University of Glasgow | School of Computing Science

Team V - How Not To Kill Your Dog

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Abstract

The abstract goes here

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Chapter 1

Implementation

1.1 Abstract

1.2 Developing a Web Based Application

One of the requirements for our project was that our final product should be available to use to any user with an Internet Connection. More specifically, any student should be able to access the application and practice on their drug calculations in their free time wherever they are with any device that can access the Web. This can be a laptop computer, a mobile phone or a tablet computer.
It was, therefore, clear to us that creating an application that needs to be installed on a machine in order to be usable was not an option. After a discussion with the team we decided that the most suitable solution would be to implement a application that would be accessible via a Web Browser. A web application would make it possible for any user to access our application from any device simply by navigating to our Web Applications URL address.

1.2.1 Using a Web Application Framework

After doing some research looking for the best possible option for developing web applications we decided that we would make use of a web development framework rather than writing the code for the whole application from scratch.

Developing from Scratch

Developing an application from scratch has the potential to take up much needed time from the Development Phase. For each different page of an application there needs to be a unique file (for example an html document) that will be sent to the client's web browser when the page is called. An application usually has the same layout on every page with basic components, like the applications logo or the applications default buttons, being displayed on each page. It is therefore clear that having a separate file to correspond to each different page of an application can lead to a lot of coding overhead and 'boiler plate' code. In the case of a change request, a developer will need to modify the code in each different page separately which would take much of our development time. Time was a major concern for us as we only had a limited amount of time to get the application designed, developed, evaluated and delivered to our client.

Developing with a web application framework

A Web Application Framework is a set of prefabricated software building blocks that programmers can use, extend, or customise for specific computing solutions" (Leif Azzoperdi, DIM3 Lecture 3). A framework would allow us to start implementing our application with a concrete base to support us by providing default functionality whilst allowing us to extend or override functionality to suit our specific requirements. "One significant advantage to using a framework is that you're required to write only a minimal amount of code to get up and running from scratch"(Professional Python Frameworks: Web 2.0 Programming with Django and Turbogears page 48). This was one of the most important reasons for which we opted in using a Web Application Framework for our project. Afterwards, there was one more decision that needed to be undertaken. There are a number of frameworks available on the web so we had to decide on one of them before starting our implementation.

1.2.2 Which framework to use?

We came down to three popular web application frameworks that would help us develop our software but we had to decide on one of them. Our supervisor suggested that three of us take one of the three frameworks each and try to build a simple application in one week. This would not only show us what can be built with that particular framework but it would also show us how long it take for a developer to learn how to use the framework, and how much can be built in a week by using that framework. The three options were

- Web2Py
- Django
- Ruby on Rails

After our frameworks evaluation we came to the following conclusions about them: Ruby on Rails offers useful code generators which can produce functions out of one line of code written by the developer and has a build in testing framework which can be particularly useful for our testing. However, the mystery behind the code generators can cause confusion to developers and thus increase development time.
Web2Py uses a Python-based template language and supports development from a Web Browser. We have been using python for our introduction to programming course in Level 1 of our university studies so it would python is a language we have all used and are comfortable with. Moreover, a developer needs not have their own computer with them to work on the development of the application. Web2Py gives the ability to a developer to work on the code of the application via a web interface which can be particularly useful in case one of the team members is traveling and is not able to use their own computer to work on application.

Django is an MVT (Model, View, Template) based framework that runs with Python on its back end. This gives us the advantage of having separation of concerns in our application since different components in the framework act independently from each other so a developer can work on one part of the application while another can work on a different component without having to wait for a different component to be completed. Django is an extremely customisable framework since it comes packed with a lot of functionality which can be used out of the box or can be further modified to reflect our goals and objectives. On the other hand it might take time to learn since it has its own way of doing things and a developer needs to adapt to it.

1.2.3 Why Django

We decided to use Django since it gives us great flexibility as to what our end product can be like, it is documented extremely well online and even though learning it can take some time, we consider it to be a well worth investment since we will have to use Django in one of our courses in second semester as well.

1.3 Development in Django

As its being described on djangoproject.org, Django is ”The Web framework for perfectionists with deadlines”. It is a rapid web development framework that can save you the trouble of writing repetitive boilerplate code. A developer using Django can achieve greatness with minimal coding. Django comes with an object relational mapper which means that we can define our database schema in Python code by defining classes and Django will then produce an sql code that can be injected in our database with minimal effort from the developer in order to create any tables required for the project. It has a dynamic build in administration interface which can be customised according to our needs. This can be used, in our case, as a way for a Course Coordinator or a Tutor to create new topics, add slides and questions to each topic, create questions for the final assessment page and create new users or groups of users with special permissions. This will be discussed further in this report.

1.3.1 The MTV Model

The MTV model used by django is a development mode very similar to the MVC model which is widely used by a number of web application frameworks such as Backbone.js SproutCore and the Cocoa framework used in Mac OS X and iOS applications. Django, since it likes to do things its own way, uses a ”modified” version of the MVC model. Its model is called MTV (Model, Template, View). The model in the MVC plays the same role as the model in MTV which is sensible. However, the ”View” in the MTV maps to the ”Controller” of the MVC and the ”Template” of the MTV maps to the MVC’s ”View”. Of course this is slightly complicated so it might cause some confusion to a developer coming from an MVC background. The MTV in general defines the way everything works in Django. Everything in Django can be broken down to 3 components; The Models, the Templates and the Views.

1.3.2 Models

”A model is the single, definitive source of data about your data. It contains the essential fields and behaviours of the data you are storing”(Django website). In other words, any a table in the database can be created by defining a model in the Models.py file. A database field for that table can be defined as an attribute of the corresponding model. The command ”manage.py syncdb” will then read the Models.py file create an SQL code and then run it agains the applications database to create any tables defined by the developer. For example if the code in picture below is run it will create a Database table of topics where each topic has a title and a publication date.

```
class Topic(models.Model):
title = models.CharField(max_length=100)
pub_date = models.DateTimeField('Date Published')
```

1.3.3 Views

A view takes care of what is sent to a browser when a specific URL is requested. It is responsible for making any requested action as this is defined in the tags of the html page associated with each view. Such actions might be read or write to the database commands or any other actions that are required by a page.

1.3.4 Templates

A template is usually an html file. It is the base of what will be send on to a web browser client. It described how the data should be presented to the user and can contain a number of Django tags and variables. A tag is surrounded by ”Django that a special action needs to be taken at that point of the page. This special action can be an ”if” statement, a ”for” loop etc. A variable is simply telling Django to load a specific value from the Database and display it at this point of the page. Templates are used by Django as the model for a page to be sent to a web client.

1.3.5 Controller

Each Django application has a ”urls.py” file which holds definitions that will be matched against requests by web clients. An example url definition in ”urls.py” could be

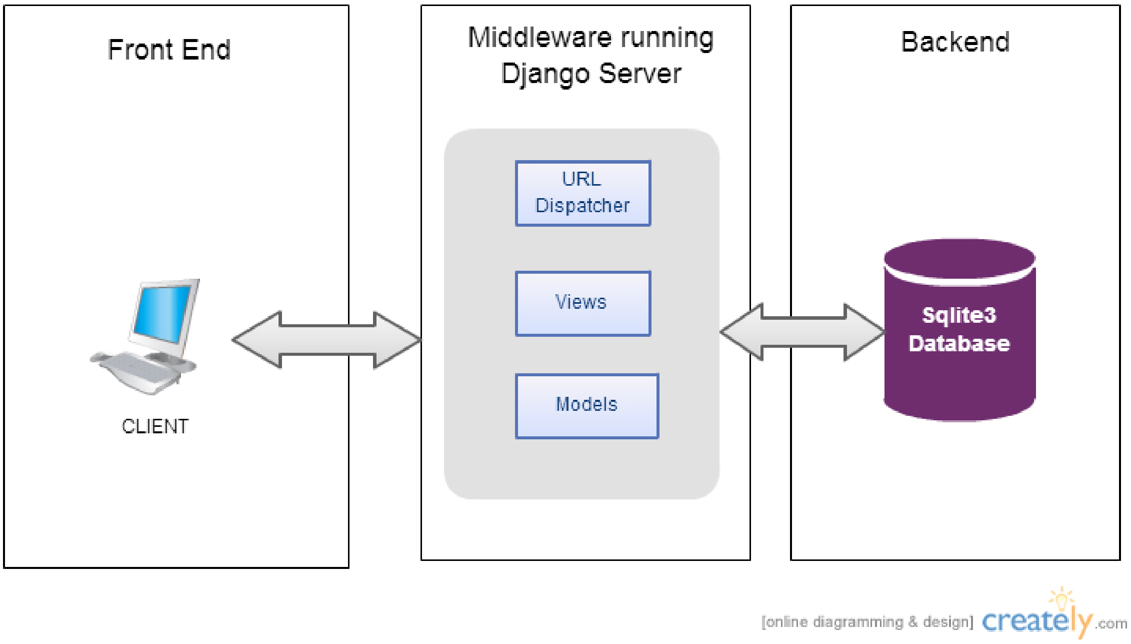
`"url(r ˆ'contents', 'views.contents')".`

In this scenario if our server is hosted on 127.0.0.1 port 8000 and a client requests ”127.0.0.1:8000/contents” Django will match the request with the definition in ”urls.py” and call the appropriate view which is the second argument of the url() function. In this case it will be the ”contents” view.

1.4 3-Tier Architecture

For our implementation we used a 3-Tier Architecture.

1.4.1 N-Tier Architecture Diagram



1.4.2 Front End

The application can be accessed by any user with a web browser such as Internet Explorer, Google Chrome, Mozzila Firefox, Safari and so on.

1.4.3 Middleware

This is our Django server. Responsible for matching requests from Clients using the URL dispatcher which in return calls the appropriate View which then fetches any required context from the Models.py and our Backend Services.

1.4.4 Back End

This is our Sqlite3 Database. Other database options included MySQL, Oracle or PostgreSQL. However we opted in for Sqlite3 since it offers all the functionality we need and Django provides more support for it as it is its default option.

1.5 Back End - Data Models

Our database consists of 4 basic data models.

1.5.1 Data Model:Topic

Field Name	Type	Notes
title	CharField	1000 characters max
pub_date	DateTime	

1.5.2 Data Model:Question

Field Name	Type	Notes
qTopic	ForeignKey	Points to a Topic object
text	CharField	1500 characters max
answer	CharField	100 characters max

1.5.3 Data Model:FinalTestQuestion

Field Name	Type	Notes
text	CharField	2000 Characters max length
answer	CharField	100 characters max

1.5.4 Data Model:Slide

Field Name	Type	Notes
sTopic	ForeignKey	Points to a Topic object
image	ImageField	

1.6 Managing the Front End

The way Django is generally managing the Front End of an application is quite straight forward. It simply takes a predefined template (html file), adds any required content from the models (database objects) and sends the file over to a web browser. However creating simple html files and feeding them the data from our models is not enough to produce a high quality web application. The fact that we were not experienced in web application was not helping us find a solution without investing some time on researching. In our quest to find a way to manage the front end design we looked at a number of solutions. Some of them were the ”Backbone.js”, ”Tastypie” and ”Pyjamas”. At a first glance each of these frameworks seemed promising. However, trying to use them to produce high quality front end design became more of a time wasting challenge rather that a time worthy investment.

1.6.1 Possible frameworks for Front End management

Backbone

As its website states, ”Backbone.js gives structure to web applications by providing models with key-value binding and custom events, collections with a rich API of enumerable functions, views with declarative event handling, and connects it all to your existing API over a RESTful JSON interface”. Fair enough, now how can we proceed and use this Framework with our Django application? A number of github repositories were available online, all with example applications using Backbone. However, since all of them were out of date and description for Backbone and Django integration was vague at best, we soon abandoned the idea of using Backbone.

Tastypie

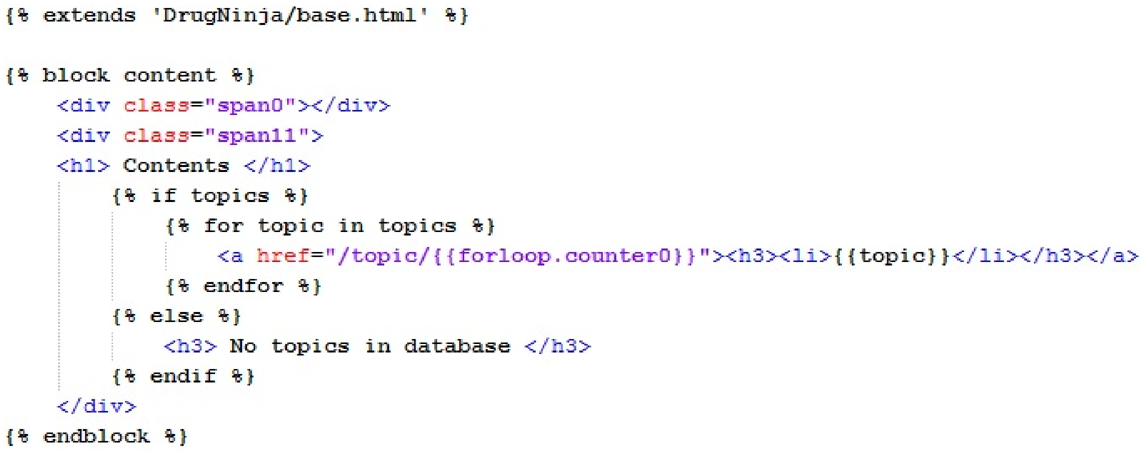
TODO!

Pyjamas

Pyjamas is a framework which takes code written in Python and translates that into javascript and jquery code without the need of having a developer experienced in using javascript and jquery. We managed to get Pyjamas set up successfullly, but the result was not exactly what we expected. The design looked poor and we had to invest even more time in advancing our skills on coding a GUI with python

Compination of traditional Django friendly frameworks

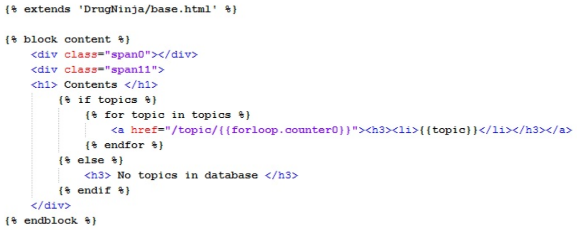
Luckily for us, one of our team members who is really confident on his web design skills convinced us that surely using traditional web design methods, such as writing the code for the templates directly in javascript and using a simple collection of tools such as the Twitter Bootstrap might be worth looking into. He suggested that he can try work out a first draft of the Topics page so that we can see what he can produce with these tools and judge for ourselves. Creating the page actually took him less than one hour and that was a wakeup call for us since the sample page he created was both looking aesthetically nice and the technologies used were working with the Django seamlessly with minimal effort. We started by creating a base.html template. Django gives a developer the option to create templates that inherit from other templates. So any code that needs to be repeated in every page needs not be defined more than once. Our base page with no additional content can be seen on figure ”base.jpg”. This includes the basic layout that should be displayed on ALL templates of our application. So to make the connection between our base template and all other template we had to define an empty Django tag called content block in our base.html template. Then on every page that needs to inherit from base.html we can define the content block so that it includes any additional data that each specific template may require. An example of how a block is defined in a base template is shown in figure baseblock.jpg and then the way the base template is inherited and the content block is used can be seen on figure ”extendsbase”.



```
{% extends 'DrugNinja/base.html' %}

{% block content %}
    <div class="span0"></div>
    <div class="span11">
    <h1> Contents </h1>
        {% if topics %}
            {% for topic in topics %}
                <a href="/topic/{{forloop.counter0}}"><h3><li>{{topic}}</li></h3></a>
            {% endfor %}
        {% else %}
            <h3> No topics in database </h3>
        {% endif %}
    </div>
{% endblock %}
```

Figure 1.1: A picture of a gull.



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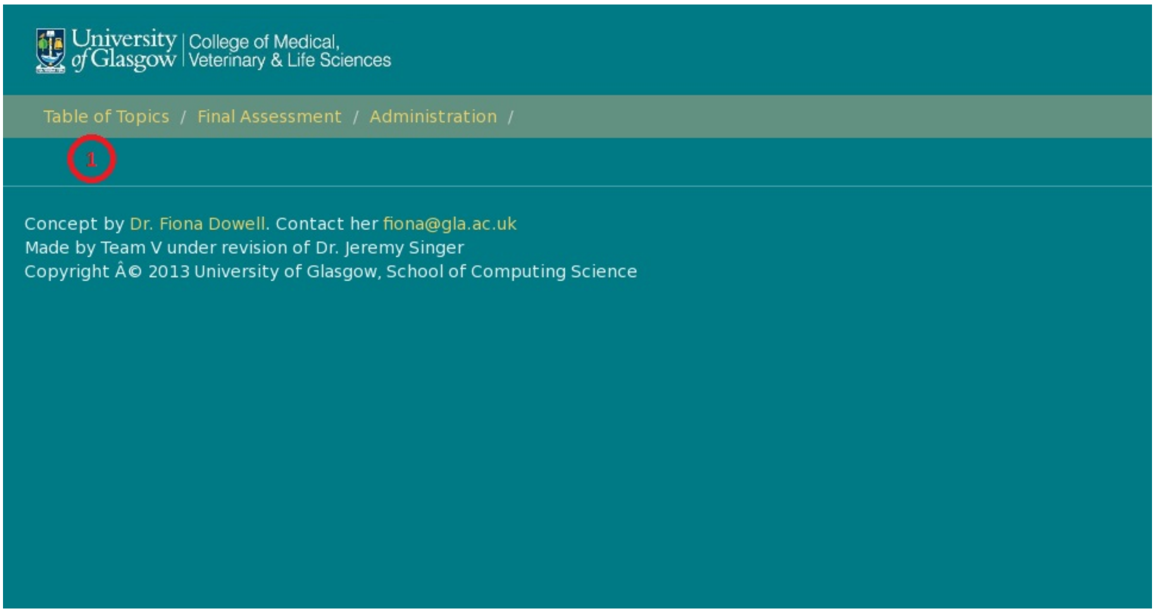
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Table of Topics / Final Assessment / Administration /
1

Concept by Dr. Fiona Dowell. Contact her fiona@gla.ac.uk
Made by Team V under revision of Dr. Jeremy Singer
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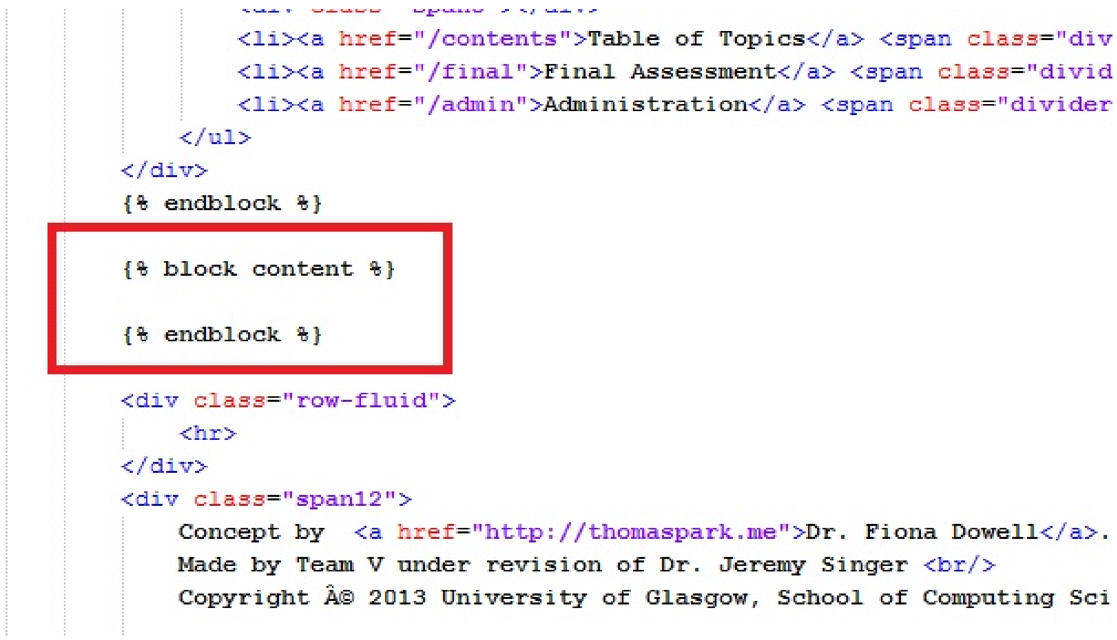

```
        <li><a href="/contents">Table of Topics</a> <span class="div
        <li><a href="/final">Final Assessment</a> <span class="divid
        <li><a href="/admin">Administration</a> <span class="divider
    </ul>
</div>
{% endblock %}

{% block content %}

{% endblock %}

<div class="row-fluid">
    <hr>
</div>
<div class="span12">
    Concept by  <a href="http://thomaspark.me">Dr. Fiona Dowell</a>.
    Made by Team V under revision of Dr. Jeremy Singer <br/>
    Copyright Â© 2013 University of Glasgow, School of Computing Sci
```

1.7 Middleware: Linking the back with the front

Talk about how the Django server makes the connection between the front end and the back end.

1.8 Message Passing

1.8.1 Database Request Format

Database requests description and sequence diagram

1.8.2 Answer Validation Request

Answer validation request description and sequence diagram

1.8.3 Topic Related Data Request

Topic Related Data request and sequence diagram

1.9 End Product

1.9.1 Desired Functionality

How the desired functionality mentioned in Requirements and Design sections was realised through the implementation

Welcome Page

How the Welcome page is implemented

Topic Page

How the topic page is implemented

Contents Page

How the content page is implemented

Final Assessment Page

How the final assessment page is implemented

Administration Page

How the administration page is implemented

1.9.2 Interaction Diagrams

Topic Page

Interaction diagram for communications and message passing between the Topic page and the server.

Contents Page

Interaction diagram for communications and message passing between the Contents Page and the server

Final Assessment Page

Interaction diagram for communications and message passing between the Final Assessment Page and the server

1.10 Challenges and Solutions

Talk about the risks and challenges faced during the development phase of the project and how these were faced.

1.11 Known Issues