

Development of an e-Library Web Application

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ABSTRACT

A digital library (or e-Library) is an online collection of digital objects. These objects include text, visual, audio, and video material stored in electronic media formats. A library system also provides means for organizing, storing, and retrieving the information contained in the library collection.

In this paper, we present the architecture and development of a digital library application called *HodHood*. It is a team effort initiated and maintained by al-Huda University in Houston, Texas. The project will build and maintain a platform for all Islamic Sciences, in as many languages as possible or there is authentic relevant material. At the early stage it will form a container for written or published books, articles, videos etc., and eventually grow to translate contents. We utilize state-of-the-art web technologies to develop a demo single-page application to show the functionality of the e-Library system.

Keywords: Digital Library; Content Management, Web based Applications; JavaScript; Mobile-friendly Application, Single-Page Applications

1. INTRODUCTION

An e-Library Application is a web-based document management system. These documents or objects include books, articles, presentations, reports, visual, audio, and video material stored in electronic media formats. These digital content may be stored locally, or accessed remotely via computer networks. A library system also provides some means for organizing, storing, and retrieving the information contained in the collection. Digital libraries can vary in size and scope, and can be maintained by individuals, organizations, or affiliated with established physical library buildings or institutions, or with academic institutions [1].

The aim of the *Hodhood* e-library is to be an encyclopedia of Islamic knowledge with a full research system

consisting of many integrated modules. The encyclopedia will contain two types of contents, namely structured content with searchable and interactive unified web resource, and unstructured contents in the form of free style articles and or books. The project will also include contents related systems including OCR to convert legacy/classical contents to machine readable format, and a Machine Aided Translation System to translate original Arabic content to other languages.

We initially attempted to use Wikimedia [2] as a platform because of the extensive capabilities including, out of the box translation management, multilingual capabilities especially Right to Left (RTL) text display, the community support for Extension Development, and finally the out of the box support for Semantic and Resource Description Framework (RDF). However, we have run into the following challenges:

- 1) Wikimedia is intended for static pages and does not support dynamic pages or natively database-driven pages.
- 2) Categories and Page Templates are very powerful tools to create pages and structure, however, can easily grow out of control and increase the site complexity and troubleshooting.

We decided to use the latest web technologies to design and develop the *Hodhood* e-library. HyperText Markup Language (HTML) describes and defines the content of a webpage. HTML5 is the latest evolution of HTML and includes new attributes and behaviors. HTML5 with JavaScript (JS) and Cascading Style Sheets (CSS3) provide the building blocks for most of the modern browser-based applications.

Single-Page Applications (SPAs) are web-based applications which load a single HTML page and dynamically update the page content as the user interacts with the application through menus and side bars. Fluid and responsive web applications are created, without constant page

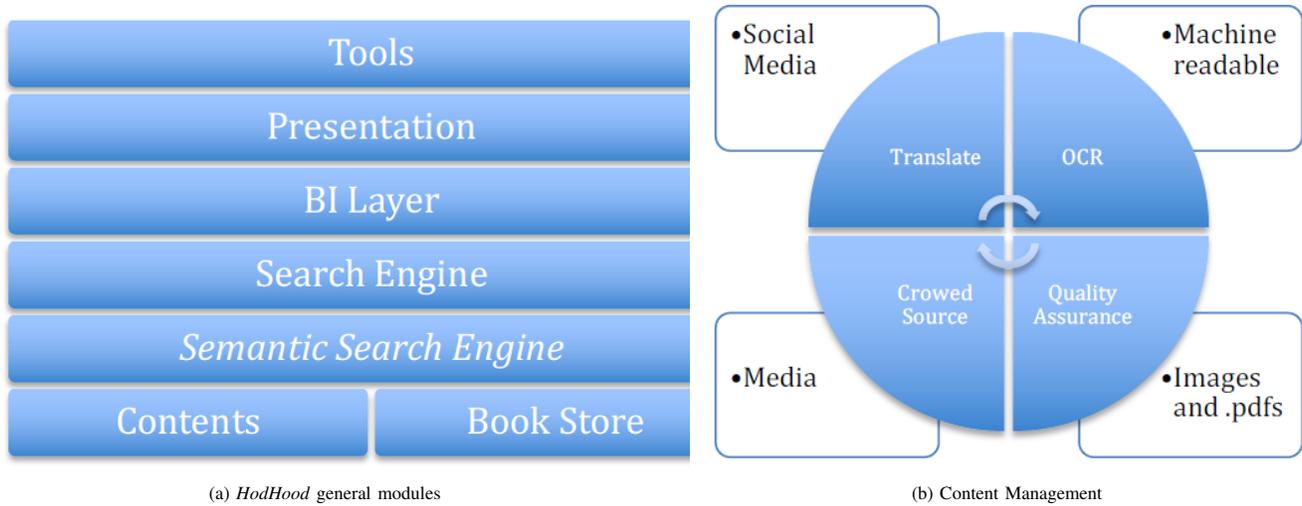


Figure 1: *HodHood* e-Library Architecture

reloads, using AJAX (Asynchronous JavaScript and XML) technology, which communicate with server-side scripts to receive as well as send information in a variety of formats (usually from/to a persistent storage like database). The applications that uses basic functions of persistent storage namely Create, Read, Update, Delete (CRUD) are called CRUD applications.

The rest of this paper is organized as follow. In section 2, we provide some background related to modern web development. We provide the e-Library architecture in section 3. We present the demo application in section 4. The conclusion of our work is provided in section 5.

2. BACKGROUND

In this section, we review some of the JavaScript libraries which are designed for modern browsers and smart devices. These libraries exploited the advancement in HTML5, CSS3 and JavaScript and provide an Application Programming Interface (API) for developer to create web-based mobile-friendly applications. Lightweight frameworks add structure to a web application and offer a way to handle navigation between different views, and typically split the application into layers implementing the Model-View-Controller (MVC) design pattern. These libraries and frameworks are developed using pure JavaScript, so users get interactivity without requiring round-trips to servers and without any additional plugins.

- **AngularJS** is a toolset for building the framework most suited to application development. It is fully extensible and works well with other libraries. Every feature can be modified or replaced to suit unique development workflow and feature needs [3]. AngularJS is often used for creating single-page applications, where only certain portions of the page (sub-views) are updated as a result of the users actions or data being sent from the server. Mobile Angular is another User Interface (UI) framework that is

built on AngularJS and Bootstrap for mobile-friendly application development.

- **Bootstrap** is the most popular HTML, CSS, and JS framework for developing responsive, mobile first projects on the web [4]. It is an open source library of UI components developed by Twitter. The components are built using the responsive web design principles, which makes this library extremely valuable for web applications that needs to automatically adjust its layout depending on the screen resolution.

In one of our previous works [5], we reviewed some state-of-the-art web technologies, third-party libraries and frameworks that can be utilized to fulfill the promise of interactive browser based custom visualization applications. These libraries uses client-based technologies for appending and manipulating Scalable Vector Graphics (SVG) elements, which is supported in almost all modern browsers, smart phones and tablets.

In [6], we presented some interactive and beneficial/Islamic web applications and provided the features, benefits, resources used, and implementation details. In [7], we introduced a novel web based network visualizer and simulator application which utilizes HTML, JavaScript and Bootstrap.

3. HODHOOD E-LIBRARY ARCHITECTURE

The *Hodhood* encyclopedia is a full research system consisting of many integrated modules (Fig. 1a). Each module contributes specific function to the overall user experience. The user may have full access to *Hodhood* functionality or may be limited to specific public features.

The project intends to use Open Source Systems as much as possible. However, certain parts of the project may be accessible through subscribed service to insure reliability and support. The high level architecture shows the general modules of *Hodhood* Islamic encyclopedia (Fig. 1a).

The encyclopedia will contain two types of contents, namely structured content with searchable and interactive

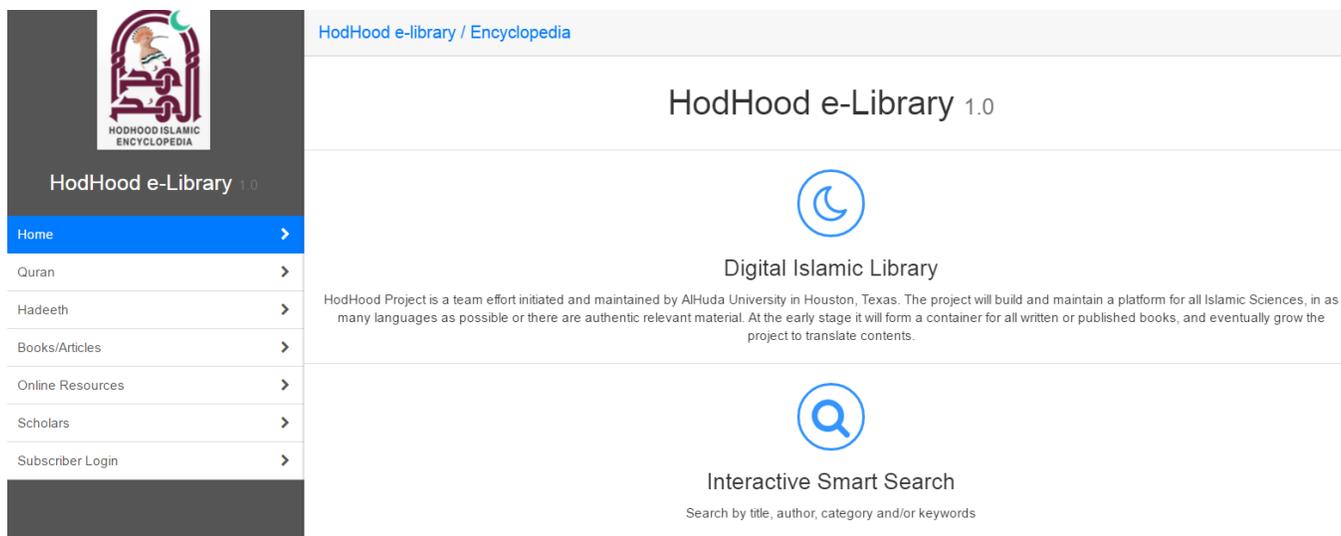


Figure 2: *HodHood* e-Library: Home page

unified web resource, and unstructured contents in the form of free style articles and or books. The project will also include contents related systems including OCR to convert legacy/classical contents to machine readable format, and a Machine Aided Translation System to translate original Arabic content to other languages.

Fig. 1b shows the process to include contents in *Hodhood* Islamic Encyclopedia. It includes extracting machine readable contents, .pdf or images, Media files and Social Media Contents into the HodHood contents processing system including OCR and Translation.

The tools module assists the researcher by providing many systems to view and the research results. It also aids the researcher in producing a professional research paper in terms of annotation, citation and grammar corrections. The book store module will Offer visitors to buy Copy write material. The portal module provides a personalized experience for registered customers to collaborate and cooperate on a given research topic.

3.1. Business Intelligence Module

Business Intelligence (BI) is an umbrella term that refers to a variety of software applications used to analyze an organization’s raw data. BI as a discipline is made up of several related activities, including data mining, online analytical processing, querying and reporting. The Business Intelligence Module intends to provide researchers with tools to perform various data mining procedures.

The tool can also be used by *Hodhood* Islamic encyclopedia to analyze user’s behavior, search key words, time spent in each page per topic etc. to produce valuable information relating to what users are concerned about.

Open source data mining product like *R*, which is a programming language and software environment for statistical computing and graphics supported by the *R* Project for Statistical Computing. The *R* language is widely used

among statisticians and data miners for developing statistical software and data analysis. There are lots of extensions, including graphical representation of Data and a lexical analysis library included as GNU license product. There are also an extensive learning material. *R* also supports Arabic text (UTF-8) and can be used for analyzing Quran and Hadeeth text.

Microsoft Machine learning offers a streamlined experience for all data scientist skill levels, from setting up with only a web browser to using drag-and-drop gestures and simple data-flow graphs to set up experiments. Azure Machine Learning Studio features a library of time-saving sample experiments, *R* and Python packages, and best-in-class algorithms from Microsoft businesses like Xbox and Bing. Machine Learning supports *R* and Python custom code, which can be dropped directly into the workspace [8].

Google Analytics helps analyze visitor traffic and paint a complete picture of the audience and their needs. Reports like traffic sources track the routes people take to reach a page and the devices they use to get there [9].

4. DEMO APPLICATION

We have utilized the technologies and libraries introduced in previous sections and developed a fully-functional demo application. In this demo, we have developed some important framework including database and interactive and responsive user interface for quick access to information. Fig. 2 shows the main page of the application. This demo shows the ease of use, maintainability, simplicity to add features and functions without requiring specialized skill set. The demo application is hosted on Apache web server on Linux operating system. MySQL database is utilized to store all related into appropriate tables and to perform SQL queries (simple or complex) to search within the tables. We are using PHP for server-side scripts to access the information from the MySQL database.

HodHood e-library - Qur'an

Surah Stats Search Word Cloud

List of Surah/Chapters

#	Name	Meaning	Arabic	No. of Ayat/Verses	No. of Ruku
1	The Opening	Al-Fatiha	الفاتحة	7	1
2	The Cow	Al-Baqara	البقرة	286	40
3	The family of Imran	Aal-e-Imran	آل عمران	200	20
4	The woman	An-Nisa	النساء	176	24
5	The Table Spread	Al-Meada	المائدة	120	16
6	The cattle	Al-Anaam	الانعام	165	20

Figure 3: HodHood e-Library: Quran section

HodHood e-library - Hadeeth

Sahih Bukhari Sahih Muslim Sunan Abi Da'ud Jami' al-Tirmidhi Sunan an-Nasa'i Sunan Ibn Majah Riyad as-Salihin

Sahih Bukhari

search

Id	Ref	Text	Arabic
1	Reference: Sahih al-Bukhari 1 In-book reference: Book 1, Hadith 1 English translation: Vol. 1, Book 1, Hadith 1	Narrated 'Umar bin Al-Khattab: I heard Allah's Apostle saying, "The reward of deeds depends upon the intentions and every person will get the reward according to what he has intended. So whoever emigrated for worldly benefits or for a woman to marry, his emigration was for what he emigrated for."	حَدَّثَنَا مُحَمَّدُ بْنُ أَبِي عُمَرَ، قَالَ سَمِعْتُ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ يَقُولُ: "إِنَّمَا الْأَعْمَالُ بِالنِّيَّاتِ، وَإِنَّمَا لِغَيْرِ اللَّهِ مَا نَوَى، فَمَنْ كَانَتْ هِجْرَتُهُ إِلَى دُنْيَا يُصِيبُهَا أَوْ إِلَى امْرَأَةٍ يَتَّكِفُهَا فَهِيَ حِجْرَتُهُ إِلَى مَا هَاجَرَ إِلَيْهِ."
2	Reference: Sahih al-Bukhari 2 In-book reference: Book 1, Hadith 2 English translation: Vol. 1, Book 1, Hadith 2	Narrated 'Aisha: (the mother of the faithful believers) Al-Harith bin Hisham asked Allah's Apostle "O Allah's Apostle! How is the Divine Inspiration revealed to you?" Allah's Apostle replied, "Sometimes it is (revealed) like the ringing of a bell, this form of Inspiration is the hardest of all and then this state passes off after I have grasped what is inspired. Sometimes the Angel comes in the form of a man and talks to me and I grasp whatever he says." 'Aisha added: Verily I saw the Prophet being inspired divinely on a very cold day and noticed the sweat dropping from his forehead (as the Inspiration was over).	حَدَّثَنَا عَبْدُ اللَّهِ بْنُ يُوسُفَ، قَالَ أَخْبَرَنَا مَالِكٌ، عَنْ هِشَامِ بْنِ غَزْوَةَ، عَنْ أَبِيهِ، عَنْ عَائِشَةَ أُمِّ الْمُؤْمِنِينَ - رَضِيَ اللَّهُ عَنْهَا - أَنَّ الْخَارِثَ بْنَ هِشَامٍ - رَضِيَ اللَّهُ عَنْهُ - سَأَلَ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ فَقَالَ يَا رَسُولَ اللَّهِ كَيْفَ يَأْتِيكَ الْوَحْيُ فَقَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ " أحياناً يأتيني مثل صلصلة الجرس - وهو أشده علي - فيفصم عني وقد وعيت عنه ما قال، وأحياناً يتمثل لي الملك رجلاً فيكلمني فأعي ما يقول ". قالت عائشة رضي الله عنها ولقد رأيتُه ينزل عليه الوحي في اليوم الشديد البرد، فيفصم عنه وإن جبينه ليَتَقَشَّدُ عَرَفًا.

Figure 4: HodHood e-Library: Hadeeth section

- We have complete Quran database with English Translation and Transliteration. All Chapters or surah are listed to easily drill into each chapter and then to each verse or Ayah (Fig. 3). Sentiment and word frequency analysis results are also displayed.
- Hadeeth database includes information from six major collections. Hadeeth text is displayed in Arabic and English and also show the authenticity of the hadeeth. Multi-language search within each collection is also available (Fig. 4).
- Books and Articles section contain some sample materials under major categories. The material can be downloaded with one click. Each material is displayed with its metadata including author name, keywords, summary, etc. (Fig. 5)
- Online Resources section include external links to some open-access journals in Education, Finance and Economics. The user can also search within those open-access resources (Fig. 6).
- Scholars section provide access to Muslim scholars of first three centuries. This includes Companions, Followers, Successors and 3rd Century scholars. Information is retrieved from muslimscholars.info website [6]. Multi-language search within each category of scholars is also available (Fig. 7).

HodHood e-library - Books

All Qur'an Hadeeth Aqeedah Seerah Akhlaq Fiqh Finance History Education

All

Name	Authors	Category	Type	Access
Is Kindergarten the New First Grade?	Daphna Bassok, Scott Latham, Anna Rorem	Education	Article	html pdf
A Short Review of the Historical Critique of Usury (Riba)	Wayne A.M. Visser and Alastair McIntosh	Finance	Article	Download
Sharh 'Umdah al Fiqh	Ibn Qudama	Fiqh	Book	Part 1 Part2
Enjoy Your Life	Dr. Muhammad Adb Al-Rahman Al-Arifi	Seerah		English
200 Golden Hadiths	Abdul Malik Mujahid	Hadeeth		English
Bulugh Al-Maram	Ibn Hajar Al-Asqalani	Hadeeth		English
Atlas of the Quran	Dr. Shawqi Abu Khalil	Qur'an		English Arabic
Shariah Opinions (Fatwa) On Murabaha	Dr.Abdul Sattar Abu Ghuddah	Finance		English
Explanation of al-Aqeedatul-Hamawiyyah	Saaleh al-Uthaymeen	Aqeedah		
Sharh Aqeedah al-Tahawiyyah	Ibn 'Izz Al-Hanafi	Aqeedah		part 1 Part 2

Figure 5: HodHood e-Library: Books/Article section

HodHood e-library - Resources

Online Resources

Name	Category	Search	Access
AERA Open	Education	<input type="text" value="search"/> ↗	http://journals.sagepub.com/articles/ero?pageSize=100 ↗
Cogent Education	Education	<input type="text" value="search"/> ↗	https://www.cogentoa.com/journal/education/volume/4 ↗
Current Issues in Comparative Education	Education		http://www.tc.columbia.edu/cice/current-issue/ ↗
Early Childhood Research & Practice	Education		http://ecrp.uiuc.edu/bytitle.html ↗
Open Review of Educational Research	Education	<input type="text" value="search"/> ↗	http://www.tandfonline.com/toc/rer20/current ↗
Education Sciences	Education	<input type="text" value="search"/> ↗	http://www.mdpi.com/journal/education ↗
Cogent Economics & Finance	Economics & Finance	<input type="text" value="search"/> ↗	https://www.cogentoa.com/journal/economics-and-finance/volume/5 ↗

Figure 6: HodHood e-Library: Online Resources section

5. CONCLUSION

We highlighted the importance and significance of an e-Library system. We presented some of the latest framework, web based tools and libraries available today for mobile-friendly responsive browser-based applications. We utilized these framework to developed an interactive and responsive e-Library demo application. This system also facilitate research and education in the related areas.

As future work, we will continue building on the e-library application to add new features, improve user friend-

liness and performance. This includes applying data mining and analytics to extract useful information and links between different resources.

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HodHood e-library - Scholars

Companions (Sahaba, RA) Followers (Tab'a'een) Successors (Taba' Tab'a'een) 3rd Century (Taba' Taba' Tab'a'een) Advanced Search

Companions (Sahaba, RA)

Id	Rank	Famous Name	
2	Companions (Sahaba, RA)	Abu Bakr As-Siddique	أبو بكر الصديق رضي الله عنه
3	Companions (Sahaba, RA)	'Umar ibn al-Khattab	عمر بن الخطاب بن نفيل رضي الله عنه
4	Companions (Sahaba, RA)	'Uthman ibn 'Affaan	عثمان بن عفان رضي الله عنه
5	Companions (Sahaba, RA)	Ali ibn Abi Talib	علي بن أبي طالب بن عبد المطلب رضي الله عنه
6	Companions (Sahaba, RA)	Talha ibn 'Ubaidullah	طلحة بن عبيد الله رضي الله عنه
7	Companions (Sahaba, RA)	Zubayr ibn al-Awwam	الزبير بن العوام بن خويلد رضي الله عنه

Figure 7: HodHood e-Library: Scholars section

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