

A 3D Interactive Multimedia Map for the Federal Polytechnic Auchi,

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ABSTRACT

To develop web-based maps, geospatial data viewing tools and associated APIs (Application Programming Interface) are employed. Google, Microsoft, and Yahoo are three of the most popular technologies available. The Google Maps Application Programming Interface (API), for the most part has witnessed increased interest in providing online map services. One of the major benefits of using these technologies is that the base data (for example, aerial imaging, street network, and so on) is already stored remotely on web servers and made available to users. Again, Google Maps is particularly popular due of its open API, which allows for quick modification of the map application. Despite the fact that base data is provided, users must store application data in XML or database format (for large datasets). The Maps API is a platform that allows application developers to combine spatial data from a variety of sources to create new tailored services, which are referred to as "mashups" in the industry. The Maps API's usage has fundamentally changed internet mapping applications. However, the map "mashups" have one major problem, which this study addresses. Because map "mashups" are focused on delivering customized services or data fast using the Maps API platform, they often lack complex functionalities and user interfaces that allow the user to control the data output. The purpose of this article is to illustrate how to create an advanced online mapping application that allows the user to manipulate data. The paper presents a case study of developing a web-based map tool for showing information about the important sites of Auchi Polytechnic in Auchi. The web-based map application was created using Google Maps (API), HTML, CSS, and JavaScript.

Keywords: Online Mapping, Google Maps API, HTML, Javascript

1. Introduction

Google Maps, which was first introduced in 2005, has changed the way people use internet mapping services. Asynchronous JavaScript and XML (AJAX) was implemented in Google Maps to establish a continuous connection between the client and the server for quick

downloading of additional map information (Peterson, 2008). Google also provides programmers with the Application Programming Interface, which is a set of source code (API). A programmer can use the API to access a collection of data structures, object classes, or methods written in JavaScript, PHP, or another scripting language (Udell, 2009). Gaining access to Google Map features and services requires the registering and obtaining an API key. The newest version of the API supports the most common web browsers such as Internet Explorer 7.0+, Firefox 3.0+, Safari, Chrome, Android, and mobile browsers such as the Apple iPad and iPhone. They all come with a full JavaScript implementation. Because of these characteristics, Google Maps JavaScript API is the most extensively used Maps API for online mapping (Peterson, 2012). Several Maps APIs are available for online mapping, including Yahoo! Maps API, Microsoft Bing Maps API, Nokia Ovi Maps API, and ESRI ArcGIS API.

Studies by Johnston, (2009); Peng, (2010); Roth, (2009); Chow, (2008); Pan, (2010); Scholefield, (2008); Pejic, Pletl, and Pejic, (2009); Bildirici, (2010); Liu, (2010), Hu, (2012), USDA, (2011) reveal In recent times, there has been a spike in interest in using the Google Maps API to build web-based mapping services, ranging from simple apps that display a few points of interest with information windows to advanced map mashups. Scholefield (2008) used Google Map API, Oracle RDMS (Relational Database Management System), Microsoft SQL (Structured Query Language), Perl, eXtensible Markup Language (XML), JavaScript, Hypertext Markup Language (HTML), eXtensible HTML (XHML), and Cascade Style Sheet (CSS) to create a online map solution for tourism in eighteenth and nineteenth-century Edinburgh. Pejic, Pletl and Pejic, (2009) created an eTourism application that uses Google Map API to display major tourist locations. Bildirici and Ulugtekin, (2010) show a web mapping service with Google Maps (API V2) mashups, in which points, polylines, polygons, through JavaScript code, from data recorded in Keyhole Markup Language (KML), XML, and Geodatabase formats are overlaid with Google Maps. Liu and Palen, (2010) study the utilization of Google Maps mashups to address crisis management for nine natural catastrophes, including earthquakes, fires, and sea level rise, utilizing data sources that are near real-time and publicly available. Hu (2012) used Google Maps API, Yahoo! Flickr API, and YouTube API to construct an online tourist guide for the Southern Illinois University Edwardsville campus using mashups in multimedia mapping, which mix spatial data, multimedia material, and functionality from many sources. Hu (2012) also creates an online map service using the Google Maps JavaScript API, as well as other JavaScript

technologies like jQuery, XML, and MarkerClusterer, to show and search over 600 garden locations from the USDA's People's Garden Initiative. However, there are two major problems in the map "mashups." To begin, the application developer uses open-source tools such as XML files, Google Fusion Tables, comma-separated values (CSV) files, or Keyhole Markup Language (KML) files to prepare spatial data. The time and effort required to reformat the original data, as well as the fact that the data is not maintained in a database that can be updated in real time, are both disadvantages of such systems. On the whole, while map "mashups" are centered on delivering customized services or data fast using the Maps API platform, they often lack additional functionalities and user interfaces that allow the user to edit the data. The purpose of this article is to demonstrate the viability of an online mapping application with enhanced functionality that allows visitors to edit data. The Federal Polytechnic, Auchi, in Auchi, Edo State, Nigeria, presents a case study of developing a web-based interactive map service to display tens of significant school sites and locations on the Internet. Google Maps (API), HTML, CSS and JavaScript are employed in the development of this web-based map application. Major web browsers, including Microsoft Internet Explorer (IE) 7.0+, Google Chrome, Mozilla Firefox, and Apple Safari, are expected to work with the online map application.

2. Aim and Objectives

The aim of this study is to understand the application of Google API with java script and its utilization for a web-based interactive map for Auchi Polytechnic campus one. The related objectives are:

- To develop a web application for mapping of Auchi Polytechnic Campus One
- To understand the functions of Google API and Java Script for GIS Web Mapping

3. Methodology

The code available on Google Map API is taken, and using Microsoft visual studio code developer, scripts are generated. The Microsoft visual studio code is utilized to create the forms and design of actual mapping representation. Finally, the desired output is made available for users.

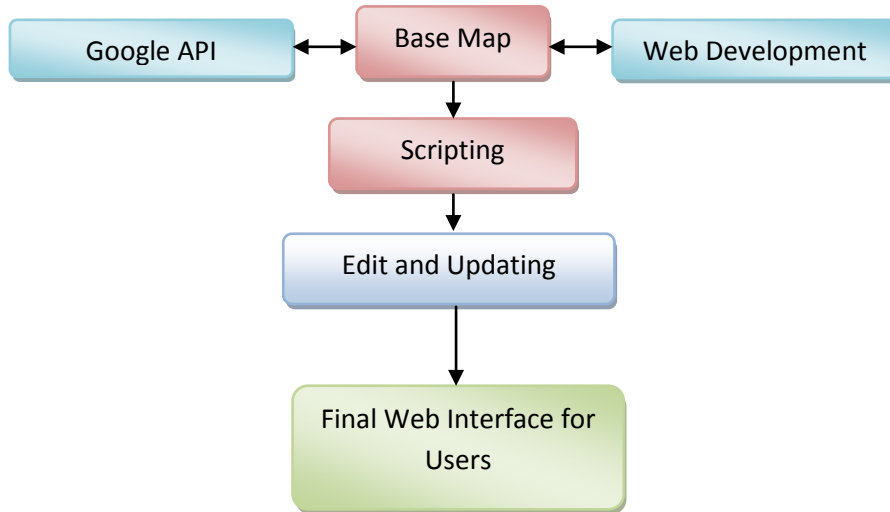


Figure 1. Methodology for the development of Auchi Polytechnic Interactive Online Map interface.

3.1 Study Area

Auchi Polytechnic, Auchi Campus is the study area. The institution is located in Edo North, Etsako West L.G.A. The study region is located between lat:7.0668 N and lng:6.2748 E in terms of geographical coordinates. Figures 1 and 2 depict the map of Edo state and the map of the Auchi Polytechnic campus (both on a Google Earth background).



Figure 2. Map showing the study area (Auchi, Edo State, Nigeria).

3.2 Data Set

The data set for this project contains location coordinates, information regarding the various schools, institutional building and facilities within the campus; their names, geographic location, as well as multimedia files, bulletins/publications from the various schools and departments.

3.3 Design of the Map Application Interface Using HTML, CSS and Javascript

The interactive online map application is a web application, and similar to every other Maps API implementation, this project is based on web development. Google Maps' native language is JavaScript. Furthermore, Google Maps is made out of XHTML (Extensible HTML) and CSS (Cascading Style Sheets) (Udell, 2009). Every Maps API implementation is based on a web development using scripting languages because the online map application is a web application. Equally, Google Maps' native language is JavaScript. XHTML (Extensible HTML) and CSS (Cascading Style Sheets) are also used to create Google Maps (Cascading Style Sheets). Microsoft Visual Studio code is used for the implementation, which is a lightweight version of Microsoft's Visual Studio (VS) that includes a collection of free software products in the form of Microsoft's integrated development environment (IDE).

The following are necessary steps to the implementation of the Auchi Polytechnic interactive map on Microsoft Visual Studio Code.

1. Getting a Google Maps Key
2. Including the Google Maps Key in the application's home page

```
<head>  
<script src = "http://maps.google.com/maps?file=api&v=2&key=Map Key" type= "text/javascript">  
</head>
```

3. Creating a map place holder for the map's display using the <div> tag within the body of the code

```
<head>  
<script src = "http://maps.google.com/maps?file=api&v=2&key=Map Key" type= "text/javascript">  
</head>  
<body>  
<div id = "map" style="width: 800px; height:800px"></div>
```

</body>

4. We proceed with writing all of the map's functionality code within the html <body> tag after setting the place holder

a) Create (instance of) google map using a constructor method ex: Gmap()

```
var map = new GMap2(document.getElementById("map"));
```

b) Center the map and set the zoom level to 10, for example (Google allows a zoom range between 0-17)

```
map.setCenter(new GLatLng(7.0668, -6.2748), 16);
```

c) Adding basic map controls for zooming and base data selection

```
map.addControl (new GLargeMapControl ());
```

```
map.addControl (new GMapTypeControl ());
```

```
var pt = newGLatLng (a, b); [Creates a point of interest centered at a (latitude), b(longitude)]
```

```
var marker = new GMarker(pt); [Creates a Symbol for the point of interest]
```

```
map.addOverlay(marker); [Overlay point of interest on base map]
```

```
var dist = new GSize (18, -22); [Specifies spacing for information window]
```

```
var info = "Auchi Polytechnic Auchi<br>Buil!"; [Content of the Information window]
```

```
map.openInfoWindowHtml(pt,info,dist); [Place the info window relative to the point of interest]
```

Interactive Map Layout Code:

```
<link href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.min.css" rel="stylesheet">
<link href="https://maxcdn.bootstrapcdn.com/font-awesome/4.7.0/css/font-awesome.min.css" rel="stylesheet">
<link href="interactive-map.css" rel="stylesheet">
<script src="https://ajax.googleapis.com/ajax/libs/jquery/3.1.1/jquery.min.js"></script>
<script src="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/js/bootstrap.min.js"></script>
<script src="interactive-map.js"></script>
<script src="C:\Users\Kanoba\Documents\CSS - My Site\Mymap"></script>

<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>Auchi Polytechnic Interactive Map</title>
</head>
<body>
<h1>Auchi Polytechnic Interactive Map (A Tetfund IBR Project)</h1>
<div id="map"></div>
<script>
function initMap(){
var options = {
center: {lat:7.0668, lng:6.2748},
zoom:18
}
var map = new google.maps.Map(document.getElementById('map'), options);
```

```

var marker = new google.maps.marker({
  position: {lat:7.045580752074912, lng: 6.246327369600029},
  map:map,
  icon:"https://img.icons8.com/nolan/2x/marker.png"
});

const detailWindow = new google.maps.InfoWindow({
  content: '<h2>Campus One Gate</h2>'
});

marker.addListener("mouseover", () =>{
  detailWindow.open(map, marker);
})
}
</script>
<script async defer src="https://maps.googleapis.com/maps/api/js?key=AIZAzyDE74xwSAML91gOPZIGH6sRfCy47qIX11g
&callback=initMap"></script>
</body>
</html>

```

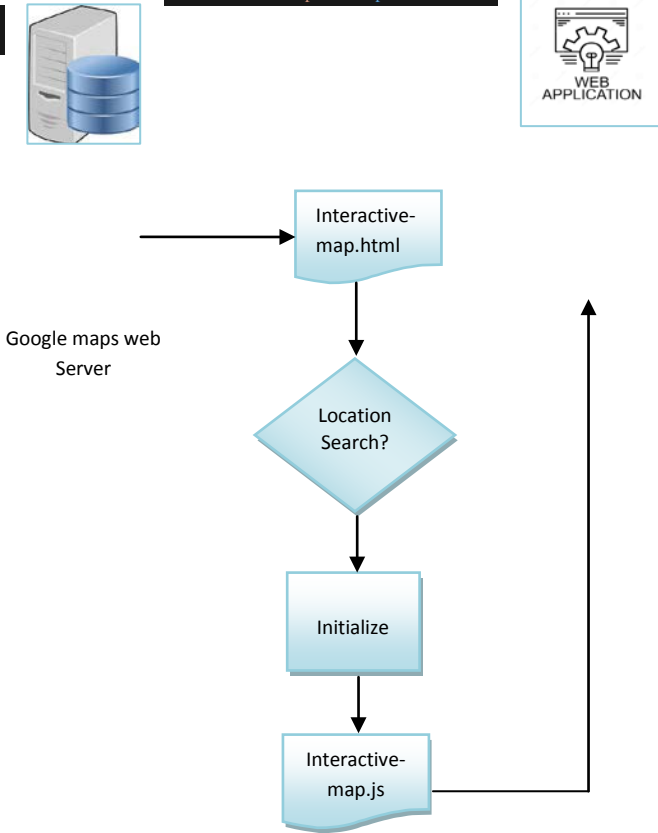


Figure 3: A conceptual framework for the Auchi Polytechnic Interactive online map application development.

3.4 BASE MAP

The base map aids in the interpretation of the interactive map of Auchi Polytechnic by providing geographic context. Because of its great benefit and spatial influence in the geoinformation superhighway, Google Earth was employed as the project's reference map. The remotely sensed image aided in the creation and understanding of Auchi Polytechnic's interactive map.

3.5 ACQUISITION OF FIELD DATA

The field data was collected using Apple's iOS 14.3's "Maps" program. The data was collected in the following manner: the instrument, an iPhone 6s GPS, was transported to the field. Buildings and roads were selected as point coordinates with the help of the "Maps" application. The equipment was put in the center of the building and then permitted to receive satellite signals for around two minutes before the X and Y coordinates were collected (tabulated in the field book).

4. RESULTS AND DISCUSSION

Customarily, web maps may not be presented in an interactive layout. The programmer will design and develop a user interface that allows decision making on usage based on the intended outcome, such as viewing different map data layers or features, reviewing feature characteristics, updating current information, or contributing new material. In this work, the internet was used to download Google Earth satellite imagery. By also conducting social surveys, we yielded some non-spatial data, and GPS observation was used to directly collect the x, y coordinates of the school's location for georeferencing. This project leveraged on the very efficient mechanism Google Maps' API provides for delivering digital cartographic information to Internet users with a quick response time and user-friendly interaction. On the interactive maps' web interface, a user can pick between two map formats using Google Maps' basic Map Type control: roadmap or satellite imagery. The Auchi Polytechnic Interactive online map application's startup display in Google Chrome is shown in Figure 2. At the initial launch of the web page is the display of Google Maps with location markers on various sites within and around the polytechnic. When a marker on any of the polytechnic's location is clicked, an info window pops up, revealing the stored information about the location.

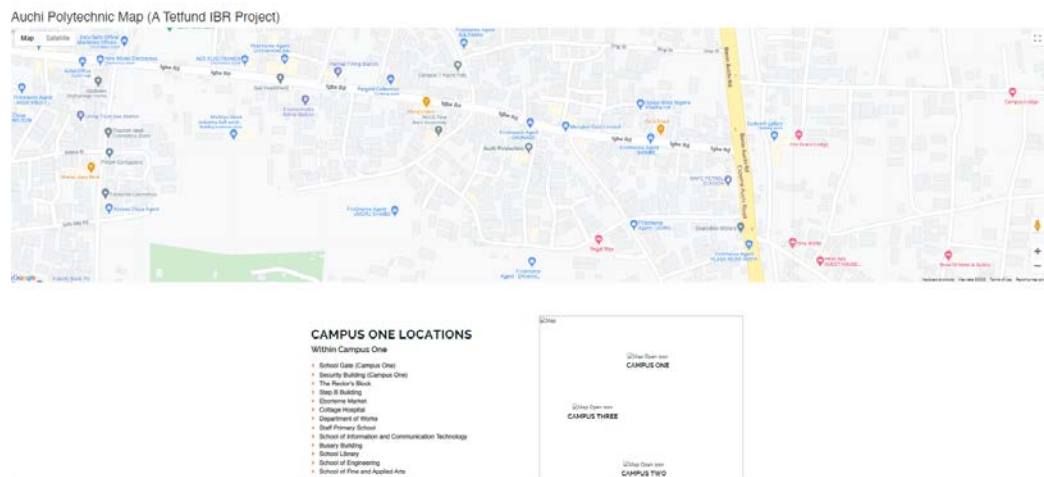


Figure 4. View of the Auchi Polytechnic Interactive Online Map interface

5. CONCLUSION

This paper demonstrated how to create an online mapping application using the Google Maps API, HTML, CSS, and Javascript. The extensive functionality to display the locations and institutional buildings, amenities is provided in the case study offered in this article. It also has advanced search, filtering, and tabbed interface features that allow the user to manage the interactive data. The most significant benefit is accessibility: a web map, like any website, can be accessed from any device with an internet browser and access to the internet. Based on the findings of this study, the following conclusion may be drawn: in current internet age, a web map of the institution or other establishment is vital since people can access it easily via their smart phones, tablets, and computers as long as they have internet access. It is worthwhile to conclude that the synergy between geospatial and the World Wide Web has aided in a higher degree by allowing the worldwide community to engage via the internet, share data, and gain unprecedented access to information.

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REFERENCES

- Bildirici, I. O. and N. N. Ulugtekin. (2010). Web Mapping with Google Maps Mashups: Overlaying Geodata. A Special Joint Symposium of ISPRS Technical Commission IV & AutoCarto in Conjunction With ASPRS/CaGIS 2010 Fall Specialty Conference, November 15-19, Orlando, Florida.
- Chow, T. E. (2008). The potential of Maps APIs for Internet GIS Applications, *Transactions in GIS*, 12(2), pp. 179-191.
- Hu, S. (2012). Multimedia Mapping on the Internet Using Commercial APIs, *Online Maps with APIs and Mapservices* (M. P. Peterson, ed.), Springer, pp. 61-71.
- Johnston, L. R. and K. L. Jensen. (2009). MapHappy: A user-centered interface to library map collections via a Google maps "Mashup". *Journal of Map and Geography Libraries*, 5(2): 114-130.
- Liu, S. B., and L. Palen. (2010). The New cartographers: Crisis Map Mashups and the Emergence of Neogeographic Practice, *Cartography and geographic Information System*, Vol. 37, No. 1, pp. 69-90.

Pan, B., J. C. Crottsa, and B. Mullerb. (2010). Developing Web-Based Tourist Information Tools Using Google Map. <http://www.ota.cofc.edu/pan/PanCrottsMullerDevelopingGoogleMap.pdf>. Last accessed on May 7, 2011.

Pejic, A., S. Pletl, and B. Pejic. (2009). An Expert System for Tourists Using Google Maps API, 7th International Symposium on Intelligent Systems and Informatics, SISY '09.

Peng, X. and X. Wu. (2010). Digital campus map publishing based on Google Map API Journal of Geomatics, 35(1), pp. 25-27,

Peterson, M. P. (2008). International Perspectives on Maps and the Internet: An Introduction, In M. P. Peterson (Ed.), *International Perspectives on Maps and the Internet* (pp. 3-10), Springer.

Peterson, M. P. (2012). Online Mapping with APIs, *Online Maps with APIs and Mapservices* (M. P. Peterson, ed.), Springer, pp. 3-12.

Roth, R. E. and K. S. Ross. (2009). Extending the Google maps API for event animation mashups. *Cartographic Perspectives*, 64, pp. 21-31.

Scholefield, K. (2008). Web based map services for scientific tourism: a case study of eighteenth and nineteenth century Edinburgh. Master of Science Thesis, <http://hdl.handle.net/1842/2475>.

Udell, S. (2009). *Beginning Google Maps Mashups with Mapplets, KML, and GeoRSS*. New York, NY: Apress.

United States Department of Agriculture (USDA). (2011). People's Garden Initiative. http://www.usda.gov/wps/portal/usda/usdahome?navid=PEOPLES_GARDEN. Last accessed on February 9, 2011.