

# From Poster to Mobile Calendar: An Event Reminder using Mobile OCR

Fatiha Bousbahi

Information Technology Department

College of Computer and Information Science, King Saud University, Riyadh, Saudi Arabia

**Abstract**—Technological innovations are the foundation of new services today. Successful services address real-life issues that help people manage life more conveniently using relevant technologies. Currently, images are a part of daily life. People are often taking pictures of different posters for different events as exhibitions, workshops, conferences, etc., with their mobile. Unfortunately, sometimes these pictures are forgotten and events' dates expire. As consequence, people miss events they were interested in. Hence, with the vision to provide technology-powered services, affordable and turnkey applications, this paper presents Event-Reminder, a fully automated lightweight reminder system builds upon a mobile offline OCR (Optical Character Recognition) with touch interaction making some daily tasks easier. Event-Reminder is a mobile application that would recognize the images' text content, extract event's date and venue and upload this event information automatically to mobile calendar in order to remind the user about the event at proper time. A prototype system is introduced in this paper.

**Keywords**—OCR; API; mobile apps; reminder systems

## I. INTRODUCTION

With the proliferation of mobiles, images become part of daily life. Indeed, people are often taking pictures of different posters for different events as concert, exhibitions, workshops etc., with their mobile. This results in many images hard to manage, to search and remember. People may miss their events they were interested in. A reminder application that would recognize the images' text content, extract date and venue and upload this event's information automatically to mobile calendar in order to remind the user about the event at proper time would be excellent help. Another audience who can benefit from this reminder system is patients that want to remind their physician appointments. The patient takes an image of her/his appointment and the system will save it in the user's mobile calendar.

Reminder systems were developed for many purposes such personal task reminder [1], location reminder [2,3] medication reminder [4], activities reminder for memory impairment [5], etc. But most of them require input fields which can be tedious for mobile owners expecting intuitive navigation and easy applications. Thanks to smartphones which become more and more efficient and consequently promote ease and efficiency of applications' design by including new technologies. Most of these new technologies and technical innovations hold big promise for businesses and their customers. Indeed, the challenge consists to convert the potential into actual capability by delivering working services into the market. Yet, new

technologies, however exciting they are, could be too complex to be adopted by people in their daily live because people prefer simple and relevant technologies that help them manage life more conveniently. Indeed, 14% of smartphone owners reported deleting an app that was difficult to use [6]. Hence, an intuitive and easy smart phone application has been proposed in this paper, which will help people attend their medical appointments or events they are interested in at proper time.

Actually, there are many expiry date reminder applications available but what makes this special, we focus on reminder based on print media describing event or appointment which will be elapsed in due time while integrating new technologies. Everything in this application is done automatically with no need of internet. The application is developed with a consideration that it does not take up significant time or effort. Furthermore, the application is developed with low cost software.

In this article, we describe an android application that builds upon the latest mobile OCR, touch interaction and leads to a new portable tool. We have implemented a prototype system.

The remainder of this paper is organized as follows. Section 2 describes background and work related to the tools of OCR. The proposed system is presented in Section 3. The system design and evaluation are reported and discussed in Sections 4 and 5, respectively. Section 6 concludes the paper and presents a number of directions for future work.

## II. BACKGROUND AND RELATED WORK

### A. OCR Technology: An Overview

Nowadays, documents are more and more scanned allowing for the convenient access and sharing of files. Yet, these scanned documents are simply images of the original files which impede editing and searching. Thanks to OCR (Optical Character Recognition) technology, the text of these documents is made more accessible [7]. OCR technology enables users to convert paper content into electronic files thus transforming physical paper into searchable and editable digitized documentation. In the early 2000's, OCR began appearing in modern technology, as it was promoted as an online software service, a cloud computing solution, and recently, began to appear in mobile software such as postal processing, banking, healthcare, assistive technology for visually impaired people and language translation applications [8].

Since its inception, OCR technology has expanded from simple character recognition tool into plenty used and specialized technologies, able to boost large business process. Indeed, today, OCR has become trending with the use of new technologies. OCR has become a way for developers to develop a different use-case with the integration of it.

### B. Mobile OCR

Mobile Optical Character Recognition describes an OCR process which is entirely executed on a mobile device. All image pre-processing and text recognition algorithms work without a server connection and only use the mobile device's camera solution and processor power.

There are several Text Recognition SDK provided by major technology companies such Mobile vision API [9], Tesseract [10], ABBYY Mobile OCR [11], Anyline [12] to name few. To choose an OCR SDK for our application, we took into account four factors: accuracy, free licence, offline, real-time recognition and simple coding. Indeed, we chose Mobile Vision API since it meets our requirements.

### C. Mobile Vision Text API

Google's Mobile Vision detects faces, barcodes, and text in image or video by having API installed on a device. It works without cloud. Its biggest advantage, no network call is required to detect text. It works in real time on the device as well as on live camera. The identified text could be in any sequence. This API gives an application the ability to read text that appears in an image by transforming electronic images of printed documents into searchable electronic records. It recognizes text in any Latin based language. It also represents the structure of recognized text, including paragraphs and lines.

### D. Reminder Systems

The idea of using expiry date reminder system is not new. Much work has been done in the past. More, the idea of using a smart phone application expiry date reminder has been developed in Android [13] as well in iOS [14]. To reduce manual entries, some application used RFID technology which bring some improvements.

As example, [15] is using RFID technology to detect the objects the user s/he might have forgotten when s/he is leaving home. Each object is identified with its name, RFID number and its class. The system uses taxonomy with two levels: classes and objects. The reminder system is connected to the user's calendar. An event object list can be built by the user or automatically detected and recorded by the system. The reminder system checks the objects carried in the user's bag when s/he is leaving home. This means the system shall detect the user's exit from house. An RFID reader is installed near the front door which can be very inconvenient to the user. More, although the RFID tags deployed in the public areas can help reach the goal, the tag price is still too high to make it feasible in real applications. In addition, this kind of reminder system needs internet connection to the server where the objects information is recorded in a database.

ShotVis [16] is a prototype of android mobile application that permits to take images of text captured from mobile devices and extracts information for visualization. Before data

visualization, users must clean, select, and label dimensions from data extracted by an OCR through a series of sketching gestures. Then it automatically manipulates the data according to the supported gestures. The OCR software used in this prototype is not indicated. But we understood from the article, that the prototype needs a net connection to send the image to be processed by the OCR on a server.

Several existing reminder systems using OCR are focusing on medication. The most interesting we could find in the literature is an android application which consists to extract medicine bag information, reminder patient to take medicine as well as information regarding potential interactions [17]. The application uses online Tesseract OCR to recognize characters after performing image pre-processing involving binarization, denoising, skew correction, layout analysis, and character cut. The researchers needed to use also Median filter to remove noise from images and Affine Transform to accomplish skew correction before sending the data to the OCR. The application development is somewhat costly. It necessitates a database, an online OCR and other software.

Another interesting medication reminder system was developed by [18]. The researchers tried to automate more tasks such setting the medicine time automatically in the mobile calendar. But there is no explanation in their article about how medicine information is extracted from the recognized prescription and embedded in the calendar. Other prototypes are focusing on expiry food products [19].

### E. Released Applications

There are some expiry date applications which are released in the market [20]. We cite among others, CozZo, a free fridge & pantry manager app. It helps to avoid food waste by checking the expiry date. Another one, Pharmaceutical Track & Trace is a mobile application which permits users to check if the medicines are counterfeit and or expired.

After analysis, we noticed that the existing reminder systems are not fully automatic. They have lots of manual work and they are much time consuming since they are using online OCR added to other software. More, there is possibility of hanging down of the existing systems due to the manual work or net disconnection. Table I shows a comparison between the existing reminder systems and the proposed system Event-Reminder.

In the present work, an attempt has been made to implement fully automatic reminder system based on mobile Optical character recognition. Low cost software was used to develop this event reminder application.

TABLE. I. COMPARISON OF EXISTING SYSTEMS AND PROPOSED SYSTEM

Features	Existing System	Proposed System
Method	Manual/Partial automatic	Fully automatic
Time	More time consuming	Less time consuming
Database	Yes	No
Net Connection	Yes	No
Identification	RFID+OCR/barcode + OCR	OCR only

### III. SYSTEM OVERVIEW

As it was mentioned in the previous section, the existing reminder systems are useful but they are not fully automated. They are providing quit functionalities manually which can be automated nowadays with the new available technologies.

Event-Reminder is an android mobile application (Fig. 1). Its goal is to provide an efficient technical solution that can serve people with different ages and level of education. It enables users to make use of advanced technologies to facilitate their live by saving time, effort and money.

Event-Reminder focuses on three automated tasks: the first one is getting text from a paper document describing an event into the user’s mobile; the second one is to extract relevant information about this event and finally embed the event in the built-in calendar of user’s mobile.

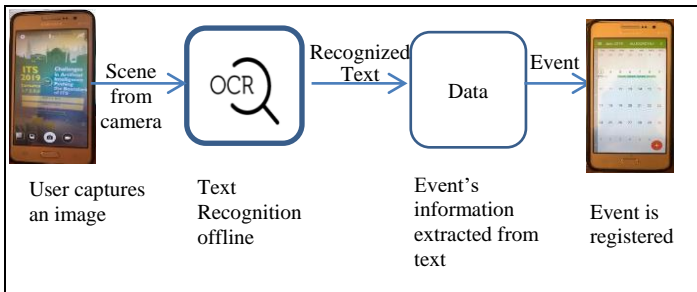


Fig. 1. Event-Reminder Architecture.

Event-Reminder recognizes the image’s text content, extract date, title and venue then embeds it automatically to mobile calendar. A notification is sent on time to the user as a reminder about her/his event.

### IV. SYSTEM DESIGN AND IMPLEMENTATION

When designing Event-Reminder, we were keen to include the basic requirements that users want and expect in any mobile application. We included, the following most important ones:

- **Utility:** The proposed application enhances efficiency for tasks that are performed often by people.
- **Intuitive:** A full automated application where the number of clicks is reduced to an absolute maximum and no entry fields exist, all without limiting functionality of the application.
- **Simplicity:** A usable and simple design which focuses on tasks at hands and avoid any other features that aren’t actually essential to what the user wants to perform.

The proposed application is composed of three components which are Text Recognition API representing the OCR module, Pattern Extraction algorithm and the mobile application. In the proposed application we use Mobile Vision API. By integrating Mobile Vision API and Pattern Extraction algorithm with the mobile application we will have the whole complete Event-Reminder application as shown in Fig. 1. The application components are described in the following sections:

#### A. The Application’s Interfaces

When the application is launched, the initial interface allows the user to capture a scene (see Fig. 2(a)).

Application’s functions:

- The user is able to focus her/his camera on some regions of the image to be captured
- The user is able to see the captured text.
- The user is able to save the relevant information in her/his mobile calendar.

Event-Reminder is very easy to use and could be used by a wide range of people. Fig. 2 illustrates the application’s interfaces and how to use them.

#### B. OCR Module

The proposed application deals mainly, with events’ posters and medical appointment which have few text and more contrast between text and background (see Fig. 3(a)). We do not need pre-process such images, which save time while executing the application.

As shown in Fig. 1, the system is an android mobile application which captures a real-world scene from a printed data of an event with the user’s smart device camera. While scanning the printed document, the user is able to focus regions in the image to be taken as input to recognize and produce the corresponding editable text as output. It overlays a selectable region in the view so that the required fields can be conveniently scanned within the region (see Fig. 3(b)). Once the required relevant information is in the small region, the capture button on the interface can be clicked to scan it. The output is an editable and searchable text (Fig. 3(c)).

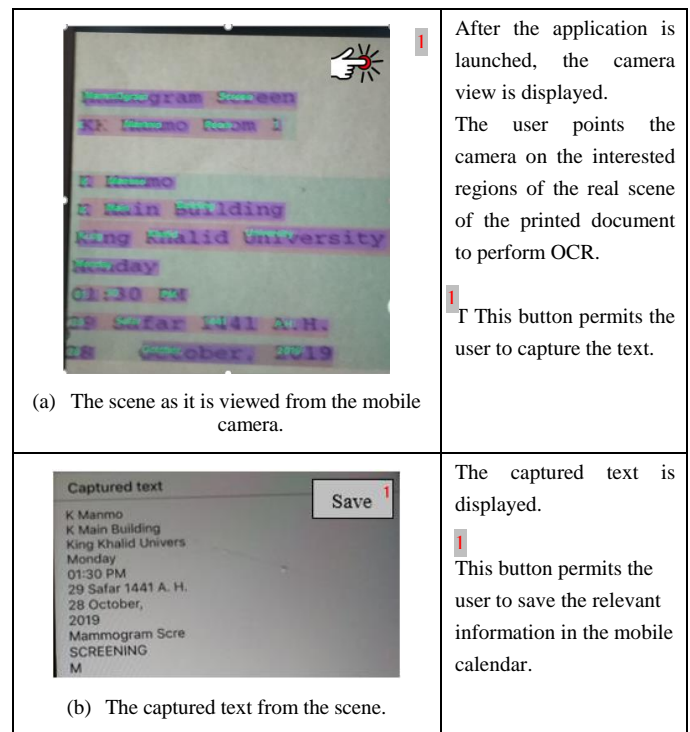


Fig. 2. Application’s Interfaces.

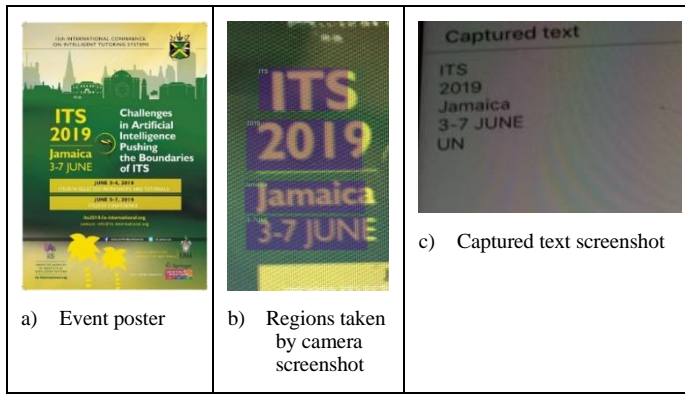


Fig. 3. OCR Modules Process.

Before, integration with the mobile application, we implemented the OCR module with Mobile Vision Text API which is an android offline image recognition library. To recognize text, we implemented three important parts: a detector object named TextRecognizer which processes images and determines what text appears within them; a camera manager pre-configured for vision processing named CameraSource. This is set to use rear camera by default. And to read text straight from the camera, a Detector Processor, which will handle detections as often as they become available. To accurately display the scanned text, we defined a layout using a specific method from the library.

C. Data Extraction from Captured Text

The pattern extraction work in the proposed system deals with sources such as events' posters and printed appointments forms as those for hospital. These sources are usually small and semi-structured. For instance, an event poster or hospital appointment are never more than a page's worth of information and are organized in such a way to make it easier to find dates, names and venue. The text (Fig. 3(c)) obtained from OCR module is made editable so that the edited text is searched and parsed to extract entities of interests. In this module, two functions are utilized. The first one searches keywords, such as: visit type, visit place, visit day, visit date to mine the needed information (case of hospital appointments) and regular expressions to extract date. When the document scanned is not a hospital appointment, the output of the search is null. In this case, the second function executes a date pattern recognition algorithm using Java regular expressions to mine matching pattern from strings. Indeed, Java 4 and later includes an excellent regular expressions library in the java.util.regex package [21]. Each line in the editable text is inspected to find the date first. The information surrounding the date is considered as the remaining information about the event. Since, only the fields of interest are scanned, the parsing is very fast. Once the relevant information is extracted, the user can click on the save button and the event is registered automatically in the mobile calendar.

We utilize Android Studio to implement user interfaces using XML and to implement all classes using Java programming language.

V. EXPERIMENTATION AND EVALUATION

To test the performance, utility and the usability of the proposed system, we conducted some tests in real world with two android devices having versions 4.1 and 4.2.

A. Dataset

Experiments have been carried out with our prototype system to evaluate its performance and usability. We created a dataset with different posters and appointments collected from real-world events and medical appointments. The images have mostly not more than ten lines of text with different background colors/images, font types, font sizes, font colors, quality, etc. All images were of printed materials. 100 images were collected. Table II shows samples of dataset used. Some of them described past events.

B. Performance Testing

Each succeed case which embedded the correct relevant information in the right date of mobile's calendar is counted as correct counter (r) and each case was incorrectly embedded is counted as incorrect case. The accuracy rate can be calculated by = R/ number of testing cases.

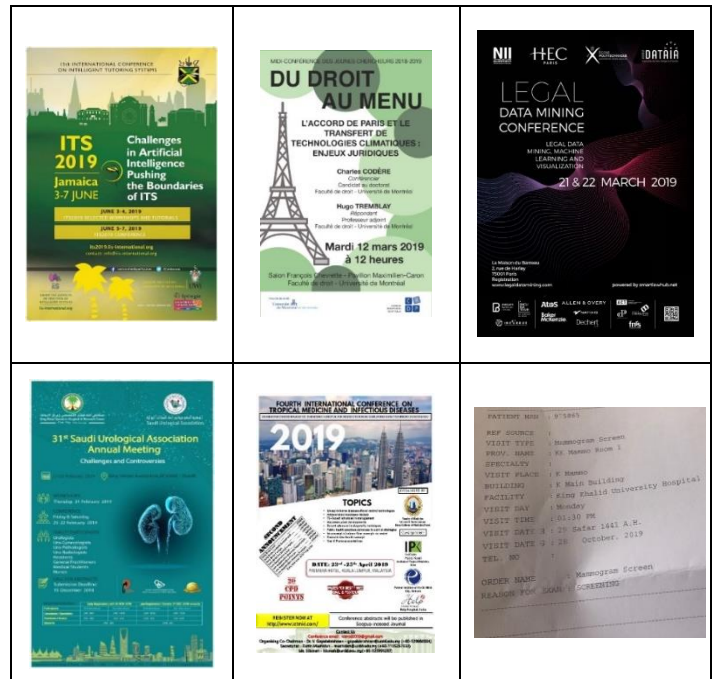
To assess the accuracy of the Event-Reminder, we used the following accuracy formula:

$$Accuracy = \frac{\text{number of images correctly processed}}{\text{total number of images}} * 100$$

The average time was calculated as follow:

$$Average\ time = \frac{\sum x_i}{n} * 100 \text{ where } x = \text{time for each image and } n = \text{number of images.}$$

TABLE II. DATASET'S SAMPLES



The error rate is calculated by:

$$= \frac{\sum f/n}{4} * 100$$

where  $f$ =number of failed images and  $n$  = number of images.

The experimental results pointed to the effectiveness of our proposed system. As shown in Table III the application fails with only four images among one hundred. Only six images among one hundred were partially recognized, but the application succeeds to find the relevant information and save the corresponding event. As shown in Table IV, the accuracy of the proposed application was found to be 90% with an average time to perform the whole tasks less than 4 seconds. The error rate was found to be less than 1%. This implies that our system is beneficial to users.

### C. Usability and Utility Testing

Most important function of a mobile application is to provide utility or value to users. Utility can come in many forms, entertainment value, a solution to a problem, or enhanced efficiency for tasks that are performed often by smartphones' owners as the case in the proposed application in this paper.

To determine utility and usability of the proposed system, experiments were conducted. Event-Reminder was tested by ten female participants aged from 18-60 years including five university teachers, two students and three patients having medical appointments in the university hospital. All of the participants are used to utilize mobile apps. The test was conducted individually within participant's free time at King Saud University. The session test, took no more than twenty minutes with each participant. After using the application, each participant evaluates it according to six factors: utility, functionality, simplicity, intuitive navigation, easy navigation, timing using five-point scales: Excellent, Very Good, Good, Fair, Poor and then replies to one open question - "Will you use it, if it is available?".

TABLE III. EVENTS' POSTERS AND APPOINTMENTS RECOGNIZED AND EMBEDDED IN THE CALENDAR

Type of printed data	Success	Failed	Partial
Text recognition	80/100	8/100	12/100
Fields of interest extraction	80/80	-	10/100
Events embedded in calendar	80/80	-	10/10
Events out of date	5/80	-	-

TABLE IV. EFFECTIVENESS OF THE PROPOSED SYSTEM

Type of printed data	Image background	Number of samples	Avg. time taken	Accuracy
Events' posters	Non-uniform	80	<4s	90%
Medical Appointment	Uniform	20	<3s	100%

### D. Results and Discussion

After trying the application, all of the participants found the applications idea excellent. Most of the participants also, found the application very useful and usable. Indeed, the participants observed that there are no field entries, more, the number of clicks is reduced to an absolute maximum, all without limiting functionality of the application. Hence, all of them agree that the proposed application fall in the technology satisfying users daily life needs in simple manner. All the participants appreciate that the application is easy, fast and does not need internet connection. In addition, most of them will use this application if it is available in their phones.

### VI. CONCLUSION

We witness an era where technology advancements increase efficiency and reduce cost to develop smart applications. In other hand, smartphones' owners are always looking for services and applications to perform numerous daily tasks to save money, effort and time. In this paper we present an intuitive and easy reminder application developed with low cost using technologies namely OCR and smartphone to facilitate certain tasks for people. Unlike other reminder applications, the proposed application is a full offline application which permits to use it anytime and anywhere. More, it is a fully automatic application which performs without typing on smartphone keyboard. The proposed system automatically extracts relevant information from images of event posters or medical appointments, making use OCR technology within a smartphone. This information includes the name of the event, its date, time and venue to be embedded in the smartphone calendar. The usability and utility tests show that the application satisfies highly mobile users' needs. Finally, the system can be easily used on any Android smartphone.

One of the limitations of this application is that it can only extract text in English or French as it cannot recognize characters in any other language. Other languages will be added in future work as well an iOS version will be developed.

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