



College of Engineering

## CS CAPSTONE TECHNOLOGY REVIEW

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# APP TO SUPPORT FIELD DIAGNOSTICS IN VETERINARY MEDICINE

PREPARED FOR

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### Abstract

Currently, there are many difficulties for veterinary pathologists trying to perform remote diagnostics. There are not any effective ways for people out in the field collecting samples to communicate with specialized experts located in laboratories. As a result, this project will involve creating an android mobile application that will be used as a bridge to connect the field personnel with the veterinary pathologists in laboratories. With this mobile application, the field personnel will be able to take pictures of the individual that is being analyzed and then send the pictures along with other data such as the patient, location, and time to a pathologist. The pathologist will then be able to use the provided information to perform a necropsy and send feedback to the field personnel. This project is intended to support remote field diagnostics in veterinary medicine.

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## 1 INTRODUCTION

The OVDL wants a native Android mobile application that collects field data and images, stores the information on a native SQLite database, sends them to the lab's MySQL database, and gets real time feedback from the lab. A stretch goal for the app is having a feature that analyzes the images taken using the phone's built-in camera and gives the user feedback on image quality. It should only send images that are well lit, do not have shadows or discoloration, and clearly show the subject. If there is time, the team will try to implement it because it would be beneficial for the client.

## 2 IDE

To create the Android app the team will use an Integrated Development Environment (IDE) to design and build the app software. It is very important to choose one that provides all the functionality needed from simple app layout, usability and image capture to database connectivity and image quality assessment.

### 2.1 Visual Studio

Visual Studio is Microsoft's IDE, which has only in the past few years started offering native mobile development with Java for Android. With some downloaded extensions it can have Java autocomplete, which shows options for functions and parameters as they are typed. Apps can be tested on connected devices or an Visual Studio's Android emulator. Visual Studio comes with a debugger, a feature every good IDE has. There are some downfalls with Visual Studio like the GUI and usability of resource files. It has no drag and drop feature for layouts, everything must be either programmed manually or created somewhere else and imported. Visual Studio is however the best option for creating a mixed Android app with C++ and Java. No other IDE does this very well. It is a useful option, but for this project a mixed app is not necessary so Visual Studio is not the only option. [1]

### 2.2 Android Studio

Android Studio is an IDE made specifically for Android development by Google. It supports Java and Kotlin, but java is much more popular. Java autocomplete is especially helpful in Android Studio with the boost of IntelliJ. It is great for beginners because it provides lots of helpful hints, code completion, and an excellent debugger. The best feature, which is unique to Android Studio, is the drag and drop UI which makes creating layouts convenient. Developing apps can be tested on a connected device or one of Android Studio's emulators. Another nice thing about Android Studio is how fast it works, building projects in half the time of other IDEs. For building this app Android Studio is the obvious choice, as speed and an easy learning curve will be essential to the success of the project. [1], [2]

### 2.3 Eclipse

Eclipse has been a popular IDE for many years, and not primarily for Android development. It is a Java IDE and has functionality for much more than mobile development. Because it is large and has so many options, it is very slow in every part of development. Android apps are often programmed in Java so supporting them is not a leap for Eclipse. It has Java autocomplete, which is helpful for new and experienced developers. Eclipse does not have a nice GUI like Android Studio, which makes it more difficult to design screen layouts. There is no drag and drop feature, everything must be coded manually. While technically functional, Eclipse is a clunky and outdated IDE for Android Development and it would take too long to learn for the less experienced developers on the team. [2]

### 3 DATA TRANSFER

A significant amount of data will be processed through the app and stored in a remote database, and the app needs an Application Programming Interface (API) to handle the sending and receiving of that data. Some of the data is sensitive and confidential therefore data security might be a concern for the clients. The MySQL database that will be storing the data is server based, and because the phones will not always have internet connection they need a serverless way to store data locally, which is why an SQLite database will be used. The API will need to transfer data from the local SQLite database to the MySQL database on the server.

#### 3.1 SOAP

Simple Object Access Protocol (SOAP) was developed by Microsoft for accessing web services using XML, and is still the most secure way to implement messaging services over the internet. It is large and has an extensive and very strict set of rules that standardize it. This makes it secure, but harder to use and much harder to implement than REST. A nice feature of SOAP is the built in error handling, which provides helpful feedback for fixing errors when they are encountered. SOAP is transport independent, meaning it can be used over HTTP or SMTP, which provides some flexibility when building web applications. It is a strong contender because of this independence and for information security, which could be useful for the confidential data gathered in the app. [3]

#### 3.2 REST

Representational State Transfer (REST) provides access to web services over the HTTP protocol in a simple, flexible way. REST is flexible because it can output data in many different forms such as CSV, JSON, and RSS, not just XML, which makes it easy to parse in any language. It is simple because it can just use a URL to obtain information without a rigid structure. REST is easy to implement and the data it supplies is simple to process, making it a preferred method for many web and mobile applications. It does compromise on data security in favor of efficiency and speed, which unless the data being transferred is highly sensitive, is not often a problem. However, for important passwords and sensitive information REST may not be the best tool, even though it is so simple and efficient. [3]

#### 3.3 JSON

JavaScript Object Notation (JSON) is a simple format used to organize and store data for transfer. JSON uses the universal data structures ordered lists and name/value pairs to organize data so it can be used with any programming language. JSON is often used with REST APIs to make data exchange easier for programmers. The JSON format is easy for humans to read and edit, not like XML which uses metadata and tags in a less defined format. For this project data gathered in the app will be stored in JSON format, stored on the SQLite database, and converted and transferred to the MySQL database by an API. [4]

### 4 IMAGE QUALITY ANALYSIS

The most important part of a remote autopsy report is the images; the pathologists need to clearly see the specimen to make an accurate diagnosis. Any discoloration, shadow, or blur in the image could lead to an inaccurate diagnosis or force a pathologist in the lab to request more images from the user. Checking the image quality before adding it to the report is a stretch goal, but a worthy one the team hopes to achieve.

#### 4.1 Android Camera

The Android Camera package can be easily included in an Android Studio Project, and provide functionality that will be necessary for this app. There are classes that can gather information about the phone's cameras such as number, quality, and settings. There are also classes to select which camera to open, the front or back facing camera, open it within the app with a customizable appearance, and capture an image as a JPEG or RAW image. Most importantly, Android Camera has configurations that can be set for each image captured to ensure quality. There are fields for color correction, brightness, exposure, focus, orientation, and many more that can be configured with the phone's sensor and flash. A field to record the location of the image is also included, which will absolutely be used in the project. [5]

#### 4.2 Xamarin

Xamarin is a cross-platform product which can be used with Visual Studio for Android Development that contains a Camera Class API. This class has options for controlling the phone's camera functions from within an app. It is used to set "image capture settings, start/stop preview, snap pictures, and retrieve frames for encoding for video" [6]. The Camera Class is a client for the Camera service, which manages the actual camera hardware. Xamarin includes classes for detecting camera information such as orientation, focus, and flash, all of which could be useful for this project. The team will not be using Xamarin because the project will not be done using Visual Studio and it is not needed in Android Studio. [6]

#### 4.3 Mitek MiSnap

MiSnap is an image capture SDK that can be included in a native Android app and provide image quality feedback instantly with the phone's camera using machine learning and computer vision algorithms. It can detect brightness, glare, focus, and ensure the image captures all necessary information. It is mostly used for mobile banking transactions and automatically filling out forms online. Pieces of the software could be used to make sure images taken with this app are clear and do not have shadows or glare obfuscating the object of the image. It is customizable and could supposedly be integrated into the app easily. The customization could be complicated due to the large scale of the SDK, and it is not open source so obtaining the rights is not free. [7]

### 5 CONCLUSION

The IDE that will be used for the project is Android Studio. It is the easiest IDE to learn, with a drag-and-drop GUI, high build speeds, and the project only requires an app for the Android Operating System. Because the team is using Android Studio it will also use the Android Camera package because it can be easily implemented with the IDE. SQLite will be used for database storage on the phones because that is what the client wants and it is the best way to store the data locally. A REST API will be used to transfer data between the app, website, and database. The API will utilize the JSON format for organizing the data during transitions. The Android Camera package provides some of the image analysis functionality, but supplementary software will be needed for a higher caliber of image analysis. This is a stretch goal for the project, and might be implemented by the clients after the project is completed. All decisions must also be approved by the client.

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