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**Fingerprint Attendance System**

G-KSOFGH84 BSc in Software Development

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Submitted Date:

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**Chapter 1**

**1.1 Abstract**

For our final year project, we were trying to do an application that all colleges could use to sign people into lectures and get attendance in a more modern and technological way. We wanted to get rid of the old pen and paper approach of signing into lectures and wanted everyone to be able to just get on their phone and sign in quick and easy. We created a simple and easy to use application using Android studio and java as well as Mongo DB and NodeJS.

The idea for the project came from the interest in Biometrics that are being used today for recognition of people, so we wanted to use the fingerprint as a way of only you the student to be able to sign into a lecture using your own fingerprint and your own phone.

Second part to the idea was that students were always able to be signed into lectures by their friends since the lecturer passed a paper around the class for students to sign in and in the case of there being marks going for attendance in some modules, some students were able to gain marks for free without showing up to class which inspired the application idea.

Here are the Authors of this Project:

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**Chapter 2**

**2. Introduction**

This chapter includes the brief introduction to our project, where the idea came from, the technologies (Which will be expanded later on in the paper.), our learning experience, and our learning outcomes as well as the challenges that we encountered as well as a description of our GitHub repository.

This project is for our final year in Software Development in Applied Project and Minor Dissertation. This project will allow students to sign into their lectures using their phones finger print scanner. We are using Java as our programming language, MongoDB to store finger prints and users and we will be developing the application for Android. The reason we are developing this app is to stop students from signing in their colleagues during lectures that they are not in, as well as creating statistics for each student’s attendance rate.

Our motive was to involve students into lectures as much as possible and in the era of technology, where students are on their phones every day, they will be also able to use them to sign into lectures daily without lecturers having to pass around a sign in sheet.

For this project we decided to go with android development using Java and MongoDB, even though we have tried different languages and different databases, we felt that going with native development will be the most ideal way of doing this application.

This project does not use a huge variety of technologies, but it uses a piece of technology in a phone that we have never used in any of our projects which is the finger print scanner that is built into the phones lock or home button as well as MongoDB which we have merely scraped the surface of during our course.

We thought it would be a great idea to incorporate peoples fingerprint to sign into lectures since everyone’s fingerprint is different to one another and since the college doesn’t use biometrics for students it gave us an idea to incorporate the phones fingerprint scanner into our application which also gave us the idea of making an app that allows students to sign into lectures using their fingerprint.

It gave us a massive opportunity to learn about the fingerprint scanner on our phones and how the fingerprint is stored on our smart phones. The time frame we got for the project put us under a little bit of pressure but thought us how to manage time well and spread our goals into different intervals.

Developing for android expanded our knowledge of application development for phones as well as expanded our knowledge on java and different API’s.

Using the fingerprint scanner on our smart phones opposed a challenge as it was tough to figure out how to store such data in a database which was the longest and toughest part of our application development.

**2.1 Objectives**

Our Objectives:

* Create a mobile phone application
* Create a Database to store fingerprints and users
* Create an administrator only option
* Create an attendance sign in using student’s fingerprints

**2.2 GitHub**

The project files can be viewed here: <https://github.com/Sarlianth/fingerprint-auth>

In this repository you can find all the files and source code that are used to run the application, as well as the .apk file which allows for easy installation on android devices.

In the FPP folder we have all the source code for the database-application connection.

The Readme.md file contains a description of the repository.

**2.3 Specifications**

These are the goals we set for our application to have in it when it is fully developed.

**2.3.1 Application Specifications**

- Login page

- Create user page

- Sign into class page

- Edit user page

**2.3.2 Database Specifications**

- Store users

- Store their fingerprint relative to their G00XXXX number

**3. Methodology**:

At the beginning of the project we decided what we are going to do and from there we were researching different technologies to use for it. At the beginning we decided to go with AngularJS and Bootstrap but when we began our development we started running into errors since we were not experienced in developing applications using these technologies so in the end we decided to go with Java and MongoDB, the native way of developing applications for Android, which turned out to be much more possible and realistic to do for the scope of our project. Each team member was assigned different areas of the project to divide the work evenly. Adrian S. was assigned the login page at the beginning of the project and later on all the backend development, Adrian G. was assigned the database connection to the application as well as the front end of the application and Robert had the dissertation and database connection to do but most of the work was done between all the members of the team in order to have even work done and nobody was left to do anything on their own.

**3.1 Research**:

After the project scope was decided we started researching different technologies to use in the project and we all came to the decision of using AngularJS, Bootstrap, Couch and Pouch DB. After beginning our development, we have ran into many errors that we were not able to figure out on our own and that has discouraged us from using these technologies, so we decided to sit down again and change it around which brings us to the current state of the application which is Java, MongoDB and Android Studio, since we have been developing in Java since the beginning of our course we were more than confident to develop this application using this programming language.

**3.2 Sprints**

The project development was done in Sprints, in which each sprint lasted as long as it was necessary to last.

**Sprint 1**

This was the first sprint and the kick off of our project. Here we began our research on what we were going to do and what technologies we were going to use for the development. In this time, we were mixing and matching different technologies and trying them out before we finally decided on the final architecture of the project.

The research consisted of reading through documents, articles, and different developer’s experiences on what would be best to develop for Android and which database would go along best with it.

The system on we were going to develop was set out from the start of the research, we all decided we were going to develop for Android since we are all Android users and through our research we found out that from the year 2012 and to the year 2016 more than 65% of phone users were android users and less than 20% of the users were iPhone users which made us choose Android as the operating system even more.

Our initial decision was AngularJS and Bootstrap as well as Couch and Pouch Databases for online and offline synchronization.

**Sprint 2**

This was the stage where we began developing in AngularJS, Bootstrap, Couch and Pouch DB and we started running into errors even though we were following tutorials online on how to do base setups of the application.

Once we started running into these errors we were hesitant whether to do this in the chosen technologies and so we decided to change it around and started researching different programming languages to develop in and we have decided that since we have major experience in Java then why not start developing in Java using Android Studio.

After changing the language of development and the IDE we decided to change the database for it to go along with the changes we decided that MongoDB will be best to go with Java.

**Sprint 3**

Here we were researching fingerprint scanners and how do they work when they are being used in a third-party application. What we found out was that in order for a third-party application to be able to use your fingerprint scanner, you must have a fingerprint registered and saved on your phone prior to using the app in order for the application to be allowed to use it.

We also thought about the phones without a fingerprint scanner and decided to do the old-fashioned way of signing in by just using usernames and passwords.

**Sprint 4**

In this sprint we have started development of the application where we create a basic login page where a user can simply put in an email and password and when the details were entered the user was able to go in the main page of the application.

This was only the test of whether the user can login without entering any details into the fields provided and whether the username field accepted anything other than an email in which we were successful.

**Sprint 5**

Here we started to do the connection between the database and the application itself. We created a database online on MongoDB which all of us can access for development purposes.

The database was created, and a connection was made with the application when the server was booted up on the local machine, but no data was being passed through yet.

Once the connection was established and was working fine we started to pass dummy test data through and encountered a few errors when passing the data, the problem was that data was not being updated the way it should have been in the database.

**Sprint 6**

In this sprint we have come to conclusion that we are not going to be able to make fingerprints be stored in a database. The reason for this is that android does not allow third party applications to interact with the built-in finger-print scanner in the phone. Therefore, we have decided to remove the finger print authentication and change the app to only be used by members of staff in the college.

We decided to develop two applications: Android (for teachers to mark attendance) and Web application (This can be used to generate statistics and adding/removing classes from the database.)

**Sprint 7**

**4. Technology Review**

This section is to give a general idea of what technologies were used to develop this app, it gives a small description of all the technologies.

All the technologies used are open source and are available for use for anyone who wants to develop applications using these technologies.

**4.1 Java**

Java making its first appearance in 1995, is a general-purpose programming language that is concurrent, object-oriented and class-based. It was developed with the intention of WORA which is write once, run anywhere, meaning that the compiled code written by the programmer can be ran on all devices that support java without having to recompile the code.

Java being the most popular programming language for many years and used by millions has many people developing in it making it easier to fix errors that we encounter by researching them online.

**4.2 Android**

Android is a mobile operating system used in Smartphones, Tablets, Smart TV’s, Cars and Smartwatches first released in 2008 and was developed by Google. The operating system was based off Linux Kernel and other open source software that was suitable for touch screens.

Android allows for easy installation of applications on mobile devices using the .apk files that can be easily created which is why we have chosen it as our base platform for our application as iOS requires too much licensing and is not open source, which makes it very hard for us to deploy any applications onto the store.

**4.3 Android Studio**

Android Studio is the official integrated development environment(IDE) for the Android OS. It’s a free and open source development kit for anyone to download and use. Android studio is a replacement to the Eclipse Android Development Tools.

**4.4 MongoDB**

MongoDB is a free, open- source database which can be used cross platform. It goes under the NoSQL database category which is more of a document-oriented database system. MongoDB’s initial release date was February 2009. We have chosen MongoDB as our database because it is a very good database for indexing its files which makes it easy to search through when looking for a specific piece of information, it can store files as well as data, it’s very good at replicating its files for back up purposes.

**4.5 Nodejs**

NodeJS developed by Joyent and Node.js developers are an open source JavaScript run-time environment that executes server-side JavaScript code

**4.6 GitHub**

This is a three-man project so the best way to share our code and be able to develop from our homes while still being in synch was GitHub.

GitHub is a platform for developers where they can upload their source code at any given time and where others can view it as long as the repository is not private and contribute to it as far as they are the contributors in the repository.

GitHub allows for teams of developers to tackle a big project and keep it well organized by commenting all of their commits and making sure that every user understands what is going on.

It is important to know that GitHub allows users to post issues about their code so others can have a look at it and see if they are able to fix said problem with the code when an issue arises.

**4.7 ASP.NET**

ASP.NET is an open-source server-side web application framework created for web-based development to produce dynamic web pages. Developed by Microsoft in 2002 to allow programmers to build dynamic web services/sites/applications.

We decided to use ASP.NET to build our frontend web framework which allowed us to create modern application using .NET and ASP.NET services based on HTML, CSS that provide simple, fast and scalable solution. Web application was developed for admin and parent/student use.

**Planning**:

At the beginning of the project we sat down as a group and we were brainstorming ideas on paper on what we should do for our project. The idea came to us when we started talking about biometrics and fingerprint scanners being used to unlock our phones, so we have decided why not make an application where the student signs into a lecture using their phones fingerprint scanner and their G00 number to login to their account.

One of us was doing a presentation on biometrics and one of the points was that every fingerprint in the world is different to one another so the idea of signing in using a fingerprint seems plausible as every student in the college will have a different fingerprint.

**Meetings**:

We decided to meet twice a week if possible and work on the project for as long as we could. We always went to each other’s houses where we could work without any distractions and concentrate of work as much as possible. Each week we worked even the smallest amount just to have work done and not put ourselves behind.

We held meetings with our supervisor once a week to update him on our progress and to tell him any problems that we run into while developing.

As we got closer to the deadline of the project we started meeting up even more and working even harder on the project to get it done.

All of the meetings were successful, and we always got something done and out of the way to move onto the next problem on our list.

**Problems**:

In the beginning there was a huge problem with our chosen technologies. We were unable to wrap our heads around the new programming language and the new database that we never used before, so we had to start changing things around and researching more technologies to use which was the biggest problem of all in this project scope.

As we went forward with our development we started running into different minor problems that we solved within a couple of days with the help of our colleagues, stackoverflow (which was the main problem solver), and our supervisor.

**Language and Technologies**:

When looking at the project idea we wanted to develop something for android since that is what we all have and decided that the best language for developing android applications is Java since for years Java is a well working language with android and java is a language we all know and love to code in since we have been doing it since first year of our course. Next was a database for our project and we did enough research to figure out that mongoDB will go best with Java and android since it’s light and easy to use. As for the choice of the platform on which the application is based on, we chose android for a few reasons: 1.Is that we three have been using android for years, 2. When researching development for IOS it became apparent that IOS has many restrictions when it comes to their biometric scanner and publishing to the store 3. Research has shown that a huge amount of phone users on the market are android users for many consecutive years.