Rizvi College of Engineering

Department of Computer Engineering

Project Synopsis Report

on

EarlyBuddy: Smart alarm for routines

Submitted in partial fulfilment of the requirements

of the degree of

Bachelors of Engineering

by

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Abstract

EARLYBUDDY is a smart alarm clock application designed for Android users. Primarily, it makes use of traffic analysis to help wake up the user on-time in situations where a delay is predicted. Instead of setting a single wake-up time, users can choose a timeframe during which they need to wake up. The app will then select a specific time from within that window based on the delay calculated using frequent updates on the traffic data. If it senses that the user will be late to their destination, it will adjust the existing alarm to wake up the user accordingly. Users can also add their routines for the morning, these routines are factored into calculating the overall delay. These routines are optional, but are recommended, as they allow the user to plan their morning and also give the application more data to use to calculate delays.

Sleep is not created equal for all humans. For users who struggle to get out of bed in the morning, EARLYBUDDY has challenges that the user has to complete, such as solving a math puzzle, in order to turn off the alarm. The app includes other modes too. To disable the alarm, users might have to solve a calculation, enter the CAPTCHA text, or even shake the phone vigorously. The main idea behind being actively waking-up the mind and body before the user hits the snooze. Additionally, users can put their phone on the mattress beside them, EARLYBUDDY will use the device's sensors to figure out their sleeping patterns. This can be used to evaluate the quality of night's sleep user is getting and setting off the alarm at the most natural moment.

Keywords: alarm, routine, heavy sleep, traffic, analysis, activity.

Certificate

This is to certify that the project synopsis entitled “EarlyBuddy: Smart alarm for routines” has been submitted by Bhavana Choudhary, Amruta Dabholkar and Rushikesh Gajmal under the guidance of Dr. Varsha Shah in partial fulfillment of the requirement for the award of the Degree of Bachelor of Engineering in Computer Engineering from University of Mumbai.

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Index

1. INTRODUCTION

Effective time management is important for every individual's personal life and career success. A lot of time is experimentally proven to be wasted unproductively each day, which can be put to better uses. Waking up at the correct point of time in the morning not only helps in waking up less tired and less stressed but also saves time during commute if the delay caused by traffic is already taken into consideration to set the alarm time. Adequate sleep optimally impacts mental functioning and therefore impacts a student's performance during examinations or otherwise. In a 24-hour period, the pattern of sleep one experiences directly correlates with their physical health, mood, and mental functioning.

The quality and quantity of sleep, both, help one positively and also play an important role in one's health. A positive effect can be seen on performance due to good sleep, while a lack of sleep can affect one's memory, alertness, cognitive functioning, learning abilities, and also immune system. Researchers have thus investigated numerous technologies like smart alarm clocks and approaches which collect information that can increase user's awareness of their sleep habits to persuade them to adopt healthier routines.

EarlyBuddy, is a smart alarm app that uses traffic data and sleep analysis to wake up user at the best possible time. The android application uses the traffic data supplied by a third party API to check whether the user will be late arriving to their destination. The application analyses the user's body movements during the night, which can tell the application when the user is coming out of deep sleep or entering another phase of sleep. Once a timeframe is entered, the application polls the API for data about the journey the user specified. If the journey is affected by delays and the user will be late, the application will wake the user up immediately.

2. LITERATURE SURVEY

2.1 Existing System Survey

Alarm applications are common on almost all stores available for getting applications, both for Android and iOS, in free and paid versions also. Apps designed for alarms with additional functionality like tracking user location during their journey, are also available already. These applications remind the user to wake up before they reach their journey destination, but this feature cannot be used to ensure that the user will reach there on time and not get delayed in traffic. They only track the stops in journey specified by the user and select a specific time that would alert the user of the oncoming destination. EARLYBUDDY app is specifically designed to serve this purpose, it calculates the overall delay that the user might have to face by analyzing traffic data for the set timeframe also taking into account the user's routine like coffee, breakfast, bath, etc.

Also, few alarm apps support functionality like mind-activities for heavy sleepers, sleep tracking using mobile sensors, weather updates, etc. but none of them provide a proper solution to prevent users from being late to their destination due to traffic delays. This android application is a "one-stop solution" for all the above mentioned features.

2.2 Limitations Encountered

Real-time route traffic analysis in an alarm app is a useful feature that will help not only in getting out the maximum possible sleep for the day but also in analyzing traffic patterns in users usual travel routes. However, this system is still not available for use while setting up multiple alarms since route set needs to be constant. And finally, the main drawback of this application would be the limitations in per day request allowances of using TomTom API.

1. Sleep is monitored only when an alarm is set in the app.
2. Hit and miss of TomTom API.
3. Less reliability on phones accelerometer.
4. Inability to set different routes at a time.

2.3 Problem Statement

Realizing the need of efficient management of time as well as sleep for an individual, while setting an alarm for the morning, by designing an application that reliably wakes the user while

keeping them alert and focused, that too on time-every time.

Traditional alarm clocks on the market are ineffective or unpleasant when attempting to wake the user up, therefore, to design an application that helps people wake up less tired, less groggy and fully awake, using persuasive measures. This will in turn help in improving performance and reducing problems like sleep irregularity, grogginess, snoring, tiredness, etc., which are detrimental to a person's personal and professional lives.

2.4 Objectives

Following are the objectives of this project:

- Optimizing quality of user's waking life, including his/her productivity, emotional balance, brain and heart health, immune system, creativity, vitality, and even weight.
- Monitoring sleep behavior and collecting information that can increase users' awareness of their sleep habits, and to persuading them to adopt healthier routines.
- Increasing public awareness of the positive effects of adequate sleep and increasing the proportion of adults who obtain sufficient amounts of sleep to improve health, wellness, productivity, quality of life, and public safety.
- Recognizing heavy sleepers and help make their mind alert in morning by including various activities to prevent snoozing, snoring or grogginess.

2.5 Scope

In our project we concentrated on the commuters especially students who wish to obtain maximum possible sleep in a day, even if it means just five extra minutes, due to their tight schedules. It is very important to concentrate on sleep since it deeply affects person's productivity, emotional balance, brain and even heart health. To wake up fresh and less tired required a healthy alarm system that also had additional mind activities for heavy sleepers like solving easy math equations, entering Captcha text, shaking the phone, etc.

These key points together were the focus of the project. A little delay in the morning can result in getting stuck in traffic which would ultimately delay reaching destination on time. So traffic analysis for selecting most perfect time to wake up was the main aim.

3. PROPOSED SYSTEM

1.1 Algorithm

The working algorithm of the application can be given below as follows:

- Set time or timeframe for the alarm.
- Optionally add the journey route and daily routine activities.
- Now the alarm is added.
- Find the best time for the alarm from the set timeframe based on traffic analysis by TomTom API and considering any added routines.
- Analyze sleep patterns using phone's accelerometer based on "big" movements calculated as below.
- Chart the analyzed sleep patterns of user on graph.
- Heavy sleepers function to ensure they are fully awake and not snoozing.

The accelerometer reading algorithm can be given below as follows:

Twenty times a second, the accelerometer updates its X, Y, Z values. Using the equation below, we can calculate the variance of acceleration between each sensor change.

$$accelCurrent = \sqrt{(X^2 + Y^2 + Z^2)}$$

$$variance = accelCurrent - accelLast$$

where,

accelCurrent - newest acceleration,

accelLast - previous acceleration that the accelerometer calculated

Using this variance, we can check if it is over the threshold for recording data as movements. This is to keep a track of the how "big" the movement is. Every minute, we will commit the amount of motions, the max variance of motions, the average variance, and the timestamp of the recording to Realm Database.

1.2 Platform Requirement

Device (mobile/tablet) supporting android version 5.0 (and later).

1.3 Tools and API used

- **TomTom**: To get the traffic data that the application requires, the application polls the API for the data on the user's journey i.e. start and end location, and time of arrival.

- **Google Maps**: Using the Google Maps API, the application supplies the user with a map in which they can enter their journey details.
- **Google Maps Geocoder**: This API allows the application to convert longitude and latitude points into actual addresses, which are more understandable and user friendly.
- **Phone's accelerometer**: updates its X, Y, Z axis values to detect movement
- **MPAndroidChart** for Analysis Section
- **Realm** Database
- **Stetho** for Realm Database Debugging

1.4 Design Details

The diagram below shows the basic architecture and use of each of the various components used while designing the system / application.

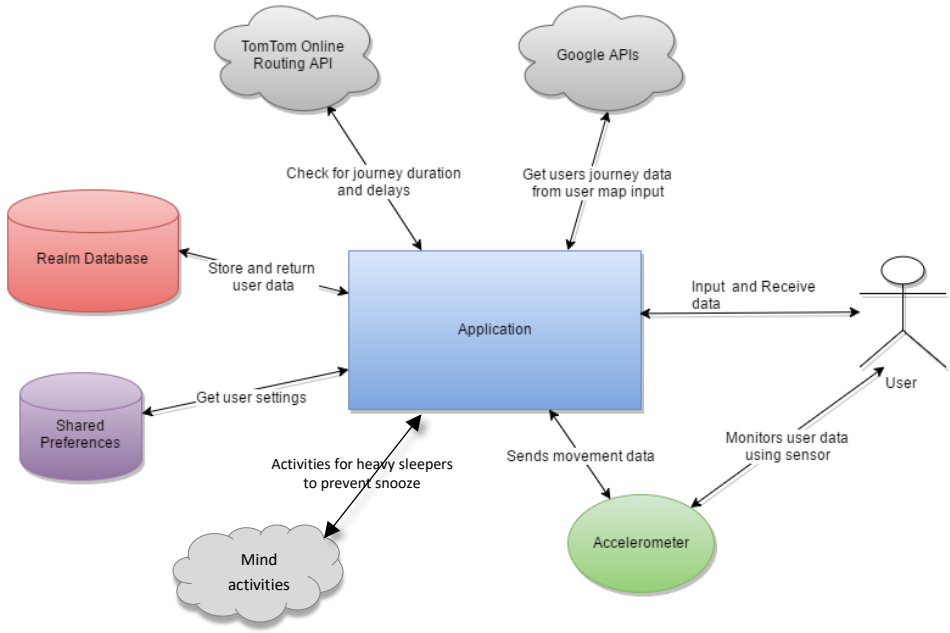

Fig: Basic architecture of the system / application

1.5 Methodology

In this project we have made use of Google maps geocoder to allow the user to pinpoint locations on the map, select the route for their commute and set the time frame for wake-up. After this TOMTOM API will analyze the traffic on the route during the time frame period to select the exact time for alarm that would help to reach destination on time and avoid delay due to traffic. It includes analyzing traffic data using the API for different time frames and routes to determine best algorithm for alarm time adjustment.

We have also explored phone's inbuilt accelerometer to determine user's sleep activities accurately, without much battery drain. This is helpful since no additional equipment or gears are required for sleep tracking and we have made use of an existing mobile technology which is otherwise unused. Researching on various sleep-cycles of different users for heavy sleep functionality and brain activities to help reduce grogginess or tiredness. Users can also specify "routines" for the morning. These are activities that they can save and specify before setting the alarm. These routines are then taken into account along with the traffic data. These routines are optional, but are recommended, as they allow the user to plan their morning.

4. IMPLEMENTATION PLAN

This project will be implemented in different phases. The first phase would be to implement the basic user interface for setting an alarm which would include a clock to set time and options to add journey and routine respectively. After that we will implement the algorithm for performing accurate sleep analysis using the phone's accelerometer.

The next phase would include adding heavy sleeper functionality to pop-up on hitting snooze. This functionality includes activities like solving simple math problem or entering correct text to shutdown the alarm.

Activity	Description	Efforts in person weeks	Deliverable
1	Planning	3 weeks	
2	Requirement Gathering & Analysis	Included in above	LLD / DLD Document
3	Design	2 weeks	
4	Coding and implementation	12 weeks	Code release
5	Testing and bug fixing	2 weeks	Test Report
6	Deployment	1 week	App Release
	Total	**20 weeks**	

Proposed Cost:

This project does not have any investment as it is a software based project.

CONCLUSION

Sleep is a physiological process essential to life. Cognitive performance is susceptible to inadequate sleep durations, defined as fewer than 7 hours a day for adults. Inadequate sleep decreases general alertness and impairs attention. Sleep deprivation and symptoms related to sleep disorders have not only been ignored but also inadequately understood. In this project we design a system / application that can be used for bettering every individuals sleeping habits, giving them an opportunity to get maximum possible sleep and reaching destinations on time every day. The additional functionality for heavy sleepers is widely popular in recent alarm application available.

In terms of future functionalities, we wish to implement better analysis of the sleep which would require incorporating more sensor data and integrating data from fitness bands that are widely popular nowadays. This might be helpful in making the analysis of users sleep more solid and accurate. Another feature which we couldn’t implement was the public transport aspect of the application. As future work we would like to add support for public transport facilities since it is the most popular means of transport in India.

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