National College of Ireland

BSHC

Software Development

2021/2022

Caoimhe Ruddy

18341311

X18341311@student.ncirl.ie

Farming Friend

Technical Report

Contents

Executive Summary

In this report I will give you a background on my reasonings for selecting this project, who and how this project will make an effect and I will outline and make clear my aims in terms of features and how I expect the project to perform. I will also give you an understanding of the tools, software's and technologies I plan to incorporate into this project.

1.0 Introduction

1.1. Background

The idea for this project came from my family's sheep farm. My father currently is tracking all records for each and every individual sheep using pen and paper. Needless to say, with all of this paperwork to file and keep track of it is easy to make errors, lose records, or mix them up. While farming one Saturday morning dosing the sheep with my father, the project idea came to me. I was looking at the ear tags on the sheep and figured surely there must be a way to just be able to scan the ear tag of the sheep as it is unique for each one and keep the records electronically of what sheep has been dosed, how much it got, what it got, when it will be due to be dosed again etc. That way it would eliminate the need for us to write down on paper each sheep unique identifier and the dosages etc. As my father and I would always have our phones in our pockets anyways, why not use the mobiles to be able to achieve this?

After getting back into the house and telling my father about the idea that hit me while we were farming, he agreed that it would be of great benefit. The more I then began to think about this project idea the more and more the idea started to grow. I began to think about what if we could keep track electronically of things such as the productivity of the sheep, the age of the sheep, the reproductive history of the sheep i.e which Rams it has been bred with before, the number of offspring it has had in the past etc. All of this would benefit the farmer hugely as it would firstly help them to keep track of everything and cut out a lot of paper work and secondly aid them in making more informed decisions especially in the process of culling out sheep due to old age, poor fertility, or poor reproductive history.

I began to do some research on the sheep ear tags and wither there was already applications of this type that I didn't know about. I soon discovered that the ear tags are in fact RFID tags. A lot of the current applications and services of this type require you to purchase an RFID reader which can cost the farmer between hundreds and thousands of euros to purchase just to get started. Then, in order for them to sync/update/view the data from the EID/RFID tag reader they have to connect it to either a laptop or PC in order to access it. I really believe there must be another way to cut out this inconvenience for the farmer. There must be some type of artificial intelligence, computer vision, machine learning or optical character recognition which could be used in place of this and to simply the experience for the farmer onto one single application.

1.2. Aims

The aim of this project is to automate and cut down on paperwork for farmers. It will be a quick and convenient way in which the users will be able to sign in using the

registration page or begin to create an account by using their herd number which is unique to each farm, as well as the farm owners name, email, and phone number. Once the user has created an account and or signed in, they will be then able to keep track of all details for each individual sheep on the farm in one single place. This will hugely cut out slow paperwork processes currently in place and will be a secure way to record all livestock. I want the user to be able to scan the ear tag of the animal and instantly be able to see records and results for that animal. This will allow the user to see when the animal was last medicated, and when they are next due to be medicated in addition to other features such as the age and offspring history of the animal.

1.3. Technology

For this project I plan to use visual studio code as my integrated development environment (IDE). I will use GitHub as my central repository where I will host my main branch of development for the project. I intend to use Python as the primary programming language which I will use but I also intend to incorporate other languages such as Cascading Style Sheets (CSS), Hypertext Markup Language (HTML), and Hypertext Pre-processor (PHP) to create the registration page, the styling, and the rest of the project. I shall use MySQL to organise and manage the database. In addition to these technologies, I also plan to use Tesseract OCR which is a free optical character recognition software along with OpenCV and Python for the identification of the ear tags. In addition to all of this I will use PIP which is a package management system that will allow me to easily keep track of all the packages and dependencies for my project.

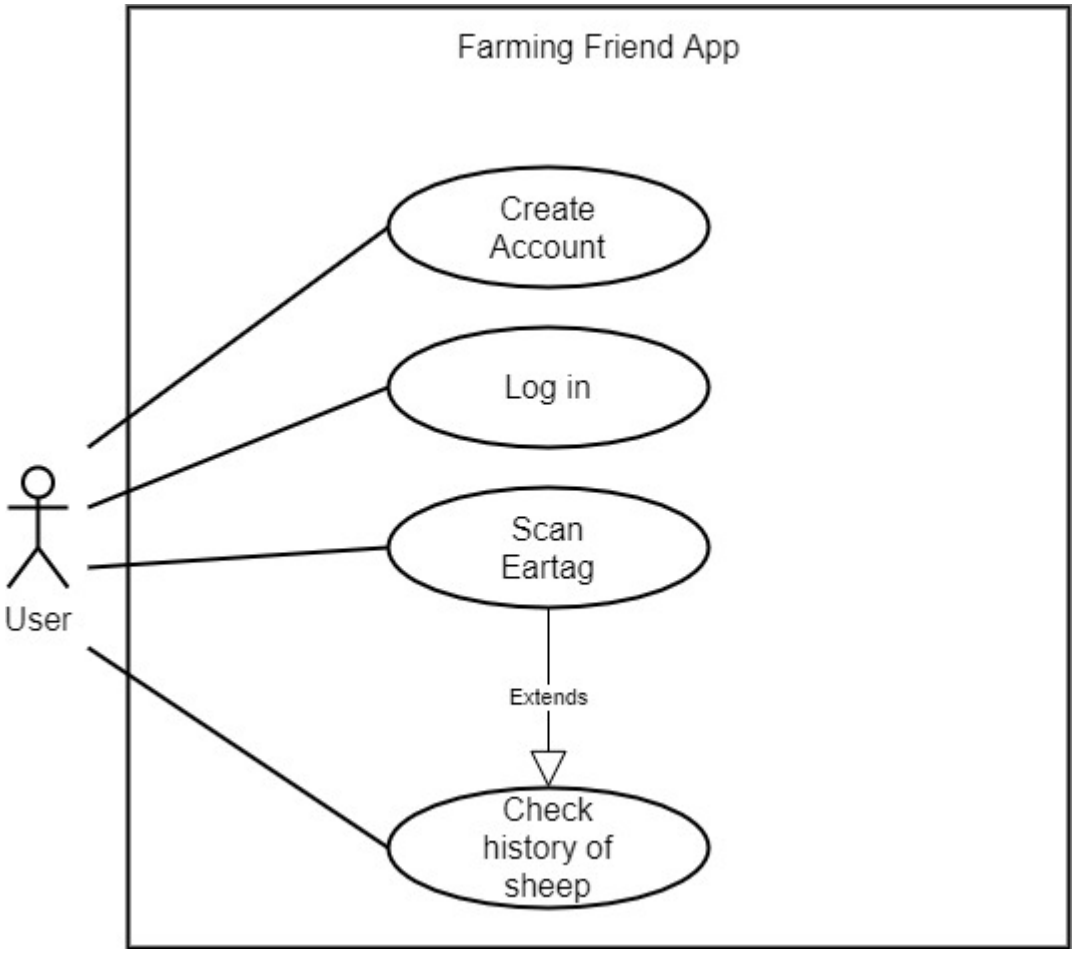
1.4. Structure

To briefly give you an idea of the structure of this document I will firstly begin with a background into the idea itself and how it came to be. I will continue to make clear my project idea by outlining the aims of the project as well as outlining the technological aspect of the project. I will then move forward with the requirements and highlight the expected user interactions. Continuing after this I will then present you with some graphical images of how the project is expected to look. This will then help to paint a clearer picture in your head of the project.

2.0 System

2.1. Requirements

2.1.1.1. Use Case Diagram



2.1.1.2. Requirement 1: User Registration

2.1.1.3. Description & Priority

This is the main priority requirement as it is essential that anyone using this application has an account. This it important so that we can relate ear-tag identifiers to specific farmers/users. By having this requirement that users must have a registered account or sign up this will make it a more tailored experience for each user as it will allow them to see the correct history of each animal that they own.

2.1.1.4. Use Case

This is the use case of a user either logging in or creating an account as this is a requirement in order to use the project.

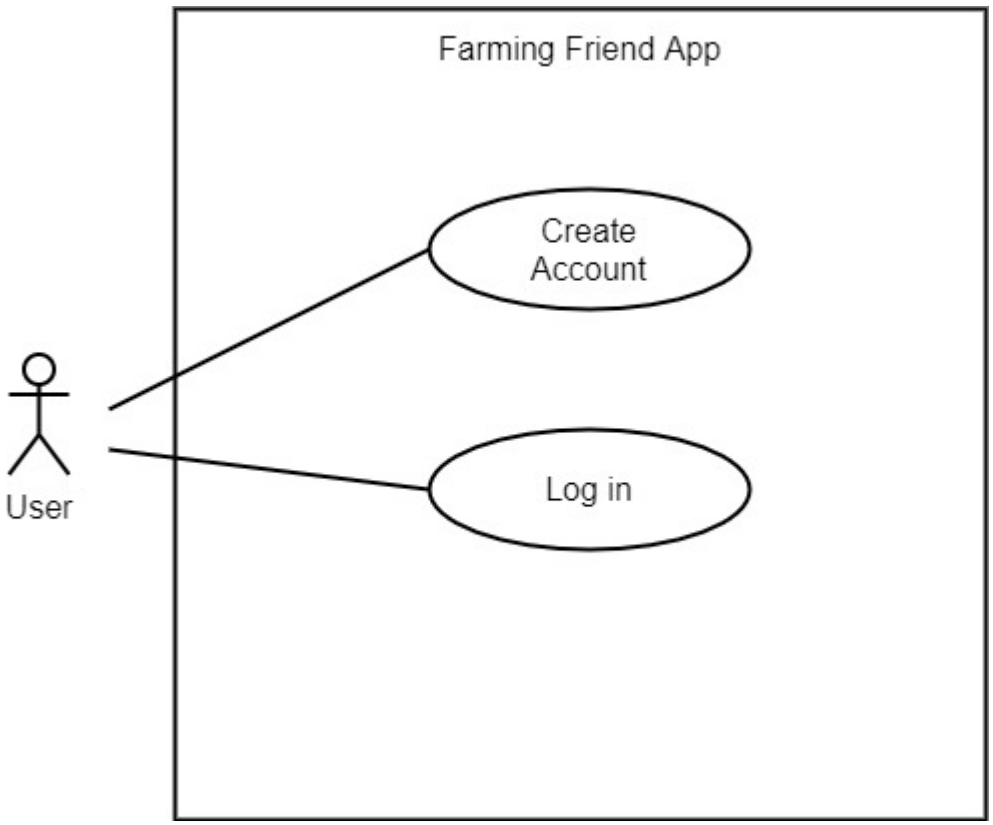
Scope

The scope of this use case is to explain the welcome page.

Description

This use case describes the interactions of the user when they first arrive on the welcome page.

Use Case Diagram



Flow Description

Precondition

The system is in initialisation mode when a user opens the application.

Activation

This use case starts when a user either logs in or creates a new account.

Main flow

1. The user logs in
2. The system verifies the entered details are correct.
3. The system grants or denies the user access.

Alternate flow

1. If the user does not have an account
2. The user fills in their correct details into the fields
3. The user selects submit and a new account is created

Termination

The system either creates the new user account or logs in the existing user.

Post condition

The user can then freely use the application now that they have been logged in.

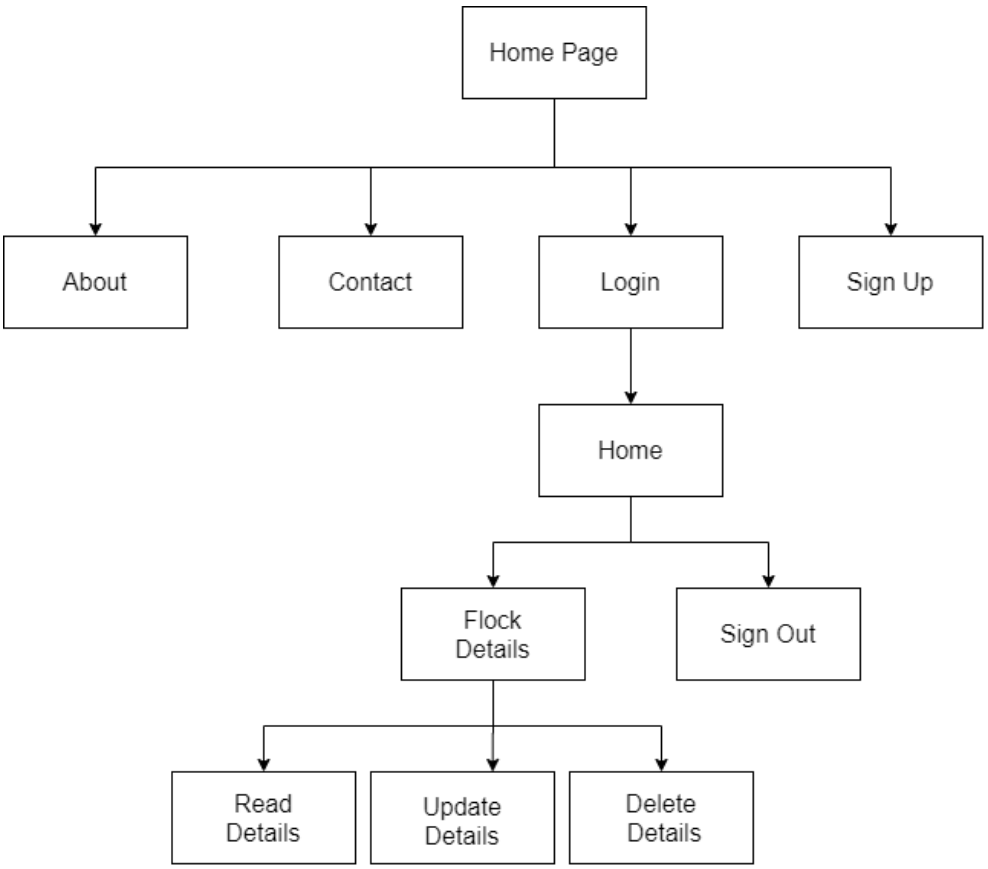
2.1.2. Data Requirements

Users will be required to provide some data in order to create an account and use the application. The users will have to provide their full name, email, phone number, and their herd number.

2.1.3. User Requirements

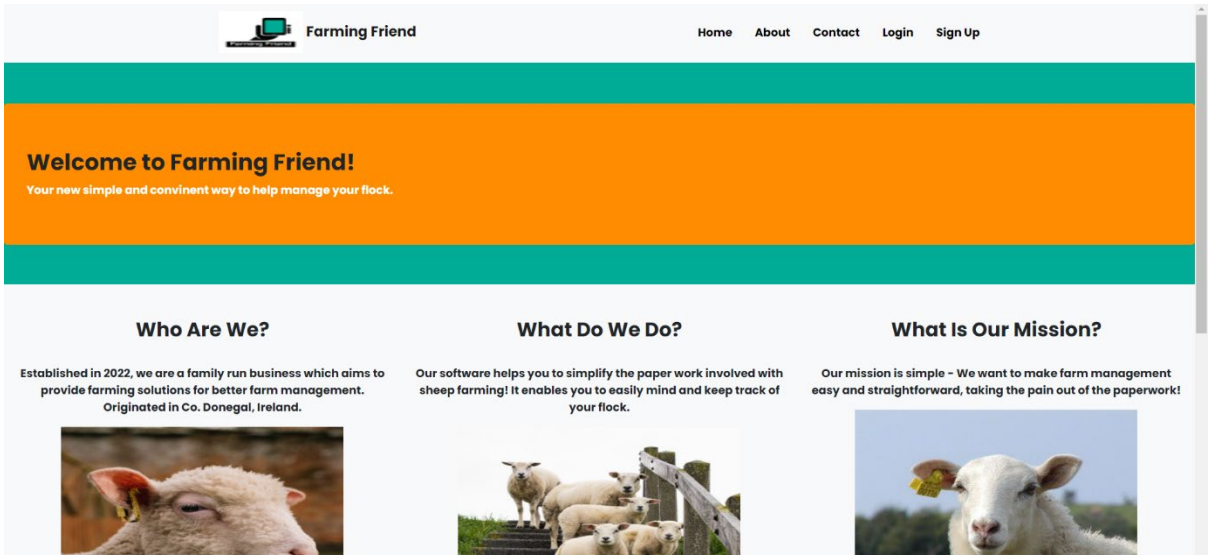
Users will be required to provide correct details in order to make an account and holding an account is also required.

2.2. Design & Architecture

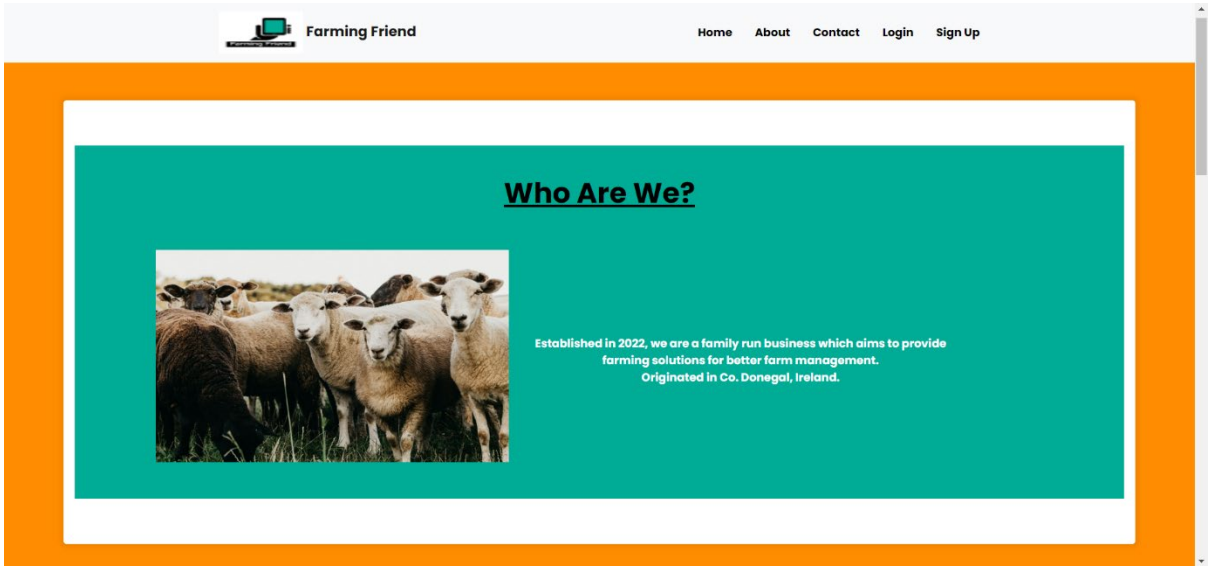


2.3. Graphical User Interface (GUI)

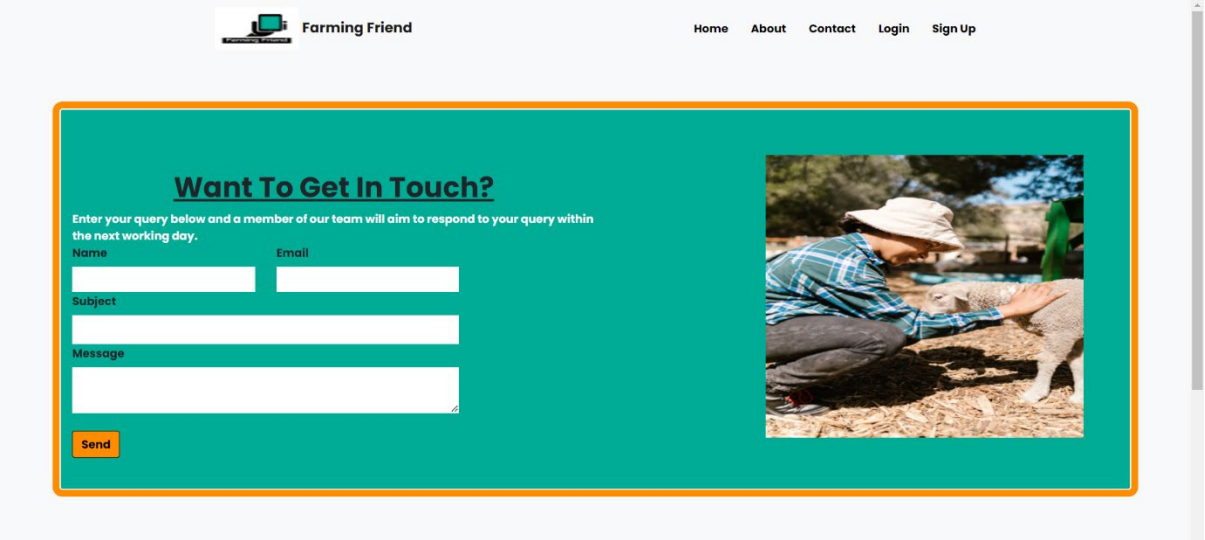
Below you can see the graphical user interface of the project. This first image is what you will first see when you immediately open the application. This is the home screen which welcomes the user to the application. Each page has a navbar and a footer.



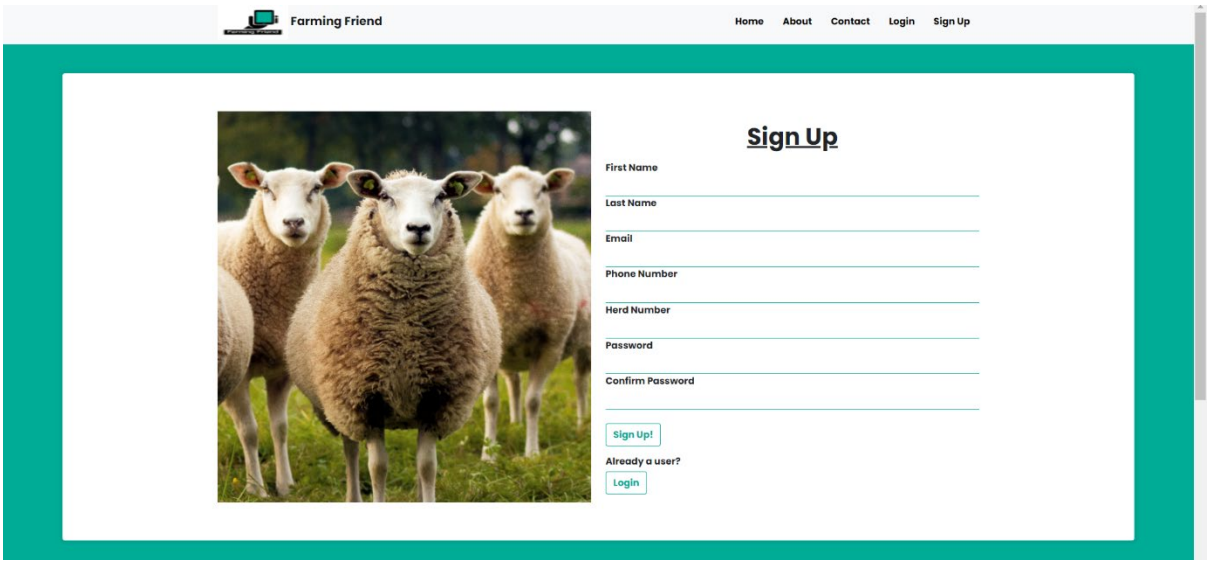
This next image is what you will on the about page. The about page gives the user some details as to what we aim to provide, who we are, and what we do.



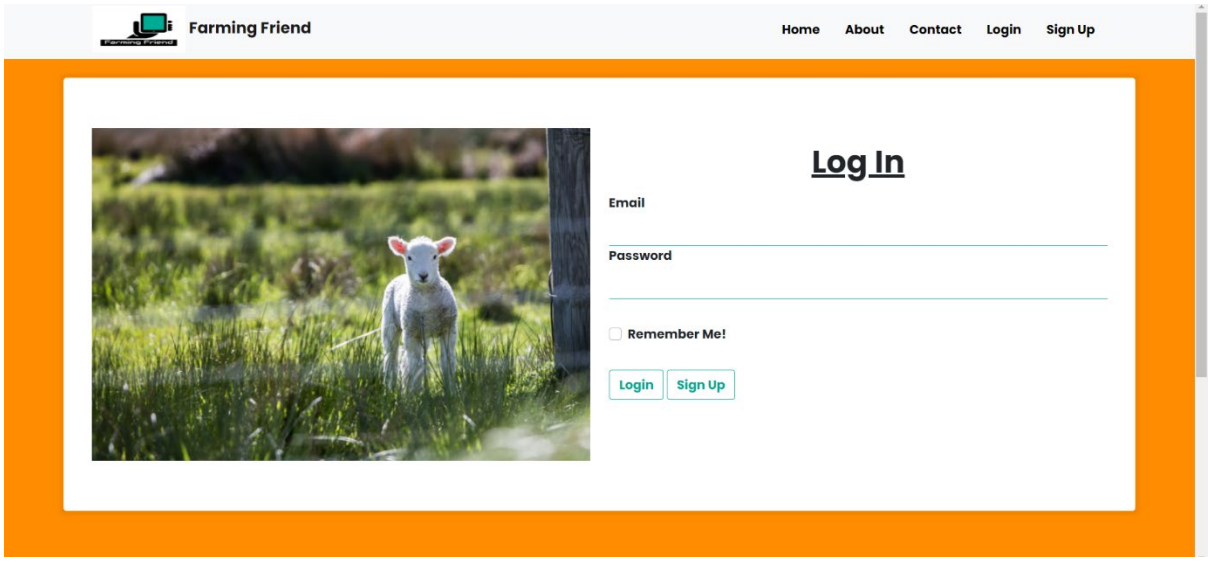
Next is the contact page. If a user wishes to get in touch with us wither it be for extra information, help, or otherwise they can simply fill out the form in the contact page. They will only need to provide a few details in order to do this along with a short message of the description of the issue they wish to get in contact about.



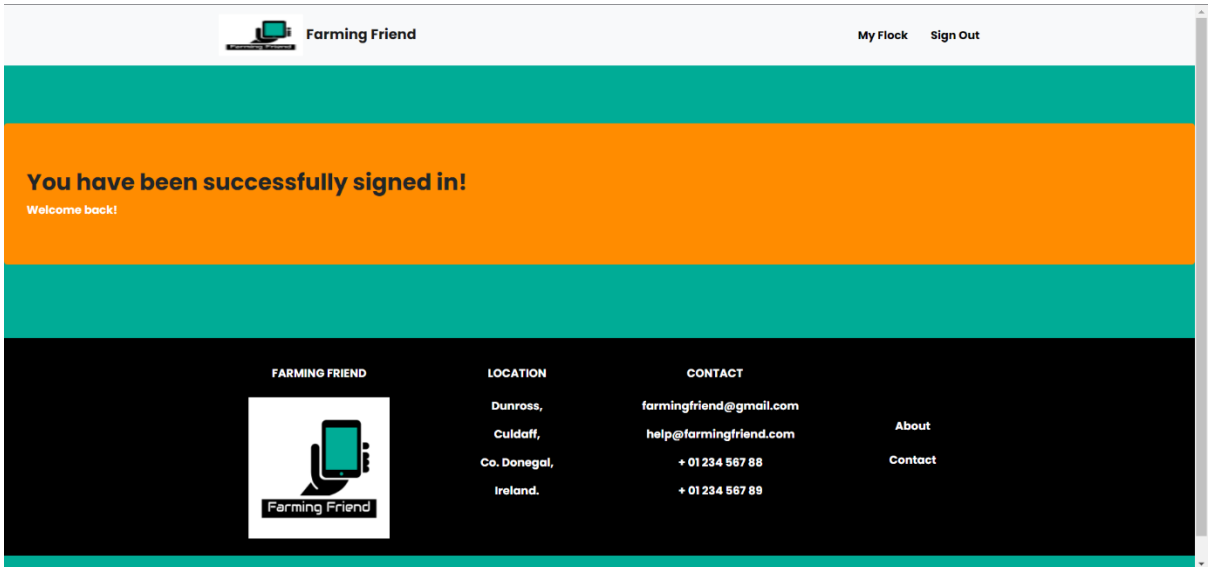
If a user wishes to create an account they can do so on the sign up page. Below is an image of how the sign up page looks. In order to create an account the user must firstly provide a few details. They must insert into the form their first name, last name, email address, phone number, and finally make a suitable password and confirm it. Once they have completed this they can then select the sign up button where their account will then be created.



Once a user has already got an account created they can then sign into the application. Below is an image of the graphical user interface. The user will need to insert their email and password in order to sign in. If the user already has an account and wants their details to be remembered for a faster and more convenient login then they can select the 'Remember me' button. But if a user doesn't already have an account to login with they can then select the 'Sign Up' button where they will then be taken to the sign up page where they can create an account.

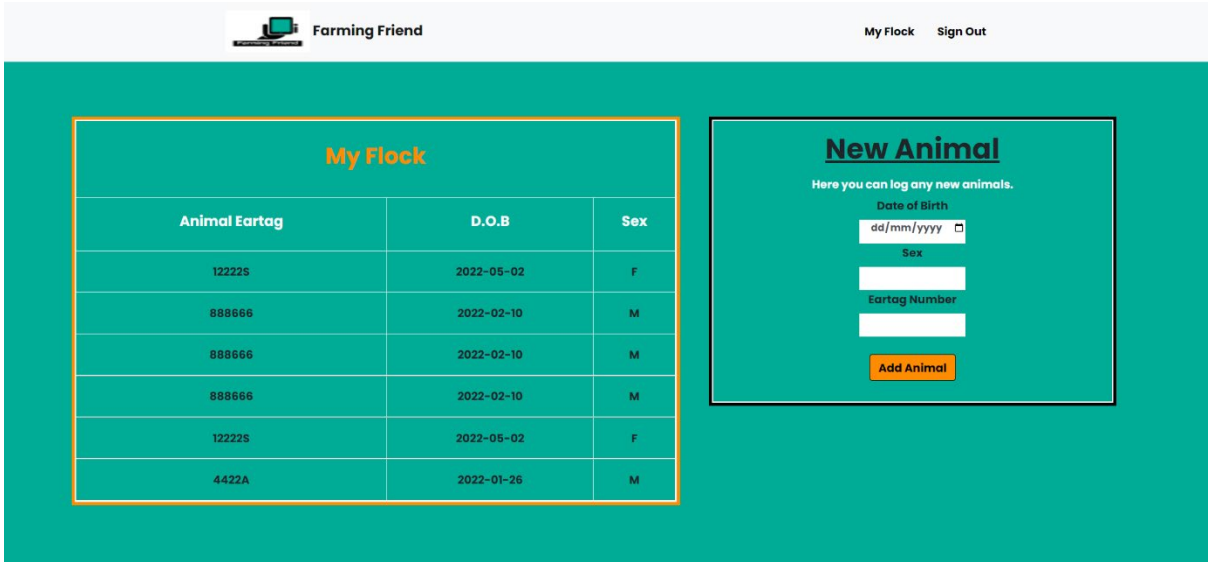


Once the user has successfully created an account and has logged in to the application they will then be greeted with this view.



From here the user can then head to the 'My Flock' button in the navbar where they will then be taken to this screen. You will notice that the colour scheme has been consistent throughout the

application. Each graphical user interface is unique yet it still stays on brand with the rest of the application following strictly the colours which have been set for the project.



3.0 Conclusions

In conclusion I would say that the main huge advantage of the project is that it will allow the users to easily keep track of flock details. By being able to keep all of this data related to the livestock all in one single application it eliminates the need for filing livestock information and endless paperwork. This application also benefits the user as it will allow them to make much more informed decisions. For example, without this application if the farmer wanted to find out how old the sheep with the eartag identification '123ABC' was, then they would have to maintain a well organised filing system where they might eventually find this information on a piece of paper somewhere, whereas if they had the application they could easily see the whole flock, filter by eartag and see when the sheep was born. This enables the farmer to figure out the age of the sheep so that they can then decide wither or not it is time to cull the sheep from the farm. Meaning that the farmer could then bring in or produce new livestock to replace these animals therefore meaning the performance and profits of the farm could increase with the right farm management. A drawback from the application would be that the user has to manually insert the data for each animal to begin with.

4.0 Further Development or Research

If this project had additional time and resources, it could definitely head in a positive and successful direction. Technology is gradually being integrated into all sorts and aspects of farming and the future of farming is looking much more efficient because of this. With machine learning and artificial intelligence becoming much more popular and advanced I believe it could be the future of this project. Instead of using optical character recognition to pick up the identifying text on the ear tags, machine learning could determine what is an ear

tag and what is not. As well as also detecting what identifier is on the ear tag. This is just one future potential development for the project.

5.0 Appendices

5.1. Project Proposal

National College of Ireland

Project Proposal

Farming Friend

07/11/2021

BSHC

Software Development

2021/2022

Caoimhe Ruddy

18341311

X18341311@student.ncirl.ie

Contents

1.0 Objectives

The idea of this project is to be able to scan the ear-tag of sheep on an application where you could then find out information about that individual sheep and log information such as immunisations, treatments received etc. I want to be able to easily keep track of the whole flock in one centralized application therefore, reducing paperwork and filing.

I want to be able to recognize the sheep ear tag and to keep all records of every individual sheep. Currently EID/RFID readers are being used which then have to be synced, some doing so by Bluetooth to an application and others have to be manually updated by connecting to a laptop or PC. I want to be able to cut this out and simplify this process so that all you will need is the mobile application and no EID or RFID readers as these can be expensive.

On top of this I want the application to almost be like a smart diary in a way, such that it would be able to alert/notify the farmer when sheep need to be re-vaccinated or need to receive more treatment/dose. Dosing must be done every six weeks and it can be a pain to remember to do this on time so I want there to be this functionality in the application that will accommodate this issue and benefit the farmer.

2.0 Background

The idea for this project came from my family's sheep farm. My father currently is tracking all records for each and every individual sheep using pen and paper. Needless to say, with all of this paperwork to file and keep track of it is easy to make errors, lose records, or mix them up. While farming one Saturday morning dosing the sheep with my father, the project idea came to me. I was looking at the ear tags on the sheep and figured surely there must be a way to just be able to scan the ear tag of the sheep as it is unique for each one and keep the records electronically of what sheep has been dosed, how much it got, what it got, when it will be due to be dosed again etc. That way it would eliminate the need for us to write down on paper each sheep unique identifier and the dosages etc. As my father and I would always have our phones in our pockets anyways, why not use the mobiles to be able to achieve this?

After getting back into the house and telling my father about the idea that hit me while we were farming, he agreed that it would be of great benefit. The more I then began to think about this project idea the more and more the idea started to grow. I began to think about what if we could keep track electronically of things such as the productivity of the sheep, the age of the sheep, the reproductive history of the sheep i.e which Rams it has been bred with before, the number of offspring it has had in the past etc. All of this would benefit the farmer hugely as it would firstly help them to keep track of everything and cut out a lot of paper work and secondly aid them in making more informed decisions especially in the process of culling out sheep due to old age, poor fertility, or poor reproductive history.

I began to do some research on the sheep ear tags and wither there was already applications of this type that I didn't know about. I soon discovered that the ear tags are in fact RFID tags. A lot of the current applications and services of this type require you to

purchase an RFID reader which can cost the farmer between hundreds and thousands of euros to purchase just to get started. Then, in order for them to sync/update/view the data from the EID/RFID tag reader they have to connect it to either a laptop or PC in order to access it. I really believe there must be another way to cut out this inconvenience for the farmer. There must be some type of artificial intelligence, computer vision, machine learning or optical character recognition which could be used in place of this and to simply the experience for the farmer onto one single application.

3.0 State of the Art

Currently, there is an application made by Shearwell Data that is called 'EID Connect'. This is an application which requires the purchase of a handheld EID stick reader in order to use. It allows a user with the EID stick reader to import the data which they have just collected on the stick reader onto the application live. They can then export the data using cloud storage, email etc.

What makes my project stand out from this stated example above is that I want to eliminate the use of the EID stick reader and instead use the camera of the mobile application to determine and recognize the sheep identifier. I want all the information to be accessible instantly on the app rather than having to sync/import the data from a stick reader. I believe that every farmer has a mobile device in their pocket anyways so why not utilize this to make it more convenient from having to take an EID reader to the farm each time.

4.0 Technical Approach

For this project I intend to take an agile approach. I plan to create a JIRA board which will allow me to break down my requirements into manageable chunks of work by creating user stories. By doing this it will allow me to prioritise my tasks as well as manage my workload by tracking what has been done, what is in progress, and what needs to be done. I plan to use CI/CD during the development of this project so that problems can be identified early. This in turn will save me time and prevent huge bugfixes or crashes at the end of the project. As well as this I plan to use PIP which is a package management software that will allow me to keep track of the dependencies and packages in the project.

5.0 Technical Details

After doing some research into many aspects of this project such as the sheep tags, RFID and EID. I feel that the technical approach I need to take in order to avoid having to use an EID/RFID reader is to use OCR (Optical Character Recognition). I have investigated different OCR engines and have decided that the best option is to use Tesseract with OpenCV using Python. Tesseract is an OCR engine that is open sourced, free to use, and is compatible with various operating systems. As python is new to me there will need to be a lot of research and self-learning on my behalf to get up to the standard that I will need to complete this project, but it is a challenge which I am up for.

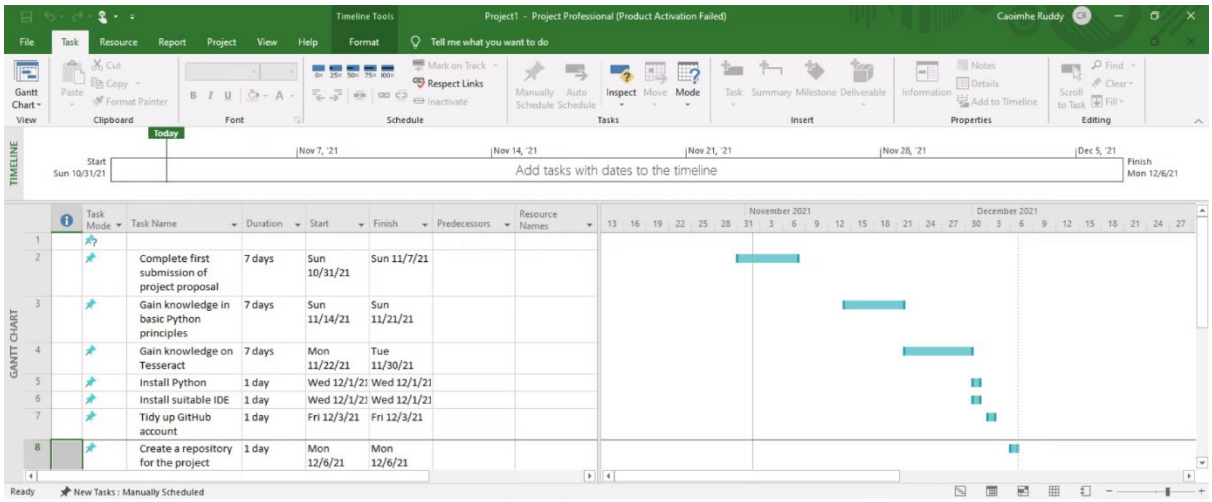
6.0 Special Resources Required

I suppose a special resource which I will need to complete this project is the RFID sheep ear-tags. Thankfully I have plenty of access to this resource! I have included an image below of an ear-tag.

I have highlighted with a red rectangle the part of the ear-tag which is human-readable. This is the part that helps to identify each individual sheep uniquely for humans and hence, the section of the ear-tag that I will need to be able to recognize in my application.

6.0 Project Plan

Below is a screenshot of the Gantt Chart which I created using Microsoft Project.



7.0 Testing

This project can be evaluated by the impact it will have on saving the farmer time as well as the improvement of flock management by the farmer. Not to mention the analysis which can potentially be performed on the data gathered.

By choosing to introduce CI/CD this will help a lot in terms of testing as it will help prevent coding errors and will help debug and detect bugs sooner. As well as this I plan to use

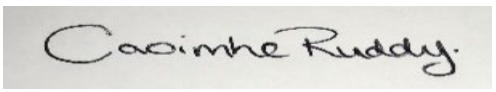
Pytest. Pytest is an open source testing framework for Python for unit testing and to write and run repeatable automated tests.

6.2 Reflective Journals

Supervision & Reflection Template	
Student Name	Caoimhe Ruddy
Student Number	18341311
Course	BSHCSD4

Month: October

What? This month I have finally managed to come up with an idea. I have had two project idea sessions with Frances Sheridan to explain to her my idea and to gather her feedback/thoughts on it. I have also managed to submit my first project pitch video this month. In addition to this I have also made contact with the lecturer in which I wish to have as my supervisor for my final year software project and they have kindly agreed that they would take me onboard! I then made the request for this lecturer to be supervisor so that whoever is assigning can keep in mind my request.
So What? Finally gaining the inspiration for my idea for my final year project has been a huge step forward for me and the biggest success so far! I have now submitted my project pitch and I have tried my best to explain it to the best of my ability while also getting across the major benefits of this project.
Now What? Now I must wait for my idea to either be denied, accepted, or amended in order for me to move forward with it. I must also await confirmation of who my supervisor is going to officially be so that I can then make contact and get the ball rolling.

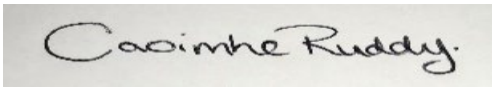
Student Signature	

Supervision & Reflection Template

Student Name	Caoimhe Ruddy
Student Number	18341311
Course	BSHCSD4

Month: November

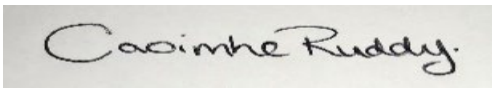
What? This month I have submitted my first draft of my project proposal. I have also gotten my project approved and my supervisor has been assigned. I have continued to communicate and meet with my supervisor every Monday. I have researched into testing strategies and how I plan to go about testing my project. I have installed python, visual studio code, and git. On top of this I have tidied up my GitHub account and created a repository for my project.
So What? From completing what I have stated above this month, this allows me to continue with expanding on my first draft of my project proposal to provide more information and to develop my project plan further. It also means that I now have the IDE in which I plan to start my development in as well as a clean and prepared GitHub account.
Now What? Now I must continue to expand on my project proposal across all headings. I must also develop my project plan.

Student Signature	

Supervision & Reflection Template

Student Name	Caoimhe Ruddy
Student Number	18341311
Course	BSHCSD4

Month: December

What? This month I have been able to start with the development of the project. I have began development on the sign in and registration pages. I have expanded on my technical report this month including all of my requirements and have submitted my mid-point submission to be graded. This included a video presentation of the project so far, and also my technical report which I have been working on this month. In addition to all of this I have been continuing research and learning into Python, OpenCV and Tesseract OCR.	
So What? From completing what I have stated above this month, this allows me to continue with the development on my project.	
Now What? Now I must continue to work and develop on my project.	
Student Signature	

Supervision & Reflection Template

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Course	BSHCSD4

Month: January

What?

This month I have been busy preparing for TABAS and finishing off CA's. I have found it hard to get back into the development swing after the Christmas break and this has been a slow month in terms of progress on the project.

This month I have been able to start with the development of the project. I have began development on the sign in and registration pages. I have expanded on my technical report this month including all of my requirements and have submitted my mid-point submission to be graded. This included a video presentation of the project so far, and also my technical report which I have been working on this month. In addition to all of this I have been continuing research and learning into Python, OpenCV and Tesseract OCR.

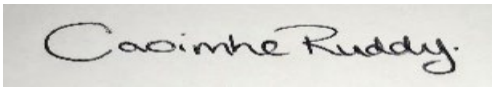
So What?

I realise that I need to get moving again with the project and continue developing and working on it as I don't want to fall behind in my project plan.

From completing what I have stated above this month, this allows me to continue with the development on my project.

Now What?

Now that college has began again I know that this will help to ease me back on the right track and into the swing of things as I also realise that I will soon have CA's which I will also have to work on.

Student Signature	

Supervision & Reflection Template

Student Name	Caoimhe Ruddy
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Course	BSHCSD4

Month: February

What?

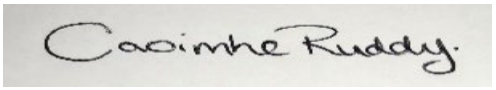
This month I have gotten back into the swing of things and I am making good progress. I have been preparing for the project showcase. I created my showcase calendar and I completed my project profile template on the class OneNote for the showcase website. I have been in touch with Helen and have got the approval on both my CV and my showcase profile. I have also gotten the approval from Helen for my LinkedIn and images also. In addition to all this I have now created my database. My registration page for my web application is also now successfully accepting and storing inputted data into the database. This month I have reflected on my project plan with my supervisor and I have made the necessary adjustments to ensure I am balancing my workload correctly.

So What?

From reflecting and reviewing my project plan with my supervisor and making all the necessary adjustments to the plan I now feel a lot more confident that I know exactly what needs to be done. I feel more comfortable with the workload that I have set out for myself too.

Now What?

Now I must continue to stick to my plan that I have set out with my supervisor. I will follow the plan closely and will highlight any concerns or barriers to my supervisor as they arise.

Student Signature	

Supervision & Reflection Template

Student Name	Caoimhe Ruddy
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Course	BSHCSD4

Month: March

What?

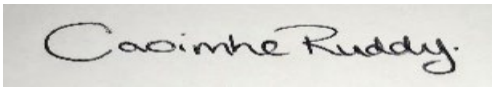
This month I have managed to create and complete my poster for the project showcase. I have also selected some royalty-free photos for my project this month and have added them through the application. I have began to create the other pages of the application, I have not yet added in any styling to the pages but I have created the barebone of them. I have also been testing my registration/sign-up page to ensure that the database is correctly accepting the form data submitted by the user. This month has also been busy as I have been trying to manage completing assignments for other modules which are due at the end of this month alongside feeling unwell due to coronavirus.

So What?

So now that I have created the pages of the website I am now able to begin to incorporate my theme throughout the application which will help to make the appearance look a lot nicer and more appealing for a user. I have now only have one assignment and one assessment in April to complete so the workload from the other modules is easing thankfully.

Now What?

Now I must begin the styling of the website so that it is responsive and appealing for the users.

Student Signature	

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Course	BSHCSD4

Month: April

What? This month I have massively increased the appearance of the frontend. I have added the styling to the pages of the application. I have done this using both Cascading style sheets(CSS) and Bootstrap. This month I have now completed all other assignments and assessments for my other modules and no longer have any deadline or due dates for these.	
So What? So now that I have improved the user interface side of things I can work on the back-end to connect up to this front end that I have been working on.	
Now What? Now that I am feeling better and have no other assignments or assessments to complete I can now finally focus solely on my project. I now need to update and increase my documentation for the project as well as really pushing through now with the Tesseract OCR and Python side of the project and begin to incorporate this into the work I have already done in the project.	
Student Signature