DUY TÂN UNIVERSITY
International School

Capstone Project 2

CMU-SE 451

Architecture Document

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Craft Village Pollution Monitor System

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PROJECT INFORMATION

Project acronym	CVPMS		
Project Title	Craft Village Pollution Monitor System		
Start Date	01/03/2023	**End Date**	15/05/2023
Lead Institution	International School, Duy Tan University		
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Project Web URL	*https://github.com/Casca113s2/craft-village-pollution-monitor-system*		
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1.0	21/08/2022	Initial Release	Bui Duc Huy	
1.1	17/10/2022	Update C&C, Module View diagrams	Bui Duc Huy	
2.0	14/03/2023	Update Activity, Module View diagrams	Hua Hoang Phuc	
2.1	29/03/2023	Update Activity, Context Diagram	Hua Hoang Phuc	
2.2	13/04/2023	Update Activity, Module View diagrams,	Hua Hoang Phuc	
2.3	28/04/2023	Overview, Prediction AI	Bui Duc Huy Van Cong Le Ca	
2.4	13/05/2023	Allocation View, Prediction AI	Huynh Ba Nhan Bui Duc Huy	

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1. Introduction

1.1. Purpose

This document will cover the following information:

- Brief description of the project (project overview, business goals, general constrains about technical and business problems).
- Architectural drivers (functional requirements, quality attributes and constraints).
- Architectural design (C&C View type, Module View type, Allocation View type).

1.2. Business needs

- Desiring to help people have more awareness of pollution from craft villages, a system that will allow people to submit data of craft village and keep track its pollution status.
- A system that will provide the user the abilities such as take a survey, include the image of the pollution, view survey history, etc.
- An AI system will also provide the application to analyze the pollution based on the user's provided image.
- An AI takes the production information and then give the prediction of pollution types that the craft village will facing.
- The system should also give the administrator the ability to manage their user and data.

1.3. Proposed solution

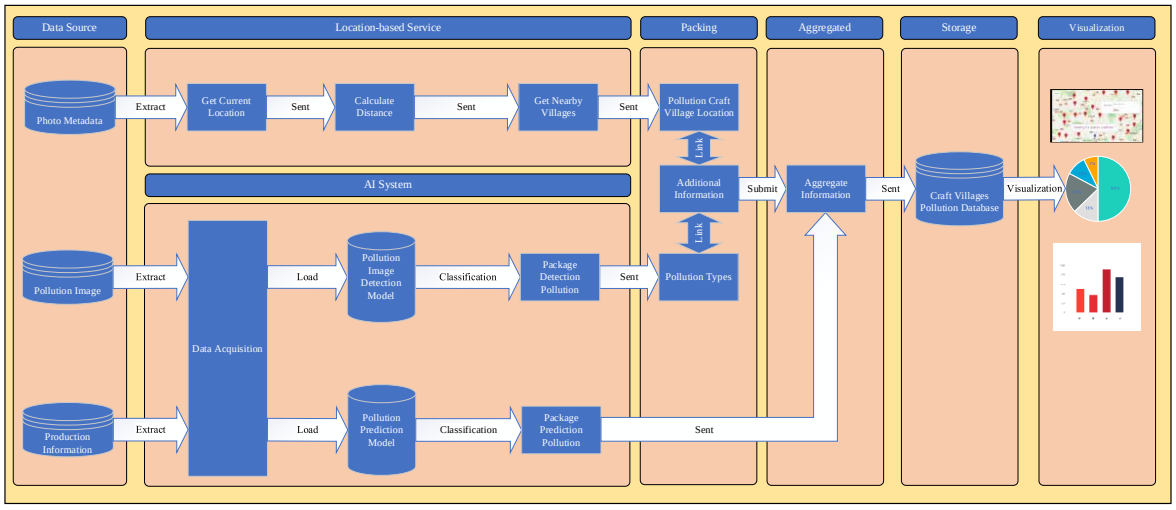


Figure 1. *Craft Village Pollution Monitor System*

Our team will wrap around the above problems and help everyone monitor and resolve the pollution problems from their craft village area more effectively. Some aspects that will make our system that the people will find much more effective:

- Our system will help everyone to monitor your local craft village despite where your location. This means whether you stay in a big city or a small village at the top of the mountain our system will still function.
- Our system will provide a function that lets people make an instant report to the local environment department.
- Our system will detect all kinds of pollution instead of focusing on some specific kinds. This will help to collect a variety of data that could help people to a bigger picture about their pollution levels in the area.
- Our system will have an AI that will take images from people then analyzes the image to know what kind of pollution the user is facing and the result will be automatically filled into the form which will be sent directly to the local environment department to resolve the problem. This is so easy to use that even an elementary school child can do and it also reduces a massive amount of the cumbersome and bureaucratic process that people have to go through.
- Our system will have an AI that will take the production information and then give the prediction of pollution types that the craft village will facing. By combining the pollution from the image and the prediction then the result will be more accurate.
- Our system is also integrated with location-based technology to detect the location of the pollution and layout the data on the map for the user to monitor.

1.4. Business drivers

Based on the business needs and business solution our team decides to make a Craft Village Pollution Monitor System.

1.5. Project goal

The goal of the project is to build a Craft Village Pollution Monitor System (CVPMS) within the budget of $3000 and deliver on time by the end of May of 2023.

2. Architectural drivers

2.1. Functional requirements

Table 1. *Functional requirements*

ID	Function	Description
FE01	Login	Use username/password to login into the system, can use the function of the system.
FE02	Register	Use to register a new account
FE03	Forgot Password	Use to recover password
FE04	Change Password	Use to change current password to new password
FE05	Send Mail	Use to sent verify code or new password to registed email
FE06	Edit User's Information	Use to change registed information
FE07	Change Language	Use to change application language from English to Vietnamses and vice versa
FE08	Take Pollution Photo	Use to take pollution photo
FE09	Detect Location	Use to detection location of user automatically
FE10	Auto Fill Information	Use to autofill necessary information after application detect pollution types from image and get location
FE11	Add New Village	Use to add new village to database
FE12	Detection Pollution Types	Use to auto detect pollution types from image
FE13	Add Additional Information	Use to add additional information for the survey
FE14	Submit Survey	Use to sent survey to database

FE15	View Finished Survey	Use to load the finshied survey for user to review
FE16	View In Progress Survey	Use to load the in progess survey for user to review
FE17	Accept/Decline New Village	Use to give an accept/decline a new village
FE18	Create Local Authority Account	Use to create a new local authority account
FE19	Display Dashboard	Use to load necessary according to user role

2.2. Business constraints

- Project begins from Mar 1st, 2023 to May 15th, 2023. After delivery, the team will rectify defects in the deliverable (no additional functionalities or features).
- Resource availability is defined below: 01/03 – 15/05 with 5 members.
- Product follows Mentor's requirement.

2.3. Technical constraints

- **Technical to develop**
  - Language: Java (Spring Boot), Dart (Flutter), Python (Flask, FastAI)
  - Develop tool: Visual Studio Code, SpringToolSuite4
  - Version Control System: Git/GitHub
  - Database Management System: Oracle SQL Developer
- **Environment**
  - Operation systems: Microsoft Windows, MacOS, Android, iOS

2.4. Quality Attribute

Table 2. *Quality Attributes: Availability*

Scenario	**A1**
Attribute concern	**Downtime of system**
Description	The operating time of the system should be 95% to have

	time for backup data, maintenance and repair.
Source	Internal to system
Stimulus	System pause
Artifact	System
Environment	The system works normally
Response	Be temporarily unavailable while backup data, maintenance and repair are being effected
Response Measure	Uptime of the system should be 95%, downtime is about 1.2 hours per day

Table 3. *Quality Attributes: Performance*

Scenario	**P2**
Attribute concern	**The latency of initiating transactions**
Description	Users initiate transactions under normal operations. The system processes the transactions with latency less than 5 seconds.
Source	Users
Stimulus	Initiate transactions
Artifact	System
Environment	Under normal operations
Response	Transactions are processed
Response Measure	With latency less than 5 seconds

Table 4. *Quality Attributes: Performance*

Scenario	**P3**
Attribute concern	**The throughput of the system**
Description	At peak load, the system is able to complete 100 normalized transactions per second.
Source	Internal to system
Stimulus	Multiple transactions at the same time
Artifact	System
Environment	Peak load
Response	Throughput
Response Measure	Throughput is 100 transactions per second

Table 5. *Quality Attributes: Usability*

Scenario	**U4**
Attribute concern	**Using effectively**
Description	Craft Village Pollution Monitor can be easy for end-users to create a report after 10 minutes using.
Source	End-users
Stimulus	Create a report
Artifact	System
Environment	The system work normally
Response	Easy to use
Response Measure	Easy to use after 10 minutes using

2.5. System Context Diagram

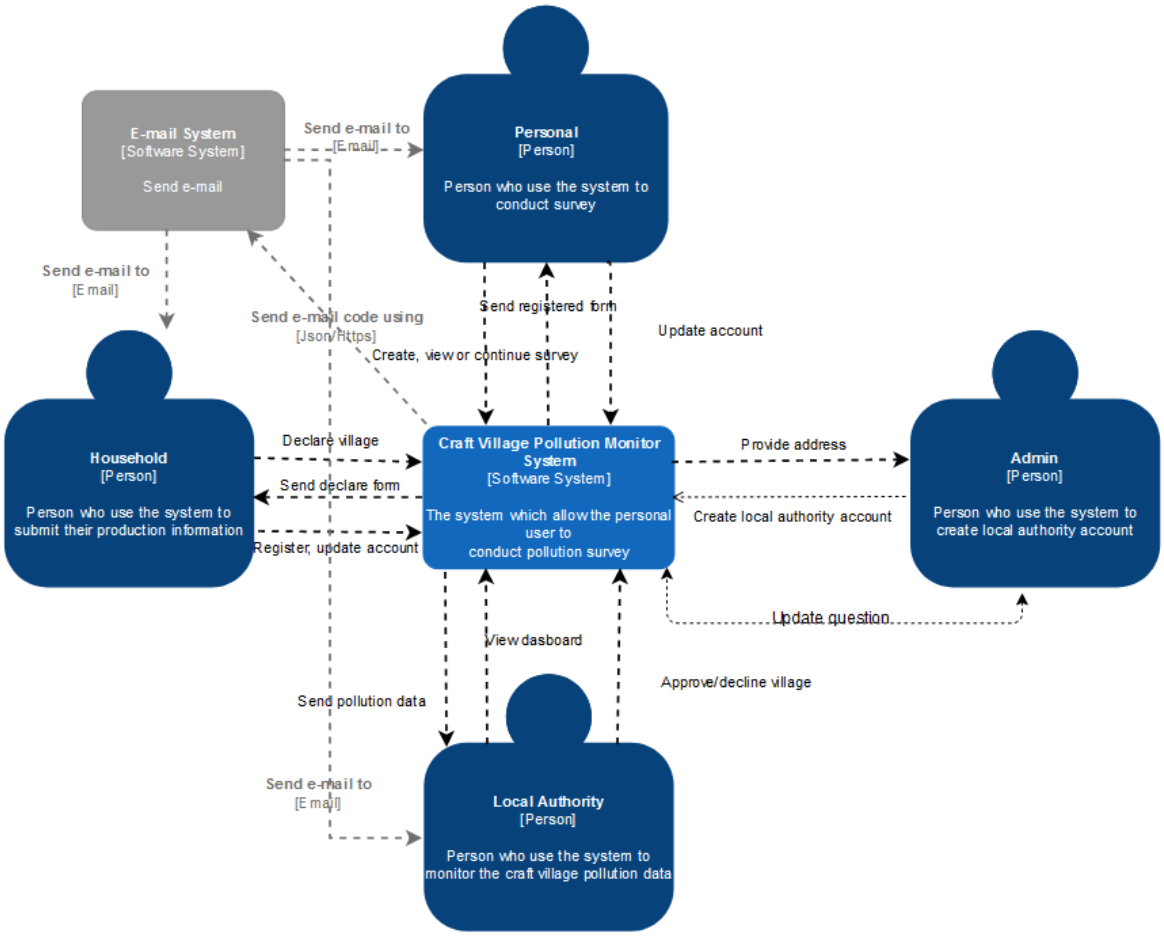


Figure 2. *System Context Diagram Overview*

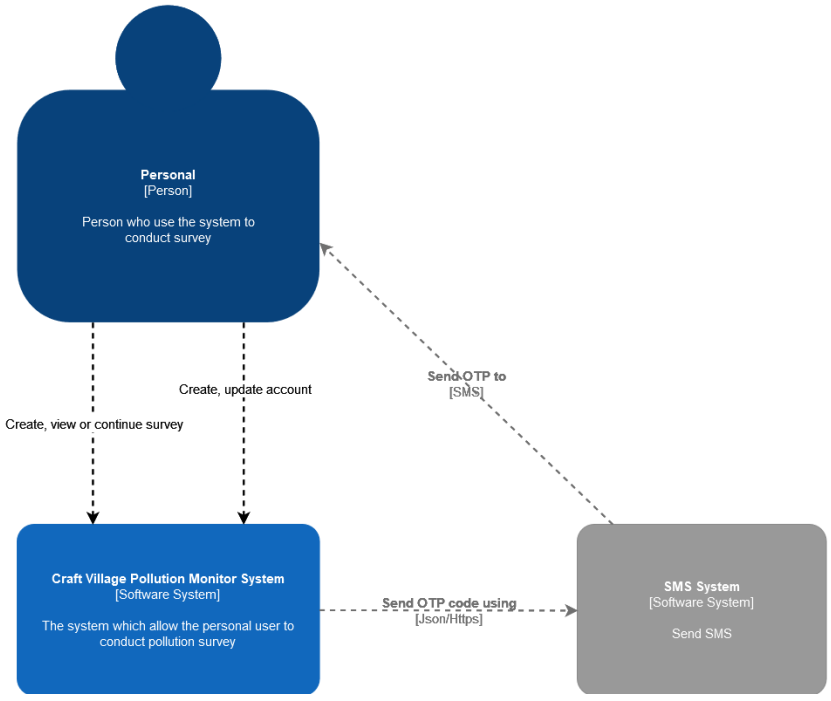


Figure 3. *Personal System Context Diagram*

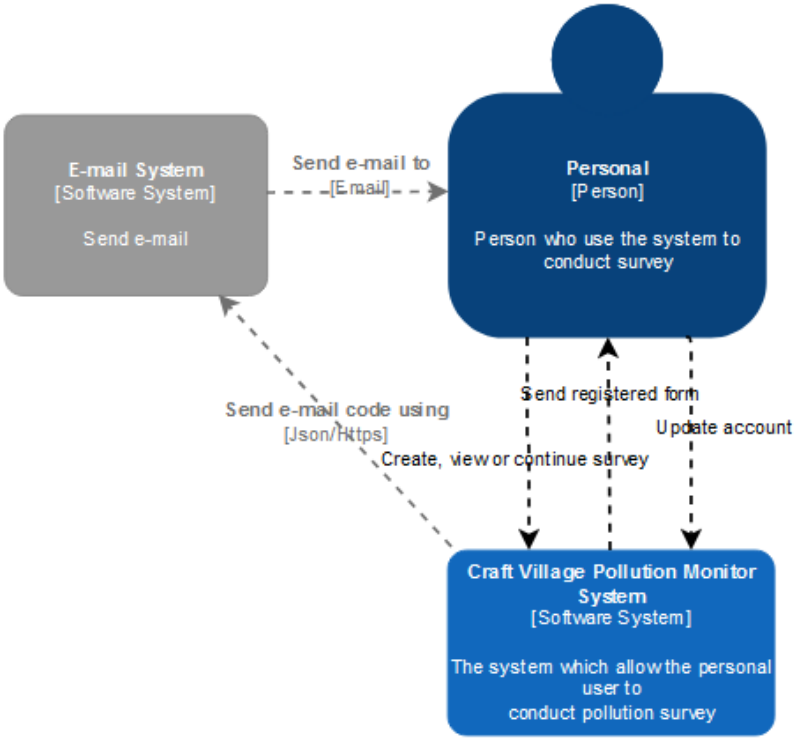


Figure 4. *Household System Context Diagram*

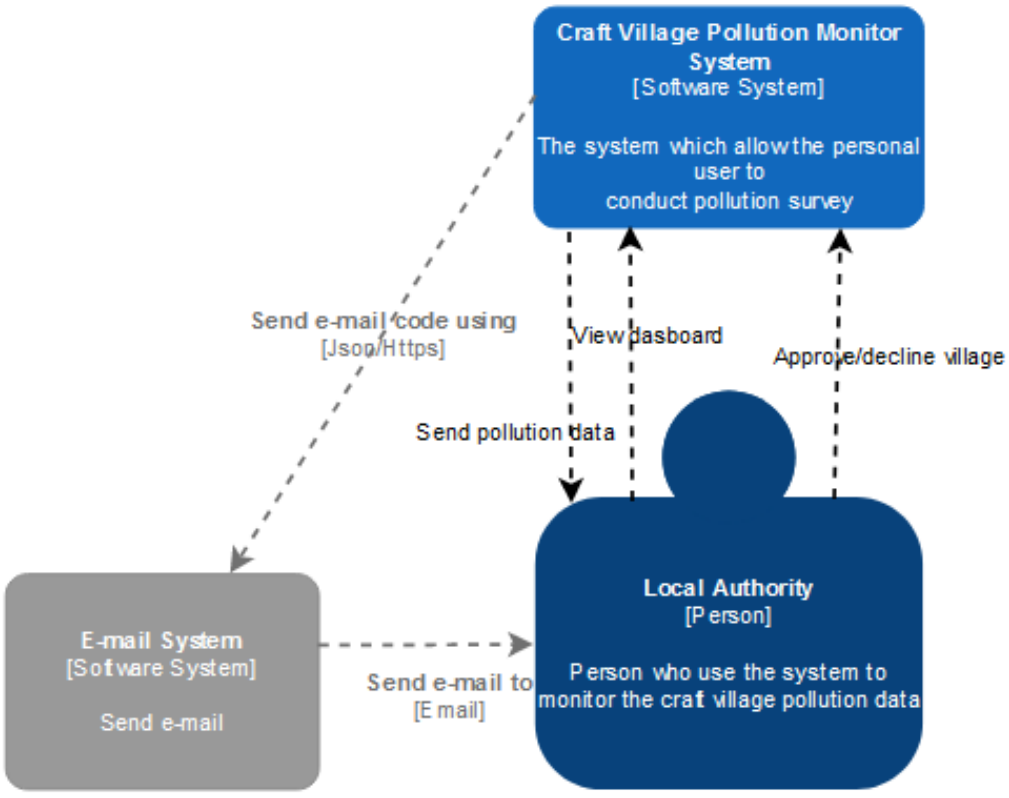


Figure 5. *Authority System Context Diagram*

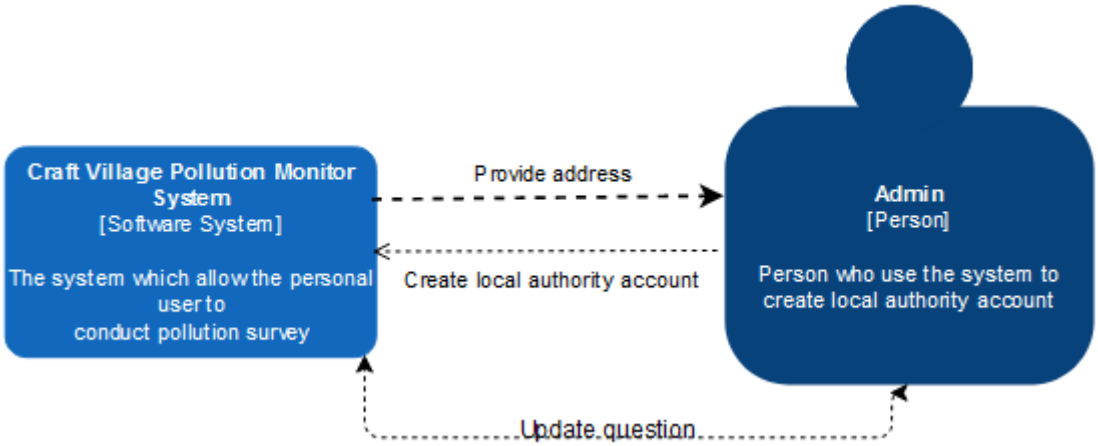


Figure 6. *Admin System Context Diagram*

Prose:

- The personal user, they can:
  - Create a new survey;
  - View previous survey;
  - Report;
- The household, they can:
  - Submit their production information;
  - Request add their village;
  - Declare their current village;
  - Report.
- The authority, they can:
  - View craft village's data (village production information, pollution status, etc);
  - Approve/decline a new village.
  - Update village**.**
  - Report**.**
- The admin, they can:
  - Create authority account.
  - Update question to training data.
  - Download data set.

3. Activity Diagram

Activity diagram is a graphical representation of workflows of stepwise activities and actions with support for choice, iteration, and concurrency.

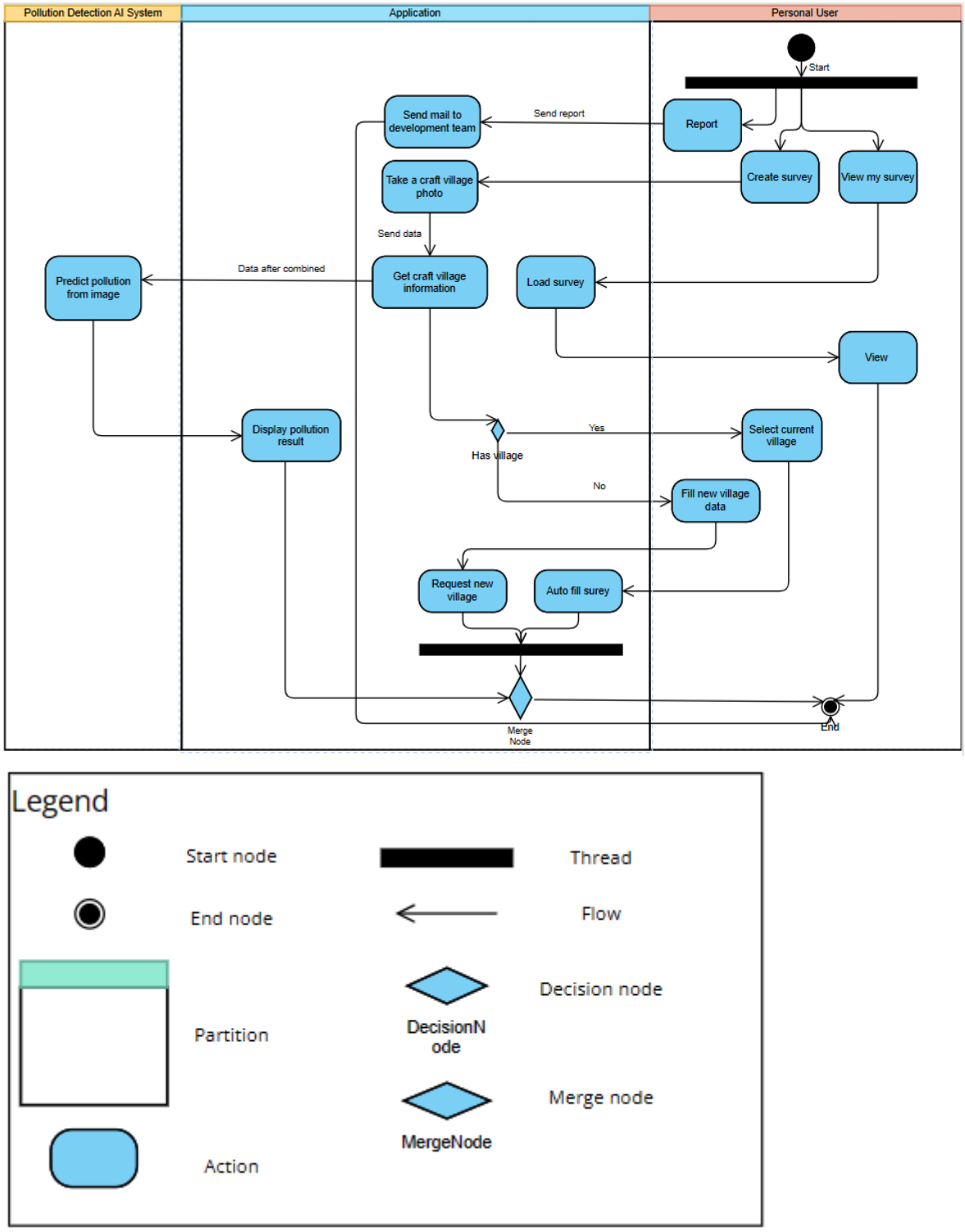
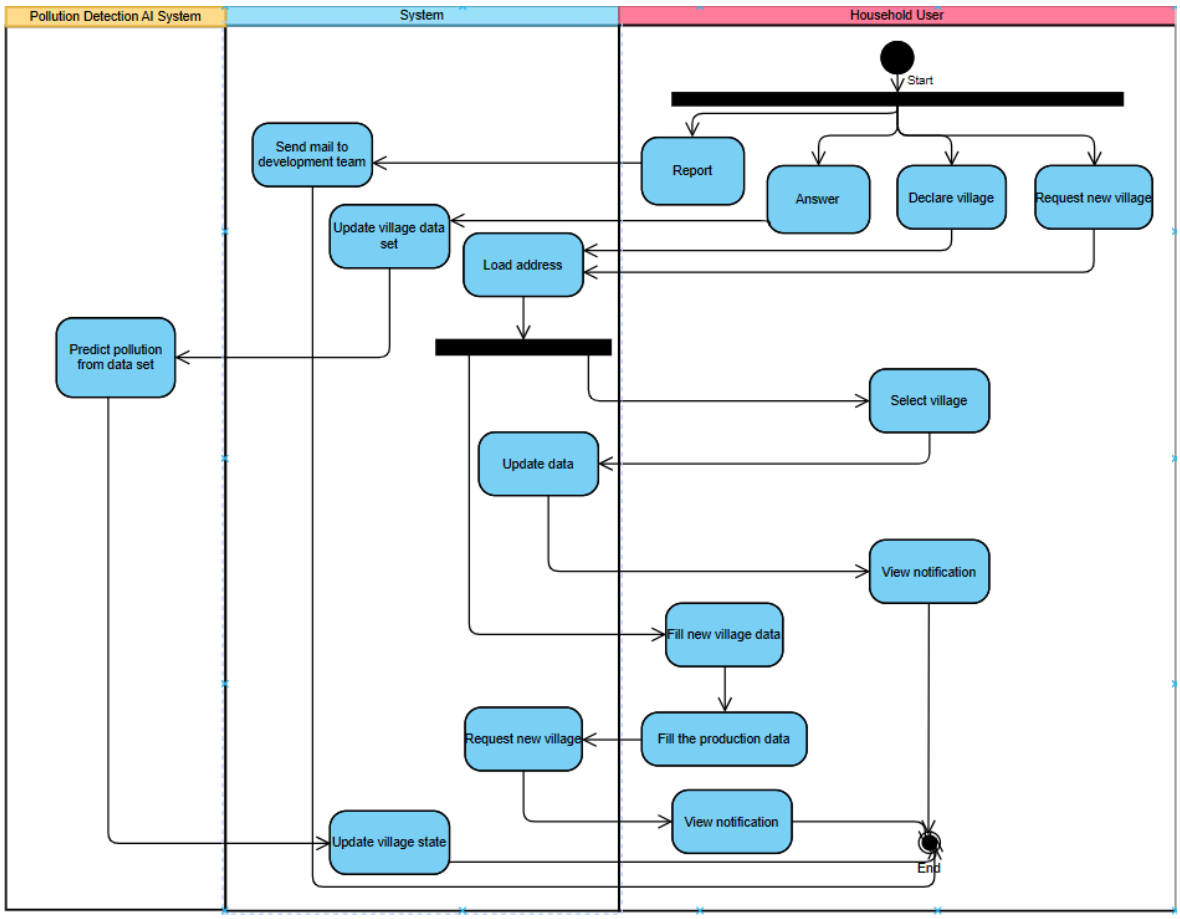


Figure 7. *Activity Diagram (Personal)*



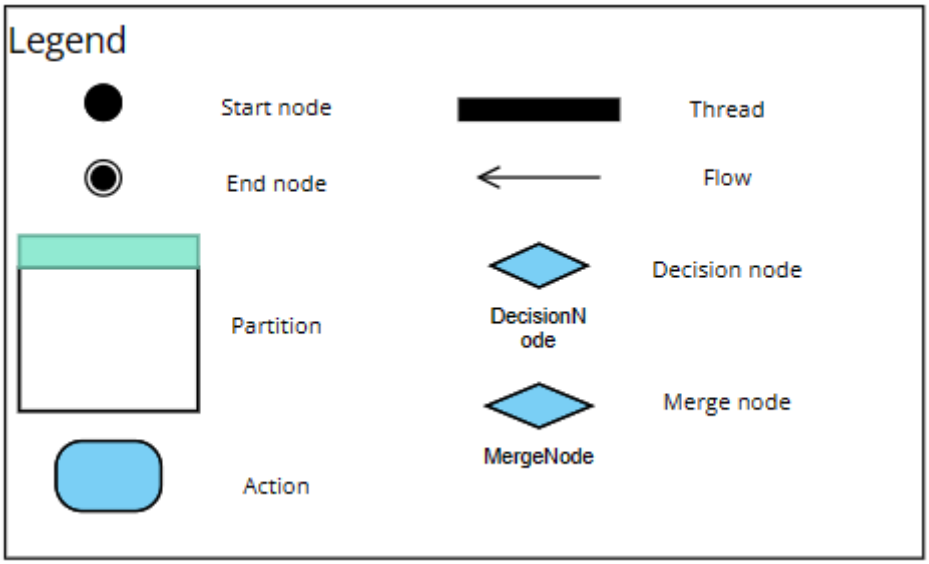


Figure 8. *Activity Diagram (Household)*

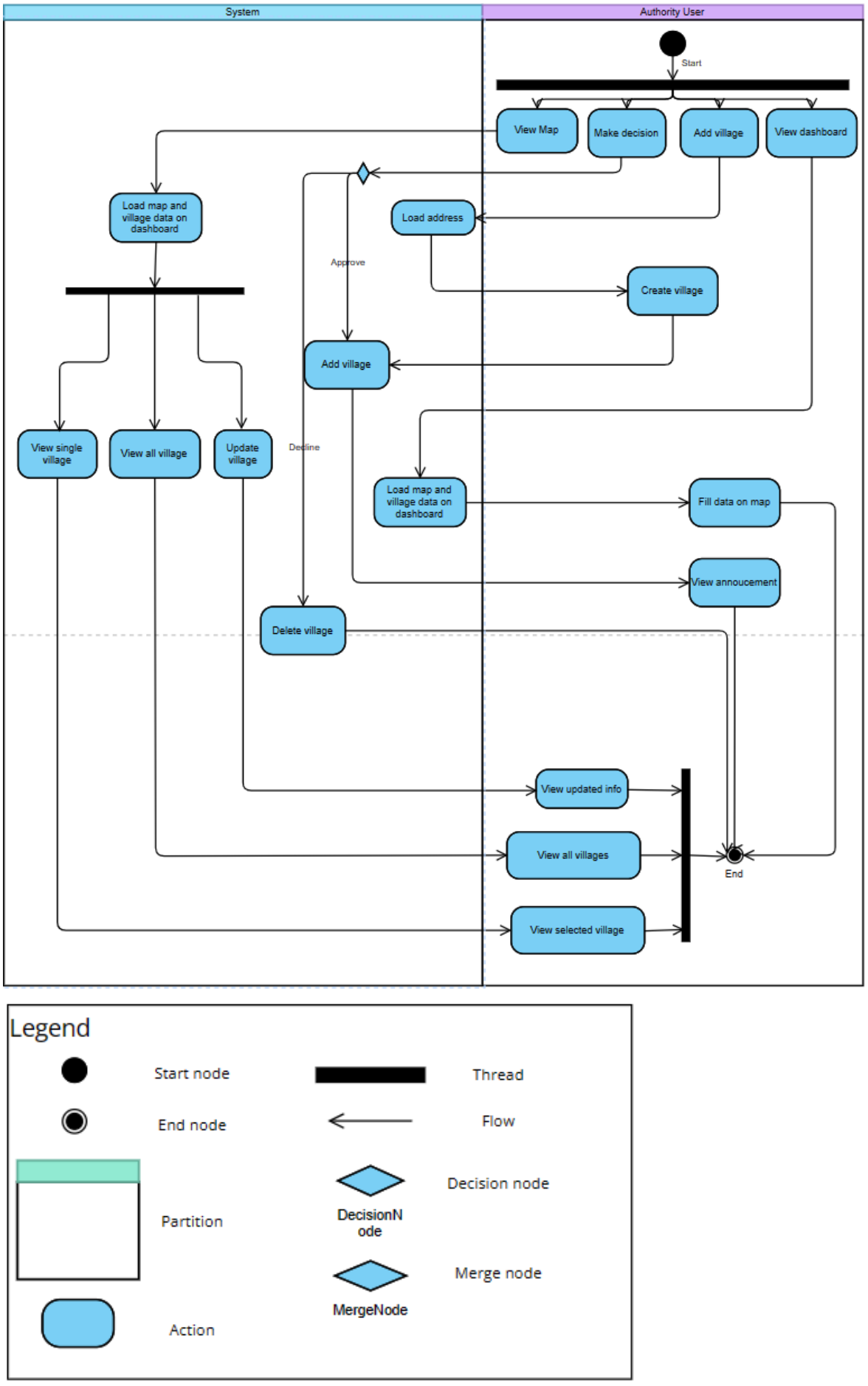


Figure 9. *Activity Diagram (Authority)*

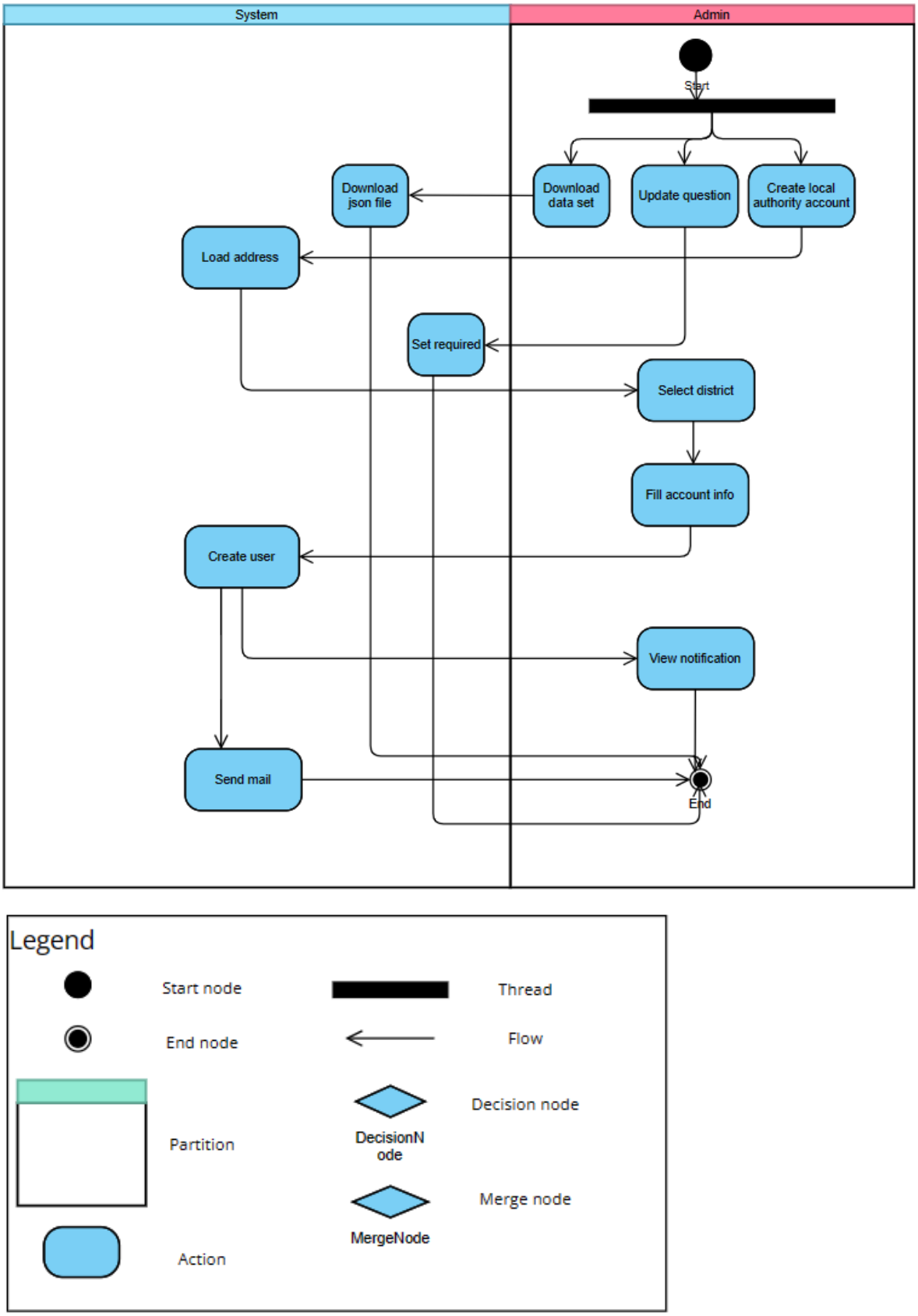


Figure 10. *Activity Diagram (Admin)*

4. C&C view

The diagram below shows the overview architecture including components and other related components.

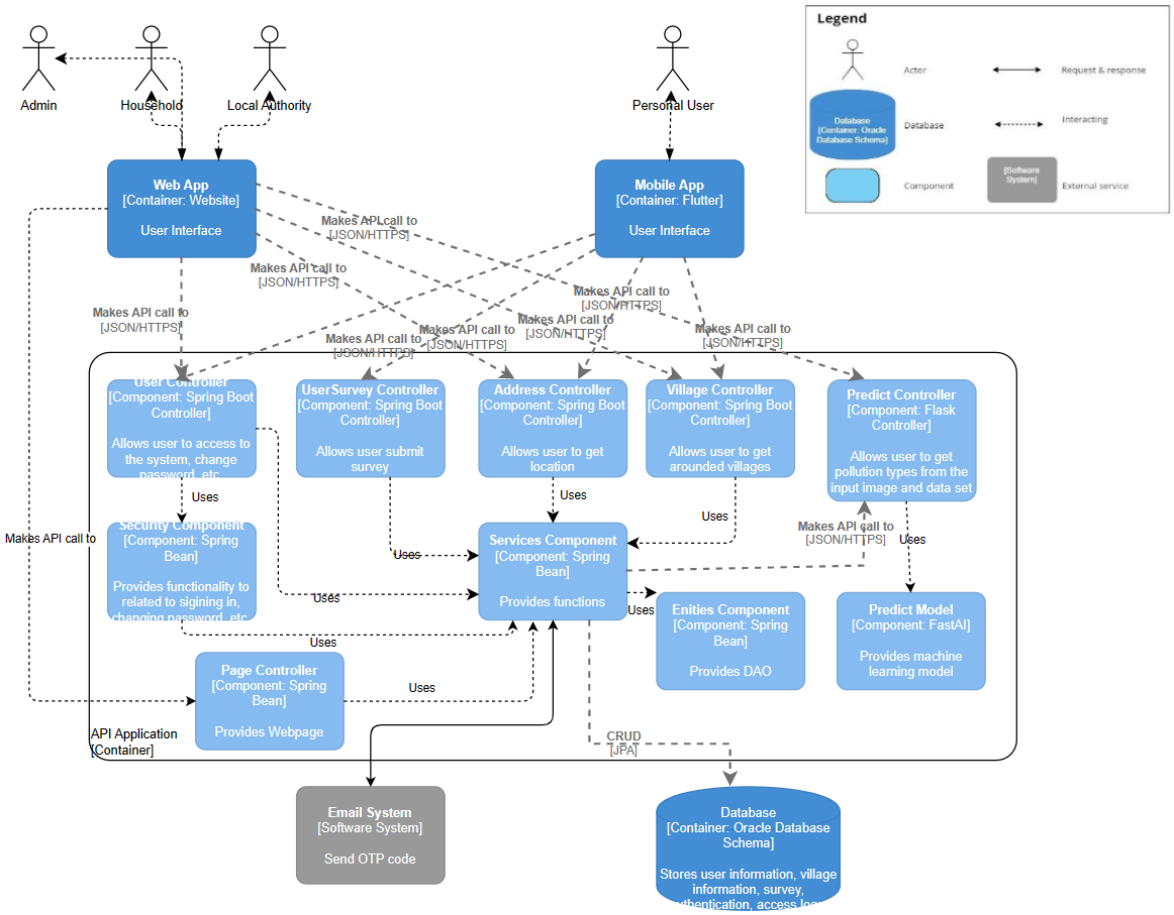


Figure 11. *Component & connector view*

5. Module View

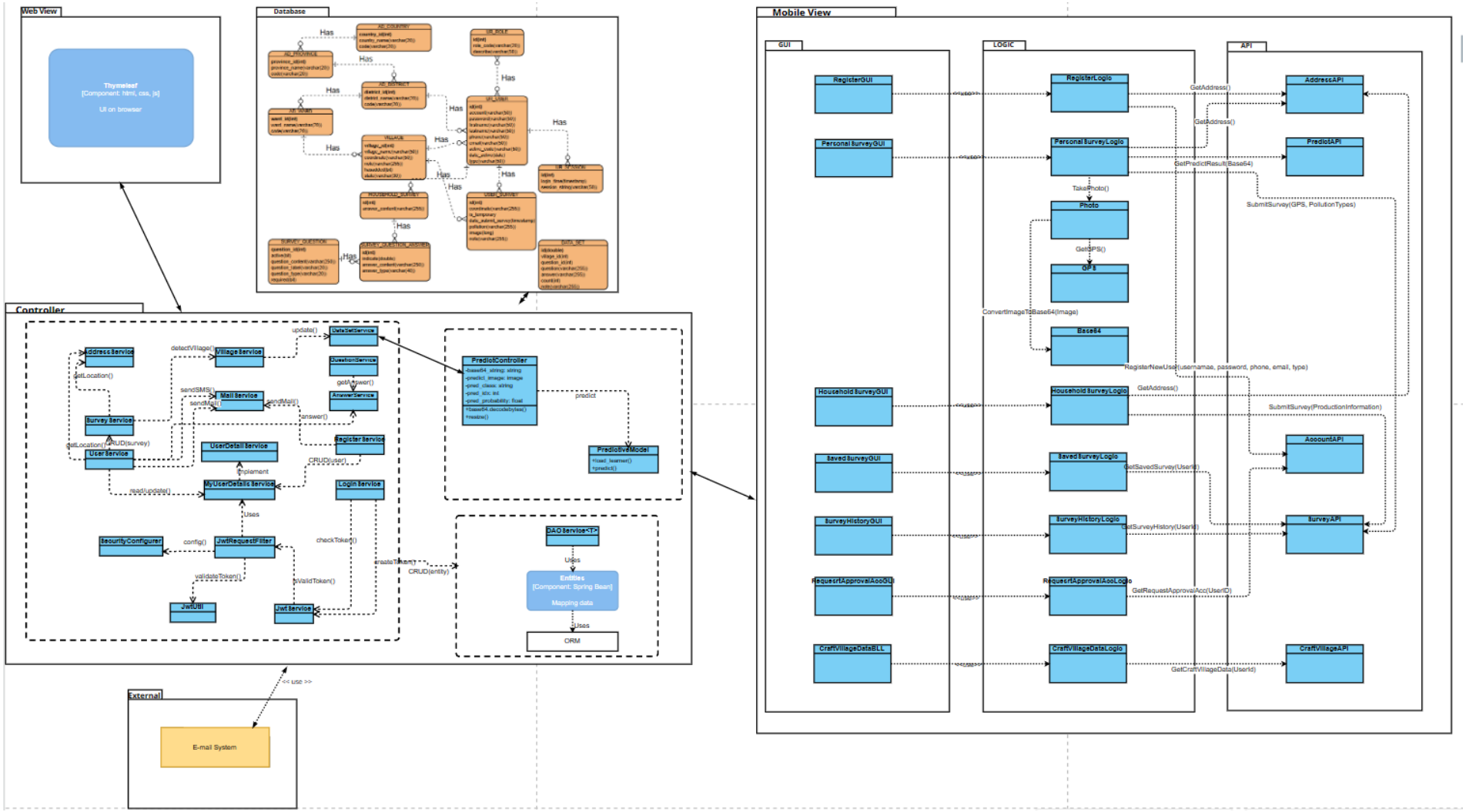


Figure 12. *Module view*

Prose:

- The CVPMS includes 5 packages and a database that helps the app run effectively.
- In the Web View package, we use Thymeleaf (Java template engine) to process and generate HTML, Javascript, and CSS.
- The App View package which has 22 classes are often used and we customize it to fit our requirements.
- The Controller package contains 16 classes, the Entities component, and the ORM model. The PredictController and the PredictiveModel are used to predict and return the types of pollution. We build a "bridge" between the software and relational databases using the ORM model and the Entities component.
- The Module package contains 10 models and the relation between them.
- In the External package, we use the E-mail System and the SMS System.
- Finally, the app is connected to the Oracle Database.

6. Allocation view

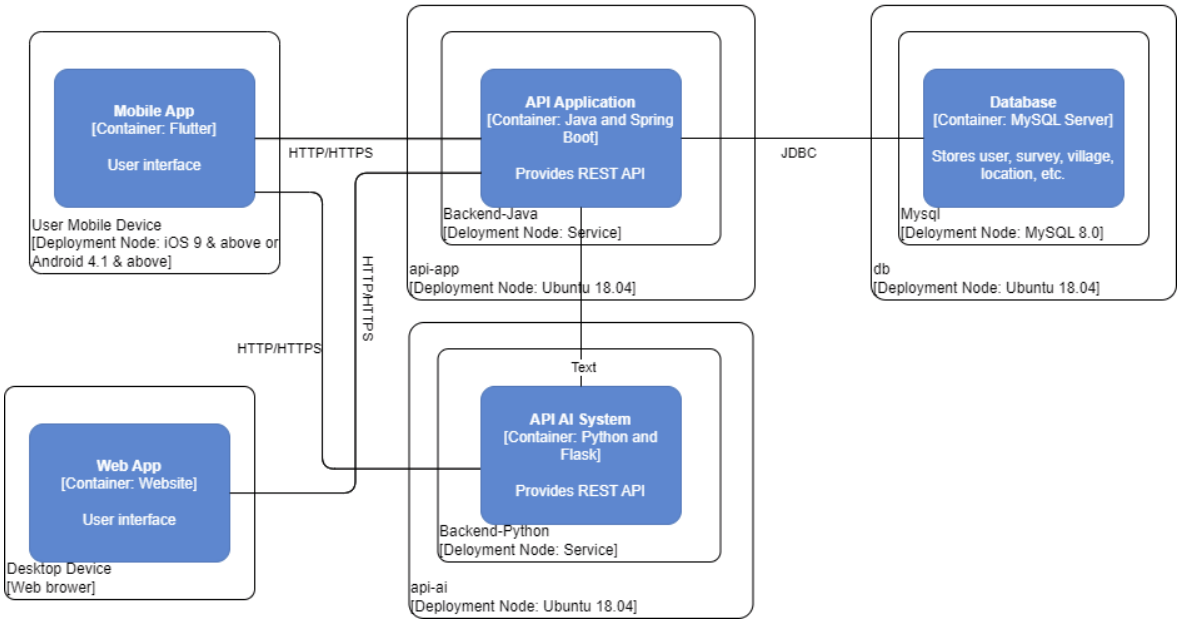


Figure 13. *Allocation view*

Prose:

The user can access our system by using Web App (Household User and Authority User and Admin) and Mobile App (Personal User) via internet.

7. Proposed architecture for Image Classification

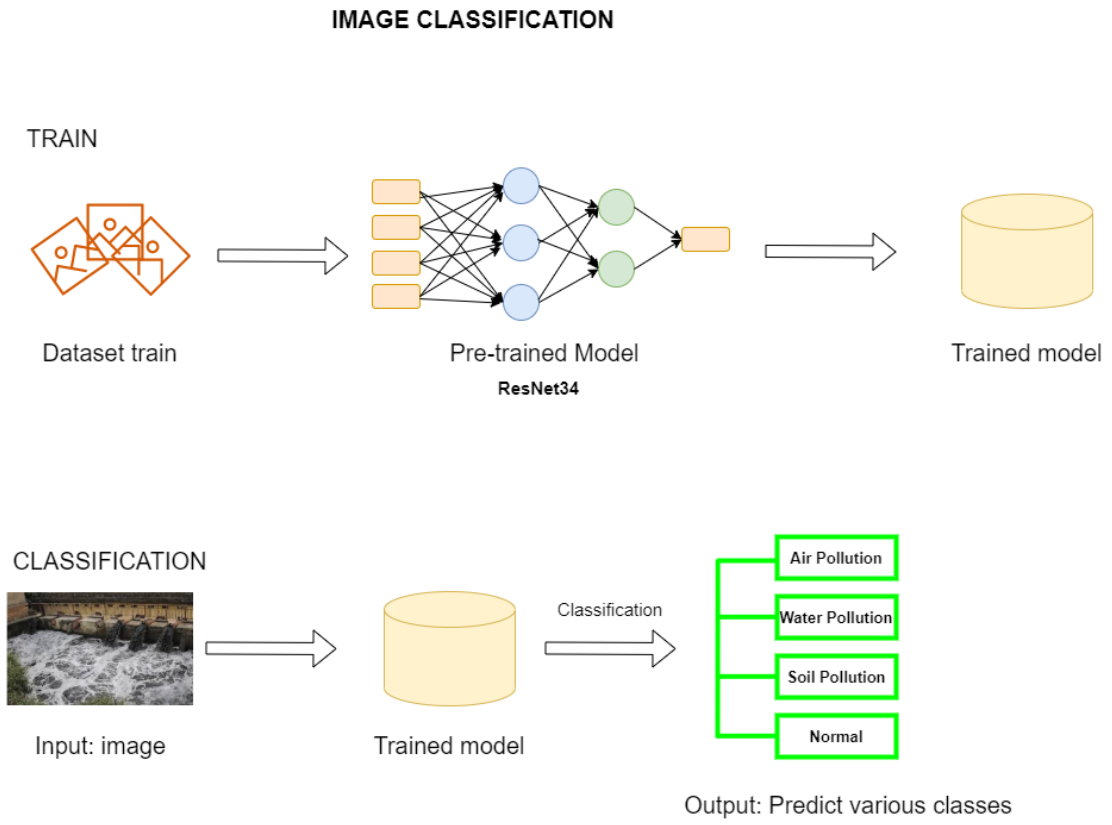


Figure 14. *Image Classification Architecture*

Prose:

To train a machine learning model, we use the dataset and the Pre-trained Model (ResNet34). From an input image, the trained model can predict various pollution classes.

8. Proposed architecture for Random Forest Classification

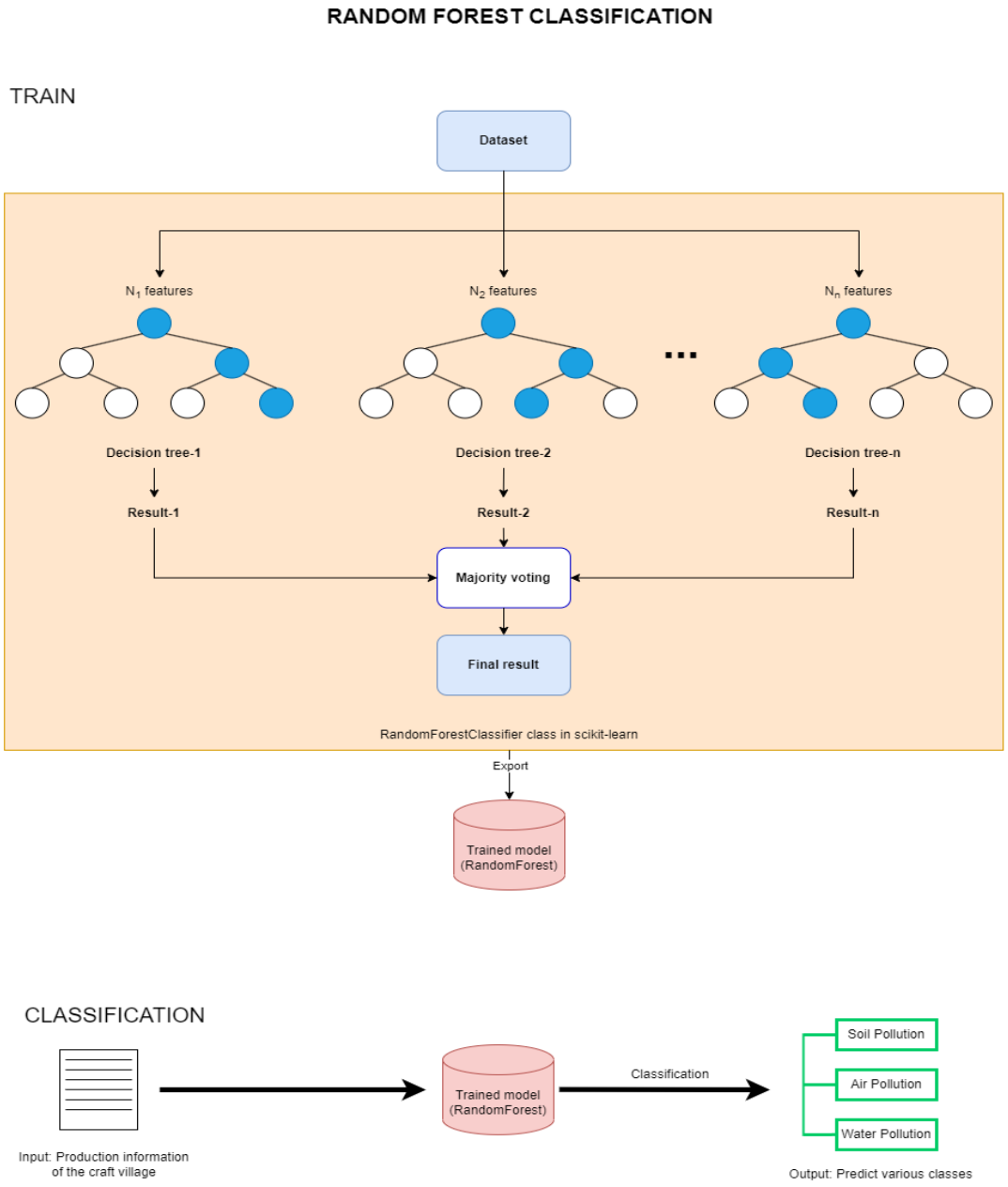


Figure 15. *Random Forest Classification*

Prose:

To train a Random Forest classifier model, we use the dataset and the RandomForestClassifier class in scikit-learn. The trained model (RandomForest) can make predictions on the Production information of the craft village. The output of the prediction will be the predicted various classes.

9. References

No.	References	Document Information
1	Design standards, Document standards	https://www.softwarearchitecturebook.com/svn/main/slides/ppt/26_Standards.ppt
		https://standards.ieee.org/standard/1471-2000.html
		https://c4model.com/
		https://machinelearningcoban.com/tabml_book/ch_model/random_forest.html
2	Patterns	https://en.wikipedia.org/wiki/Architectural_pattern
3	Evaluation standards	https://www.iso.org/obp/ui/#iso:std:iso-iec-ieee:42030:ed-1:v1:en
		https://gabrielfs7.github.io/software-architecture/2019/10/18/atam-analyze-evaluate-architecture/
4	Draw.io	https://www.draw.io
5	Visual Paradigm Online	https://online.visual-paradigm.com/