

## National College of Ireland

### Project Submission Sheet – 2021/2022

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**Programme:** MSc in Cloud Computing **Year:** 2021  
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**Project Title:** PetKeepers Application  
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**Date:** .....13/12/2021.....

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# PetKeepers Application

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**Abstract**—In this project, we propose and introduce to people an app that will make it easier for students to connect with pets. Pet owners who want to leave their pet alone while they're going outskirts, so they can go to the site and search for pet keepers. Along with keeping the home or premises safe and secure, a pet sitter is also responsible for keeping the pets and the regular care routine of an animal while the owner is away from home for one or more days or nights. PetKeeper is there to ensure that pet owners can keep their pets in a safe and friendly environment because they are volunteering themselves making sure their pets are healthy and be taken care of. Keeping the technology standards high, we have deployed our application on public cloud AWS using robust docker containerization and CI/CD approach. With the PetKeeper OnDemand Platform, pet owners in your area who require your services can locate you with a single click, even if they are unaware of your existence. Every possible lead will be matched and provided directly to you.

## I. INTRODUCTION AND PROJECT OBJECTIVES

**O**Pet ownership is extremely prevalent among community residents, with 39 to 51.5% owning a pet. It is widely accepted that pets promote good health and wellbeing, both physically and mentally. We conducted research on the positive effects of pet ownership on physical and mental health. The student and the dogs have a strong connection, the owner is prepared to spend money on their pets to ensure their pets' health. PetKeeper matches caring pet sitters, groomers, and dog walkers with pet owners like you. PetKeeper is a platform that allows you to safely hire trusted Pet Sitters, dog walkers, and pet care providers. You can use Petkeeper to find people to care for your pet, or you can use it to make additional money by sharing your passion for animals. You may also utilize pet supporter to tell the world about your pet!

- **For PetKeeper:** We seek possible jobs for you. You are the Supporter of the Owner while the owner is on vacation or has other tasks. Get actual job leads and opportunities wherever you are and allow pets to be part of their family. To ensure pets' health, owners must ensure that they receive the greatest diet and health treatments at the clinic or hospital.

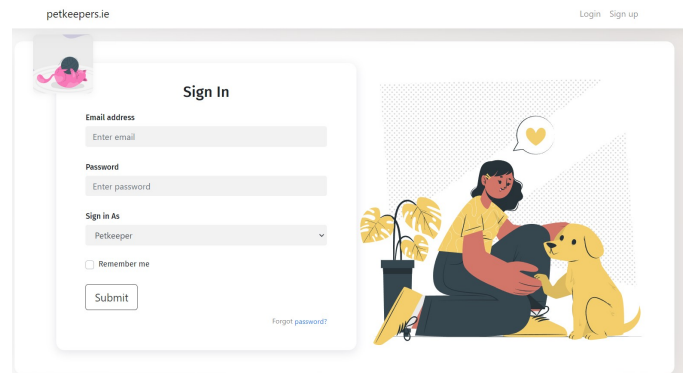


Fig. 1. PetKeppers Application

- **For PetOwner:** Owners of dogs, groomers, and pet boarding— Petkeeper will identify the best pet sitter, dog walker, and pet care providers for you right away if you don't know which one to look for. You may now get them at any time and from any location by pressing a button, and a potential Pet Sitter will apply for your position via chat right away.

**Technically,** Our PetKeepers application is a secure, scalable application with an automated deployment procedure that ensures that every new or modified feature is immediately available to our end users. We chose an Amazon Public Cloud Services EC2 instance with a public VPC and secured ingress/outgress IP setup for a scalable and secure running environment, as well as a connection to the AWS RDS service for CRUD operations. Static code analysis is used to detect vulnerabilities and ensure that coding standards are followed. We used Jenkins for continuous delivery and several plugins to automate the process of software version control so that it is available to end customers without any downtime. The goal of this project is to create a user-friendly, aesthetically pleasing Petkeeper application that meets the needs of end users.

## II. SOLUTION ARCHITECTURE AND DESIGN

**S**olution Architecture means by which a solution is defined, delivered, managed, and operated; the structure,

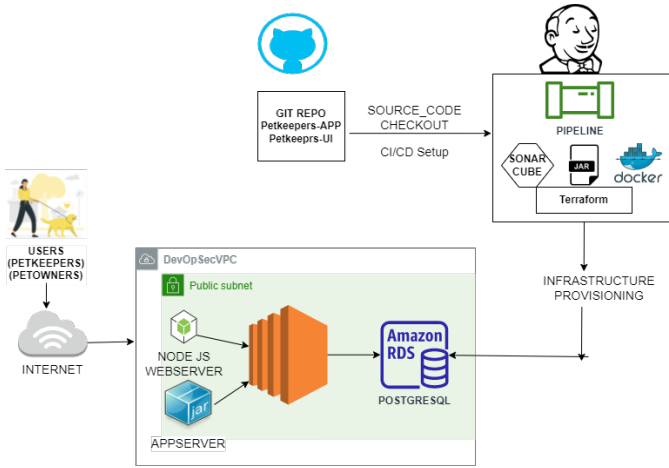


Fig. 2. Solution Architecture Diagram for Petkeepers

qualities, and behavior of a solution [1]. A solution is a response to a business problem that may or may not involve the use of technology. The goal of solution architecture is to identify a solution or a group of solution possibilities, as well as its components. In general, there are numerous alternative solutions to an issue, each of which has varied levels of applicability. [2]

With reference Figure 6 Structured Approach followed for Petkeepers Design to be summarize as follows:

- The goal is to ensure that solution architecture design options are consistent.
- Ensure that the solution meets all of the Application criteria.
- Provide a check list to ensure that the solution design options are correct.
- Create solutions that are realistic and achievable in order to suit the needs of the company.

Data stores are used to store information such as records of users, logs, transactions and other information that are used by the login admin for registration and login management. This type of data is used to manage registration and login.

With familiarity with the DFD level 1 of the Login and Registration, you will know the broad context terms. Additionally, this may also serve as a reference on how the inputs or data are fed into the system. The following data flow diagram illustrates the general process done in Login and Registration monitoring. This will also act as a guide when you get to the more in-depth portions of the Login and Registration data flow diagrams.

Proceeding ahead with Design of our Application reference to Figure 3 and Figure 4 a detailed workflow chart has been discussed to give significant insight on Petkeeper Application development life cycle.

### III. STATIC CODE ANALYSIS

Every software program has a unique business context, environment, and goal. Potential threats and dangers

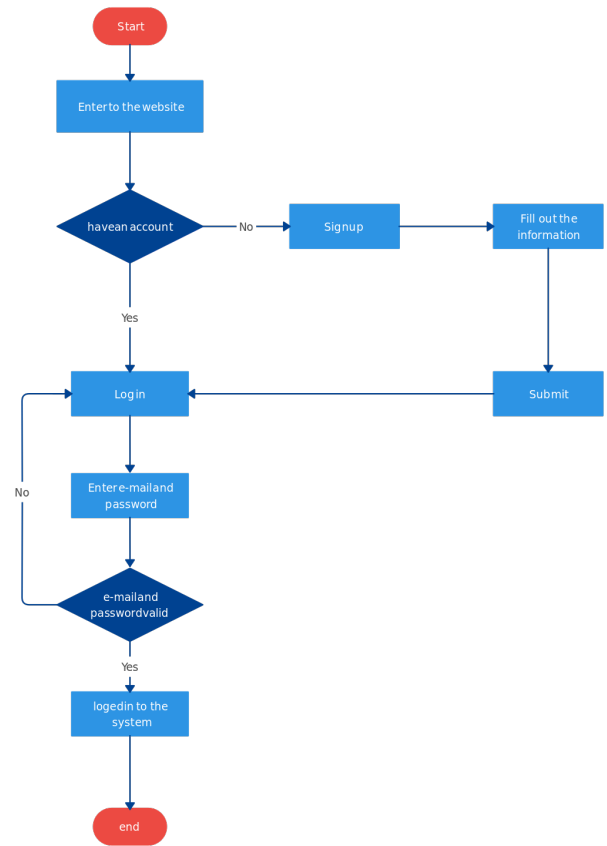


Fig. 3. DFD - Login

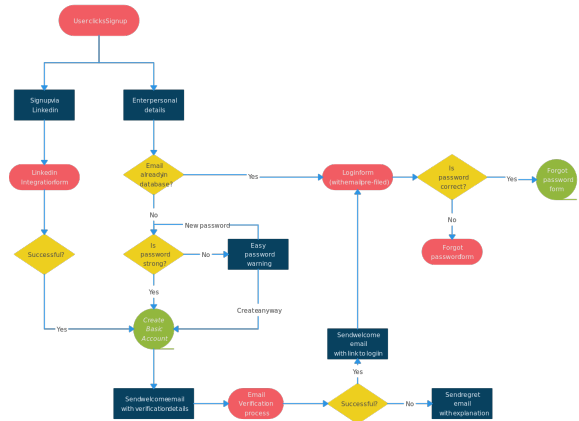


Fig. 4. DFD - Register new user

should be established in relation to the protected values, and vulnerabilities should be prioritized accordingly. Without executing the application, static analysis tools search the source code for vulnerabilities and inspect all possible execution routes and variable values [3]. This makes the operation simple, repeatable, and independent of whether the application can be run. Static code analysis can be used throughout the development life cycle to help programmers find and fix bugs and security problems early on. Static code analysis is linked to source code analysis, making it programming language

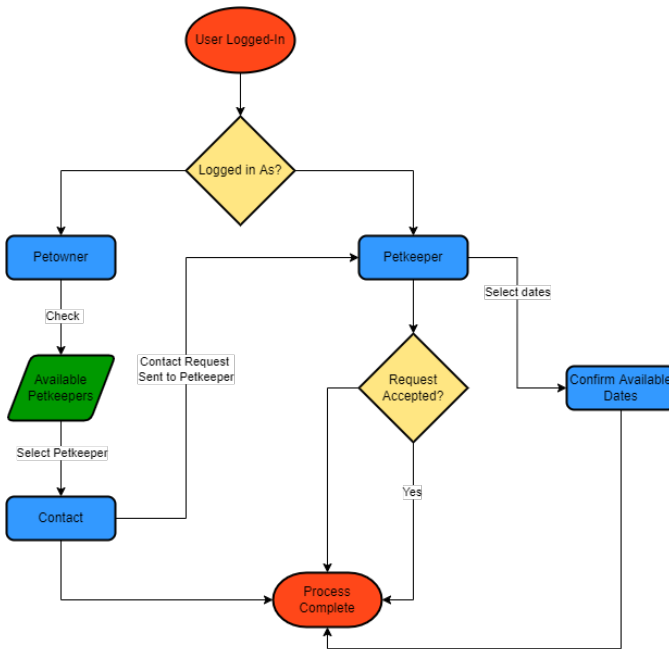


Fig. 5. PetKeepers Application Design.

specific. The fact that automated code analysis tools commonly produce false positives and false negatives is one of the biggest barriers to their broad use. A model that fails to reflect a crucial component of the program, resulting in a variety of false negatives, is called an under-approximation [4].

Basically, static code analysis is checking the program or code for errors without executing it. Often people confuse it with testing but they are two way different terminologies. [5] So it starts with a review which consists of proper formatting, naming conventions, checking the time complexity and space complexity and gradually refactoring the code. As far as its regarding finding bugs we need to inspect java bytecode for occurrences of no. of bugs. Once we find the bugs we need to perform no. of steps, We need to analysis the bug patterns, look for the false positive conditions or scenarios and consider the possibility that they are not always right.

The IDE's like Eclipse or IntelliJ often provide warnings about unused variables, empty catch blocks, unreachable codes etc [6]. These warnings affect the overall execution of the program. Unused variables hold a block of memory in the JDK environment. Static code analysis, helps the programmer or the developer to write the code in a very efficient way. This enables them to find the structural code problem that could affect the quality and performance of your application. It is mostly about identifying structural and exclude checks. We are using Sonarqube for static code analysis with continuous integration with jenkins.

The Petkeeper DFD demonstrates the logical flow of the application. The application has two landing pages. They switch between the usertype which is petkeeper or petowner. If the user signed in as a petowner, he will be able to see the list

of available petkeepers between a specific range of date with thier name, photo, ratings and location. The contacts of the users are not directly available on the web application because of the security reasons. Therefore, once the user is successfully logged in as a petowner, the user will have to select to the petkeeper depending on their on reviews, descriptions or photos. Once the petowner has shortlisted the petkeeper, he needs to hit the contact button. After hitting the contact button, a request mail is forwarded to the petkeeper. The petkeeper then accepts the request and they can now communicate. The web application works solely for being the mid-ground for helping the both types of users. No payment available but donations are always welcome. The petkeeper also choice to not to respond to the mail if the they feel its not legitimate.

Talking about the petkeepers landing page, the petkeeper can update his/her availability as per thier convenience. The details of the petkeepers will only and only be available in the list when the petkeeper is available. So the petkeeper's landing page consists of a date range selector, Once the petkeeper selects the dates and submits, the data is updated in the database.

#### IV. THE CI/CD PIPELINE

**A** The CI/CD pipeline is a series of procedures that must be followed in order to deploy a new version of software. Pipelines for continuous integration and delivery (CI/CD) are a DevOps or site reliability engineering (SRE) strategy aimed at improving software delivery. In a CI/CD pipeline, monitoring and automation are utilized to improve the application development process, especially during the integration and testing phases, as well as during delivery and deployment. Although each stage of a CI/CD pipeline can be accomplished manually, automation unlocks the entire potential of CI/CD pipelines. [7] Jenkins is a free and open source server for task automation. It helps with continuous integration and delivery by automating the building, testing, and deploying aspects of software development. [8]

- **Build** - This step is referred to as continuous integration, and it entails writing and compiling code. Teams collaborate to develop off of source code and incorporate new code while rapidly identifying any bugs or disputes. This is a phase where developers build and compile source code through their local system to Github repository, merge Team changes and module integration, making code ready for infrastructure deployment. .
- **Test** - Once the source code is checked in, the first and foremost requirement is the step where the code is put to the test. Integrating SonarCube plugin with jenkins has allowed us to automate the test case scenario and find relevant vulnerabilities, allowing developers and teams to make application secure from malware attacks like SQL injections etc. [9]
- **Release** - Only after succesful execution of Test stage, Jenkins then creates a workspace ready for building business logic by downloading all dependencies mentioned

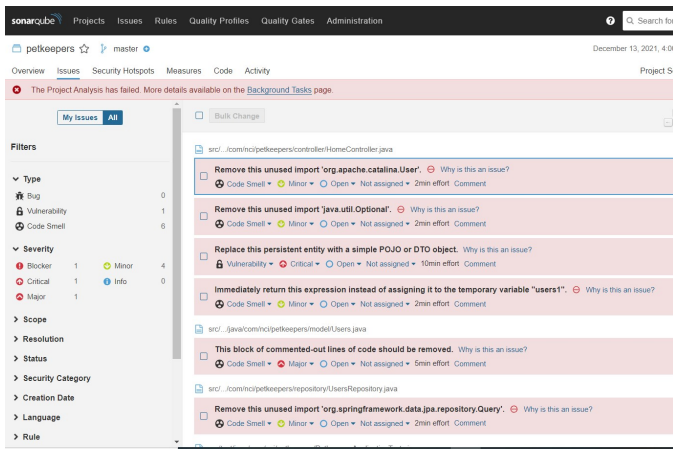


Fig. 6. Static code test Analysis

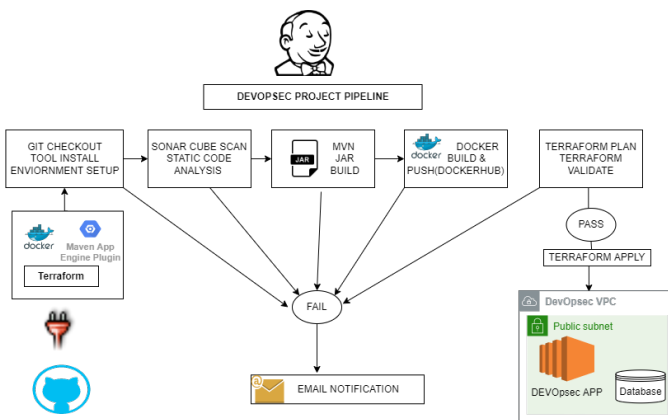


Fig. 7. CI-CD Pipeline workflow.

in environment file. **In the Era of Devops**, we adapt to new solution of lightweight docker by containerization our image and running multiple images in single docker image, storing to Docker registry for version control and secure access letting your own your release distribution.

- **Deploy** - Lastly, In order to stimulate and make application available we have used Terraform to provision our server environment at one click. Terraform is an open-source, infrastructure as code software platform that allows you to manage hundreds of cloud services using an uniform CLI approach. Terraform uses declarative configuration files to codify cloud APIs allowing users to define and provision data center infrastructure using the Hashicorp Configuration Language (HCL) or JSON as a high-level configuration language.
- **PostRunAction** - (optional) The Post Build Step can be configured to only run when the build has reached a certain status. If something goes wrong, do something (send logs to someone?) Do something if it's passed or unstable we call PostRunAction to take action based on conditions defined.

## V. OBSERVATIONS, SHOWING HOW A CODE CHANGE FLOWS THROUGH THE PIPELINE

Every software project has a set of 'processes' and 'practices' that must be followed in order for the project to be completed and deployed successfully. As the project's size and scope grow, the number of problems grows inexorable and implementation of a CI/CD pipeline as such is only half successful. Further, You must establish continuous monitoring and observability to complete the deployment, which will allow you to collect metrics and actionable insights. Figure 8 depicts how code flows through various stage in order to meet end user requirement and resulted into a successful business application model.

- **GitSourceCheckout** - This is the stage where we have setup a succesful secure connection with the GitReoplo in order to pull the latest code to Jenkins Workspace for steps ahead.
- **Declarative Tool Install** - This branch is used for declaring tool integrated with Jenkins in order to install them as environment variable for particular build execution. Terraform and SonarCube has been initialized along with calling maven clean to initiate executable lifecycle of application.
- **SonarScanTest** - This is the step where the code is put to the test. Integrating SonarCube plugin with jenkins has allowed us to automate the test case scenario. At the end of this phase developer can clearly analysis the application failures, vulnerabilities and bug via custom dashboard created at sonar server.
- **Jar Release** - Once we pass through critical test stage , a successful promotion leads to the release stage of calling maven build for the jar creation of our application. This is the stage where a local build profile will be triggered and based on source and application properties outcome will be expected. A successful run will be a jar creation having business logic stored in localworkspace of Jenkins.
- **Terraform init,plan,apply** - In order to stimulate and deploy application in production we have used Terraform to provision our server environment at one click. Terraform is an open-source infrastructure as code software platform that allows you to manage hundreds of cloud services using an uniform CLI approach. Terraform uses declarative configuration files to codify cloud APIs. With Terraform tf file we have jotted our basic resource parameters few like ami, VPC subnet and security group parameters to let terraform create a robust and safe architecture at one click. With init stage, terraform initialize the environment and connection with cloud, Terraform plan generates an execution plan, which allows you to see what modifications Terraform intends to apply to your infrastructure and at the end, terraform apply auto approve trigger the final execution of the environment creation at the connection cloud.
- **PostRunAction** - The Post Build Step can be configured to only run when the build has reached a certain status



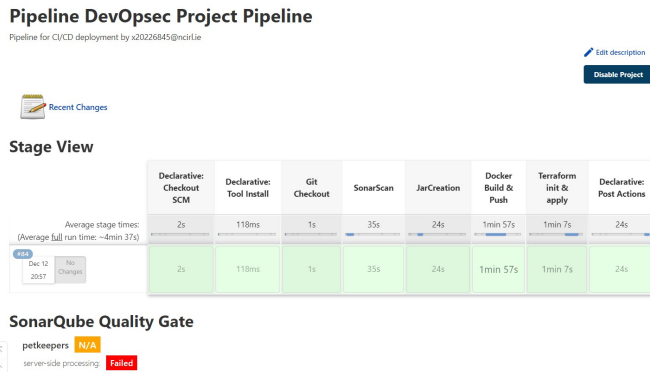


Fig. 8. code workflow through stages of Pipeline.

as an example If something goes wrong, do something (send logs to someone?) Do something if it's passed or unstable. In our Pipeline we have configured a workspace cleanup after all stage completion and email notification for the Jenkins Pipeline build logs with build status.

## VI. TEST PLAN AND EXECUTION DEMONSTRATING THAT YOUR APPLICATION IS SECURE FROM INJECTION ATTACKS AND AT LEAST 2 OTHER OF THE OWASP TOP 10

The test plan for the petkeepers web application follows all the traditional processes which is integrated throughout the software development process [10]. The backend application consists of various test cases which are the executed on every build. Unit testing integration is important as sometimes some functions are depended on each other. Unit testing validates even if we are making changes in a specific module or a part of code, the overall functionality is not hampered [11]. Considering our application, the unit test cases basically can be divided in three types of test cases rest api based, db connection and operation bases and business logic based. During application building or packaging, the application goes through compilation and testing. The build fails even if one the test cases is not giving expected result. Test cases also act like additional step for security and finding vulnerabilities.

The application uses Spring boot as backend technology. This enables the developers for adding additional security threat which handled by spring internally. Spring security provides various filters depending upon their use cases. For example we have added to XSS filter to avoid cross-site scripting attacks. The XSS injection attack involves the attacker injecting malicious code into a web application. [12] The attacker interacts with the application through a web browser or HTTP client tool such as Postman. We had used AWS Secrets Manage where all the password and sensitive data is stored. AWS Secrets Manager provides various features where the passwords are not integrated in the code which is available in the repository. This eliminates the possibilities of sensitive data getting compromised. There are various ways of minimising the the vulnerabilities.

[10] The application consist of a proper logging which helps us to understand the end to end application process. Proper logging always helps. For logging through out the application we can AOP. [10] OWASP Top 10 provides list of highlighted vulnerabilities.

## VII. CONCLUSIONS

To conclude, while there are many ways in which technology negatively effects our society, however, it has immensely benefited us in many aspects aiding in the improvement of our lives. Technology and imagination are meant to be scaled. Similarly, Petkeepers Application is an conceptual solution of providing a matchmaking platform that is available on demand and benefit different society in various aspects. With a exponentail growth in Devops Market adapting a new set of practises to shorten software development cycle and with automate continuous Integration and Delivery methods ,Infrastructure as service our aim is maximum utilization of resources with high success rate of implementation and secured services. For future works, The development of this proposed paper, conceptual Business Plan, and product will be carried further with and the user will be able to employ the development's outcome.

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