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Talking Diary: A Novel Approach for Automatic Audio Note Categorization and Event Scheduling for Android Application

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Abstract— Smartphone usage is very common nowadays. People tried to regulate their routine tasks using different mobile applications. In this research, a novel approach for note classification and scheduling is proposed to facilitate mobile users in automatically organizing their daily routine tasks with a single audio note. The proposed model has been implemented in an android application named "Talking Diary". Talking Diary is an android application comprised of three modules namely auto audio note classification, auto audio note scheduling, and working hour's calculator. The proposed model of classifier computed similarity score by extracting N-gram weights from Concept Net to perform classification. The scheduler generates events and alarm on receiving the audio note. Working hours are calculated on the basis of using GPS location. Testing of Talking Diary android application is performed by collecting 500 sample notes from the random population of participants. Accuracy, Recall, and Precision is calculated for the correctness of classifier. Test cases were developed to ensure the performance of the scheduler and work hour calculator.

Keywords— Audio Note Classification, Auto-scheduling, N-grams Technique, Concept Net, Text classification

I. INTRODUCTION

The trend of organizing daily tasks using mobile applications is common now because of mobile easy access. Mobile applications are easy to use. In the recent past, mobile applications are implementing artificial intelligence techniques to automate the task for the sake of user ease. This research focus is on designing an android application for automatically organizing the user's daily routines to some extent. An android application is developed for this purpose adapting artificial intelligence techniques to automate organizing and scheduling tasks. The main motivation behind this research is the reviews and deficiencies exist in the android applications available on Google Play Store. People lookup for automatic regulating and classification applications rather than manually saving and organizing their notes. People write text notes of their pending tasks for remembering in the form of sticky notes, mobile notes, and diary notes. There is no such system exists for automatic classification of note. Moreover, they schedule their life event and add reminders in calendars manually and forget the scheduler of important meetings either schedule verbally or via an email. To cope with the aforementioned problem we get from user's reviews, there is a need for a user-friendly, easily accessible and efficient system to automate these scheduling and classification. In this paper, a novel model approach is proposed using the semantic network Concept Net and N-gram technique to automate classification and scheduling tasks. The proposed model is implemented in Talking Diary android application for testing. Talking Diary is an android application divided into three modules to perform auto note classification, auto-scheduling and working hour calculators. The design of the Talking Diary interface is user-friendly and simple. Users can record an audio note with a single button click

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provided on the home screen of the application. Talking Diary converted audio notes into textual form and then the Talking Diary classifier classifies the note into the folder with the greatest similarity. This application protects the user from hazel of saving and finding a specific audio note into different folders. Talking Diary each component adapted different artificial intelligence techniques. Talking Diary different modules with internal adapted models and artificial intelligence techniques are discussed further in this paper under section system architecture.

Many desktop, web and mobile applications are already developed for keeping records of reminder note i.e. Google Keep [1], Notes [2] Samsung Notes, Color Notes: Notepad Notes, Keep my Notes, Diary with Lock, Diary, Dairo, Offline Diary. Users manually create and write notes using these applications. There is no auto-save and auto note organizing feature in these android applications. These features are missing in all existing android applications. After a thorough study, the drawbacks of the existing systems and the user's reviews about the applications on the Play Store are the main motivations behind developing the Talking Diary system. We have adapted text classification techniques for automatic categorization of audio notes into user-defined dynamic category folders. Text classification is the process of assigning text to some pre-defined categories. In a few decades, text classification is used to classify documents into different categories using term frequency and inverse document frequency algorithms [3]. In 2006, Elberrichi et.al and Scott et.al classify text using used WordNet [4] synonyms [5] and hyponyms [6]. Majewski et.al used Concept Net for text classification using a kernel text classifier [7]. In this research, Concept Net is used to extract similarity weights between words for computing similarity of an audio note with user-defined categories. Concept Net is a freely-available common sense knowledge semantic network for research purposes. A model is proposed to calculate the overall similarity score of a note with each user-defined category. Experimental results are shown later under the results section.

II. System Architecture

This section describes the component of Talking Diary each entailed with different artificial intelligence techniques. The system architecture of the Talking Diary is illustrated in Fig. 1: Classifier, Scheduler, and working hour calculator. Talking Diary can be installed on all kinds of mobile phones with an Android operating system. Concept Net [7] is used to extract similarity weights. Other technologies used are Volley Library, Google Sign-in API, and Google Map API, Google Firebase, Swipe layout, GitHub library, Graph View library, Design Support, Recycler view and Voice to Text API. Fingerprint password protection, Autosave, and reminders notification are the few other features of Talking Diary applications. The graphical user interface of Talking Diary shown in Fig.2 is user-friendly and efficient. The home screen consists of a recording button for audio note recording. After recording the note, the note is converted into text using Google Voice to Text API. The converted text then passed to the classifier and scheduler for further processing. Components of Talking Diary are discussed in detail further in this section.

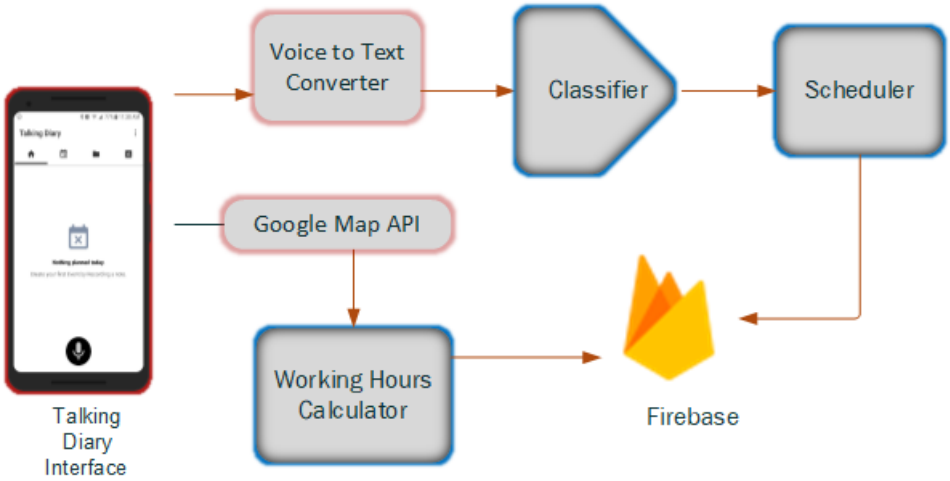

Fig. 1 System Architecture Design

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A. Note Classifier

The classifier received the note in textual form for Natural Language Processing. Stanford Core NLP tools are used for word tokenization, stop word removal and POS tagging. Tokenizer converted the text into n number of unigrams tokens T shown in eq. (1). After extracting unigrams tokens T from the text, unigrams T is matched with the user-defined category folders name j. Folder's names are dynamic and defined by the user himself shown in Figure 3. Similarity weights of unigrams T with each category folder name j are extracted from the Concept Net semantic network. Concept Net is a common-sense knowledge semantic network, having similarity weight between words. In eq. (2) Ti represents unigrams token 1-n whereas Wij represents the weight of Ti against each category. Classifier sums up the Wij, weights of all the unigrams against each folder category, using eq. (2). The total similarity score of each textual string against each category j is calculated using eq. (2). Cj is the total weight of the whole text against the j category folder. Category folder with maximum similarity score Cj is assigned to the note. The proposed mathematical model is as follow:

$$T = T1 \ldots\ldots Tn \qquad (1)$$

$$Cj = \sum_{i=1}^{n} TiWij \qquad (2)$$

$$\text{Assigned Category} = [C \square \ \text{MaxSimilarityScore}(Cj)] \qquad (3)$$

Suppose the user records an audio note “Buy Apple” and the available category folders are Events, Meetings, Work, Friends, Shopping and Budget. Classifier classified this audio note in the shopping folder because weight against the shopping folder is high than all other folders, an illustration of computation is given in Table 1. If the similarity score against each category is zero then the classifier put it in the general category folder shown in Fig.3.

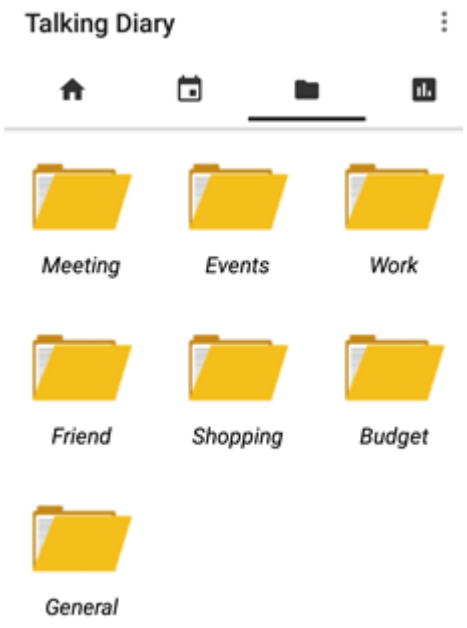

Fig. 3 Categories of Classifier for Experiment Evaluation

TABLE 1

CLASSIFIER ILLUSTRATION

Text: Buy Apple Unigrams T: T1: Buy, T2: Apple	**Extracted Weights of T1 from ConceptNet**	**Extracted Weights of T2 from ConceptNet**
Available Categories: C1(Events)=T1W1,1+T2W2,1=0+0=0 C2(Meeting)=T1W1,2+T2W2,2=0+0=0 C3(Work)= T1W1,3+ T2W2,3=0+0=0	T1W1,1 = 0.00 T1W1,2 = 0.00 T1W1,3 = 0.00 T1W1,4 = 0.00	T2W2,1 = 0.00 T2W2,2 = 0.00 T2W2,3 = 0.00 T2W2,4 = 0.00

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C4(Friends)=T1W1,4+ T2W2,4=0+0=0 C5(Shopping)=T1W1,5+T2W2,5=4.25+0=4.25 C6(Budget)= T1W1,6+ T2W2,6=0+0=0	T1W1,5= 4.25 T1W1,6 = 0.00	T2W2,5 = 0.00 T2W2,6 = 0.00
Assigned Category= MaxSimilarityScore(Cj) C= shopping		

Outline of Classifier Algorithm:

```
Classifier (Unigrams [ ],n,Categories_folder_Name[ ],k)
        T=Unigrams
    for j=1 to k
                for i=1 to n
                    Wij= WeightExtractorConceptNet(T[i],j)
                    C[j]=C[j]+Wij
    Assigned_Category_Folder=MaxSimilarityScore(C[ ],j)
      Move to Assigned_Category_Folder
```

B. Scheduler

This section describes the working of the Talking Diary scheduler component. The scheduler received an audio note in the textual form. It then finds unigram "Remind me" in the unigrams strings. If it exists then the scheduler triggers the calendar events and adds an event to the mobile calendar. Calendar event extracted day and time from the unigrams by string match technique to generate the reminder notifications.

Outline of Scheduler Algorithm:

```
Scheduler (Unigrams [ ],n)
        T=Unigrams
    for i=1 to n
            if(T[i]==”remind me”)
                    TriggerCalendarEvent( )
                    exit
```

C. Working Hours Calculator

Working Hours Calculator (WHC) track and refresh the location of the user every two minutes. The user has to enter the office timings manually in application only once then application prompt user if he will not be present at the required location at the mentioned time. WHC calculate the office hours per day, per week and per month and also shown if there is a deficiency of office hours. WHC automatically calculated the office hours on a daily basis. Users can view weekly and monthly reports of working hours. The duration of stay at the workplace is calculated by mapping the difference between the check-In and check-Out timings. Results are shown on the mobile screen in graph format as shown in Fig. 5.

III. TESTING AND EVALUATION

Talking Diary android application is available on the play store[1]. We have collected a dataset of 500 notes, for classifier testing, against pre-defined six categories from the random population of participants who are the mobile users and have some daily schedule. The dataset is available on GitHub[2]. Six pre-defined categories taken as an example for testing purposes are Events, Meetings, Work, Friends, Shopping and Budget. The collected dataset is given as input to the Talking Diary classifier. The proposed model was applied to the collected dataset for classification. It gives 92.2% accuracy for classification, 461 sentences out of 500 sentences are correctly classified by the Talking Diary classifier.

[1] https://play.google.com/store/apps/details?id=info.semicolen.talkingdiaryasmartcampanion
[2] https://github.com/hanimunir/Dataset/blob/master/sentences_2.txt

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Accuracy of results is computed as follow:

Accuracy = total correct categorized sentences / total number of sentences * 100

= 461 / 500 * 100= 92.2

The effectiveness of the classifier is further evaluated by measuring Recall and Precision. These parameters measure the correct classification beyond accuracy. The confusion matrix for recall and precision is shown in Fig. 2. Classifier recall and precision for each category are given in Table 2. Results show high recall and precision values for each category.

N=500	Events	Meeting	Work	Friend	Shopping	Budget	General
Events	76		3	1			4
Meeting		72		1		1	
Work			68			2	3
Friend	3	1		68	3		
Shopping					85	2	
Budget		1			2	85	2
General	-	-	-	-	-	-	-

Fig.2 Confusion Matrix

TABLE 2

EVALUATION MEASURES FOR CLASSIFIER

Category	Recall	Precision	F1
Event	0.904	0.962	0.932
Meeting	0.972	0.972	0.972
Work	0.932	0.958	0.945
Friend	0.906	0.971	0.937
Shopping	0.977	0.944	0.960
Budget	0.944	0.944	0.944

Test scenarios were developed for testing the correctness of the scheduler and working hour calculator output. The application generated results of input audio note “Remind me of a project meeting at 11:00 AM” for scheduler are shown in Fig. 4.

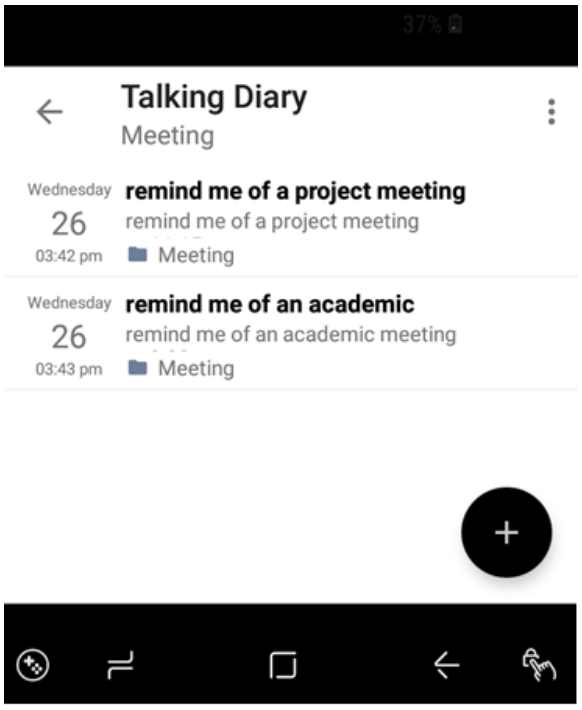

Fig. 4 Scheduler Experimental Evaluation

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To ensure the working of the working hour calculator module, the location of Riphah International University, Lahore, Pakistan was taken as a test scenario. Check-Inn time was approximately 8:00 AM and Check-Out time was approximately 4:00 PM daily. Results are computed at the end of weekday Friday. The results of the working hour calculator are shown in Fig. 5.

Fig. 5 Working Hour Calculator Experimental Evaluation

IV. CONCLUSION

A mobile application interface is developed in this research for auto audio note classification and scheduling, adapting artificial intelligence techniques. A proposed model gives high accuracy, recall and precision values. Mobile application usage is very common nowadays. People try to organize their tasks using mobile applications. In this demonstration, the focus is on automatic note classification, scheduling and working hour calculation for android application. Our contributions include the proposed model of using Concept Net for classification and automatic scheduling from an audio note. In future work, emotion and recommendation generation, based on a person schedule and busy routines, will be induced in Talking Diary application, for making Talking Diary a smart companion of android users.

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