

# A Context-aware Mobile Application for Cultural Learning

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## ABSTRACT

The rapid development of emerging technologies for mobile devices makes them able to contribute strongly to the creation of new paths for learning. In this paper, a novel context aware mobile application (YouGuide) is proposed to encourage and promote the cultural learning. Prophetic narrations (Hadith) texts are considered as a very important source of Islamic culture. This application uses prophetic narrations texts as a cultural learning resource. A new way of learning is proposed for Islamic legislation sources. Besides, the proposed system puts into consideration the technical and pedagogical issues to enhance the learning process. YouGuide is tested on 20 users. Two questionnaires are conducted with test users. The results of both questionnaires show that our application doesn't have any serious usability problems and the proposed system can be used to promote cultural learning with increasing the progress of Hadith learning.

## Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]: Self-assessment.

## General Terms

Algorithms, Design, Experimentation.

## Keywords

Context-aware, M-learning, Mobile application, Cultural Learning, Hadith Learning.

## 1. INTRODUCTION

Mobile devices and smart phones have become widely used. The pervasive nature of mobile technology enhanced the opportunities for mobile users to find a learning resource related to their current situation. The learning resources in context-aware mobile applications can be adapted to the information are collected from the surrounding environment on the real time.

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Mobile Learning (M-Learning) is any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies. It creates an environment of anywhere, anytime learning [1].

The most serious issue faced by mobile learning is the lack of a solid theoretical framework which can guide effective instructional design and evaluate the quality of programs that rely significantly on mobile technologies. Transactional Distance is a pedagogical theory can be used in the theoretical framework. The relation between Transactional Distance and learning outcome is: if learning outcomes in any distance education course are to be maximized, Transactional Distance needs to be minimized or shortened [2].

Context-awareness is the ability of the computer to sense and act upon information about its environment such as location, time, temperature, or user identity. Context-aware systems acquire and utilize information on the context of a device in order to provide services that are appropriate to particular people, place, time, event, etc. [3]

Although context-dependent delivery can be relevant to non-mobile applications, the flexibility offered by the mobile devices and user mobility places mobile applications at the very heart of context-aware computing. The “ambient” view of context is environment-centric. Yet, services adaptation needs to be driven by factors beyond the environment. To accommodate for such factors, context is classified into three categories, human factors, physical environment and time [4]. The context categories have different dimensions. Technology for modifying the weights associated with different dimensions dynamically to better represent the context is open research issue [5].

## 2. RELATED WORKS ON CONTEXT-AWARE MOBILE LEARNING

There are a lot of researches that have been done on context-awareness applications to enrich human computer interaction and the provision of more relevant and useful services to the end user [6].

In the experiment conducted by [7] on sample of undergraduates student in Near East University in North Cyprus, its findings state that mobile learning can increase the environmental awareness of students.

An innovative heuristic algorithm was developed by [8] for planning personalized path of context-aware ubiquitous learning. The experimental results were from the learning activities conducted in a natural science butterfly-ecology course of an elementary school to depict the benefits of the innovative approach.

Another study is designing M-learning platform for a location-based local culture course [9]. In order to make the learning process more enjoyable and to coach students to recognize geographical location of landscapes, augmented reality and scaffolding theory are used.

In [10], context-aware ubiquitous learning environment is applied for conducting complex science experiment. An expert system is designed to assist the learners to check each step for operating the single-crystal X-ray diffraction procedure in the real world. Moreover, suggestion is given to the learner based on the inference rules provided by the experienced researchers and an adaptive guiding strategy for each student was implemented.

A two-tire system was used by [11] to develop location-aware mobile learning system for natural science courses. They tested their system in Botany course to enhance the students' knowledge and observation.

The study carried out by [12] claimed that contextualization, location, and culturalization are important issue in designing and selecting learning content in general. But, these issues become crucial in mobile devices with small screen and limited resources. Profiling mobile phone users in order to filter learning content is a prerequisite for a successful M-learning strategy.

Two important attempts for cultural learning systems were discussed. In the East, the project ZENetic Computer is a first and very promising approach for cultural computing addressing Eastern cultural determinants. In the West, an interactive experience was proposed based on the narrative 'Alice's Adventures in Wonderland' to address the main characteristic of the Western culture [13].

### 3. YOUNGUIDE: A CONTEXT-AWARE MOBILE APPLICATION

Although Islamic culture has environmental, spatial, and temporal features [14], learning resources adapted with the mobile environment are insufficient. In this study, we propose a novel context-aware mobile application that combines pervasive nature of mobile computing and the ability of sensing environment with prophetic narrations texts.

The following subsections explain the system structure and the system functions of our proposed application.

#### 3.1 The System Structure

The proposed system chooses the most appropriate prophetic narration texts based on the current context of the user, moreover, gives the user the ability to contribute in the system response enhancement by evaluation and feedbacks. Fig. 1 shows the system block diagram.

**-System inputs:** The proposed system links between cultural resources and the current context or situation. Although there are many context dimensions that we can use in our application, more dimensions mean more complexity. Therefore we focus on three dimensions; location, time and user preferences respectively.

**-System Data:** The main data in the system are prophetic narration texts (Hadith) from the book of Sahih Albukhari [15], one of the most accurate sources of Islamic Culture and Legislation [16]. We store the selected prophetic narration texts in a shared preferences file in the system.

**-System Outputs:** There are three context dimensions that the system is aware about. The system responds to changing of each dimension's value in the form of understandable output for the user. For example, when the user changes his location, the user will be informed by two types of outputs. One is the notification that draws the attention of the user, and the second is the appropriate Hadith text related to the new location or place.

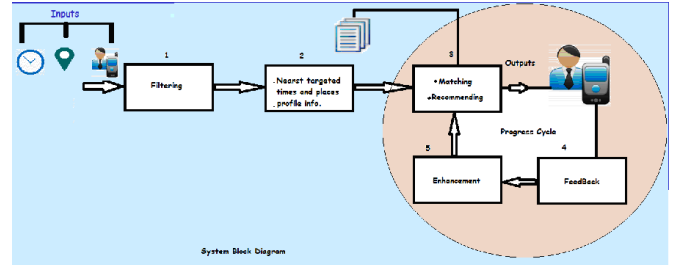


Figure 1 System block diagram

#### 3.2 The System Functions

**Filtering :** The process of inputs filtering tends to feed the system with the easy to match cases, for instance, there are some types of places cannot be matched easily to Hadith texts because; these types of places do not have similar categories of Hadiths in the book of Sahih Albukhari.

Technically, there a lot of filtering techniques, one of them is Regular Expressions that can be used to extract information based on a predefined pattern. In the proposed system, regular expressions are used, for example, to extract a certain type of location from the many location inputs. The criteria of extracting depend on the suitability of extracted information to be matched to the Hadith text.

**Matching and Recommending:** The object of matching and recommending process is to match the filtered inputs with Hadith texts. Hadith texts in the book of Sahih Albukhari are categorized into different categories related to different life activities and historical events [15][16]. Fig. 2 shows an example of the categorization of Hadith texts, by classifying each Hadith text to a main category. In this study, we use these 5 categories and each category represents one of Islamic legislation necessities: Religion or Belief category, Life category, Regeneration category, Money category, and Brain or Knowledge category.

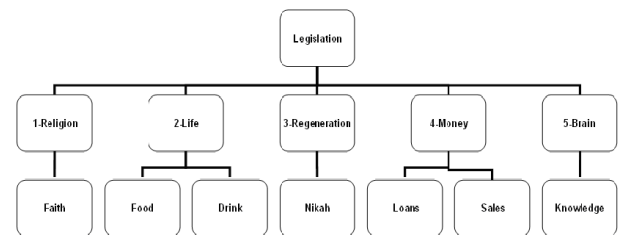


Figure 2 Hadith texts categorization including level 0, 1 and 2.

This classification of Hadith texts depending on category, gives two advantages:

- Facilitates the process of matching and recommending.
- In the case of unsuitability, i.e. Hadith text is not suitable for the user situation, the recommended Hadith text from one subcategory can be changed to another in the same main category.

For matching appropriate Hadith with the context, each Hadith (as a leaf node) is indexed with a weight vector which represents the location of the Hadith in the categorization tree. For example the weight vector of Sales subcategory is  $\langle 2,4,2 \rangle$ , as it belongs to level 2, and its main category is the fourth category (4-Money), and its priority in between subcategories from (Money category) is 2. The priority information of each category and Hadith is taken from the book of Sahih Albukhari which lists the category and its Hadiths by using general to specific order. The main steps of matching and recommend algorithm is given in Algorithm 1

**Algorithm 1** matching and recommending.

```

Input targeted times, places, and user profile information
If targeted information matches a subcategory
    Print the matched Hadith text
Else
    Input user feedback
    If user feedback matches a subcategory
        Print the matched Hadith text

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For instance, if the user wants to learn Hadith based on location, then the near places to the user are listed. When the user ticks a place from the list, then the application offers Hadith text related to the selected place. Fig. 3 shows the application response when the user selects a place related to food.

If the user finds that the recommended Hadith is not suitable for the current place, the application responds by recommending another Hadith from the most similar subcategory under the main category of the previously recommended Hadith. In order to calculate similarity degree between subcategories, we use Dice similarity measure [17]. If the current place cannot be matched with any Hadith category, then the user can give a feedback to the application to define the place's category. User feedback for place's category, shown in Fig. 4, helps the application in the matching process.

After reading Hadiths from the categories, the application gives the user a report about his/her progress on 5 Hadith categories. The performance is displayed in percentage format of the rate of the number of reviewing Hadith by the user over the total number of Hadiths in each category. Therefore, when the user sees 100% of the progress for one category, means that he/she read all the Hadiths in this category.



**Figure 3.** The recommended Hadith for food



**Figure 4** User feedback for a place category.

### 3.3 Development Environment

For developing YouGuide we selected Java programming language, which is used for Android platform applications. Eclipse with ADT Plugin is the editor environment for our project; we also used SDK Android with version 19.0.1 to provide an Android emulator with requirement libraries to build Android application. We use Google Places API to know the learner's current location via GPS and help to find the nearest places to current location of user.

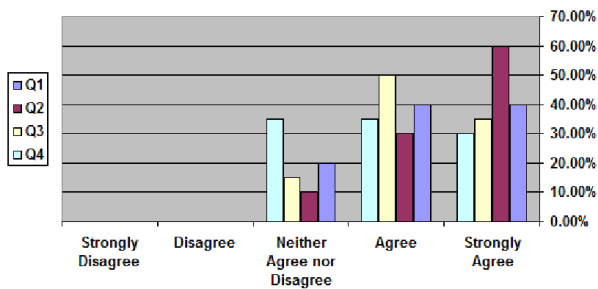
## 4. EXPERIMENTAL RESULTS AND DISCUSSIONS

In order to evaluate our application with the users' perspective, the experiments are performed by 20 participants, the age range of participants is between 19 and 49 years, their education levels are between undergraduate students and graduate students from different majors such as computer engineering, electrical engineering, economics, etc. and some of them are lecturers. The participants' genders are 3 females and 17 males. The participants are supported by a detailed user guide before the test. After using the application for a few days, they were asked to fill the questionnaire. Questions are listed in Table 1.

**Table 1.** The questions of the survey.

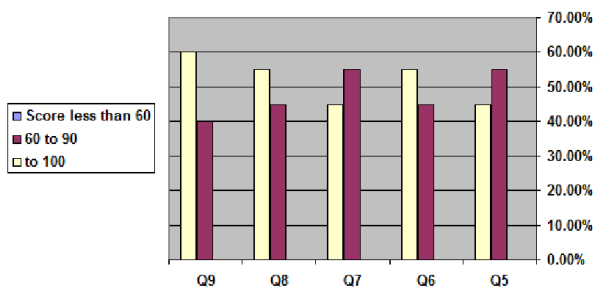
|   |   |
|---|---|
| The questions related to context category evaluation (1- strongly disagree 5- strongly agree) |   |
| Q1  | Application can response (i.e. find appropriate Hadiths) correctly to surrounding places. |
| Q2  | Location's feature of app motivated me to read more Hadiths.                              |
| Q3  | Time's feature of app motivated me to read more Hadiths.                                  |
| Q4  | User Profile's feature of app motivated me to read more Hadiths.                          |
| Q10   | I believe that I am able to learn more Hadiths with using this application.               |
| The questions related to Hadith categories evaluation   |   |
| Q5  | State your score for Life category:   |
| Q6  | State your score for Money category:  |
| Q7  | State your score for Belief category:   |
| Q8  | State your score for Regeneration category:   |
| Q9  | State your score for Knowledge category:  |

Fig. 5. indicates that the majority of users were motivated more by the location context's category to learn more Hadith, followed by Time context's category, and Profile context's category.



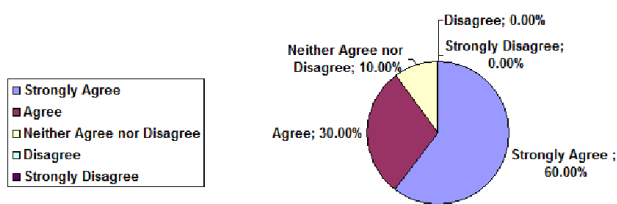
**Figure 5 Percentage of respondents of context categories questions.**

Fig. 6 indicates that the maximum score was for knowledge category, and the other categories get equal scores .



**Figure 6 Percentage of respondents for hadith categories questions.**

Fig. 7 shows the respondents evaluation for Q10. Fig. 7 indicates that the majority of respondents (60% Strongly Agree , 30 % Agree) believe that they are able to learn more Hadiths using the application.



**Figure 7 Percentage of respondents for learning hadith question.**

## 5. CONCLUSION

Nowadays mobile devices are widely used for the purpose of learning. Context-awareness is an important feature in the mobile learning applications. The application using this feature adapts the learning resource to be suitable for the current context of the learners. In this study, a context aware Android application is proposed for promoting Islamic cultural learning via prophetic narrations texts - Hadiths. Five main categories (Belief, Life, Regeneration, Money, and Knowledge) and their subcategories

are used with the book of Sahih Albukhari for constructing Hadith dataset. The application implements three different types of context (Location, Time, and Profile). If the context is matched to appropriate Hadith category by using Regular Expression, notification is appeared then recommended Hadith by the system is printed on the user's screen. For enhancement of recommending system, the system gets user feedback. If feedback is negative, suitability algorithm finds the most suitable Hadith by calculating similarity degree of the current Hadith subcategory with other related subcategories.

The application is tested by 20 users (university students and lecturers). Experimental results are obtained based on the user performance and answers of the questionnaire. Results indicate that our application doesn't have any serious usability problems and using YouGuide motivated the users to learn more Hadiths.

In addition, we examined by the questionnaire the effect of each context category or dimension on the learning motivation. We discovered that location dimension of context has motivated the users more, followed by time, and profile. Therefore, we conclude that location as a context dimension is more important for this type of cultural learning. Also, we conclude that time and profile dimensions must be improved and developed carefully. We refer the low degree of motivation for learning using time, and profile context dimension to two reasons. The first is, that time context category or dimension was related to Hadiths of important Islamic events. And the most of these Islamic events were occurred in the Arabic month Ramadan and time periods near to it. Therefore, users could not get the whole benefits of using time dimension. The second reason, is that profile context dimension was related to the profile information of the user, and it was difficult to match all profile information to suitable Hadith in Sahih Albukari .

Additionally, we examined by the questionnaire, the Hadith category with the highest score for reading. We discovered that Knowledge category got the highest score for reading. We referred that to the nature of users, most of users either university students or lecturers.

In conclusion, we show that context-aware features of proposed application motivate the users during the cultural learning and increase their learning progress. Furthermore, we present a novel way to Islamic cultural learning via Hadith learning.

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