHP"*.

Another disadvantage associated with PHP is that it is not good for creating desktop applications.

Some of the key features associated with PHP are:

- **Simplicity:** PHP is a very easy language to learn and understand for anybody with a background in computer programming.
- **Regular expressions:** PHP supports all common regular expression operations.
- **It's free:** The free software package can be used for commercial use or any other purpose.
- **Security:** There are many levels of security to stop malicious attacks. These security levels can be tailored by the developer in the .ini.file.
- **Community support:** PHP is an open source project with an endless amount of developers created a huge knowledge pool of information regarding PHP.

The syntax for PHP embedded in a HTML document is:

```
<!DOCTYPE html>
<meta charset="utf-8">
<title>PHP Test </title>
<?php echo 'Hello, World!' ; ?>
```

3.2.2.4. ASP.NET

ASP.NET is a Microsoft web application framework designed for web development. It covers areas like web site development, web application development and development of web services. Programmers can use any language supported by the .NET framework to write ASP.NET code as long as they are compatible with the common language runtime (CLR). *"The .NET Framework provides a run-time environment called the common language runtime, which runs the code and provides services that make the development process easier."* Some of the more popular of the languages are C#, Scala and Visual Basic.

The syntax for the "Hello World" program in ASP.NET is as follows;

```
<%@ Page Language="VB" %>
<html>
<head>
<title>ASP.NET Hello World</title>
</head>
<body bgcolor = "#FFFFFF">
<p><%= "Hello World!" %></p>
</body>
</html>
```

3.2.3. Back End Frameworks

3.2.3.1. Django

Django is a web application framework written in Python that was first released in July 2005. It is one of the most widely used tools for Python web development. Some of the more popular websites using Django are Mozilla (search engine), Pinterest (content sharing service) and Instagram (social networking). One of the main focuses of Django is to use the DRY (Don't Repeat Yourself) principle to eliminate repetitive or duplicate code in the creation of web applications. The DRY principle states *"Every piece of knowledge must have a single, unambiguous, authoritative representation within a system"*.

Some of the features of Django framework are:

- **Architecture:** Django uses MTV architecture. The M stands for model and represents the data layer which will be there data stored on the cloud. T stands for template and this represents the presentation layer which relates to how something will be displayed on the web page. The V stands for view which acts as the controller
- **ORM:** Django uses a powerful Object-Relational Mapping system to communicate between the database and the web application. Django supports most common database engines like SQLite, MySQL and Oracle.
- **Development Environment:** Django comes with a lightweight web server to provide the developer a tool for testing and developing an application. Error messages and debugging provide a lot of information to the developer when using Django.
- **Django Community:** The Django community is rapidly increasing which offers a vast knowledge pool in areas like tools, training and Django related problems.

3.2.3.2. Drupal

Drupal is a content management framework (CMF) written in PHP that is used as the back end framework for 2.1% of websites worldwide. A content management

framework is a framework designed to managing the content of the web page and reuse components of the page. Currently about 30,000 developers are using Drupal with about 22,900 community-contributed add-ons available for modification and extending for new features or customize behaviour and appearance. Some establishments using Drupal as their back end framework are MTV UK (TV channel website) MIT (research University) and Harvard (University). The only technical requirements to run Drupal are Web Server (Apache or Microsoft IIS), PHP (5.2 or higher) and a Database Server (SQLite or MySQL 5.0 or higher).

Benefits of using Drupal framework are:

- **Programming Experience:** Although it Drupal provides a programming interface for developers, there is little or no programming skills required for website installation and administration.
- **Open Source:** Drupal is open source project which means developers can work on their own branch of the source code to add new features or modify existing features of the software.
- **Community Support:** There is a large online Drupal voluntary community which offers support for almost anything relating to using the framework. The community has a created documentation for Drupal to cover every topic elated to working with this framework.

3.2.3.3. CakePHP

CakePHP is a web application framework written in PHP that was initially released in 2005. The framework uses the Model-View-Controller (MVC) software architecture pattern which makes a distinct separation from the data representation and the user interaction with the data. This model represents knowledge and could be made up of a single objects or structured collection of objects. The view is a visual representation of this model that highlights and hides certain attributes relating to the model. A controller is the link between the user on the client side and the system on the server side. This provides a means of input and output and mechanisms of passing these messages between the user and the system. Some sites using CakePHP are Auctigo (courier delivery service) and Ambling Books (online audio book store).

Features associated with CakePHP are:

- **No Configuration:** No need to configure XML or YAML files to setup a database.
- **Security:** Built in tools for input validation, SQL injection prevention and XSS prevention to name a few.
- **Certification:** An exam can be taken to examine a person's understanding of the framework by testing a set of real world scenarios and CakePHP specifics.
- **Documentation:** Large amounts of documentation available on the framework.
- **Open Source:** Open source project on GitHub, developers have the ability to add new features or modify existing features.

3.2.3.4. Flask

Flask is a framework for web application development that is written in Python. *“Flask is called a microframework because it keeps the core simple but extensible”*. Flask is currently the framework that we use in our Web Development class in college so I have had some exposure to it.

Features of Flask:

- Unit Testing; Flask has integrated support for unit testing.
- Debugging: Contains development server and debugging.
- Templating: Uses Jinja2 templating.
- Community: Huge online Flask Community.

3.2.4. Conclusions on Back End Technology

After researching different areas associated with server side technology I have come up with solutions that I think will best suit this project. For the language the two that stood out were Python and PHP because are a number of excellent frameworks available that coincide with the database for the project. I chose Python over PHP for a number of reasons, it is a very powerful language, readability of the syntax is easy in terms of understanding computer code and it is currently one of the main languages being used in fourth year of Software Development. With regards to the framework I will chose between both Flask and Django. Although I am using Flask in my Web Development class I am not 100% sure about the capabilities it has as a framework so I will be more inclined to pick Django because I know from my research that this is a powerful Python framework.

3.3. Version Control

3.3.1. GitHub

GitHub is a web-based service for software development projects that was launched in April 2008. GitHub uses the revision control system Git. Public repositories are free but there is a fee to use a private repository. The GitHub community currently is over 4 million.

Authentication to the site can only be achieved through GitHub. . The site supports development in all languages and has a live repository trending page which is a good feature to let developers see ongoing open source projects.

3.3.2. BitBucket

BitBucket is a web-based service for software development projects that was launched in 2008. It is similar to GitHub with one distinct difference; it offers to use Mercurial as well as Git as the version control system. BitBucket has both public and private repositories free of charge. There are over 1 million users in the BitBucket community. Authentication for

access to the site can be achieved from a number of external sources including Facebook, Google, Twitter and GitHub.

3.3.3. Conclusion on Version Control

I have decided to go with BitBucket rather than GitHub because it seems to be a lot more user-friendly and has more features available to somebody using version control for the first time. It also has a free option for a private repository which GitHub does not offer.

4. Storage

Storage is going to be an essential part of this part project as we are going to need a location to store all data relating to users of the application. Storage is also essential for data relating to the application like the content in each lesson and certificates for each NinjaTyper.

4.1. Server

A centralized is a centralized computer system on a network that is made up of software and a suitable hardware that responds to requests sent and received around the web. Servers are said to be dedicated meaning that they are dedicated to doing only their server tasks. Servers are widely used in places that use an intranet network. Examples of this would be in the educational system in Ireland in schools and colleges.

Types of Servers:

- File Server: Computer and storage that stores files.
- Database Server: Computer system that handle database queries.
- Print Server: System that manages a network of printers.
- Web Server: Provide network access to internet or intranet content.

4.2. Cloud

One of the biggest trends in this computer age is “Cloud Storage” or “The Cloud”. What these terms refer to is an off-site storage system. The cloud is made of a number of servers. Instead of saving data to a local machine the data is saved to a remote database.

Cloud computing is made up of different layers which represent different services that are available to the client.

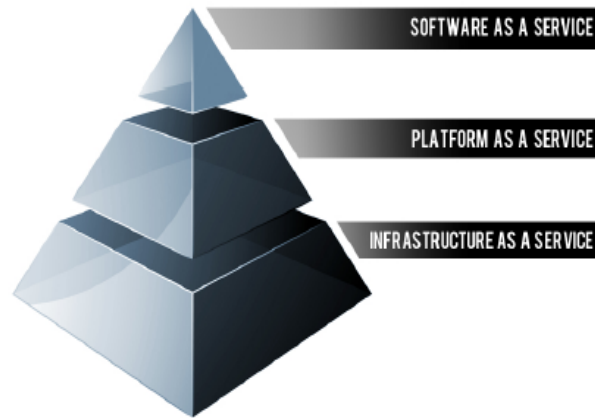


Figure 1 Cloud Computing Structure

- **Software As A Service (SAAS)**
Software as a service is a way of distributing software from a centralized location to people in an off-site location. Clients can use the software that is made available by the vendor.
- **Platform As A Service (PAAS)**
Platform as a service lets the client avail of platforms that they may have otherwise had no access to. This is a widely used model with regards to application development with an access to many development tools, testing services and other services for development.
- **Infrastructure As A Service (IAAS)**
Infrastructure is a way of outsourcing equipment to clients. This equipment can include networking components, servers, storage, and hardware. The vendor is responsible for the equipment.

4.2.1. Solutions to Cloud Storage

4.2.1.1. AWS

Amazon Web Services (AWS) is Amazon's answer to cloud computing. It is a collection of web services that make up the cloud platform. It is a platform as a service in the cloud computing structure. One of the services it offers in this cloud platform is Amazon S3. This service provides internet storage which can be accessed anytime from anywhere on the web. This provides the developer with access to fast, reliable and secure infrastructure that Amazon itself uses to run its own network of sites.

Products provided by AWS:

- Compute

- Networking
- Storage and Content Delivery
- Database
- Deployment
- App Services

Region: EU (Ireland)			
	Standard Storage	Reduced Redundancy Storage	Glacier Storage
First 1 TB / month	\$0.095 per GB	\$0.076 per GB	\$0.011 per GB
Next 49 TB / month	\$0.080 per GB	\$0.064 per GB	\$0.011 per GB
Next 450 TB / month	\$0.070 per GB	\$0.056 per GB	\$0.011 per GB
Next 500 TB / month	\$0.065 per GB	\$0.052 per GB	\$0.011 per GB
Next 4000 TB / month	\$0.060 per GB	\$0.048 per GB	\$0.011 per GB
Over 5000 TB / month	\$0.055 per GB	\$0.037 per GB	\$0.011 per GB

Figure 2 AWS S3 Pricing

Design Requirements:

- Security: Provide the infrastructure to a customer who can maintain full control over who can access their data.
- Reliability: Store data with up to 99.99% durability with 99.99% availability. There is no room for system failure resulting in system downtime.
- Speed: Amazon S3 should be fast enough to support high performance applications.
- Simplicity: Provide a simple way of using any application anywhere.

4.2.1.2. GAE

Google App Engine (GAE) is a solution offered by google in the cloud computing platform. It is a platform as a service (PAAS) that provides developers a platform for hosting and developing web applications. GAE is free but once features like bandwidth and storage are increased it fee is applied. Languages supported by GAE are Python, Java, PHP and Go and some of popular applications and sites running on GAE are Snapchat (image sharing application), Rovio(entertainment media company) and Khan Academy(educational website).

	Free quota per app per day	Pricing if you exceed your free quota
Hosting	Free quota per app per day	Price
On-demand Frontend Instances	28 free instance hours	\$0.08 / hour
Reserved Frontend Instances		\$0.05 / hour
High Replication Datastore Storage	1 GB total limit	\$0.18 / GB / month
Outgoing Network Traffic	1 GB	\$0.12 / GB
Incoming Network Traffic	1 GB	Free
APIs		
Datastore API	50k free read/write/small	\$0.09/100k write ops \$0.06/100k read ops \$0.01/100k small ops
Search API	1000 basic operations 0.01 GB indexing documents 0.25 GB document storage 100 complex searches 1000 simple searches	\$0.10 / 10k basic operations \$2.00 / GB indexing documents \$0.18 / GB / month document storage \$0.60 / 10k complex searches \$0.13 / 10k simple searches
Blobstore Storage	5 GB total limit	\$0.13 / GB / month
Email API	100 recipients	\$0.01 / 100 recipients
XMPP API	10k stanzas	\$0.10 / 100k stanza
Channel API	100 channels opened	\$0.01 / 100 channels opened
Image Manipulation API	✓	✓
Shared Memcache	✓	✓
Dedicated Memcache	No free quota	\$0.12 / GB / hour
Users API	✓	✓
Task Queue	✓	✓
Files API	✓	✓
URL Fetch API	✓	✓
Cron	✓	✓
SNI SSL Certificates	No free quota	\$9.00 / set of five SNI certificate slots / month
SSL Virtual IPs	No free quota	\$39.00 / virtual IP / month
Pagespeed Network Traffic	No free quota	\$0.39 / GB

Figure 3 GAE Pricing

4.2.1.3. Windows Azure

Windows is Microsoft's answer to cloud computing. It is a cloud computing platform and infrastructure for application development, maintenance and deployment. It supports a wide range of programming languages and offers both infrastructure as a service (IAAS) and platform as a service (PAAS). The first release of the service was in February of 2010. Windows azure provides storage, backup and recovery of any kind of data. The payment plan in place only lets users pay for what they use. To test ones knowledge of using Windows Azure examinations can be taken and the user can get certified. These examinations test people on designing and development of applications that will be hosted on the Windows Azure platform. . Some of the services Windows

Services provided by Windows Azure:

- Websites
- Virtual Machines
- Cloud Services
- Data Management
- Messaging
- Mobile Services

Benefits of using Windows Azure:

- Durable: Available in 8 regions worldwide. Built with durability in mind, geo-replication provides redundancy of your data across regions to ensure access to your data in the event of a local disaster.
- Scalable: Windows Azure scales to the data that you store. You can choose where to keep your data and scale up or across data centres.
- Cost-Effective: Pay only for what you use.

Pricing Details		Currency: US Dollar (\$)	
SQL Database Web and Business editions are charged based on the actual volume of the database, measured in GB.			
DATABASE SIZE	PRICE PER DATABASE PER MONTH (PRORATED DAILY)		
0 to 100 MB	\$4.995		
100 MB to 1 GB	\$9.99		
1 GB to 10 GB	\$9.99 for the first 10 GB	\$3.996	for each additional GB
10 GB to 50 GB	\$45.96 for the first 10 GB	\$1.996	for each additional GB
50 GB to 150 GB	\$125.88 for the first 50 GB	\$0.999	for each additional GB

Figure 4 Windows Azure Storage Pricing

4.3. Database

The database is going to a centralized location where any data in relation to the application and users will be stored. The database will itself will be stored on the cloud. Below are some of the solutions to databases to use in the project.

4.3.1. SQLite

SQLite is a software library that implements a self-contained, serverless, zero-configuration, transactional SQL database engine. SQLite is relational database management system (RDBMS). SQLite is not a separate process that is accessed by the application but is an integral part of it. SQLite is an embedded database engine. It reads and writes directly to ordinary disk files. Funding for the development and maintenance of the software is provided by the SQLite Consortium which is a membership association including companies like Nokia (mobile communications), Bloomberg (financial information technology) and Mozilla (internet search engine). SQLite comes with some programming languages like Python 2.5 or higher, Tcl/Tk and PHP comes with both SQLite2 and SQLite3 built in.

Some Features of SQLite are:

- Cross Platform: Supports operating systems like Linux, Mac OS-X, Android and Windows and it is relatively easy to port to other systems.
- Storage: A complete database is stored in a single cross platform disk file and it supports databases measured in terabytes.
- Configuration: There is no set up or administration associated with it.
- Speed: Faster than most client/server database engines.
- CLI: Command Line Interface is supplied to administer SQLite databases.

4.3.2. MySQL

MySQL is another example of a relational database management system (RDBMS). This is a database management system that is based on relational model. This means that all data is represented in terms of tuples, grouped into relations. The purpose of this model is to provide the user with a method to state what information is in the database and information they want to extract from it. This RDBMS uses Structured Query Language (SQL) data definition and query language. MySQL is a paid system with the MySQL Standard Edition starting at \$2000.

Some features that MySQL has are:

- Programming languages: There a number of libraries and API's for development of MySQL applications which use languages such as C, Java, PHP, Python and C++ for client programming.

- Platform Independent: MySQL can be executed on any of the more widely used operating systems like Mac OS Z, Linux and Windows.
- Speed: This is one of the biggest features of MySQL. MySQL is faster than other popular commercial database systems like Oracle and DB2.
- Stored Procedures: Used to make it easier on the developer for operations like inserting or deleting data. Using stored procedures improves efficacy.

4.4. Conclusions on Storage

For the cloud platform I am going to choose Windows Azure because after doing my research it seems like it is one of the best available. It is also free to a certain extent and supports all web application languages. With regards to a database I not fully made up my mind which kind of database to integrate with Python. It will be between MySQL and SQLite.

5. Similar Applications

5.1. Free

5.1.1. TypingClub

TypingClub is a free online application that was designed to equip people with the skills to touch type. The language for the application is English. It is a free application with the option of acquiring the full version of the TypingClub School Edition for a fee. *“TypingClub's School Edition has been designed to provide an easier way for instructors to keep track of their students' progress. The School Portal also allows you to customize or even create new lesson plans.”*

Features of TypingClub:

- Customize Content: In the School Edition all the content to deliver in each lesson can be customized.
- Price: The School edition work out at around \$2.99 per student.
- Web-based: Can be accessed anywhere with internet connection.

Observations made after using the application:

- Good use of colours to show successful and unsuccessful keystrokes. The fingers suggested finger for the keystroke is highlighted on a transparent hand on the page.
- The site has a page that allows the user to enter ideas on how to improve the application and webpage.
- After each lesson a lot of statistics are displayed. Speed is measured by words per minute (WPM), accuracy is given as a percentage and the time it takes to complete the lesson is displayed. It also shows the accuracy of each individual key used in the

application as well as the accuracy of the suggested fingers to use. The user has three options after each lesson, Menu, Redo and Next.



Figure 5 TypingClub Typing Page

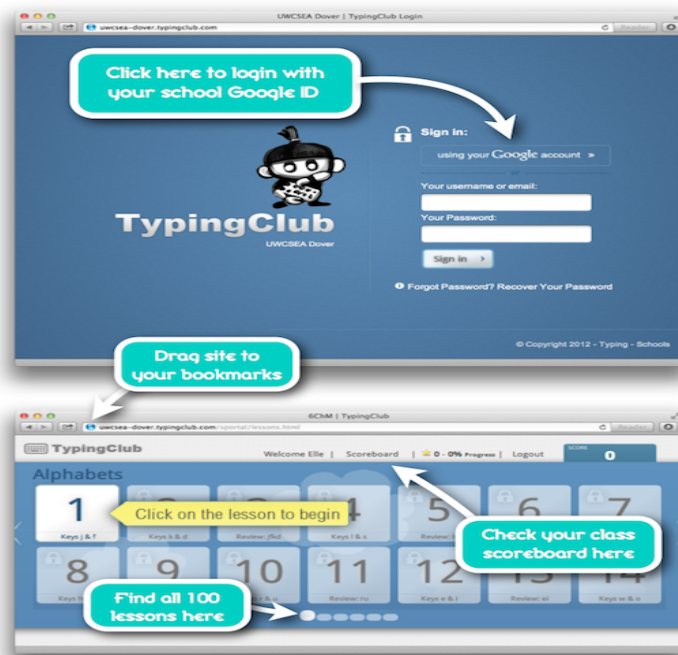


Figure 6 Typing Club Login/Lesson Selection Pages

The application takes about 5 minutes to get used to. Out of all the tested applications this is defiantly the best to learn to type.

5.1.2. TypeRacer

TypeRacer is also a free online typing application. Type racer allows people to race against each other. The way you advance forward towards the finish line is to type the correct quotes provided to you. The quotes are taken from movies, books and songs. Unlike other typing applications on the internet the application is available in 50 different languages. The application is also available for schools.

Features of TypeRacer:

- Online Live Leader board: Displays the latest high scores, the user's scores and the fastest typists around the world currently using the application.
- Multiple Languages: Supports 50 individual languages.
- Multiplayer: User can test their improving typing skills against other users of the application.

Observations made after using the application.

- The site puts you against other typists who are one the same level of typing as you.
- Upon completing a race the user is presented with the option to race again or return to the main menu.
- At the end of a race the origin of the quote the user typed is displayed i.e. "You typed a quote from the book: Being Logical: A guide to Good Thinking by D.Q. McInerney"
- Statistics for the user are also displayed including speed in WPM, time the race took and the accuracy is displayed as a percentage. The user can also review scores from the previous 10 races.
- The text bar turns a shade of burgundy when an incorrect keystroke has been entered, this can be a bit off-putting.



Figure 7 Type Racer TypingPage

This is definitely the most enjoyable of all the applications tested. It is also a good application to keep the user from getting distracted or bored.

5.2. Paid

5.2.1. UltraKey 6.0

Ultrakey 6.0 is a typing software suite that is aimed at children to develop their typing skills. Unlike other typing applications that incorporate games into the application UltraKey 6.0 uses a proven success-based methodology for advancement through the course. The application offers 14 different lessons that are made up of hundreds of subsets of exercises. The software places a strong focus on proper typing techniques and accuracy more so than speed of the typing exercises which is common in most other applications. The cost of UltraKey 6.0 is currently \$39.95 and is continuously ranked in the top three in paid typing software for children. The two main disadvantage of using this software is that it does not incorporate any numerical keys into the lessons and it only supports the English language.

Features of UltraKey 6.0

- Virtual Interactive Keyboard: If any errors are made when typing the hands on the keyboard show the proper sequence of keystrokes that should have been followed.
- Cross Platform: Engineered for Linux, Mac OS-X and Windows.
- Usage: Can support up to 8 different users 8 users and can be installed on 3 different machines.
- Multiple Languages: Supports 8 different languages.
- Multiple Themes: 12 different interface themes to accommodate people with special needs and who are visually impaired.



Figure 8 Typing Activity UltraKey 6.0

5.2.2. Ultimate Typing 2013

Ultimate Typing 2013 adapts an approach that is called EasyLearn where it combines typing activities with video tutorials to ease the use of the software. Each lesson begins with a video instructing the user of new typing concept and the video shows step by step how to do it. The program has 9 typing courses with each one focusing on a different typing skill or level. The software also provides the user with the option of taking warm up exercises prior to taking on a new course. It is currently the highest ranked typing software on the TopTenReviews website. The current cost for the software is \$29.95. One of the main drawbacks of the software is that there are no performance goals like that in other applications so the user has no target goals to work towards.

Features of Ultimate Typing 2013:

- Adaptive Learning: Software tracks user progress and prompt them to try areas where the user has had some issues typing.
- Interface similar to Windows: Interface influenced by windows so people will be at ease using it.
- Progress Reporting: Very good reporting in place to track everything that the user has done when using the software.

- Multiple Languages: Can support all languages that read from left to right and top to bottom.

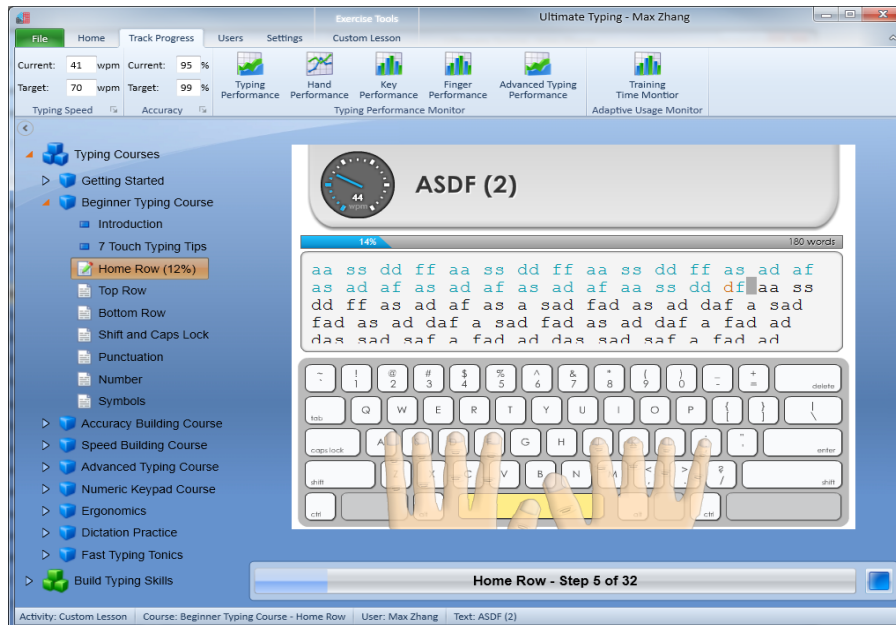


Figure 9 Ultimate Typing 2013 Activity Page

6. Meetings

- **08/10/2013**

After a number of emails back and forth Keith Lennon and I decided to meet in town for a formal meeting. I met with Keith in Fairgreen Shopping Centre in Carlow. Some of the topics we talked about were the business, what he wants from me, what I want from him and then just sharing ideas about the project.

- **19/10/2013**

I visited NinjaTypers in Fairgreen Shopping Centre in Carlow. On that day there were 8 students present between the ages of 8 -13. The current limit for one class is 10. Each of the students was using an iPad docked onto a keyboard. The typing lesson for the day was typed at the top of the page using a word processing application called pages and the students had to replicate the typed lesson a set number of times. One of the things that surprised me was how effective this method was, there were students there who had only been there 3 weeks and their typing skills were very good and their progress was advancing forward at a very fast pace. Another observation I had was with regards to some of the behaviours of the children there. There were 3 children who had an intellectual or mental disorder. Keith informed me that there were more children with disorders there that take the class and they include Dyslexia, Dyspraxia and Asperger's Syndrome.

- **18/11/2013**

I met with Keith again at Dinn Ri Hotel in Carlow. We talked about different areas of the project like the grading structure, the details that would be stored on each user, communication between both of us, layout of web pages and also some features that could be incorporated into the project.

7. Summary and Conclusion

After carrying out a lot of research in the areas that will be incorporated into my project I am more than happy with the outcome. Researching these areas has highlighted areas that I was unaware of that I would have to look into. It has also made me more aware to the amount of technologies available for a similar purpose but why these technologies are distinguished by some of the features that they pose and why using one might be more beneficial than using another. I have been able to get a better understanding of why these technologies are so widely used and so well renown. Researching different areas has also shown me where problems might occur in my project. It has definitely put my on the right path and given me a more structured approach to the project. I have been able to pick which languages and frameworks I will use and also which version control and cloud platform I will use.

8. Glossary

NinjaTypers: A typing club that teaches children to touch type.

Programming Language: Formal language used to create programs that control computer behaviour.

Scripts: List of computer command that run with no user interaction.

Client side: The user interface for an application.

Server side: The background functionality of an application.

Syntax: The structure that the programming language follows.

Naming Conventions: Rules in place to adhere to when naming parts of the computer code.

Library: A code base filled with pre-programmed classes.

Attribute: Something that an object has.

Function: Functionality that the computer program has. Something it does.

Responsive Web Design: How a web page adapts to the device it is being viewed on.

Object Orientation: How objects (things) can interact with each other.

Framework: Software that can be used that provides existing functionality.

9. Web References