

## Cloud-based Online Portal and Mobile Friendly Application for the Holy Qur'an

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**Abstract:** The impact of increased and varied mobile phone applications in the context of Qur'an is growing rapidly. Qur'an-based software products have been developed at the cutting edge of technological innovation. The developers and content providers do try to respond with applications which focus on specific Muslim branches and affiliations, as well as particular requirements of Islam. The paper deals with the design and development of a cloud based comprehensive online Qur'an portal, which can be accessed using any Internet enabled device. The main idea behind this work is to design and develop a dynamic portal, which makes all the reading and resource sections of it accessible to the audience across the Internet, whether they are using laptops, PCs, mobile, tablet, or personal digital assistants. The portal covers many aspects related to Qur'an, such as 'Al-Mus'haf', 'reciter', 'translation', 'study materials', 'videos of scholars on Tajweed', etc. The application provides a specific widget interface on a mobile phone, enabling quick access and implementing the specific multimedia features of a mobile phone. Among other features, the outcome of this work yields a resource center for Da'wah to the learners of Qur'an, whether they are students, teachers, or general public. Features like discussion forums, applications to help memorize Qur'an, Qur'an search engine, etc. are also implemented. In order to help non-Arab users, an authentic translation of Qur'an is also made available. A transliteration of Qur'an in Urdu is developed for people who cannot read Urdu but understand it. A mobile interface is created for the Qur'an portal, making it easy and efficient to be accessed from modern mobile devices, which have limited screen size. This will promote the use of Qur'an portal and associated tool from mobile phone. It is anticipated that the outcomes of this work will foster community by educating people about the Qur'an through a comprehensive portal dedicated to serve Muslims.

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### 1. Introduction

For Muslims, Qur'an is the revelation from God sent to mankind through Prophet Muhammad (peace be upon him). Thus studying and learning the Holy Qur'an plays a central role in the life of Muslims. With the proliferation of information technology, a large numbers of software and web-portals have been developed to make this learning process ever easier than before. These applications cover various aspects of Qur'anic knowledge, like reading, memorizing, recitations (both listening and practicing), semantic search of the Qur'anic text, etc. With the advance of smart phones technology and vast availability of Internet, many applications for Qur'an are being built for mobile devices.

In addition to the various applications on Qur'an, a number of research works are reported on Qur'anic text, like automatic text categorizations, semantic search in the Qur'an, recognition and correction of recitations, etc. A survey of the current tools and techniques for Qur'an reveals the following main fields of the Holy Qur'an studies:

- Reading with *Tajweed* (rules of recitation of the Qur'an).
- *Tafseer* (explanation of the Qur'anic verses).
- Translation and Transliteration of the Qur'anic verses (called *ayats*).
- Memorization of the verses of the Qur'an.
- Searching for verses/words of Qur'an, including semantic search.
- Qur'an Recitation and Bookmarks
- Authentication of Qur'anic verses available in various online documents.
- Speech Recognition technologies for learning Qur'anic recitations.

Although these available Qur'anic applications facilitate learning the Holy Qur'an, they lack a unifying framework under which a complete Qur'anic portal can be developed. Any applications on Qur'anic text need to be developed from scratch and the currently available applications have little to offer to the developers to facilitate the development tasks.

This work attempts to address this state of the art in Qur'anic applications development. The present work has two main goals in terms of developing a

framework and a Qur'anic portal. In the first case, various aspects of a complete Qur'anic portal have been identified through comprehensive survey of the existing tools and methodologies. Design issues and requirements are analyzed for these aspects. The outcomes of this approach include a cloud based API system for developing Qur'anic portals and applications. The API is designed in such a way that it facilitates the development of applications targeted for smart devices.

The other aspect of this work is the development of a complete cloud based Qur'anic portal, designed for any devices having Internet access. The portal is designed and developed under a unifying framework that includes various aspects of Qur'anic studies. The portal is designed with both portability and ability of extension of mind. Portability is achieved through the use of state of the art technologies for implementation. The functionalities of the portal can be extended in various ways. The core API of our system is made reusable, through which new Qur'anic applications can be built. In addition, the portal is designed to serve users of different languages. The system is designed in such a way that translations and transliterations of Qur'anic text in any language can be integrated with the portal without disrupting the core functionalities.

The current implementation of the Qur'anic portal is available in multiple languages and serves as a personal evaluation platform. It also includes a transliteration of Holy Qur'an for people who cannot read Urdu language. In addition to the development of the Holy Qur'an applications for non-Arabic (like Urdu speaking) users, the Qur'anic portal is designed to be highly usable and easy to use Holy Qur'an tool, and be accessible from Internet enabled devices irrespective of their platform. The portal hosts a central Holy Qur'an API and promotes creation of tools for the Holy Qur'an.

In addition to the various 'computational outcomes' of this work, this research work aims to create a platform for people to track their faith and deeds and improve upon them and to promote the creation of tools for studying and doing research on the Holy Qur'an. Through this, the Qur'anic portal become spiritually more satisfying for the researchers involved in this work.

## 2. Related work

Traditionally, Qur'an has been studied in the form of a book (called *mushaf*), in addition to the verbal preservation and transmission of Qur'an. With the availability of the tools for digitization (Muhammad, 2013), a variety of Qur'an related applications and software have been developed to cater the needs of online and offline users. These applications have been enhanced with multimedia

contents with the advancement of technology. With the wide availability of Internet, users are now able to browse a great number of websites and learn about Qur'an, *Hadith* (Prophetic traditions) and other Islamic literature. Most of these applications and websites are built from scratch, which increases the development and testing time. In this work, we present a unifying framework to facilitate the development of a wide variety of Qur'anic applications, both for web based (like Qur'anic portals) and device/mobile based (like iPhone and Android apps) applications using cloud computing techniques. Cloud techniques utilized in this work facilitates many tasks, such as accessing the data from anywhere, easiness in updating the contents, enhanced security of the information, reduced cost of development and maintenance, better control over data and performance, etc.

Before we discuss the general framework for a Qur'anic portal and the design issues related to it, we discuss the existing work on digitized Qur'anic text. This enables us to identify various 'computational' aspects that a digitized Qur'an offers to researchers. Therefore, this section gives a brief review of related work in the literature and the context of portal and web sites that are dedicated to computer applications concerning Holy Qur'an.

### Research Efforts

Researchers have attempted to apply various computational techniques in the context of Qur'an. Most of these work have focused on searching the Qur'anic text, utilizing both traditional string-based techniques and more advanced semantic search tools. Some researchers have utilized morphological operations for improving the search results.

A diacritics-less searching approach for Qur'an was proposed in (Hammo, 2007). Their approach utilizes a relational database search engine which is portable across RDBMS platforms. (Hikmat, 2013) suggested that an ontology of semantic web can be applied for carrying out semantic search in Holy Qur'an. Exploratory search was made from semantic web field of knowledge. Also, (Aliyu, 2013) proposed an ontology assisted semantic search system in the Qur'an domain. The system makes use of Qur'an ontology and various relationships and restrictions and reported 95% accuracy level. (Alaa, 2011) used formal methods for Natural Language Processing in a Qur'anic search system (QSS) to allow search using keywords in the Qur'an and retrieve the relevant verses. (Robiah, 2000) dealt with the ways to improve the view, access and retrieval of the content of *Surah AlBaqarah* effectively.

A cross language information retrieval (CLIR) system is presented by (Mohd, 2013). They described queries for retrieving more relevant results in CLIR, concentrating on Arabic, Malay or English

query translation (a dictionary based method) to retrieve documents according to query-translation. According to this study, the semantic ontology significantly improves and expands the single query itself with more synonym and related words. (Noor, 2013) provided a structural overview of speech recognition system for developing Qur'anic verse recitation recognition with *tajweed* (rules for recitation of Qur'an) checking. In their work, a function has been introduced to support the existing and manual method of *talaqqi* and *musyafahah* method in Qur'anic learning process. An automatic speech recognizer for Qur'anic based speaker-independent was developed and tested by (Ehab, 2007). The system was developed based on the tri-phone Hidden Markov Model and Maximum Likelihood Linear Regression (MLLR). (Yacine, 2011) described the process of designing a task-oriented continuous speech recognition system for Arabic, used in the voice interface of a Qur'anic reader. The authors presented the concept of the voice-controlled Qur'anic reader and the collection of the corpus and creation of acoustic model, taking into account the specificities of Arabic language and the desired application. (Samir, 2007) presented a speech-enabled Computer Aided Pronunciation Learning (CAPL) system called HAFSS. This system was designed to teach the rules for recitation of Qur'an and Arabic pronunciations to non-native speakers. (Imran, 2012) proposed a method for representing the Qur'anic text corpus as a graph, and applied a frequent sub-path mining algorithm on it to generate frequent patterns. These frequent patterns were then used for subjective indexing and clustering of similar verses in Qur'an.

Automatic classification of the verses (called *ayat*) of Surah (Chapters) *Fatiha* and *Yaseen* was presented by (Mohammed, 2005). Their proposed text categorization was based on the traditional linear classification function. (Azman, 2013) attempted to represent and classify Qur'anic knowledge using ontology. (Muhammad, 2008) categorized surahs by word-length. A software tool for categorizing any verse of Qur'an to one of predefined categories was reported in (Naseem, 2012). An approach to verify the e-citation of the Qur'anic verses as compared to the original texts from the Qur'an was proposed by (Alshareef, 2012). (Yasser, 2013) proposed an algorithm to verify the authenticity of Qur'anic quotes/verses. They tested the system using Qur'an verses found in online Arabic documents to detect any tampering or unintentional mistakes during the dissemination of such documents. (Zaidi, 2008) provided a comprehensive review of Qur'an Arabic verse recitation recognition, focusing on the techniques used with their advantages and drawbacks.

(Dukes, 2010) presented the Qur'anic Arabic Dependency Treebank (QADT) and discussed the

application of NLP techniques to the unique and challenging language of the Qur'an. (Mohsen, 2012) reported a system to detect and highlight Qur'anic verses in mixed documents. Some machine learning techniques for the classification of Makki and Madani surahs of the Qur'an are used by (Abdel-Aal, 2010). (Qurat, 2011) proposed a framework called 'DataQuest' for modelling and retrieving knowledge from distributed sources related to the scholarly texts about Qur'an. They utilized semantic web, information extraction and natural language processing techniques. (Elhadj, 2010) attempted to develop an environment for self-learning of the Qur'an and its sciences. (Razaly, 2010) proposed a system to enable the visually impaired Muslims to learn and read the Qur'an using Braille Display. (Zameer, 2013) developed a complete and comprehensive online cloud-based Holy Qur'an portal.

### **Qur'anic Applications**

A large number of applications, both online and offline, have been developed over the years to facilitate the use of Qur'an. These applications mainly focus on searching the Qur'an text or playing Qur'anic recitations. Some applications have facilities for memorizing the Qur'an, reading the explanations of Qur'anic verses (called *tafseer*), etc. We identify the key functionalities provided through these applications that serve as the preliminary functionality requirements for our framework.

The Qur'an Mobile software ([www.quranflash.com](http://www.quranflash.com)) enables users to read the Qur'an in Arabic alongside its translation on users' portable devices. The Qur'an and Hadith portal site ([www.alim.org](http://www.alim.org)) focuses on various Islamic contents, including *tafseer* (explanation of Qur'an), hadith, Muslim history and provides tools for studying Islam and memorizing the Qur'an. In general there is an effect of e-learning via the Internet or through a mobile phone to improve memorizing of the Qur'an (Zahra, 2013), and *tajweed* understanding (Aslam, 2012) (Noraziahtulhidayu, 2012).

Transliteration is the representation of letters or words from one language in the corresponding characters of another language. The Qur'an Transliteration site ([transliteration.org](http://transliteration.org)) helps non Arabic speakers to read and recite the Holy Qur'an. Al-Mudarris Qur'an Software ([www.al-mudarris.org](http://www.al-mudarris.org)) can be used for basic recitation of the Qur'an, memorization of the verses, reading and learning translation of the meanings of Qur'an in different languages, and researching the Qur'an with additional tools like bookmarks and notes. In addition, verses can be copied and used in presentation software and documents. Live Qur'an Tutoring ([www.quraninteractive.com](http://www.quraninteractive.com)) software enables live one-to-one tutoring in categories like basic Qur'an

reading lessons, Qur'an reading with tajweed (recitation rules), Qur'an translation, Qur'an memorization, Qirat (reading) competition, and basic Islamic knowledge. Pocket Qur'an Website ([www.pocketquran.com](http://www.pocketquran.com)) is available various different platforms. Al-Qur'an Terjemahan (mobile.afreecodec.com) is a new application for reading the translation of the Qur'an in the Malay language. Zaidi displays the most suitable method to be used in learning of Quranic sentence (Zaidi, 2008).

In addition to aforementioned software tools and web portals, there are a number of Qur'anic applications designed for portable devices. Many such application are available in ([quran.worldofislam.info](http://quran.worldofislam.info)). 'Palm Qur'an' Software is a complete Holy Qur'an in Arabic on the Palm Pilot. 'Pocket Qur'an' software comes with features like display with 'Othmanic' typeset with Naskh and Koufi fonts, horizontal and vertical Qur'an display, search capabilities including search for all 'word root' derivatives, and word highlight. 'Pocket Islam' contains Hadith in Arabic with tashkil (diacritical marks), prayer table, prayer schedule with Azan, Qibla according to user location and position of the sun. 'Qur'an Reader' software allows users to read the translation of Holy Qur'an with the feature of saving and retrieving bookmarks, as well as browsing to a particular verse inside a Surah. 'Noble Qur'an' software includes a transliteration, surah introductions and English translation. 'Qur'an Viewer' has Qur'anic commentary, transliteration, index, glossary, and search option. It supports plug-in Qur'an translations allowing translations into multiple languages. Qur'anic verses can be compared in any installed language. Other features include computer generated Mushaf pages of the original sacred Arabic text, as well as an advanced manuscript viewer. 'Qur'anTrans' software is a collection of three translations of the Holy Qur'an.

Among other applications on Qur'an include iQur'an III ([www.guideways.com](http://www.guideways.com)) software for iPhones and iPod with Qur'an in the Uthmani font along with color coded *tajweed* (pronunciation), verse by verse translation and recitation. Qur'an Recitation (mobiappmax.com) software provides features like audio files compressed in AMR format for reduced storage requirements. The web portal in (Qur'anExplorer.com) features audio translation. The Qur'an Majeed ([www.ecrore.com](http://www.ecrore.com)) software provides services of online search, facilities to read Qur'an in Arabic, Urdu and English and the facility of bookmarking. The Zekr Qur'an ([zekr.org](http://zekr.org)) is featured with searching, navigation, recitation, and commentary allowing customization, with translations in many languages.

The Qur'an Android (mobile.afreecodec.com) is a free, open source application that provides index,

downloadable audio recitations, ayah bookmarking, ayah share, various translations and tafseer. For memorization of Qur'an, 'Verse by Verse Qur'an' ([www.versebyverseQuran.com](http://www.versebyverseQuran.com)) provides users with access to the Qur'an in MP3 format separated into individual verse. As regard to developing Qur'an related applications, Complete Qur'an Site Code (github.com), developed with GlobalQur'an API in Java Script, is available online, where developers can use it with their own layouts.

The Holy Quran ([quran.ksu.edu.sa](http://quran.ksu.edu.sa)) has scanned copy of real printed *mushaf*, with recitations by many reciters, search feature, commentary, translations in several languages, voice translation of the Holy Quran. Holy Quran Android ([www.holyquranandroid.com](http://www.holyquranandroid.com)) is a Qur'an portal to read or memorize Quran, along with search capability to search in the translation of whole Quran.

In addition to the above, there are a number of tools for facilitating the memorization of Qur'an. Quran Memorisation (Hifz) ([www.qurantracker.com](http://www.qurantracker.com)) has various features like Hifdh Target (to set the time frame for memorization), Hifdh Review Counter, Revision Planner, Revision History, Quran Recitation, Translation, etc. Quran Memorizer ([www.islamcity.com](http://www.islamcity.com)) allows to repeat and loop a range of verses with a verse-by-verse transliteration and translation in English.

Quran Memorization online ([www.houseofquran.com](http://www.houseofquran.com)) also allows repetition of verses, and can test users' memorization by using the 'Test Mode', which basically simulates a Quran teacher. Using Quran Memorization program ([www.imaanstar.com](http://www.imaanstar.com)), users can create their own profiles for memorization, loop ayas or surahs etc.

### 3. The Techniques and Methodologies

This section gives a brief review to the main features and techniques that used in the application; Figure 1 illustrates the basic architecture of the application.

Cloud computing as mentioned before is one of the most important pillars of this application, that we can be defined as an expression that is used to describe a variety of computing concepts that involve a large number of computers connected through a real-time communication networks such as the Internet. In science, cloud computing is a synonym for distributed computing over a network, and means the ability to run a program or application on many connected computers at the same time. The phrase also more commonly refers to network-based services, which appear to be provided by real server hardware, and are in fact served up by virtual hardware, simulated by software running on one or more real machines. Such virtual servers do not physically exist and can therefore be moved around and scaled up (or down) on



the fly without affecting the end user - arguably, rather like a cloud.

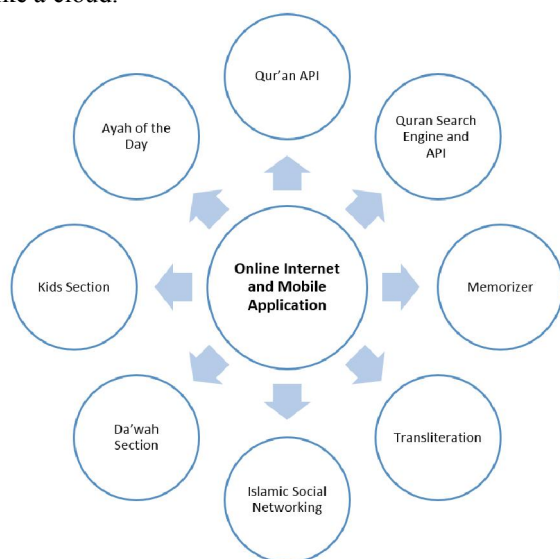


Figure 1. Basic Architecture of the Application

In our case the Qur'an Project runs from a central server, the web application, Musaf and all the features lies in the server. This means the end user just need an internet enabled device to access it. It can be a PC, Laptop, Tab or even an Internet enabled Television. This increases accessibility to tools we build. Another advantage is ability to provide API, which is different application conventional software installed in the computer or mobile or another cloud application can interact with out a web app. We can receive and give information. For example, our portal allows other applications to use the Qur'an data securely. This is made possible by the Cloud Technology. It also easy to manage update when on cloud. We don't have to make everyone update their software. We just update it in server and all gets the latest from that moment onwards. All technologies are moving to cloud. For example Google Docs is replacing MS Office. With high speed internet access to being available for more and more people the future is clear.

#### Portal design

Design and development of the portal includes:

a) **Ux., UI mockups and design:** Development of User Experience, user interface mockups and interface designs are progressing quite successfully, and are near completion. Once these parts are completed, these will be integrated into the 'Drupal 7 Instant created'. More extensive interfaces are being developed and are expected to reach to their final stages. Several aspects have been explored while designing these pages. It has been made sure that the site is free from errors, easy to navigate, and

convenient to follow. International design standards have also been followed throughout the design of webpages and interfaces.

b) **Local Test Environment:** Local test environment with all required applications and servers etc., have been setup. Packages such as Apache server with all required configuration, PHP5, several PHP and apache modules etc., have also been setup. MySQL has been installed to serve the database requirement of the portal. In future, this will have to be replicated on the server, once the server machine is received.

c) **Drupal Deployed and Configured:** A fresh Drupal 7 Instant has been Installed with standard profile and configured with the right modules required for various data. Various commonly used modules, e.g., Views, Ctools, Entity, Entity API etc. have been installed along with the deployed Drupal.

d) **Drush For streamlined and Faster control of the instant:** Drush command line tool to control the Drupal Instant has been installed. This allows easier access & faster management of the site, from command line interface, and easy back up and update of the data.

#### Multi-lingual feature design

There are hundreds of Islamic portals and websites dedicated for Holy Qur'an, but all portals are not multi lingual or fail to give a complete all in one portal or fails in making it easy for end users to use. We have included this powerful feature in our project. Following items are included in the multi-lingual section of the Portal design.

a) **Multi-Lingual Support:** Multi-Lingual support is also being incorporated in the portal design, for the support of content in other languages from the same admin interface, and also to give the user easily accessible ways to change language and interface whenever required. In future, we would require a server in order to host test server intensively.

b) **Support for Urdu and Arabic Language:** Urdu and Arabic interfaces are added to the portal screen. This allows the users to switch to any language from the home page or any inner page. Support of 'rtl' for Arabic is added in theme level. The website will also accommodate a language specific search feature. We have followed i8n standard for implementing the internationalization.

c) **Transliteration of Urdu language:** Transliterate is to represent (letters or words) in the corresponding characters of another alphabet. The website is successfully setup for transliteration of entire Holy Qur'an. This powerful feature will help non Arabic speakers to Understanding the Holy Qur'an. This help people who speak Urdu but cannot read Urdu language. Transliteration of entire Holy Qur'an was a major task to achieve as it required word

by word transliteration. We could not find accurate results with various other tools and software, therefore we decided to do it word by word. Entire transliteration has also been verified. Reader is requested to refer to screenshots of the transliteration of Urdu language, which are included in this report.

### User login interface design

User login interface has been successfully installed. When users create their own account they can set the password. But when the account is created by admin, they can give the password. This behaviour can be configured. When user logs in for the first time, the portal admin sends him a password to his registered email, then the can login if he wants, can also resets his password as he likes.

### Ayah of the day section design

Ayah of the day feature has also been successfully developed. This part of the Portal site, shows one ayah each week and give its meaning with a brief explanation. This way, users will get a chance to learn Holy Qur'an on daily basis.

### Da'wah section design

Interface pages of this section are designed. This section contains Da'wah materials, authentic books, study materials, training videos, experiences from new reverts to Islam, etc. This section will help and attract Muslim youth to join portal and share materials and learn much about Islam.

### Memorizer

A feature to help users learn/memorize Qur'an using well tested method like playing the ayah repeatedly then, fading or removing words automatically, and allowing them to check if correct etc. Allow them to mark their progress in their user account. Also, give option to test those Surah's learned so far. Memorizer allows user to create a new learning instant or use previously created one. Once the memorizer is started, Steps of memorizer area) It loads the first ayah from the instant. In addition, allow you to read, listen to it and then once you are confident enough, to check by reciting. Once you are done, you can either mark it done or maybe progress without marking it done for learning later, b) If checking is success/ or user advances to the next ayah, the same process is continued. The next ayah is loaded. User can go through the same processes, c) In each step, system checks if the ayah is last one in the instant, and d) The progress is updated in the DB, example when the user mark they finished the ayah etc. So that it won't be shown to them again. Figure 2 displays a flow diagram of memorizer.

### Kids section design

Main pages for Kids section are developed. This section caters the younger generation, to learn about Holy Qur'an, and hadith etc. This section will have stories from Holy Qur'an and hadith etc.,

presented in a way that is comprehensive to their ages. While designing this section of the portal, the needs of children have been fully considered.

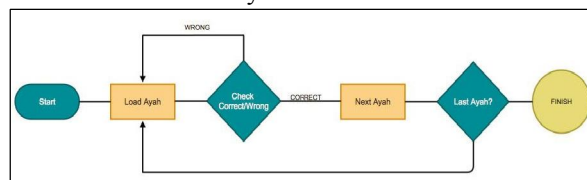


Figure 2. Flow diagram of Memorizer.

### Islamic social networking section design

This feature provides linking, integration and networking of users on social websites, such as users Facebook and twitter. This will help to drive users in and retain them in Daw'ah section. It will also give users, some training, resources etc. material. Moreover, it will serve to educate people to become good messengers of Islam, by giving them authentic knowledge about Holy Qur'an and Hadith.

### Holy Qur'an API design

This section has been fully designed, developed and implemented. Thorough testing has also been carried out to check the functionality of it. The Holy Qur'an API aims to create a centralized database of Holy Qur'an, where in third party applications or websites can be browsed. The API can boost the creation Holy Qur'an based tools and result in innovations in the field at a faster pace as it drastically reduces cost of creation of Holy Qur'an based tools. It is also expected that this can reduce the applications in using non-standard or erroneous Holy Qur'an Text in their applications or websites. Some of the main features of Holy Qur'an API are listed below:

- Seek the Holy Qur'an text through API.
- Ability to compare ayah and check for error.
- Get Holy Qur'an data using API.
- Get the meaning of an ayah.
- Search Holy Qur'an by entering parameters, such as, Ayah number, Surah name, etc.
- Ability to see the result in a format of choice, like plain text etc.

### Holy Qur'an search engine design

Holy Qur'an search section has also been successfully completed. It allows users to search the text of the Holy Qur'an and its translation with ease. The tool will aim to be an assistant for people searching Holy Qur'an. Some of the intended features of this facility are listed below:

- Allow users to search Holy Qur'an by pasting any words or ayah (full text search, like in Google).
- Allow users to search by using filters, like selected Surah's or within ayah range.
- Allow users to search in translations and transliteration.

- Cross language search
- Ability to search for commentaries, articles and translation of Holy Qur'an.
- Ability to search ayah based on topics.

#### 4. The Implementation

In this section of report, we shall present a detailed account of technical aspects related to project, which include, system development architecture, software and hardware specifications, list of software required to implement the entire system, design and development stages of various parts of the whole system, along with its sub-systems. This section also provides details about how various features of the portal and its sections have been designed and developed.

##### 4.1. Platform development

In this project, we have used LAMP platform to develop the Holy Qur'an portal, search and API features. It is worthwhile to mention that in modern times, this platform is used by important sites, such as Government organizations, banks and multi-national companies, e.g., Google, as this platform provides robustness, and security. Figure 3 shows the system architecture of a typical LAMP portal, used in our project.

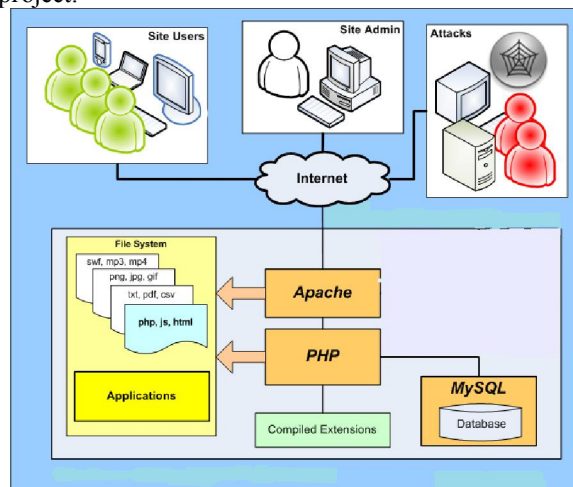


Figure 3. Structure of a typical LAMP Portal (Source: Bodvoc Ltd. 2010)

The technology stack of ours includes PHP, MySQL, Apache, Drupal 7, Gnu/Linux OS, and Twitter Bootstrap. Drupal is a free and open-source content management framework (CMF) written in PHP and distributed under the GNU General Public License. Many websites uses Drupal worldwide ranging from personal blogs to corporate, political, and government sites including whitehouse.gov and data.gov.uk. It is also used for knowledge management and business collaboration. And for building platforms such as ours. The standard release of Drupal, known as Drupal core, contains basic features common to

content management systems. Huge platforms that are scalable, flexible and secure can be built on top of this. We have used Drupal to build the platform.

##### 4.2. Technology stack used in the application

The technology stack of our project includes PHP, MySQL, Apache, Drupal 7, Twitter Bootstrap. Stack of these technologies can be shown in a top-level structure, as depicted in Figure 4. It shows Drupal, PHP, Apache, and MySQL components of the stack. It also shows how site admins and site users interact with the stack of technologies. This is a rather more simplified form of the diagram shown in Figure 3.

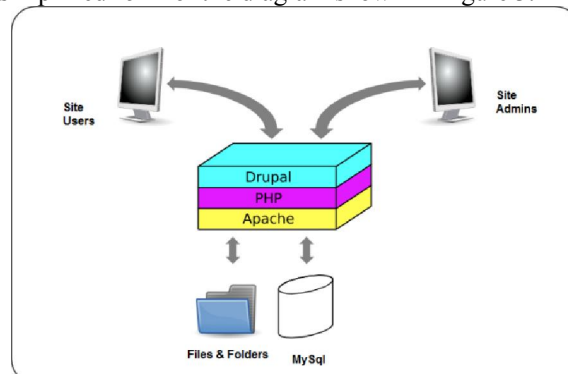


Figure 4. Diagram showing stack of technologies used in our project

Many technologies have been used in this project such as PHP, MySQL, Apache, and Drupal (<http://www.drupal.org>) which is a free and open-source content management framework (CMF) written in PHP and distributed under the GNU General Public License. Many websites uses Drupal worldwide ranging from personal blogs to corporate, political, and government sites including whitehouse.gov and data.gov.uk. It is also used for knowledge management and business collaboration. And for building platforms such as ours.

The standard release of Drupal, known as Drupal core, contains basic features common to content management systems. Huge platforms that are scalable, flexible and secure can be built on top of this. Figure 5 describes in brief the Drupal environment with its main components, Figure 6 shows a bird's eye view of Drupal architecture

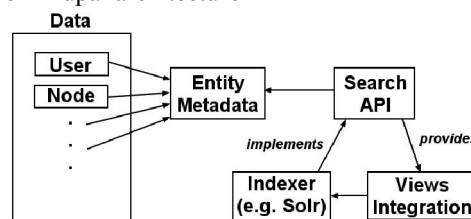


Figure 5. Pictorial view of Drupal environment with its main components.

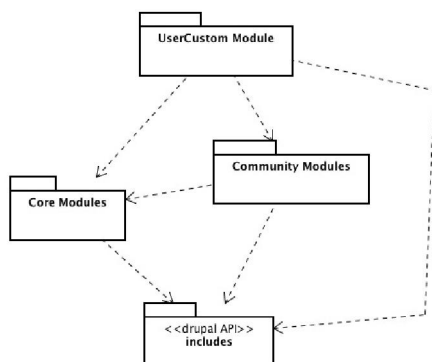


Figure 6. Bird's eye view of Drupal architecture

At the ground level there is Drupal API. It implements the basic functionality of the module system and of the CMS. Physically it is made up by a folder called includes/ which contains a set of PHP files (named with .inc extension). Each of this PHP file implements an API that can be exploited by upper levels modules. Core package contains all the Drupal Modules that implement the CMS engines. In this package one can find modules for node management, blogging, commenting, forum, menus, and so on.

On top of Core modules there are Community Modules. These are modules contributed by the open source community which are not in the main distribution. For example one can find modules for Adsense, Amazon integration, Voting and many more (here one can find a complete list of community modules available). At end there are User modules which are custom private modules built by developers for implementing specific project's needs. A typical website is deployed using Drupal API and Core modules.

#### 4.3. System design and development

In this section, we shall describe the design and development details of our project.

##### Ux., UI mockups and design

User Experience, user interface mockups and interface design are progressing and nearing completion. Once these parts are completed, it will be integrated to the Drupal 7 Instant software. Several aspects have been explored while designing the page. It has been made sure that the site is clean, minimal and easy to read. International design standards have been followed.

##### Local test environment

Local test environment with all required applications and servers etc., have been setup. Packages such as Apache server with all required configuration, PHP5, several PHP and apache modules etc., have also been setup. MySQL has been installed to serve the database requirement of the portal. This will have to replicate on the server, once the actual server is received.

#### Configuration and deployment of Drupal 7

A fresh Drupal 7 Instant software has been Installed with standard profile and configured with the right modules required for various data. Various commonly used modules like Views, C-tools, Entity, Entity API etc., have also been installed along with the deployed Drupal.

Drush, which is a command line tool to control the Drupal Instant, has been successfully installed. This allows easier access and faster management of the site from command line interface and makes backing up and updating easier. The control panel for controlling the server after setting up of LAMP instant. Our designed whole portal site is built on lamp stack, which makes use of Apache, PHP and MySQL extensively for smooth functioning. This gives great performance advantage and has no proprietary license to keep. Drupal is very modular and every feature we are building is being built as modules. Individual features can be disabled by disabling its respective module from the window above. This gives more flexibility and control over the site. Extending or scaling up of the portal site can also be done with great ease.

#### Development of Holy Qur'an search engine

Holy Qur'an search engine has been developed through the core Drupal APIs and extending the core functionalities using the contribute module like views, search API, searchapi\_db, facet API, and search API ranges, etc. The complete Holy Qur'an data is stored as an entity within Drupal, as shown in Figure 7. The metadata, such as Meccan/Madinan etc., are stored as fields attached to this entity using the core Drupal field API. Using of entity instead of core node saves a lot of unwanted weight in the db. It also allows more flexibility in longer run.

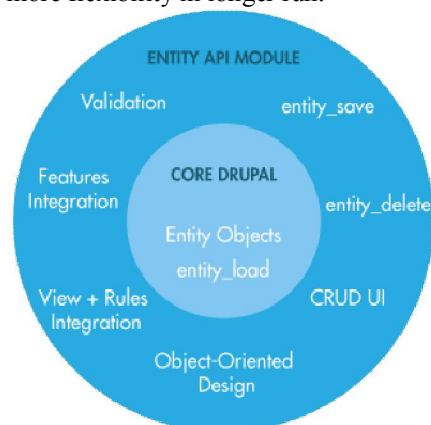


Figure 7. Holy Qur'an data stored as an Entity within Drupal

We have used this core entity of Drupal and then extended to create our own bundle for Surah and Ayahs etc. of Holy Qur'an. Then added fields using field API.



## The Bundles

Bundles are an implementation of an entity type to which fields can be attached. You can consider bundles as subtypes of an entity type. With content nodes (an entity type), for example, you can generate bundles (subtypes) like articles, blog posts, or products. In our case we have created Holy Qur'an as an entity. Not all entity types have bundles, however. For example, users do not have separate bundles (subtypes). For the entity types that do allow bundles, you can create as many bundles (subtypes) as you want. Then, using the Field system, you can add different fields to each bundle. For example, we have added our metadata using this.

## The Fields

A field is a reusable piece of content. In technical terms, each field is a primitive data type, with custom validators and widgets for editing and formatters for display.

Fields can be added to any of the bundles (or entity types) to help organize their data. Say, for example, we created field for Holy Qur'an like ayah no., surah reference, Meccan/Madinan etc. Without this it would make it more difficult, then, to control how these were displayed, or to make connections between different types of related content. This is where using fields is essential. Figure 8 shows a diagram of Entity Holy Qur'an.

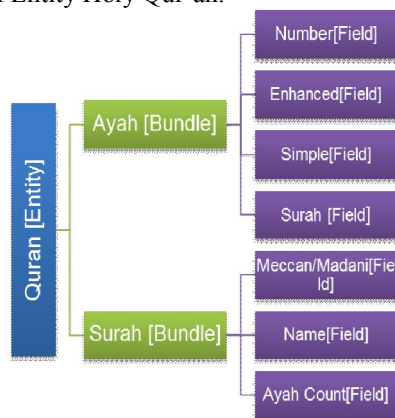


Figure 8. The Diagram of Entity Holy Qur'an.

## Design and development of search API

We have made use of the core Drupal search functionalities and then extended it with the following contributed module:

- Search API
- Faceted API
- Search API DB
- Views

Search is done by facet API. Therefore, that multiple filters can be passed and the filters work intelligently. Following two cases has been tried:

**Case 1:** Users can search by first entering some Arabic Text, say “Bismillah” and then add a surah filter, like Fatiha and then can set an ayah range. Say from ayah 1-3. Then the search will only search “Bismillah” in the Surah “Fatiha” and between Ayahs 1-3.

**Case 2:** By default if you have set a surah filter, the Meccan/Madani filter will reflect the change. For example, if you have filtered to search only a Surah revealed in Mecca, then the filter to choose to Meccan/Madani will be blurred until you cancel the Surah filter.

Search API module provides a framework for easily creating searches on any entity known to Drupal in our case the Holy Qur'an entity. It already incorporates faceting support and the ability to use the Views module for displaying search results, filters, etc. It also gives the flexibility to extend the search later using any technology like Apache Solr etc. A block diagram shown in Figure 9 depicts Search API architecture.

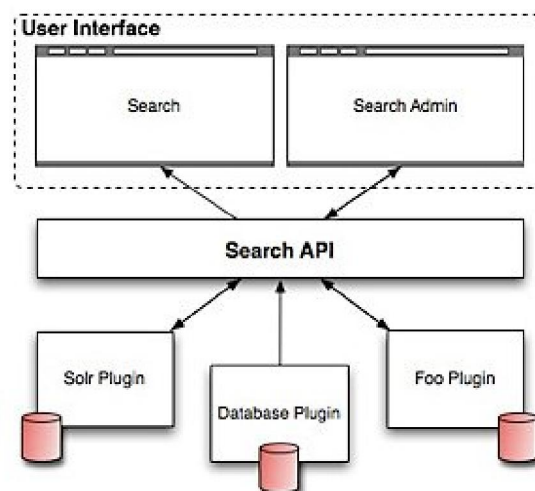


Figure 9. Block diagram of Search API architecture

Search API is implemented over Views module. It exposes the search to public. Apps, Websites or any similar systems can request various surah or ayah using the API and by passing filter. The result is exposed in form 'JSON' that is easy for these systems to consume and process.

## The Qur'an data

Ayahs of the Holy Qur'an are stored in the MySQL power Drupal Instant software. A new entity type is created for the purpose with meta data. This data is stored and options for creating relations are used here. Entity is used instead of a new content type because by default a node created by content type stores loads of data which is not required by us. Holy Qur'an data taken from Tanzil Holy Qur'an Project (<http://tanzil.net>) is fed into our system as entity. Once it is done, we will have all the flexibility of using

various Drupal APIs, such as Search API, and Field API etc. Searching is right now built using the Drupal Search API. Search is performed on the entities using these functions.

### The Qur'an search

Search for any word in the Holy Qur'an and all the Ayahs with those words shows up. The search can filter by Surah (or any additional parameters defined by us). For example if a user wants to get only the results from a particular surah, he can do it so by clicking on the Surah name. The data is added to the site systematically, Ayah by Ayah with proper information architecture and metadata's. It makes retrieving data in complex ways very easy and possible. Apart from that the data is indexed by Drupal and can be useful for full text search.

For instant using the relationships and metadata's we can pull an ayah from a surah, with the keyword given and from a particular Juz'. This is made possible by the search function of Drupal & the index. The search being on native API exposed by Drupal also makes it possible to later use solutions such as 'Apache Solr' for performance in case the site traffic grows. Therefore, the method is future centric. All the coding in the search is done in PHP and using the Drupal coding standards and API's.

### The Holy Qur'an API

The search feature is exposed as API, this is done using the services module. An external app or a website can request the site with certain options and filters Ayahs from the site, which in turn can be used to create various tools of Holy Qur'an related topics. API Service call-backs may be used with multiple interfaces like REST, XMLRPC, JSON, JSON-RPC, SOAP, AMF, etc. This allows the portal site to provide web services via multiple interfaces while using the same call-back code.

We are using the Drupal Services module to make this possible. Our entity interfaces with the Services API to return appropriate result for the requests. The API is also plugged into Drupal's inbuilt roles and permission system which gives us fine grain control over what is available and what is not. Only difference of API from search is that, this give an interface for external apps/sites to get information out of site. Holy Qur'an API enables applications to make use of our data. This was implemented with the help of services module. There will be a read only system implemented using Services module in Drupal. Each user will be given authentication to the API request. Figure 10 described the formats that are used. (Zameer, 2014)

a. <code>{surah}/detail</code>	b. <code>{surah}/{ayah}</code>	c. <code>{surah}/range/{</code>
<ul style="list-style-type: none"> <li>• This would return the meta data of the requested surah.</li> <li>• e.g., 'http://api.quranproject.com/36' would return the metadata of 36th surah.</li> </ul>	<ul style="list-style-type: none"> <li>• The will return the metadata of an Ayah, including all the fields we have in our database.</li> <li>• e.g., 'http://api.quranproject.com/36/1' would return first Ayah from the 36th chapter.</li> </ul>	<ul style="list-style-type: none"> <li>• The will return short metadata of an Ayah between a specified range.</li> <li>• e.g., 'http://api.quranproject.com/36/range/1-10' would return Ayahs 1 to 10 from the 36th chapter.</li> </ul>

Figure 10. Format of the authentication to the API request

### The Search API module

This module provides a framework for easily creating search on any entity known to Drupal software, using any kind of search engine. For site administrators, it is a great alternative to other search solutions, since it already incorporates faceting support and the ability to use the Views module for displaying search results, filters, etc. In addition, with the 'Apache Solr' integration, a high-performance search engine is available for this module.

This will return a JSON object of the first 10 Ayahs from the surah. Figure 11 shows a piece of code that aims to send a request for the second surah (that is Al-Baqara); it returned the JSON object, viewed here using JSON viewer tool.

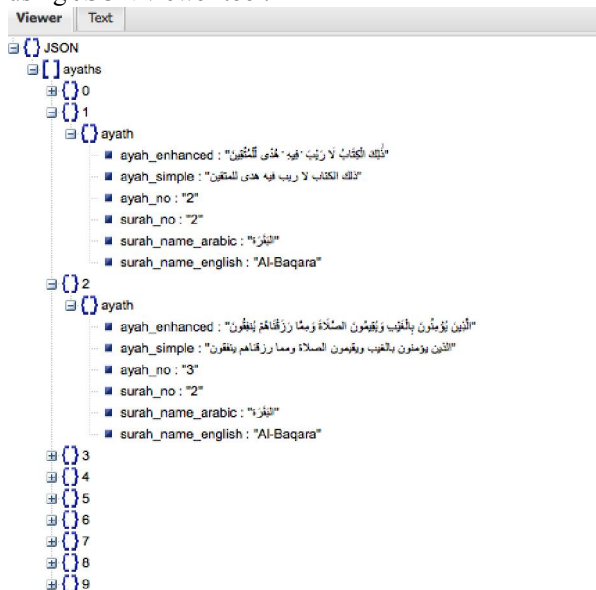


Figure 11. A small of API Search for loading Ayahs from Surah 2.

Each request object will only return 10 Ayahs, so in order to get more Ayahs, you will have to

pass the pagination parameter as shown in the code below. This returns the JSON object (viewed below using the JSON viewer tool) as shown in Figure 12.



Figure 12. A small code to show API Search (loading Ayahs by pages)

To get a specific Ayah, one has to send a request with some parameters, which works like this. The first parameter is the surah number and second parameter is the Ayah number. This will give an Ayah object that looks like below. Figure 13 shows the JSON object viewed using a JSON viewer on how to get a specific Ayah. (Zameer, 2013)



Figure 13. Screenshot of API Search to get a specific Ayah

### Search by cross language option

Holy Qur'an Search is being designed and developed using search API module of Drupal 7 software, which enables us to store the indexing in DB or Apache Solr. The API facilitates the users to search for Ayahs in Arabic using their own language as shown in Figure 14. To the best of our knowledge, such cross-lingual search is the first of its kind for Qur'anic text. For example, people don't need to know the Arabic word امي (means 'my mother') to search about 'mom' in the Holy Qur'an text. They could search 'mom' in English or the equivalent word in

Urdu or Arabic, or even in Urdu transliteration. They will be instantly presented with the results in Arabic. The same is true vice versa; an Arabic search could bring up English results. The most interesting part of this is that, a new language can be added and all the features work with that language instantly. This feature can also help users to search for Holy Qur'an audio in their preferred language, more details about cross language see (Zameer, 2014).

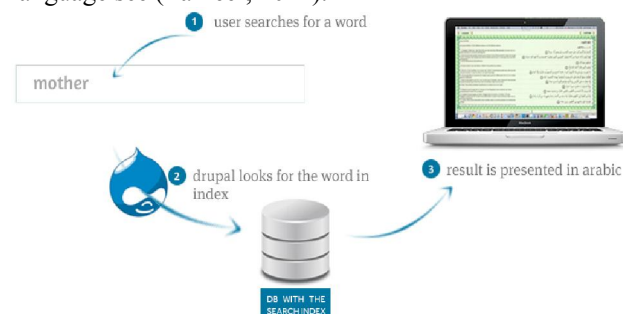


Figure 14. Visual illustration of Holy Qur'an search process

### The MUSHAF application

Development of Mushaf application as part of portal is a very important feature of this project. Its main features include the following: Recitations with many options such as, Recite surah wise, Recite Ayah wise, Recite Continuous, and Recite (Repetition). The application has been successfully designed and developed.

### The Holy Qur'an Memorizer

The Features of Holy Qur'an Memorizer in the application are 1) Multiple Instances are allowed against each user. So a single user can start learning a surah and before completing it add another instance. Whole progress is stored safely in the site. Figure 15 shows a screenshot of user's progress during learning of the Holy Qur'an, which basically lists the memorizing instants of a user. 2) Other unique feature of Holy Qur'an Memorizer includes logging of the instants, such as on what date instant was created, what surah was it, when it was started, and finished. more details for Memorizer see (Zameer, 2013).

Memorizing Instants						
Date	Sura	From	To	Status	Links	
21-10-2013	5 - Al-Maaida	35	40	Finished	Start	Delete
21-10-2013	4 - An-Nisaa	10	20	started	Start	Delete
21-10-2013	3 - Aal-i-Imraan	11	20	started	Start	Delete
21-10-2013	55 - Ar-Rahmaan	11	20	started	Start	Delete
21-10-2013	55 - Ar-Rahmaan	1	10	started	Start	Delete
12-10-2013	14 - Ibrahim	1	5	started	Start	Delete
12-10-2013	1 - Al-Faatilha	1	5	Not Started	Start	Delete

Figure 15. Screenshot of User's Memorizing Instants

### The Bookmarks

Bookmarks allow users to add bookmarks to the Mushaf on any ayah they are on. They can also add



notes along with it. It's a very handy tool when it comes learning or researching Holy Qur'an. These bookmarks are also available for later reference, and can also be accessed from within the Holy Qur'an Portal. Bookmarks can also be filtered as in memorizer. Figure 16 shows a screenshot of bookmarks feature.

Title	Sura	Aya	Notes	Link
aya-2:285	2	285	Show	go to aya
aya-71	3	71	Show	go to aya
sample	3	30	Show	go to aya
Amana Rasool	2	285	Show	go to aya

Figure 16. Screenshot Bookmarks feature.

### Self-Evaluation (Personalization)

This feature allows user to evaluate his Islamic values. It is like questioning oneself in this world, a kind of self-evaluation. User will be asked whether did he prays five times with a congregation, does he recite Qur'an, does he study hadith, does he consider his/her parents etc. Questions are asked every week. User can easily check his/her performance on a graph in terms of improving or not improving. Progress can also be seen by monthly or yearly.

### 5. The Results

As mentioned earlier, the application contains many partial systems, these systems were applied through a number of different techniques and methods. Accordingly, this section will review the results of all sup-systems that have been implemented in the application.

### Transliteration of Urdu language

As it is the first time such transliteration has been done, utmost care had been taken for its accuracy and pronunciation. A sample of transliteration of Urdu language is shown in Figure 17 [Error! Bookmark not defined.,Error! Bookmark not defined.].

S.no	Urdu	Transliteration
1	شروع	shuru
2	کرتا	karta
3	ہوں	hun
4	تعالیٰ	taala
5	کے	ke
6	نام	naam
7	سے	se
8	جو	jo
9	بڑا	bada
10	مہربان	meharbaan
11	نہایت	nihyayat
12	رحم	raham
13	والا	wala
14	ہے	hai

Figure 17. A sample of transliteration of Urdu language

After completion of the entire transliteration, we sent it for checking of errors, and found out some errors. After the modifications, we have again sent these for pre-final check, which will be done before uploading. Final progress on this will be provided in the forthcoming report. Future work in this regard is that, after the transliteration, the entire content will be extracted and uploaded in the portal in various formats as required by user.

### Da'wah Section

Figure 18 shows the screen shots of Da'wah section.

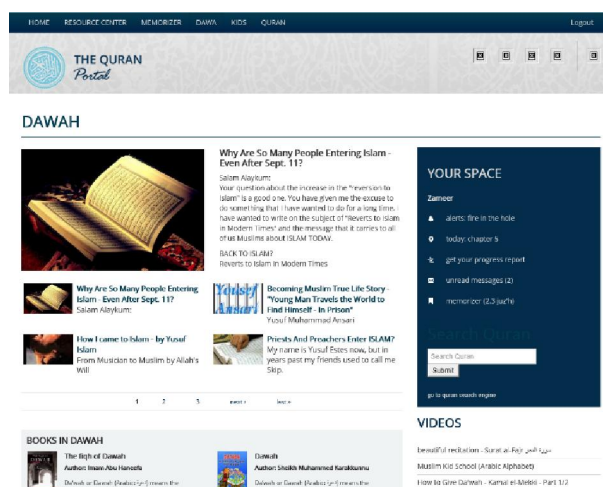


Figure 18. Screenshot of User designed Da'wah section

### Kids Section

Figure 19 shows the screen shots of Kids section.

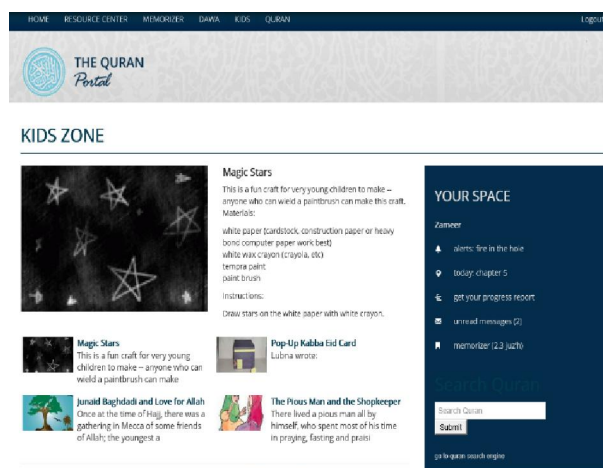


Figure 19. Screenshot of Kids Section

### Holy Qur'an Section

Figure 20 shows the screen shots of Holy Qur'an section of the Holy Qur'an Portal.



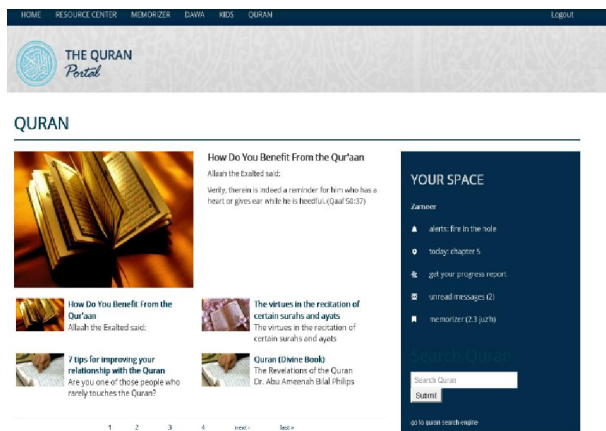


Figure 20. Screenshot of Holy Qur'an Section

Holy Qur'an section contains also "Ayah of the day"; the player of Ayah of the day can be configured to load a unique ayah for each day. And then can be associated a page with information on that ayah like its meaning, explanation, articles and essays related to the ayah etc. Users who are interested to learn Holy Qur'an step by step will benefit a lot from this section. They can study an ayah in detail each day.

### Holy Qur'an Search Section

This section is one of the important sections of the project as it allows users to search the Holy Qur'an. Some of the intended features of this facility are listed below:

- Allow users to search Holy Qur'an by pasting any words or ayah (full text search, like in Google)
- Allow users to search by using filters, like selected Surah's or within ayah range
- Allow users to search in translations and transliteration
- Cross Language Search
- Ability to search for commentaries, articles and translation of Holy Qur'an
- Ability to search ayah based on topics

Search API is implemented over Views module. It exposes the search to public. Apps, Websites or any similar systems can request various surah or ayah using the API and by passing filter. The result is exposed in form JSON that is easy for these systems to consume and process (Zameer, 2013). Figure 21 shows a screenshot of Holy Qur'an Search by TEXT.

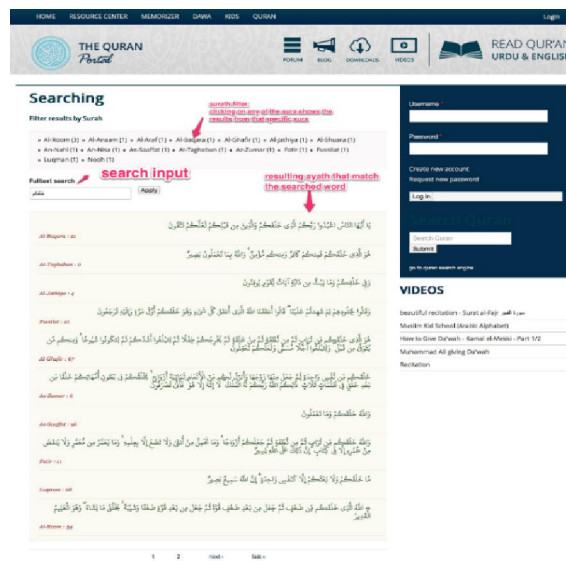


Figure 21. Screenshot of Holy Qur'an Search by TEXT

### The MUSHAF application

This feature of Mushaf application deals with translation in many languages and transliteration, which include: English, Urdu, Malayalam, and transliteration. Other features of this section include: translation is fixed, translation by mouse over option, and translation by no option. The user has flexibility to choose the view mode from the following two: Normal view, and Bulb view. Figure 22 shows the Mushaf result of recitation with other language option.

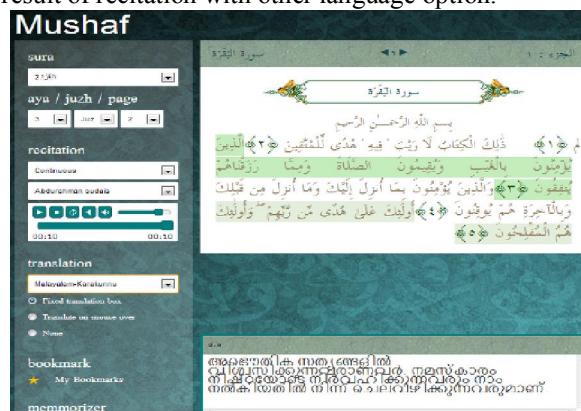


Figure 22. Recitation with other language option

### The Holy Qur'an Memorizer

Holy Qur'an memorizer is a portal feature to help users learn/memorize Qur'an using well tested method like playing the ayah repeatedly then, fading or removing words automatically, and allowing them to check if correct etc. It also allows users to mark their progress through their user accounts. It also gives an option to test those Surah's, which have been successfully learned so far. Figure 23 shows the memorizer instants.

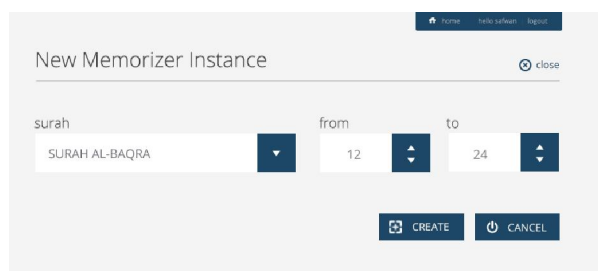


Figure 23. Memorizer Instant

### Bookmarks

Bookmarks allow users to add bookmarks to the Mushaf on any ayah they are on. They can also add notes along with it. It's a very handy tool when it comes learning or researching Holy Qur'an.

### 6. Conclusion

A complete cloud-based Qur'an portal and mobile application is developed, which could be deemed as a center point for all authentic resources and tools for users in helping them creating and hosting of Qur'an tools. This paper presented in details, the different parts of the online portal and mobile application for Qur'an. It described the overview of the technologies, methodologies used in this project, along with the computer simulation settings, the test results. It also presented a systematic review of the research and development work that has been done so far by the research community, and the developers in the area of Qur'an applications. The paper also provided a detailed account of various stages of design and development of the application, including the Qur'an Memorizer, Qur'an Search API, its multi-lingual feature and cross language information, in particular the Urdu language transliteration. The most unique achievement of the presented work is the development of API, which provides the support for multiple languages and transliterations.

### Acknowledgment

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