CollegeEssentials - A Student Support Application

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Final Year Project

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About this project

Abstract: This paper proposes a new phone application that consists of numerous features to support third level students. These features include fully customizable timetable, a countdown timer to exams and deadlines, Google maps feature that highlights useful locations around the local area and an augmented camera function which places an arrow on the camera screen that points towards a selected location. The primary technologies used were Android Studio, SQLite and PostgreSQL. The features can be accessed 24/7 and effortlessly by any user. All colleges maintain their own network for students meaning that our application can be downloaded and used at all times. This report will discuss the process of making such an application and the development of each feature to correspond with both students' and institutions' administrative concerns.

Authors: This project was developed by two 4th year development students, Aaron Flanagan and Ciaran Brennan, as part of our Bachelors of Science honours degree in Applied Software Development.

Acknowledgements:

We would like to acknowledge and thank Damien Costello for supervising this project. His expert advice and support helped guide this project to completion. We would also like to acknowledge the Department of Computer science and Applied Physics for making this possible and helping us by providing support and any tools that were needed during the development.

Running this project:

This project can be found on GitHub using the link below. It contains a small ReadMe file on how to download and run the application. The GitHub repository holds all the classes and native android files created and used by Android Studio to compile and run the project. Your computer or laptop must support virtualization, this can be checked by attempting to install Intel's hardware accelerator software or by checking in the task manager of your machine. If your machine does not support it, you will be unable to run the emulator, instead you must plug in an android device with the developer options enabled. This varies between devices so you must ceck how to enable them for your specific device.

GitHub: https://github.com/AaronFlanagan20/CollegeEssentialsApp.git

Previous Research

The original idea for this project was to develop a facial recognition music application. The application would begin by capturing an image of the users face and running a mood capturing algorithm to determine the users mood, and it would then generate a music file list based on the users mood. This projects foreground was going to include an animated graphical user interface through the use of the JavaFX library made available by Oracle [1]. The background was running a facial detection program that was described by the OpenCV Team [2]. This algorithm was going to be built upon to include facial recognition as it only produced facial detection on screen by drawing shape around the users face, but this needed a feature extraction algorithm to complete it and that's when the idea discovered a problem that could not be solved. We had to make a decision, either change language or change the idea for the project. Since the developers are both competent in Java we decided to change the project rather than change the language. The reason we could not continue in Java was because we spent weeks of research and study involving different approaches of facial recognition and feature extraction it was found that there was no Java binding libraries to OpenCV or resources that we could use. After a week of searching nothing was found that could help us, but because it was still early into the year the project idea had to be changed as to avoid further problems and time delay. At this stage the project timeline was cut short by three months.

Chapter 1

Introduction

"Tech will transform from something we actively use to a more seamless integrated experience that is 'on' all the time" [3]. This is becoming very apparent on university campuses today. It is very unusual to find a student without a personal device such as a smart phone, tablet or laptop. Popular deals with network providers often ensure individuals are connected to 3G or 4G technologies on almost a 24/7 basis, meaning demands for applications to make life easier are only increasing. However, as Corlett et al points out, most applications are designed for an office environment and are not ideal for students' concerns about time management, revision and lecture attendance [4]. Creating a student-centric application will address gaps in the current market. Our research of existing products indicated that while there were numerous applications for timetables and notes, none had these features integrated into one, nor were they institution specific. We envisioned our finished product having many reliable ways to track and record information in any educational facility to address common concerns of students.

We decided to create three primary functionalities, with the possibility of adding more, time permitting. We wished to create a timetable option, with use of a database to ensure the student's data is saved. To help new students navigate the campus, we decided to use an augmented reality camera overlay. Using the Google Maps API, we wanted to allow the user to locate the college and any notable stores or locations surrounding the educational facility. To aid in time management, students could use customisable countdown timers, colour co-ordinated to reflect the time for study that is left. We envisioned the finished product having many reliable ways to track and record information in any educational facility. When our plan was formulated for the new student application, we studied the market to see what was already available. We noticed that there are many applications with timetables or notes for phones and tablets, but none that contained all of these sections integrated into one application, or that were institution specific. After deciding what kind of application was to be built, the platform technology had to be chosen, this included research into the available systems.

Further into this report will contain a breakdown and give an in-depth explanation to how the project was approached and developed, the different software and technologies used, an evaluation of the final product and notes taken by the developers about each feature and where they can be improved and why. The following sections will be discussed about the application:

- Methodology: This explains the production approach taken to developing the individual features of the application and how they were developed within the project time limit.

- Technology review: This section discusses the various technologies used, both hardware and software. It explains how the project uses each component and gives an explanation to why this particular system/software was used and what is was used for.

- System design: This section gives a breakdown of the projects architecture. How the system is built and how everything fits together.

- System Evaluation: This section evaluates the finished project and provides a list of improvements that can be made.

- Conclusion: The final discussion about the project and evaluation of its finished state. Each section will be briefly concluded and its main points will be stated.

Our personal goals for this project are to make life easier for the student as best we can and the discussed topics are certainly a good beginning to a useful application. We also want to become accustomed to android application development as this is a vastly growing area in the information technology industry. We wanted to experience the processes involved from formulating the idea to the finished product with the ability to adapt and learn to overcome the challenges in a calm and collected fashion.

Chapter 2

Methodology

2.1 Planning

The first step of the project was planning everything that had to be done. This included when to hold meetings, what software to use for the development, what methodology to approach it with and how to test it appropriately. The first task finished was the creation of a project work flow to create a timely estimate of how long each feature will need and take into account other responsibilities the developers might have with other projects and reports. The project work flow or Gantt chart, was developed to show everything that needed to be done. It leaves out the section that assigns each individual developer to a particular area or feature because the list of features was not particularly large enough to scale out seven months of development and it was more beneficial to work as a pair due to the methodology taken. See Figure 2.1.

2.2 Software Methodology

Next was the decision of which methodology to pursue. It was decided this project would be developed based on agile methodologies. "Agile methodology is an alternative to traditional project management, typically used in software development. It helps teams respond to unpredictability through incremental, iterative work cadences, known as sprints " [5]. The traditional waterfall approach was not taken due to its limitations put on each phase of the project. Each section had to be completed in sequential order and time did not permit backtracking if a problem arouse. Instead an incremental approach was taken. Both developers met up to discuss which feature to work on and to begin working on it by researching previously made work and reading through the Android documentation to find relative libraries available. This meant that each feature could be developed no matter how long it took to finish and different approaches could be taken. One feature may have taken a week at most to develop allowing more time to improve it, while the next might have taken a month to complete. It also allowed more research and the ability to develop up-to date documentation and code during the development of each feature. If the code was re-factored or a different approach was taken that differed from the pre-determined plan specified at the beginning of this project, the developers where free to make the change and it was documented. During the development of that feature however, an iterative approach was taken. Each developer would plan, develop and test the feature and resort back to the original documentation to evaluate it. The same process would be taken again until the feature was eventually finished. At the end of each features cycle a meeting was held to discuss and evaluate it with the supervisor. These consisted of ideas on how to improve it or how to begin on the next.

2.3 Testing

At the end of a features cycle, some testing was performed before moving on. This project used three forms of testing. The first form of testing is Gradle, that is built into Android Studio. Gradle is a project build automation tool used to compile, test and run a native Java project and slow done build time and code freeze ups [6]. It complies and runs the project within Android studio. Next used was CircleCI, CircleCI is a cloud platform used for continuous integration. Every time a commit was pushed up to the repository using git, CircleCI would pull down the code from GitHub and run a selection of tests on the new changes. If it passed the test the commit would integrate with the rest of the project on GitHub, if failed it would not be integrated until the problem was fixed via another commit to update and fix the changes or revert the commit to remove the changes. Finally the developers wrote tests for the application using JUnit. JUnit is "A unit testing framework which is a central element of the Extreme Programming (XP) testing practice." [7] JUnit was used to test the actions of components in the application to see if they performed the way they were supposed to, example if a pop-up box is meant to display on the press of a button.

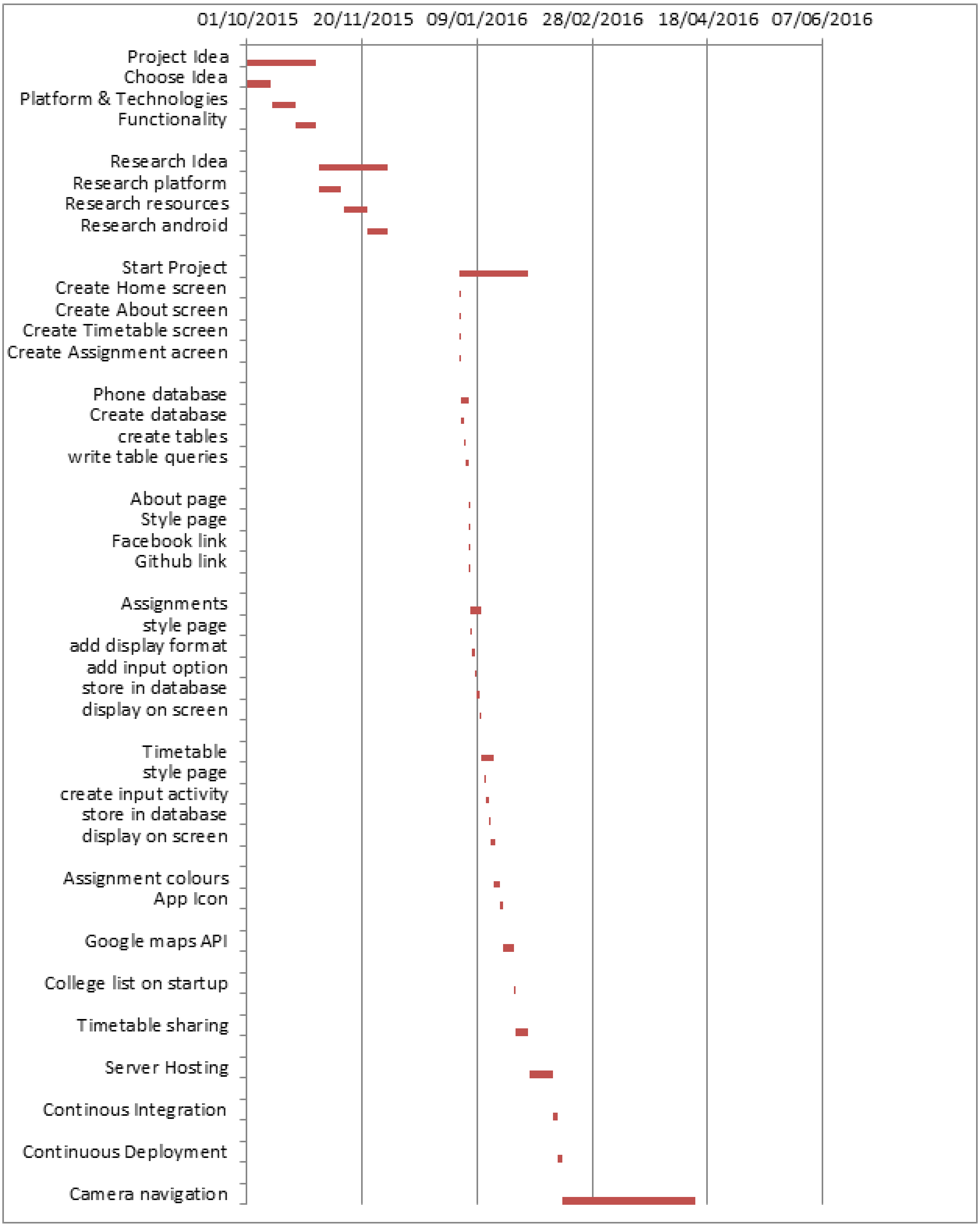


Figure 2.1: Project Work Flow

Chapter 3

Technology Review

3.1 Android

This project was built for the Android operating system. Android Studio was chosen to be used due to the fact that android support was stopped for Eclipse because Android supports the use of the IntelliJ platform, which it was built on top off. IntelliJ is the optimum integrated development environment available for this application, as IntelliJ was created and is owned by Android, meaning compatibility is not an issue. "Android is the customizable, easy to use operating system that powers more than a billion devices across the globe — from phones and tablets to watches, TV, cars and more to come" [8] and Android Studio allows for full access to these customizable features. Android is currently owned, founded and created by Google. It is built using the Java programming language. It combines all that Java has to offer with some custom made Java objects that Android use to interact with the UI component of an application like a TextView or ListView. Android overall is almost a perfect system. It's complete, modular and consistent. It makes use of the full operating system the device is running and provides high level APIs for all tasks. From a developer and users stand point it is powerful, smooth and really responsive [9]. Each section of the application is called an activity. An activity is defined by it's layout file that is in form of an XML document, discussed in the next section. These activities all perform independently from each other unless programmed otherwise. Only one can be open at a time, but another activity can be running in the background waiting for a result of the currently active one. Below is an example of an activities life cycle: Figure 3.1

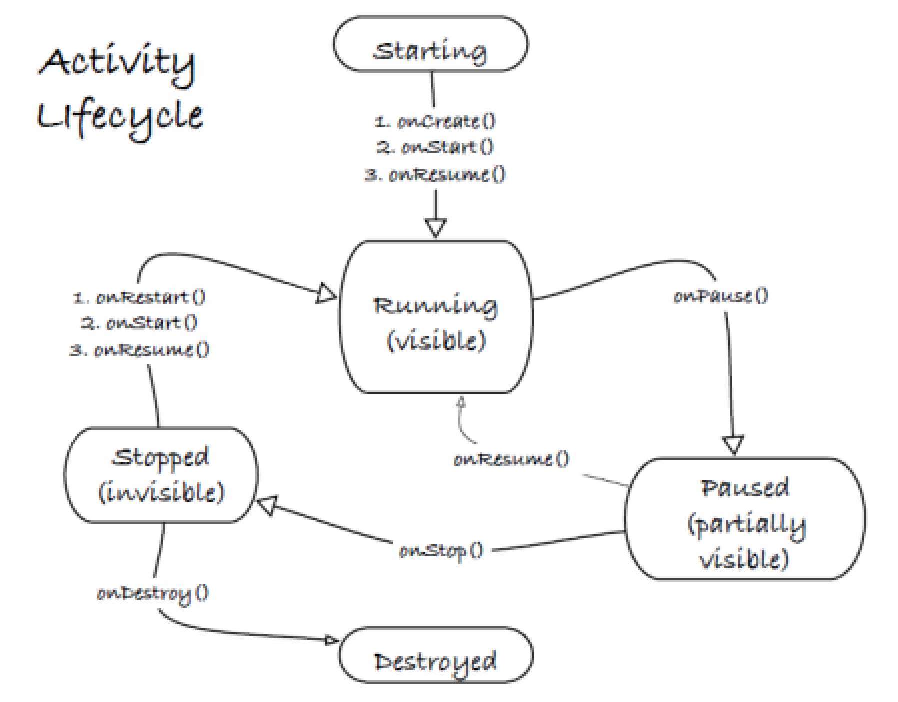


Figure 3.1: Android lifecycle

3.2 Android XML

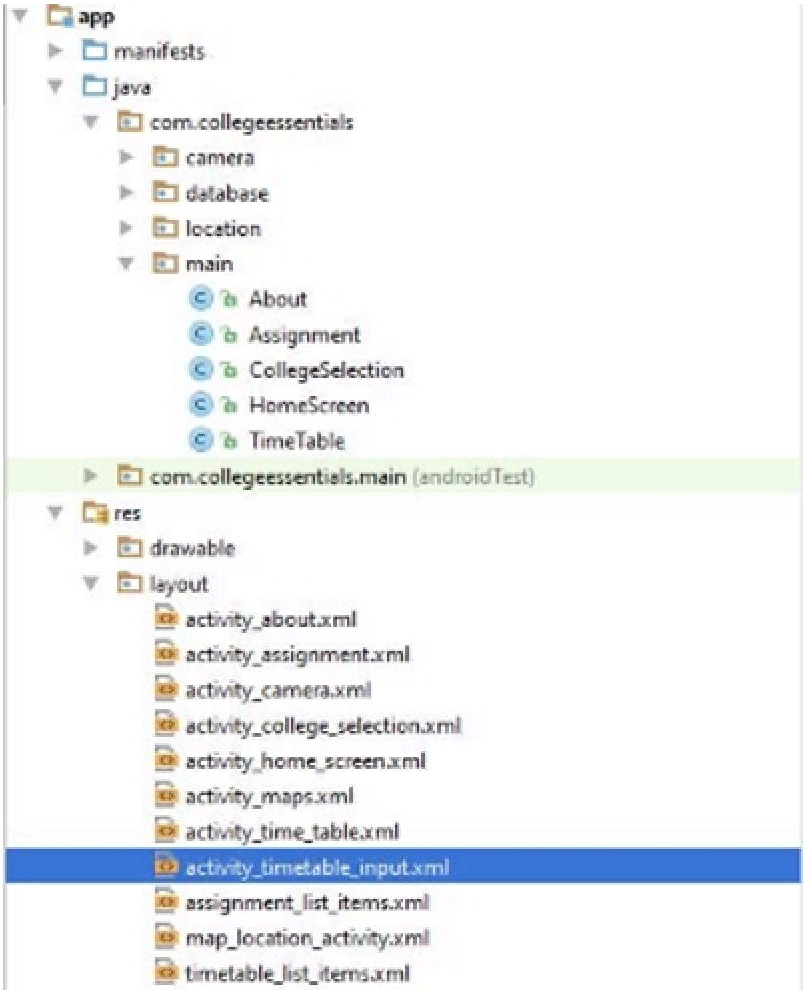
Each element in the layout file represents something that will be displayed on screen. The activity details are specified at the top and then everything is inside a container layout like a FlowLayout our LinearLayout. The element can then be programmatically fetched and used within the class to specify how it should act with an action. For each different aspect of our application we had a corresponding XML file that created formality among the different components making them all follow the same uniform on screen. This factor creates an aesthetically pleasing application, without it each component will float freely and can overlap one another. Each activity, such as the assignment or the timtable activity class, references a standard layout which means just because one activity uses a FlowLayout another can not use a LinearLayout. Each button, image, list etc.. that is displayed on the screen in our application is controlled by the layout folder containing all the XML documents. When a button is clicked it triggers the button and checks to see if it is linked to any code within the java folder and executes any runnable code when the button is clicked. In the timetable XML file there is a grid that can be filled with any information that a regular timetable would store. This is done by having a toolbar with a '+' on it and when that button is pressed it takes you to a new layout which has different fields where the module name, time and place can be inserted. Once the correct information is inserted the it is transferred from the current layout to the timetable XML file and displays it on the screen. Below is an example of a layout class that was used for the about page section of the application and Figure 3.2 showing the projects layout files.

```xml
<?XML version="1.0" encoding="utf-8"?>

<android.support.design.widget.CoordinatorLayout
xmlns:android="http://schemas.android.com/apk/res/android"
xmlns:tools="http://schemas.android.com/tools"
android:layout_width="match_parent"
android:layout_height="match_parent"
xmlns:app="http://schemas.android.com/apk/res-auto"
android:fitsSystemWindows="true"
tools:context="com.collegeessentials.main.About">

<android.support.design.widget.AppBarLayout
android:id="@+id/assignmentBar"
android:layout_width="match_parent"
android:layout_height="wrap_content"
app:theme="@style/AppTheme">

<android.support.v7.widget.Toolbar
android:id="@+id/assignmentToolbar"
android:layout_width="match_parent"
android:layout_height="?attr/actionBarSize"
android:background="?attr/colorPrimary"
android:theme="@style/AppTheme" />

</android.support.design.widget.AppBarLayout>

<RelativeLayout
android:layout_width="match_parent"
android:layout_height="match_parent"
xmlns:android="http://schemas.android.com/apk/res/android"
android:background="@drawable/background">
```

```
<TextView
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="CollegeEssentials aims to help with the navigation and life of a
android:id="@+id/aboutAppText"
android:textSize="14dp"
android:textColor="@color/wallet_hint_foreground_holo_dark"
android:typeface="serif"
android:focusableInTouchMode="false"
android:layout_alignParentTop="true"
android:layout_alignParentLeft="true"
android:layout_alignParentStart="true"
android:layout_marginTop="107dp" />

<TextView
android:layout_width="150dp"
android:layout_height="50dp"
android:id="@+id/colourText"
android:textColor="@color/wallet_hint_foreground_holo_dark"
android:text="Green is 3 weeks.\nOrange is 2 weeks.\nRed is 1 week.\n"
android:layout_marginLeft="24dp"
android:layout_marginStart="24dp"
android:layout_below="@+id/aboutAppText"
android:layout_alignParentLeft="true"
android:layout_alignParentStart="true" />

<TextView
android:layout_width="match_parent"
android:layout_height="wrap_content"
android:text="Please feel free to contact us with your questions"
android:textSize="14dp"
android:typeface="serif"
android:gravity="center"
android:textColor="@color/wallet_hint_foreground_holo_dark"
android:id="@+id/contactText"
android:layout_above="@+id/contactButton" />

<TextView
android:layout_width="50dp"
android:layout_height="25dp"
android:id="@+id/contactButton"
```

```
android:textColor="@color/wallet_holo_blue_light"
android:text="here"
android:textSize="16dp"
android:gravity="center"
android:layout_marginBottom="26dp"
android:layout_alignParentBottom="true"
android:layout_centerHorizontal="true" />

</RelativeLayout>
</android.support.design.widget.CoordinatorLayout>
```

Figure 3.2: Android studio files



3.3 SQLite

SQLite is an open-source platform independent database management system. It is small, fast and free [10]. It was chosen due to it's available features and because it is cross-platform. Multiple programs can be written in various languages like Java, PHP or even C++ and they can all access the same database file without compatibility being an issue. Almost all phone vendors and developers support SQLite. It is one of the largest deployed databases in world due to it's popularity, reliability, consistency and high performance rate when in use. The database file format can be freely copied and moved between various systems without any problems, this also applies to 32-bit and 64-bit systems and big-endian and little-endian. Another key aspect of this is the library size and database file size are both relatively small. It can be configured to run on a minimal stack space of 4KiB if needed, but usually it is sized at only 500kiB depending on the target platform. The application only has to load as much data as it needs, rather than reading the entire application file and holding a complete copy in memory. Start up time and memory consumption are reduced due to this. It stores everything in one file rather than a pile of files, making it structural and abstract because only databases created in Android are visible to the application that created them. When the application is shut down all databases are destroyed meaning only the needed information can be loaded at runtime. The state of the database is always consistent even in the event of a phone crash or power failure, this is because it uses the atomic, isolated, consistent and durable (acid) features. An SQLite database can also be queried and the data retrieval is much more robust. If you have data that is relative the file allows no association but SQLite helps with that.

3.4 PostgreSQL

”PostgreSQL is a powerful, open source object-relational database system. It has more than 15 years of active development and a proven architecture that has earned it a strong reputation for reliability, data integrity, and correctness.” [11]. PostgreSql is a external database used for this application that is connected to at runtime and holds the relevant information for each college. Based on the college selected only the information for that selection will be retrieved and used. The PostgreSQL database used is held and maintained by Heroku, a continuous deployment company. This database was used because originally the project was going to be testes by CircleCI, a continuous integration platform and then be passed onto Heroku for deployment. However the project had files the CircleCI didn’t like but Heroku needed and vice versa. Instead the database was used because it had easy access and it was already set-up to the repository own GitHub. Just like SQLite it is cross-platform, open source, robust, consistent, stable and supports ACID and transactions, which are the basic functionalities of a relational DBMS. Any device or program can connect to it without compatibility being an issue. It supports all functionality most relational database management systems do, but they are known for their data integrity and developer features. Making processes like joining very large tables of information simple. Although it’s slower than MySQL this is because they focus on optimizing query performance where PostgreSQL allows for more flexible actions like table joins and data clean-ups for the developers or using storing procedures. They focus more on the functionality and less on performance, which can be a big downfall for responsive software and websites for example.

Chapter 4

System Design

4.1 Server connection

The system design is fairly straight forward. The first page is the College-Selection activity. This consists of a ListView object that contains a list of colleges in the country. Once a college is selected the application creates a database with the college's name using SQLite and makes a connection to Heroku's PostgreSQL database to retrieve the binary of image of chosen college to display it on the HomeScreen activity. In Android they use a UIThread to handle all the on screen displays and actions, this is the main thread. However they do not allow networking actions on this thread, a separate thread must be started and ran in the background. This was not possible because the Heroku connection need to be made to continue on. To tackle this problem the main UIThread is forced to wait for the connection thread to finish, this is not the best way to handle the problem but it served as a temporary solution until another can be found. The connection was made as follows:

```
try {
        connect.start();//start thread
        connect.join();//forcing UI thread to wait until connection is complete
}catch (InterruptedException e){
        e.printStackTrace();
}
```

The connect thread created a Heroku connection which in turn called the connect method from its constructor. The Thread.join() statement is forcing all other Threads to wait until it has finished. Below are two screen-shots of the application, and Figure 4.3 describes the flow of events that take place.

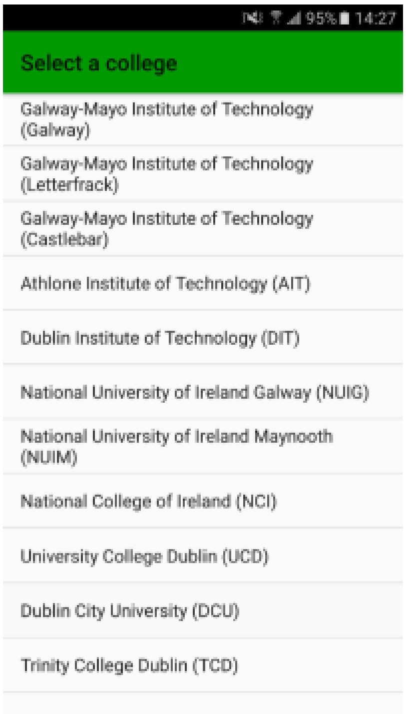


Figure 4.1: CollegeSelection activity

Figure 4.2: HomeScreen activity

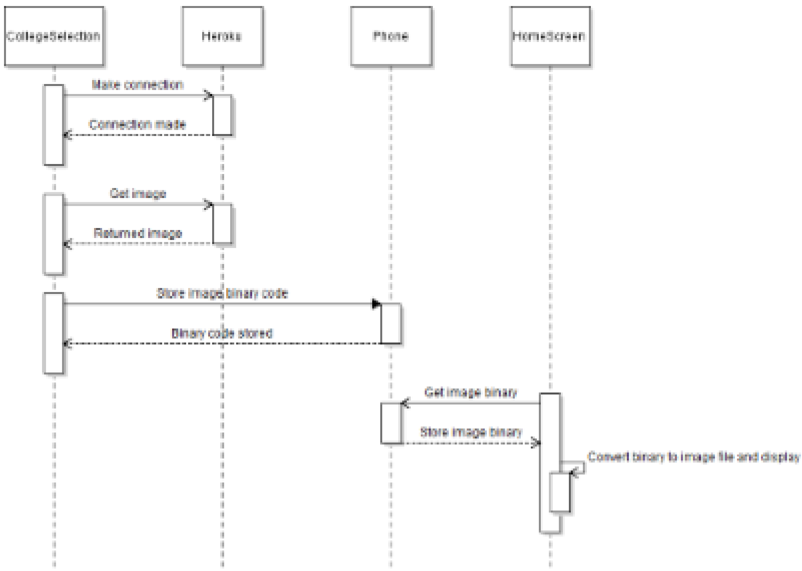


Figure 4.3: Connection to Heroku sequences

4.2 Database Technology

"SQLite is a software library that implements a self-contained, serverless, zero-configuration, transactional SQL database engine. SQLite is the most widely deployed database engine in the world" [10]. This database management system is independent and available on all mobile platforms. It uses the database query language SQL to insert, delete, update and query database tables made on the users phone and stores information relevant to the application. In Android two objects are used to create and maintain them, SQLiteDatabase exposes methods to manage a SQLite database and SQLiteHelper is a helper class to manage database creation and version management. The application contains three stand-alone tables: Timetable, Assignment and Markers. Timetable contains three columns: module name, room number and teacher name, assignment contains two columns: subject name and the due date and Marker contains three columns: marker name, the longitude and latitude of the selected place in the Google maps section.

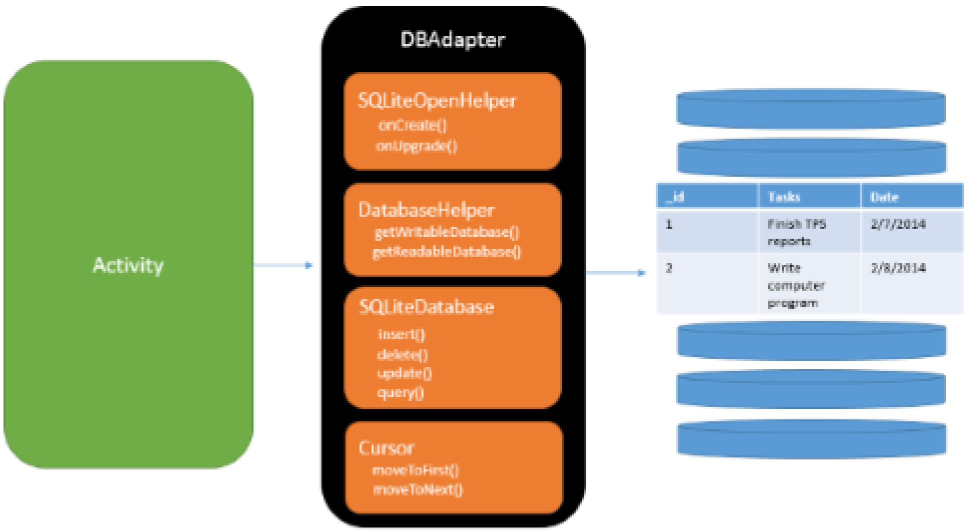


Figure 4.4: SQLite objects

[12]

4.3 Timetable activity

The Timetable class of the project creates a screen of TextView objects in the form of columns and rows that represent the days Monday-Friday and times 9:00am - 6:00pm. By clicking a TextView box or by clicking the plus icon in the top right corner a new activity begins to enter in the subject, room, teacher, day and time. This all gets stored in the Timetable table of the database. On creation the class loops through the parent layout collects all TableRows in it, it then loops through every TableRow and selects all the TextView's each of them contain, it creates a temporary TextView object sets it's allowed boundaries and calls the paintTimetable() method. See code snippet getAllTextViews().

This method takes the TextView as an argument, calls the getIDName() method and retrieves the id in the form of day-time and checks the database for any information it may contain. In the unlikely case the view does not have an id it will just return a blank string. A Cursor object is used in Android to loop through the database and store string variables of the data in each column. A check is done to see if the TextView's day and time has any information stored under it and if so it sets the text to it and paints it on screen within the TextView's specified boundaries. See code paint-Timetable()

```
private void getAllTextViews() throws Exception {
 for(int i = 1; i < layout.getChildCount(); i++){//loop through parent layout
  if(layout.getChildAt(i) instanceof TableRow) {//get every child that's a Tabl
   TableRow row = (TableRow) layout.getChildAt(i);//create temp TableRow
   for(int x = 1; x < row.getChildCount(); x++){//loop through temp TableRow
    if(row.getChildAt(x) instanceof TextView){//get every TextView in temp Tabl
     TextView temp = (TextView) row.getChildAt(x);//set child to temp
          temp.setOnClickListener(this);
         temp.setMaxWidth(temp.getWidth());//set size's
         temp.setMinWidth(temp.getWidth());
         temp.setMaxHeight(temp.getWidth());
         temp.setMaxHeight(temp.getWidth());
         paintTimetable(temp);//fill child with details stored in database
    }
   }
  }
 }
}

private void paintTimetable(TextView view) throws Exception {
 String id = getIDName(view, R.id.class).toLowerCase();//pass in an object and g
 String[] search = id.split("_");//split day from time (MON) _NINE

 Cursor c = ad.returnTimetableData();//return all data from  database

 if(c.moveToFirst()){
  do{
  // Collect each rows data
  String module = c.getString(0);
  String room = c.getString(1);
  String teacher = c.getString(2);
  String day = c.getString(3);
  String time = c.getString(4);

   if(day.equals(search[0]) && time.equals(search[1])){// if day = "mon" and tim
    view.setText(String.format("%s\n%s\n%s", module, room, teacher));//paint det
   }

  }while (c.moveToNext());//move to next row in database
 }
}
```

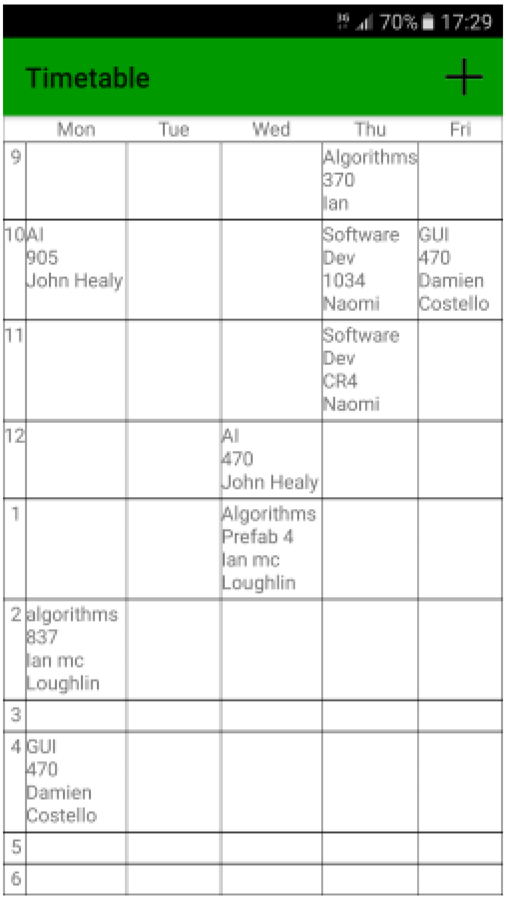


Figure 4.5: Timetable activity

Figure 4.6: TimetableInput activity

4.4 Assignment activity

The assignment activity creates a ListView that holds all of the users current assignments. Three input options are available. A textbox for the assignment name, a TimePicker to select the time and calendar to select the date. Each ListView item consists of two TextView's for the name and count down timer and a button to delete the assignment once it expires. On creation the ListView is initialized and the database is looped through and all current assignments are returned and stored in a list. This list contains the Display(Code snippet Display) object that was made a Data transfer object to hold all the data from each row. The ListView is then handed a custom ArrayAdapter called Countdown Adapter. The CountdownAdapter starts the timer that provides it with the continue down effect and sets all the views on screen(Code snippet getView()). To do this it uses the custom ViewHolder that was built to create the on screen elements and convert the time from milliseconds to days-hours-minutes-seconds(Code snippet timeDiff) and update the information and TextView with the new time.

```
private class Display {
 String name;
 long expirationTime;

 public Display(String name, long expirationTime) {
 this.name = name;
 this.expirationTime = expirationTime;
 }
}
```

```
long timeDiff = mDisplay.expirationTime - currentTime;
if(timeDiff > 0) {
 int seconds = (int) (timeDiff / 1000) % 60;
 int minutes = (int) ((timeDiff / (1000 * 60)) % 60);
 int hours = (int) ((timeDiff / (1000 * 60 * 60)) % 24);
 int days = (int) ((timeDiff / 1000) / 86400);
 tvTimeRemaining.setText(format("%d days %d hrs %d min's %d sec", days, hours, m
 return days;
}else {
   tvTimeRemaining.setText("Expired!!");
   return 0;
 }
```

```
public View getView(int position, View convertView, ViewGroup parent) {

 ViewHolder holder;
 if (convertView == null) {
  holder = new ViewHolder();//get our view
  convertView = lf.inflate(R.layout.assignment_list_items, parent, false);//add
  holder.name = (TextView) convertView.findViewById(R.id.name);//setup out name
  holder.tvTimeRemaining = (TextView) convertView.findViewById(R.id.timeRemainin
  deleteButton = (ImageButton) convertView.findViewById(R.id.deleteButton);
  convertView.setTag(holder);//set our view to hold these
  synchronized (lstHolders) {
   lstHolders.add(holder);//add our holder to the list
  }
 }else {
   holder = (ViewHolder) convertView.getTag();
  }

 holder.setData(getItem(position));//set all the data to it

 //decide what colour to set based on remaining time
 String daysLeft = getColour(holder.updateTimeRemaining(System.currentTimeMillis
 if(daysLeft.equals("red")){
 convertView.setBackgroundColor(Color.rgb(255,0,50));
 }if(daysLeft.equals("orange")){
 convertView.setBackgroundColor( Color.rgb(255,165,0));
 }if(daysLeft.equals("green")){
 convertView.setBackgroundColor(Color.rgb(0,255,127));
 }

 return convertView;
}
```

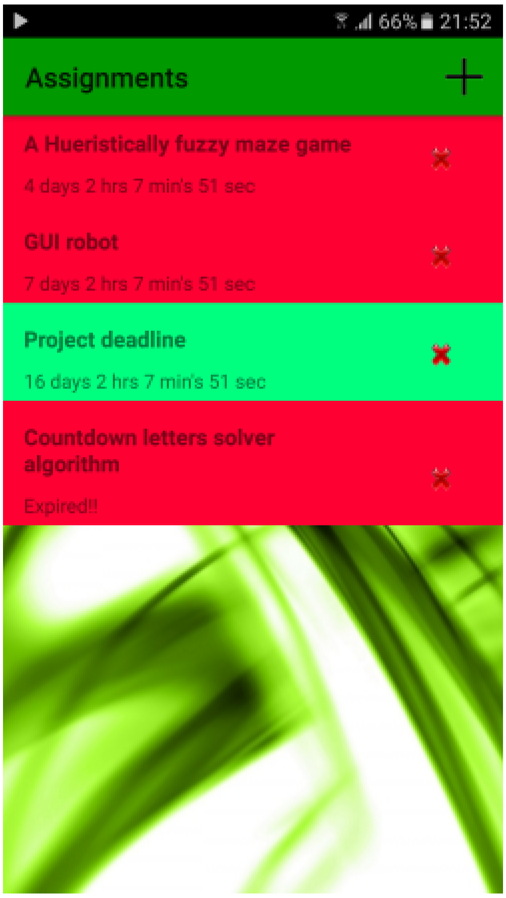


Figure 4.7: Assignment activity

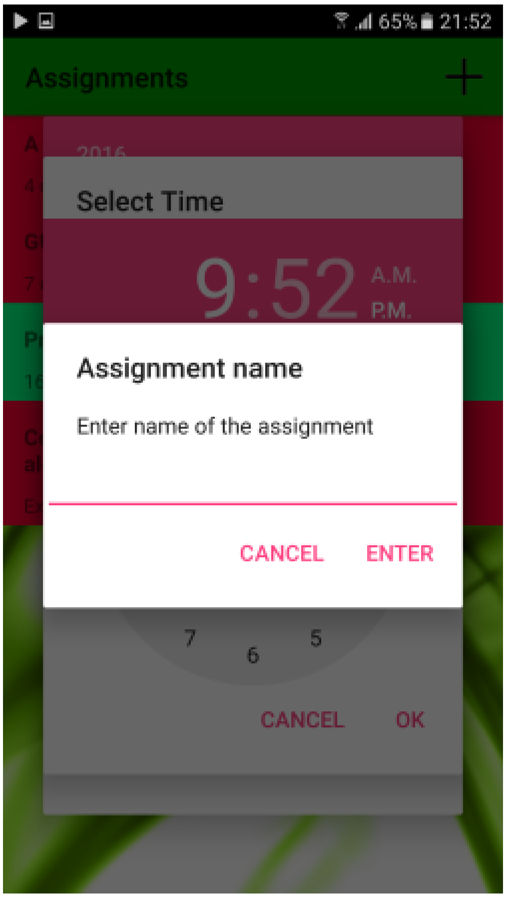


Figure 4.8: AssignmentInput

4.5 Augmented Reality

"Augmented reality (AR) is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data" [13]. Augmented reality was included in this project in the form of navigation around the selected college with a rotating arrow. This arrow points towards the location the user wants to go. On start-up of the camera activity the phone will call its camera instance and place a preview on top of it. This means the camera can be controlled and changed without altering the actual camera instance. This is accomplished by extending the SurfaceHolder object in the CameraPreview class and implementing the SurfaceHolder.Callback to receive updates when the surface changes. A SurfaceHolder is an "abstract interface to someone holding a display surface. Allows you to control the surface size and format, edit the pixels in the surface, and monitor changes to the surface" [14]. The DrawView object is then created and added to the preview. DrawView extends the SurfaceView object which is a drawing surface embedded into the SurfaceHolder. You get a reference to the main layout and add the preview to it and then add the draw view on top of that. Like so:

```
mCameraPreview = new CameraPreview(this,c);
alParent.addView(mCameraPreview);

// Create a new draw view and add it to the layout
DrawView drawView = new DrawView(this);
alParent.addView(drawView);
```

It then allows the camera to be drawn on using the onDraw method within DrawView thus creating the augmented reality effect. The draw method starts by getting the phones location by making a call to the PhoneLocation object. It then sets the point we want to go to, which in the future will be a call to the database. It will then paint an arrow on screen, calculate the degrees between the current latitude longitude point and the desired points and rotate the arrow to point in that direction.

```
@Override
protected void onDraw(Canvas canvas) {
 super.onDraw(canvas);

 canvas.drawColor(0, PorterDuff.Mode.CLEAR);
```

```
loc.getPreviousLocations();//stores last location

to = loc.getToLocation();
from = loc.getFromLocation();

to.setLatitude(53.2831252);
to.setLongitude(-9.0414227);

degrees = getDegrees(from.getLatitude(), from.getLongitude(), to.getLatitude(),

canvas.rotate((float) degrees, canvas.getWidth() / 2, canvas.getHeight() / 2);

//gmit canteen 53.2791608,-9.0105963
textPaint.setARGB(255, 200, 0, 0);//Colour red - ish
textPaint.setStyle(Paint.Style.FILL);

/* Top arrow*/
textPaint.setTextSize(70);
canvas.drawText(degrees + "", 1100, 500, textPaint);

textPaint.setStrokeWidth(20);
canvas.drawLine(1250, 100, 1250, 400, textPaint);

textPaint.setStyle(Paint.Style.STROKE);
textPaint.setStrokeWidth(2);
textPaint.setColor(Color.RED);

Path path = new Path();
path.moveTo(0, -100);
path.lineTo(50, 0);
path.lineTo(-50, 0);
path.close();

path.offset(1250, 100);
canvas.drawPath(path, textPaint);

}
```

Chapter 5

System Evaluation

5.1 Assignment Feature

The assignment countdown timer feature was fully developed and all goals were achieved. The user can enter in the name of the assignment, pick the time it's due at with the clock widget and then choose a date it was due by using a calender widget. It would then be colour coded to alert the user of how long they had left to complete it. Red meant there is less than a week to do it, orange means less than 2 weeks and green means 3 weeks or more. It functions exactly as it was outlined in the beginning with the colour co-ordination being added as extra functionality. However it does need some add functionality. The ability to change the name of the assignment is a must. If a user enters the name in wrong and they wish to change it they must delete it and re-insert it again. Also the timer is roughly around 20 seconds to slow meaning after the upload time for the assignment expires the timer is still on the 20 second mark give or take. The timer is converted from the systems nanoseconds to days hours and minutes so it has been a challenge to fine tune the timer to the exact second. The time is converted like so:

```
long timeDiff = mDisplay.expirationTime - currentTime;
if(timeDiff > 0) {
 int seconds = (int) (timeDiff / 1000) % 60;
 int minutes = (int) ((timeDiff / (1000 * 60)) % 60);
 int hours = (int) ((timeDiff / (1000 * 60 * 60)) % 24);
 int days = (int) ((timeDiff / 1000) / 86400);
 tvTimeRemaining.setText(format("%d days %d hrs %d min's %d sec", days, hours,
 return days;
}
```

5.2 Timetable Feature

The timetable sections is fully complete as outlined at the beginning also. The user can click the '+' icon or select a section by tapping on screen and they will be brought to the input activity. Here they can enter their module name, room number, lecturer name and choose what time and day the class is on. The application screen will then quickly refresh and display the class. The timetable also resizes it's self accordingly to allow extra view space for one class if any sections around it are empty. It will not take up extra space or favour over another class. There is still extra features that can be added to improve the quality of it. Users could be able to share their timetables with other users by clicking a email button. The application could have a remote id and the user can send it to the specified id in XML format. The application will open the XML file read it and populate the database with the information. Also when the user clicks on a certain class the input section should adjust it's day list and time widget so the user doesn't have to specify it again on input.

5.3 Camera Navigation

The augmented reality section was not a complete success. It does not function as planned from the beginning. The original idea was to have two or more arrows pointing to different locations around the users selected college. Only Galway-Mayo Institute of Technology was going to be developed for through this project and the rest were going to be implemented thereafter. Currently only one arrow is present on screen and is not fully functional. It obtains the angle between the current latitude longitude point and the designated point. Even this has proven to be quite difficult. The angle tends to be off by a few degrees or by a lot of degrees. It is also unfortunate that there is not many resources in augmented reality by developers or Androids documentation themselves. Few resources exist showing how to implement the SurfaceView and SurfaceHolder objects but none that are augmented reality specific. This section was a major downfall for the project and it would be advised to allow for extra time to research and practice Android development in order to pursue augmented reality in the future.

5.4 Databases

The database management system used is SQLite. This was chosen because all mobile platforms support it. This enables the phone to have a certain degree of control on what information to get when needed. Once the user selects a college on start-up of the application a database with the college name is created on the phone allowing each selection to have its own database to store a timetable, assignments and custom google map markers the user may have placed. The database model is quite simple. It stores two tables Timetable and Assignment. The Timetable activity contains three columns room, teacher and subject, while the assignment activity contains two, subject and due-date. With information stored in multiple databases the applications overall size averages around 27.5MB, which compared to a huge application likes Facebooks social network it is miniscule because Facebooks is currently at 365MB. A connection is also made to Herokus PostgreSQL database to pull down an image of the college stored and all the co-ordinates needed for the navigation section. It was done this way to save memory on the phone. Instead of each database per college storing the image and wasting memory it retrieves the binary of said image and re-converts it to a bitmap from the main screen every time the application is used and places it on screen. To do this a separate project was made to act as the Heroku maintenance code of the database, also using java. This code is used to test the pushing and pulling of information to the server. Once everything is pushed up it never has to be done again, but the code is then integrated into the project to deal with retrieving the image.

5.5 Universality

A decision to make the application universal was made during the development. All students can use the timetable and assignment features and the navigation section will be constantly updated to allow other various colleges to use it. However at the moment the application is only accessible to Android users. Android was chosen because it's native language is java and this is well-known by the developers. However the initial intentions of the project were for it to be available on all platforms. Different technologies exist that allow the application to be complied cross-platform to the IOS operating system for IPhone and Microsoft Windows operating system for Microsoft phones, but this was not accomplished because time ran out. The overall structure of the project will be concrete regardless of the operating system because of the platform neutral technologies chosen. The chosen database explained previously in the technology review of this report is SQLite. SQLite is supported by all mobile platforms as a database choice. The syntax of all the internal queries made in the application will remain the same. The same concept applies to the college selection, as previously explained Heroku's PostgreSQL database is entirely independent from the applications architecture. The only difference being the driver that enables the connection on each platform. Android uses Java's JDBC driver to connect. This driver will be of no use to the other platforms because IOS is written in either Objective-C or Swift using the ODBC driver, and Windows is written using C-Sharp and uses the ADO.NET driver. This means each operating system specific deployment of the project will need to have its own driver included and the syntax within the CollegeSelection class of the project will have to change slightly to replace the JDBC driver with the new one. Each language uses it's predefined driver in order to make a connection to Herokus database and retrieve information based on an SQL query the application makes. This was done so the phone doesn't waste memory storing information on all colleges. See Figure 5.1

In conclusion the application is universal due to the number of colleges and universities that can use it. It can also be easily transformed to be cross-platform with some minor changes needed to one section of code that makes the initial connection.

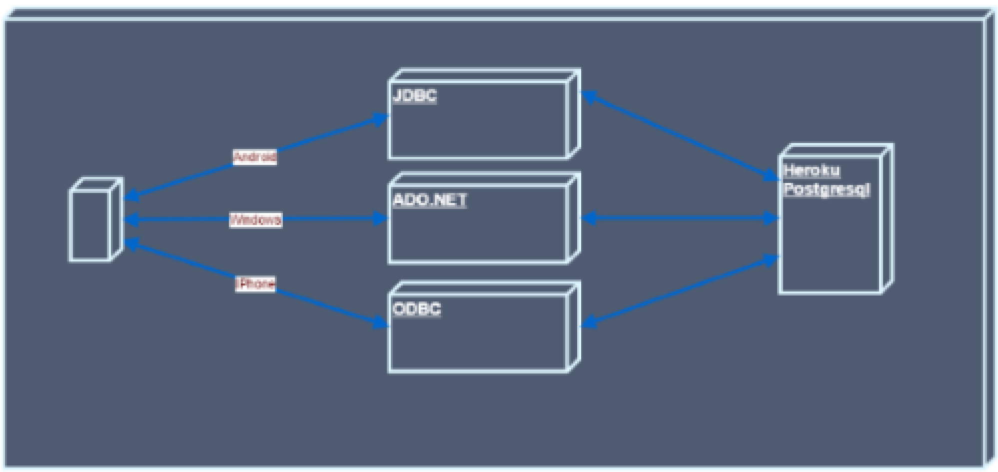


Figure 5.1: Phone Driver Diagram

5.6 Improvements

Each section of the application has areas where improvements could be made if more time was available. Below is a list of possible improvements that can be made in the future for the application in general and each individual section.

- Application: A priority queue added to handle threads because the current implementation creates a lag in the connection.
- Application: Add in an instant messenger section for students to talk to one another about their timetables and current assignments.
- Application: Add a section that users can personalize it to their preference.
- Camera navigation: More colleges and universities in the country can be added to the list.
- Camera navigation: Better graphics can be used for augmented reality.
- Camera navigation: More responsive software to deal with multiple locations within the geo-fencing area.
- Camera API: A swap from the deprecated Camera API to the new camera API made available for newer Android SDK's.
- Assignment: The ability for users to share assignments across platforms with each other.
- Assignment: Section for lecturers to upload assignments and the users can just enrol to that assignment.
- Timetable: The ability for users to share timetables with each other.
- Timetable: Section for colleges to upload timetables automatically and users can download it.
- Timetable: Colour code each section of the timetable.
- Google Maps: Option to view each individual floor of a building being seen.
- Google Maps: Provide directions from current location to a marker chosen by the user.

Chapter 6

Conclusion

We successfully achieved in building an application that helps students organize their college work which is important in achieving the best possible results. A recommendation that we would give for anyone working on a similar application would be to get a larger sample size of different phone types with unique versions of android as component layouts differ between their operating system. Through the use of Android documentation learning and coding the application did not prove to difficult as there was a vast amount of resources available apart from the augmented reality aspect. We discovered that there is a limited supply of resources in relation to augmented reality android applications so allow extra time for research in that area. We have achieved everything we set out to accomplish in the beginning with the exception of having the augmented reality side not fully functioning as expected. We have, however added extra functionality which wasn't previously planned such as the Google maps API and deciding to make the application universal in relation to being compatible for various colleges around the country. It was originally decided to only create the application for the Galway-Mayo Institute of Technology.

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