Design and Implementation of a Mobile-Based Personal Digital Assistant (MPDA)

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Abstract. In this work we present a mobile-based personal digital assistance for students of higher institutions of learning. These days, the need for a To-Do list or a daily plan cannot be over-emphasized. This is because so many things compete for our valuable. It appears that the 24 h of a day are no longer sufficient for our daily activities. Although this appears true, however, prioritizing our activities generally may go a long way in helping to manage our time. Several platforms and media that existed some years ago were based on the use of pen and paper to organize activities for the day. These can no longer match up recent advances in technology and information flow which are at a very great speed. This work leverages on the current proliferation of mobile devices where each student now has a mobile device for personal use. In this work a mobile-based personal digital assistant is developed specifically on the Android platform. The system adopts Google's material guidelines for the design of its user interface. Android Java was used for the implementation of the core aspects of the system while SQLite was used for the database. The application will help students in prioritizing and organizing their daily activities thereby making them more responsible.

Keywords: Android · Information processing · Mobile · Personal digital assistant

1 Introduction

In today's busy world, everyone needs a personal assistant which in most cases is not usually or readily available. Human-based personal assistant is prone to mistakes, tiredness or fatigue, and may likely forget important events or make decisions based on emotions. To prevent this from happening, there is need for technology and this has resulted in what we know today as personal digital assistants (PDAs). In this work, we focus on students who, these days are encumbered with so many tasks and activities

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than was the case some years back. Students have to keep track of assignments, deadlines, projects, personal pursuits and all these on the long run can weigh down the students.

Decades ago, personal digital assistants were not available; unlike what is available today; all things had to be put down on paper. People still have diaries and books where they did their major planning, but with the advent of mobile computing, applications and artificial intelligence, those methods are being replaced. Mobile electronic products are now common because of the convenient and versatile function the provide [1]. One of such devices is the personal digital assistant (PDA) which can help students to organize their time and programs thereby focusing on very important activities. A PDA is a multi-functional information and communication tool that can help students properly prioritize their activities [2]. With the growth in sales of mobile devices, there is a great opportunity to help students through the mobile platform.

According to Google, over 50 billion apps have been downloaded of Google play, that figure alone shows that a lot of people do download and use applications. The implication is that a lot of people can be influenced through mobile applications. According to Google, there are over one billion active Android users and 1.5 million devices are activated daily [3]. Android platform and devices therefore constitute a good choice on which to deploy a mobile application for students.

Although there are personal digital assistants already existing on Google play store, our own application is uniquely geared towards students with their unique features and activities. The traditional method of using pen and paper to document tasks though still very good, cannot keep up with the increasing rate of information flow. The aim of this study is to design and implement a mobile-based personal digital assistant for use by students of higher institutions. This is to be achieved by the implementation of an Android application with user interface designed using Google's creative vision design principles. The system is intended to run on Android-based devices only. The development tool used is Android studio, which is the most popular integrated development environment for developing android applications. Android studio is more preferred than Eclipse as it is more robust and support is readily available. The main programming language used is Java, XML (extensible markup language) was used for the design while SQLite was used for the database, SQLite is portable and fast. The application will help students in prioritizing and organizing their daily activities thereby making them generally more productive and responsible.

2 Related Works

Students these days have more things to learn and deal with than in the past. They are bombarded daily with distractions and alternatives, for which without proper planning and adequate help a student can stray away. With a PDA, students need not bother about some tasks. Remembering when to submit assignments or keeping track of a project can be done better with the help of the digital assistant.

Before the term personal digital assistant came to be, there were personal planners, which were in paper format already existing. As people were more engaged and nations grew, things needed to be organized. PDAs gradually became popular, but were not as powerful as what we have today. Actually, the term PDA referred to a device, which was sold to assist people and help them organize and plan their schedule. Today PDA's are not just devices but can also be software, which run on different devices. Also the PDA's are intelligent and can make use of the available hardware power in today's computer [4].

Several works have been carried out with respect to the adoption, acceptance, use and applications that run on PDAs. PDAs have been used in a number of medical and educational environments to enhance learning and data collection. The work of [5] focused on the use of PDAs as tools for learning in clinical internships while the work of [6] evaluated the usage of PDAs among undergraduate medical students. They studied the trends, barriers and the advantages of mobile devices to students. Other works which are include the one by [7–9, 14]. The work in [7] focused on using PDAs for collecting data on HIV/AIDS in an African country while [8, 9] considered the experience of Nursing students with respect to the use of PDAs. The work in [14] is also related to collection of data on infectious diseases in South American country of Peru. The work in [10, 11] though similar in part, to the one intended in this study like organizing assignments, is focused on adolescents with Asperger Syndrome and other developmental disabilities. The study in [12] assessed the practical performance of using PDAs. A general history of PDAs was provided in [13] but for the period covering 1980–2000. In [15–17], PDAs applications were developed to help students in health-related fields to effectively collect data and carry out their activities.

Today personal digital assistants go from the simple to the complex where artificial intelligence is involved. Also, each new Microsoft Windows system comes with a popular system known as Cortana, an intelligent personal assistant that uses voice commands to execute tasks on Windows operating system. There are also the less intelligent versions, which can be on a smart phone as an application. Assistant, which is also an intelligent personal assistant, is a mobile application unlike Cortana, which has a desktop version. It does tasks like telling you the nearest location to get a drink or buy some clothes [12]. There are other personal assistants such as My Study Life [13], which do not make use of artificial intelligence. Not every PDA needs artificial intelligence; in fact, some PDAs are better off without the complexities of implementing artificial intelligence.

There are existing personal digital assistants available on Google's play store, an online application store where developers can upload their applications and user can download any application of their choice. Some are free while others involve some payment before or after download. Effectiveness is a personal digital assistant carefully designed with excellent features. Accomplish [13] is another mobile-based PDA with which you can easily recognize with a reddish logo. It helps you graphically plan your time, which is a lot easier and actually, more fun that using a pen and paper. It uses a simple and conventional to-do list. MSL or My study Life is another successful digital

assistant on play store with success in the likes of My Effectiveness. My study life has 1,000,000 to 5,000,000 downloads on play store with over 23,000 5-star ratings.

One great feature about MSL application is the face that it was designed for students, teachers and lecturers. It is to make ones study life easier to manage. It has functionalities to store assignments and exams, which use the cloud to make it available on any device. It even has features to show home works due for submission, classes that conflict with exams and even that ability to add a revision task for a specific exam. Like others, Roubit [13] is another good digital assistant, though not with as many features as the others offer. It is an application that specializes in routine work that someone does every day. Roubit has a simple but well-designed interface. Roubit has an authentic blue colour, which is the default theme of the application. It has days of the week from Monday to Sunday and you can add tasks on those days using the floating button. The application makes use of material design animation such as circular reveal animation and custom check boxes.

It is certain that PDAs applications have been developed and used in a number of fields and for specific needs, our study concerns only students of higher institutions in Nigeria. This is on the premise that our educational system presently makes it necessary for students to seek assistance in the aspect of organizing their daily activities because they usually overwhelming many times.

2.1 Features of a Student Personal Digital Assistant

There are some common features of mobile-based student personal digital assistants, these features should be present in all others, and they are discussed below. These features may not be available in every single student PDA but they are feature of a modern standard PDA for students.

Android Creative Vision: The Android creative vision and design principles were created to keep user's best interest in mind. Most modern applications are designed using android creative vision. Google even says they will soon only allow applications that use material design to feature on Play Store. Apps that work in expected ways are instantly familiar to Android users, gain their trust, and ensure they engage with the app's consent, functionality, and features.

Ease of Use: The users of these applications are students so therefore, the user interface should not be complex and as much as possible the learning curve should not be steep. Addition of task and deletion should not take time or involve a long process and the app should contain short cuts of operations to enable students easily accomplish what they want with a few clicks.

Notification: With the old method of using papers, there was no notification, but with digital power, there is a lot that can be done, one of which is notification. A notification can be a simple pop up and beep that notifies the user of when a task is due, this helps the user remember because he is prone to even forgetting what he has planned. A notification runs on a service that is available even when the student is not using the application.

Planning and Scheduling: With digital assistants, students can make plans and not just for the day but for future days, they can look at their schedule for the day and make changes where necessary. With the old method of documenting on paper, planning was possible but not as convenient as planning with a digital assistant because you can edit with a digital assistant and delete peradventure the user's schedule changes. When using digital assistants you can see a whole month at a glance and see what and when you have appointments. Some PDAs even have the functionality of informing you when you have clashing tasks, which is priceless information.

Information: If a student was to plan his year with the traditional method of writing it down, he may not be able to give account of how many goals he has per month, how many are due, or how many he has accomplished. He may have little information about all this, but a digital assistant can give real time information about all things that pertains the students life, his assignments, projects and to-do list. A PDA can give the student a summarized view of all he has documented down so that he can use that information to plan further.

3 Issues with Existing Personal Digital Assistants

As with most technologies, existing personal digital assistants have some issues requiring attention. Some of the issues are highlighted below.

3.1 Lack of Features

A common reason for low star rating of applications on play store is lack of features, the issue is that an application may not be able to have all the feature desired by a particular student. A good application should be one that each student feels the application was specially designed for him or her. Some students want all in one package, while some other students love simplicity; they want the application to include just what the need and not every possible functionality. This does not make it easy for developers because they have to include the right amount to functionality to satisfy the majority of users.

3.2 Privacy and Security

Personal information is stored such as personal tasks or goals. Unauthorized persons could have access to those personal information and cause havoc. Personal things should remain personal and when designing applications that keep personal information, they should be designed to be reliable and dependable.

3.3 Learning Curve

The learning curve of some applications is actually steep though they may be great applications, and example is My Effectiveness. Learning curve indicates how hard it is

to learn software or in other words how fast a user can understand and get used to software. A steep learning curve is one that is not so easy to understand and can get complex quite quickly. My Effectiveness is a great application, one of the great names but it is complex, it has everything and some students may not like the complexity, but there are simple apps such as Roubit or the most successful of the listed, which is My Study Life, has a very simple self-explanatory interface.

3.4 Internet Access

There are parts of the world where Internet access is not readily available, and there are student digital assistants that work with the Internet. A lot of the great PDAs synchronize and this involves the use of Internet connection. Google advises developers not to develop applications that are data intensive or need constant connection. This is so that users in developing countries can use all the functionalities of these applications; updates should be less frequent also.

4 Requirements Analysis

Software system requirements are classified into functional and non-functional requirements; these will be discussed with respect to the mobile-based personal assistant system [18].

4.1 Functional Requirements of Application

Functional requirements represent what the system should do, the behaviour of the system in relation to the system's functionality. Below are the functional requirements for the mobile-based personal assistant.

- The user shall be able to add a new task for the day.
- The user shall be able to edit and delete added tasks.
- The user shall be able to view the list of all saved task.
- The system shall be able to notify the user of a task using notification manager.
- An ID shall uniquely identify each notification in the system.
- The user shall be able to view the classes he has in a day.
- The user shall be able to add new classes to any day he wishes.
- The user shall be able to edit and delete his classes.
- The system shall show the user pending tasks for a day.
- The system shall be allowing the user view the number of classes he has per day.
- The user shall be able to add, edit and delete new assignments.
- The user shall be able to add, edit and delete new projects.
- The system shall inform the user of pending assignments and projects.

4.2 Non-functional Requirements

Requirements that are not directly concerned with the specific services derived by the system to the users are referred to as non-functional requirements. Non-functional

requirements, include security, reliability, availability or performance usually specify or constrain characteristic of the system as a whole [19].

5 System Design and Modeling

The system is designed based on the requirements documented. It is in three specifications, which are physical design, the logical design and conceptual design [20, 21].

5.1 Logical Design

Logical design describes processes, and this is without suggesting how they are conducted. It involves defining business entities and relationships. Physical details are defined during the design phase when these logical models are refined into physical models. All these provide information needed to build the system.

Class Diagram: Class Diagram provides an overview of the target system by describing the objects and classes inside the system and the relationships between them [22, 23]. Figure 1 below shows the various classes of the system, from the task list also called to-do list to the Lectures which is also called classes, to the project, contacts and assignment.

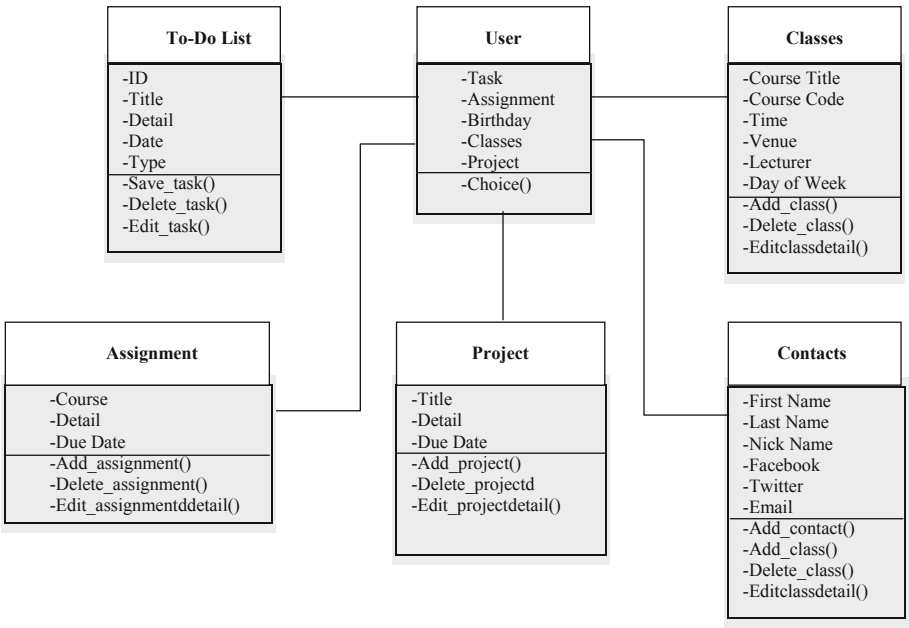

Fig. 1. Class diagram representing a mobile-based student PDA

Activity Diagram: Activity diagrams are graphical representations of workflows; they are representations of stepwise activities and actions, which include support for choice, iteration and concurrency (Fig. 2).

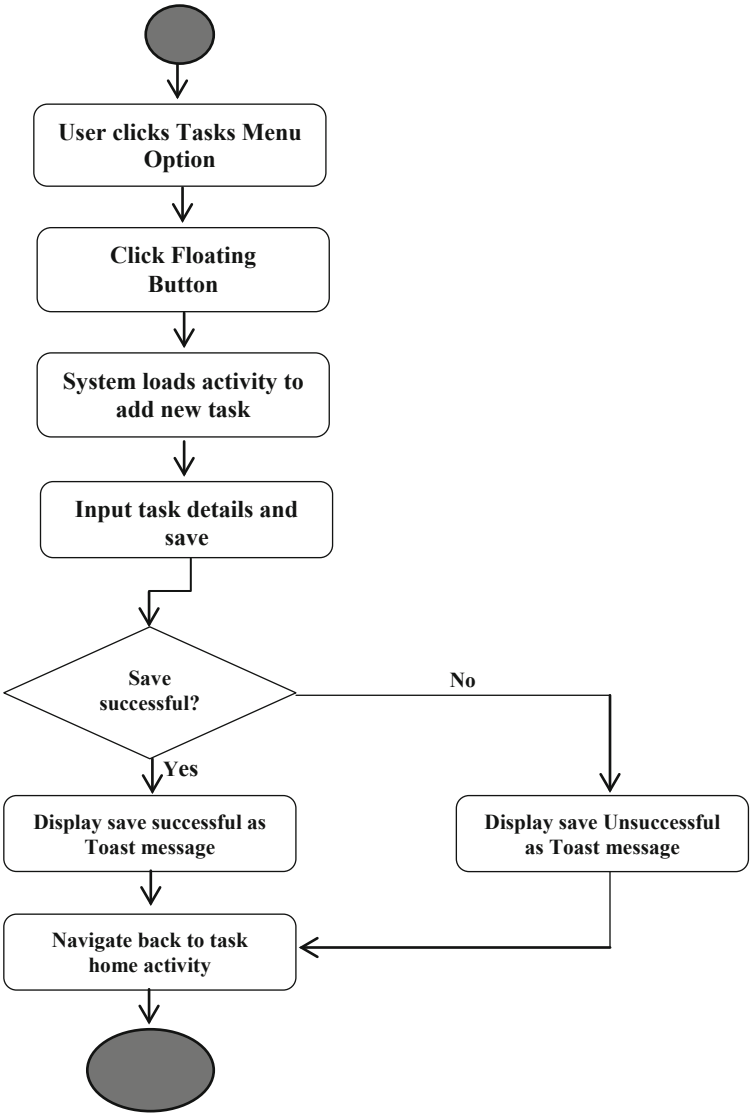

Fig. 2. Activity diagram for adding and saving a new task

Sequence Diagram: The sequence diagram is used primarily to show the interactions between objects in the sequential order that those interactions occur [24]. Figure 3 shows the sequence diagram for a user saving a task and deleting a task respectively.

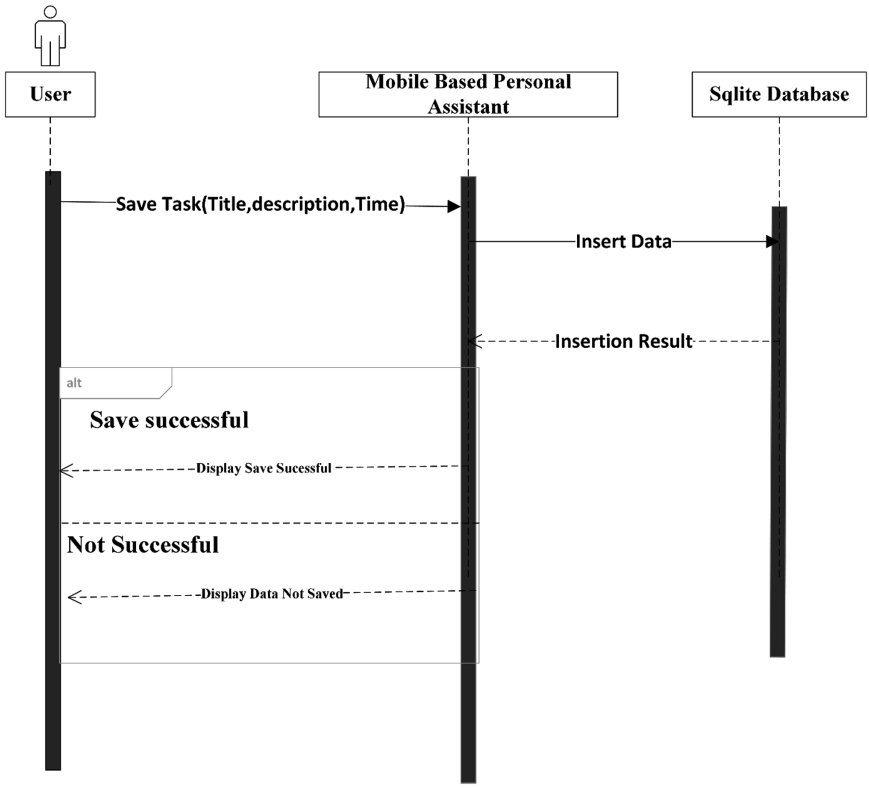

Fig. 3. Sequence diagram for user saving a task

6 System Implementation

The student personal digital assistant has been designed with material design guidelines which one of its sayings is "having a simple interface is important". According to Google, elegant, usable, highly rated apps also have simple user interfaces.

6.1 Implementation Tools Used

Android studio is the tool used for the development and deployment of the application. Android java and XML (extensible markup language) being the main programming languages used. Android java, which is object oriented, is for the functionalities and logic while XML was used for the design and presentation of the application.

SQLite [10, 11] is a portable version of the popular SQL database, unlike the server-client nature of the typical SQL database SQLite is used when a local, portable, lightweight database is needed. Therefore, it should be no surprise that a lot of android application use SQLite.

Android studio is free and very powerful, with its own device emulator, which is fast enough for development, debugging and testing purposes.

6.2 Program Modules and Interfaces

This section describes the various modules of the application. The application is made of different modules, which are independent of each other; the dashboard gets information from all these modules and displays it to the user in a summarized version for quick viewing.

The Dashboard: The diagram in Fig. 4 is the dashboard, which is the first activity the user sees after launching the application. It displays the status of things concerning the user, like due tasks, due assignments, and projects. On the bottom-right is a floating button, which is a shortcut to add task, assignment or project without using the navigation drawer. The dashboard is what sort of links all the modules together and gives the student summarized information of pending tasks due assignments and similar information.

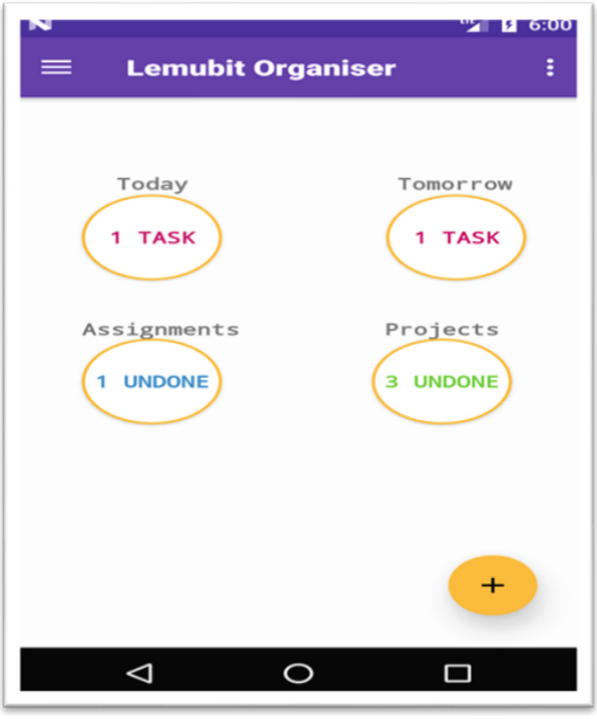

Fig. 4. The dashboard

The Navigation Drawer: Figure 5 which is the navigation drawer is the part of the user interface that displays available modules or functions of the application, the user just has to swipe right on the screen to open the navigation drawer and swipe left to close it, this enables and organised navigation with delightful motion.

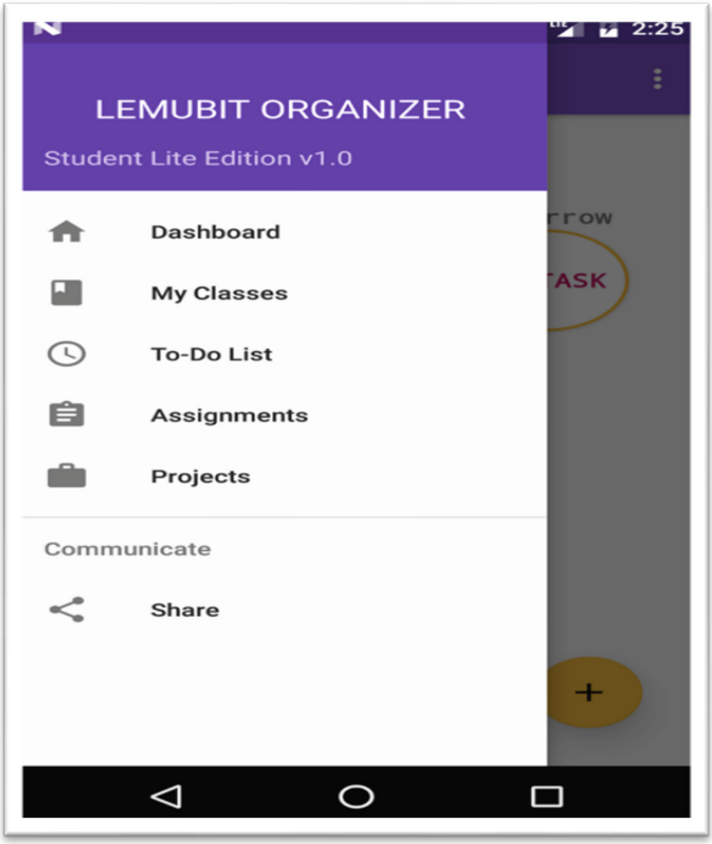

Fig. 5. The navigation drawer

To-Do List Module: This is where the student inputs their task for the day or future days. The student can go back to check saved tasks, the system notifies the student through a notification service when time is due for a particular task (Fig. 6).

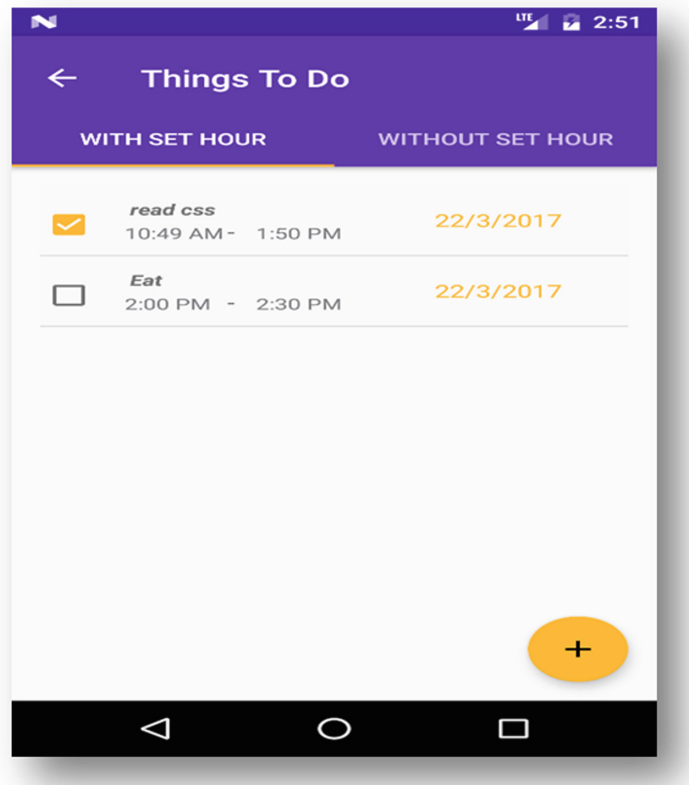

Fig. 6. Task view

7 Conclusion

The student mobile personal assistant will aid the students in their day-to-day activities and planning. Students who were asked to review the applications gave a positive review; this is good because it signifies that students are satisfied with the functionalities and user interface. The material design guideline was used to give a nice look and feel to the application. More and even better improvements will be made to the application's future releases to include or remove features desired by students. Any student using such an application will be more productive than his or her peers, will have less things to think about and will be more organized.

In order for the system to be used effectively, students need to be adequately educated about the system and how to use it. Students should also be encouraged to use the application because a user cannot know how good a product is neither can he benefit from it if he has not used it. For best experience, students should use android marshmallow for the performance and beautiful aesthetics.

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