Software Requirements Specification

ANIMAL INTRUSION DETECTION SYSTEM

Version 1.0 approved

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Revision History

Revision History

Name	Date	Reason For Changes	Version

1. Introduction

1.1 Purpose

<Identify the product whose software requirements are specified in this document, including the revision or release number. Describe the scope of the product that is covered by this SRS, particularly if this SRS describes only part of the system or a single subsystem.>

With the rapid increase in deforestation and depletion of ecosystems, animals are finding it hard to live in their natural habitat, there are numerous incidents that take place where animals get out of their enclosure in search of food.

These incidents almost always end with the animals getting hurt due to the voluntary action by the humans or by the animals getting in the middle of dangerous human activity. So, we came up with the idea of creating animal intrusion detection using image processing as a solution.

With growing security systems, it is easy to find CCTV cameras in every establishment. Even if there are no cameras, installing one does not cost you much. These optical systems capture intrusion and will alert the user accordingly. Detecting animal intrusion using image processing will help the system to send out an alert to the residents nearby and take precautions. This kind of real-time alert can avoid animal accidents and also can help the residents to do the needful

1.2 Document Conventions

<Describe any standards or typographical conventions that were followed when writing this SRS, such as fonts or highlighting that have special significance. For example, state whether priorities for higher-level requirements are assumed to be inherited by detailed requirements, or whether every requirement statement is to have its own priority.>

SRS	Software Requirement Specification
OS	Operating System

1.3 Intended Audience and Reading Suggestions

<Describe the different types of readers that the document is intended for, such as developers, project managers, marketing staff, users, testers, and documentation writers. Describe what the rest of this SRS contains and how it is organized. Suggest a sequence for reading the document, beginning with the overview sections and proceeding through the sections that are most pertinent to each reader type.>

This project is a prototype for preventing human-animal conflict and it is restricted within the forest premises. This has been implemented under the guidance of college

professors and combined efforts of all the project teammates. This project is useful in preventing human-animal conflict in remote areas and fringes of the forest areas

1.4 Project Scope

<Provide a short description of the software being specified and its purpose, including relevant benefits, objectives, and goals. Relate the software to corporate goals or business strategies. If a separate vision and scope document is available, refer to it rather than duplicating its contents here. An SRS that specifies the next release of an evolving product should contain its own scope statement as a subset of the long-term strategic product vision.>

This software can be used in the forest and remote areas to prevent the human-animal conflict and the problem of crop vandalization and domestic animal attacks by wild animals has become a major social problem in the current time and the objectives of the project are given below.

The main objective of the project is to prevent the human and animal conflict and safeguard the agricultural field and from attacking domestic animals and wild animals and also to protect them by driving them away instead of killing. We are using an integrative approach in the field of Image processing to provide a monitoring and repelling system for crop protection against animal attacks and to prevent the conflicts.

1.5 References

<List any other documents or Web addresses to which this SRS refers. These may include user interface style guides, contracts, standards, system requirements specifications, use case documents, or a vision and scope document. Provide enough information so that the reader could access a copy of each reference, including title, author, version number, date, and source or location.>

Some of the references used in this project are listed below

1. Mark O. Afolabi, Idowu and A. Olalekan, “Design and Implementation of Farm Monitoring and Security System”, International Journal of Computer Applications (0975 – 8887) Volume 181 – No. 9, August 2018

2. S Jeevitha and Dr. Venkatesh Kumar, “A Review of Animal Intrusion Detection System”, International Journal of Engineering Research & Technology (IJERT) Vol. 9 Issue 05, May-2020.

3.Saieshwar Radhakrishnan, Ramanathan.R, “A Support Vector Machine with Gabor Features for Animal Intrusion Detection in Agriculture Fields”, 8th International Conference on Advances in Computing and Communication (ICACC-2018)

4. K. Jai Santhoshi, Bhavana. S, “Intruder recognition in a farm through wireless sensor network”, International Journal of Advance Research, Ideas and Innovations in Technology et al 2018 (Volume 4, Issue 3)

5. Sahane Pradnya Sambhaji, Salunke Nikita Sanjiv and Shirsath Vitthal Somnath, “Early Warning System for Detection of Harmful Animals using IOT”, International Journal of Advance Research and Innovative Ideas in Education Vol-5 Issue-3 2019

6. Sheela., Shivaram. K. R, Chaitra, Kshama, Sneha , Supriya, “Low Cost Alert System for Monitoring the Wildlife from Entering the Human Populated Areas Using IOT Devices” International Journal of Innovative Research in Science, Engineering and Technology Vol. 5, Special Issue 10, May 2016

7. Tibor TRNOVSZKY, Patrik KAMENCAY, Richard ORJESEK, Miroslav BENCO, Peter SYKORA, “Animal Recognition System Based on Convolutional Neural Network”, ADVANCES IN ELECTRICAL AND ELECTRONIC ENGINEERING VOLUME: 15 | NUMBER: 3 | 2017 | SEPTEMBER

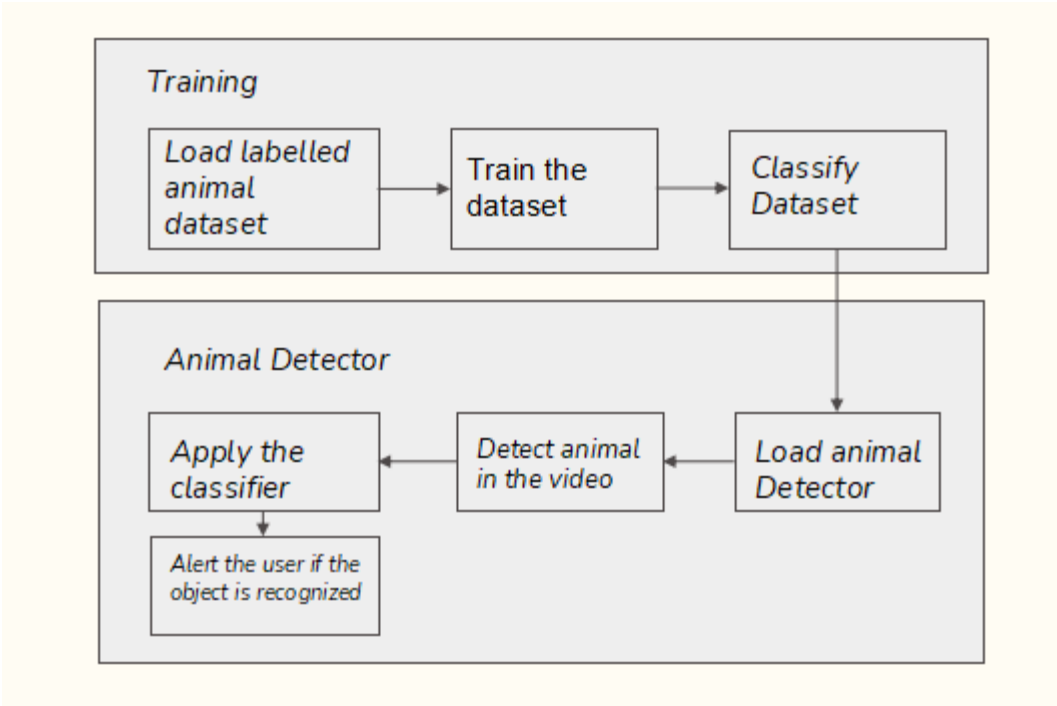
2. Overall Description

2.1 Product Perspective

<Describe the context and origin of the product being specified in this SRS. For example, state whether this product is a follow-on member of a product family, a replacement for certain existing systems, or a new, self-contained product. If the SRS defines a component of a larger system, relate the requirements of the larger system to the functionality of this software and identify interfaces between the two. A simple diagram that shows the major components of the overall system, subsystem interconnections, and external interfaces can be helpful.>

This application or software can be used as a replacement for the existing animal intrusion detection system which works with the help of sensors. With the help of a machine learning model, we detect the entry of animals and then alert the user or farmers, or forest people.

The relations involved are mentioned in the following diagram.



2.2 Product Features

<Summarize the major features the product contains or the significant functions that it performs or lets the user perform. Details will be provided in Section 3, so only a high-level summary is needed here. Organize the functions to make them understandable to any reader of the SRS. A picture of the major groups of related requirements and how they relate, such as a top-level data flow diagram or a class diagram, is often effective.>

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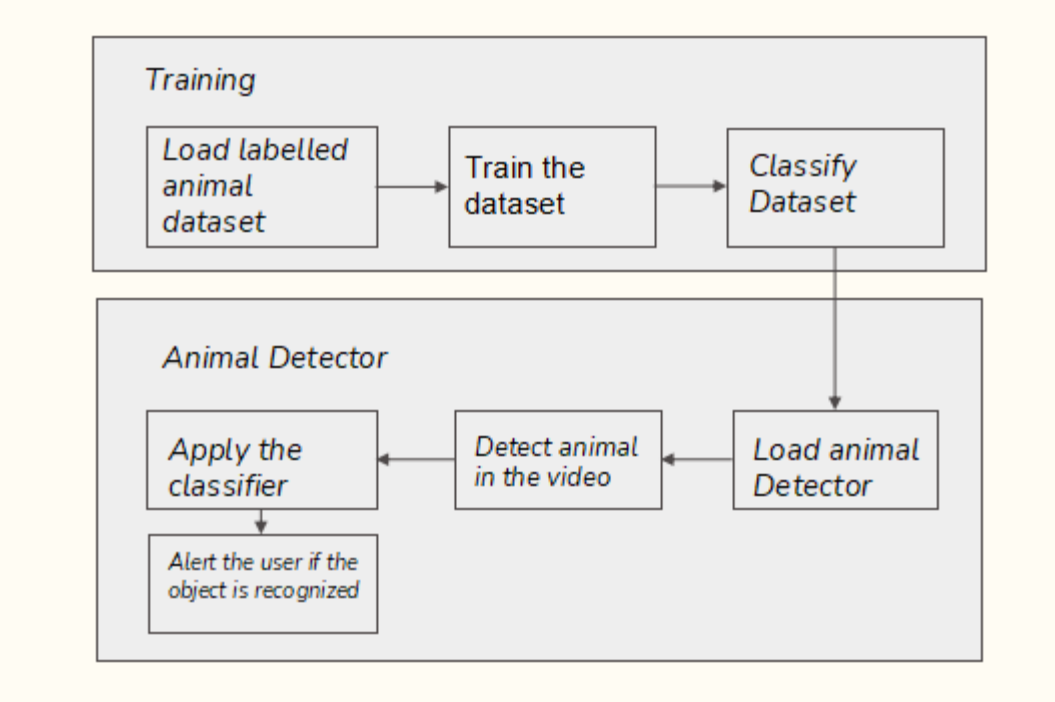
machine learning model, we detect the entry of animals and then alert the user or farmers, or forest people.

The relations involved are mentioned in the following diagram.

The animal intrusion detection system consists of three modules

- Object Detection- Detects the animals, if it enters into the agricultural land
- Object Recognition- Recognize the animals
- Alert- Alert the farmers or forest people



2.3 User Classes and Characteristics

<Identify the various user classes that you anticipate will use this product. User classes may be differentiated based on the frequency of use, a subset of product functions used, technical expertise, security or privilege levels, educational level, or experience. Describe the pertinent characteristics of each user class. Certain requirements may pertain only to certain user classes. Distinguish the favored user classes from those who are less important to satisfy.>

- Farmers-A farmer is someone who works in agriculture and raises live organisms for the purpose of food or raw resources. People who raise field crops, orchards, vineyards, poultry, or other livestock are commonly referred to as "farmers." In most industrialized economies, a farmer may own the farmed land or work as a laborer on land held by others, but he or she may also own independent farming land.

- Forest Development Authority-The Forestry Development Authority (FDA) is mandated to sustainably manage and conserve all forest resources for the benefit of present and future generations. The FDA works to conserve and sustainably manage forest resources to enable them to continue to provide a complete range of goods and services for the benefit of all Liberians and also to contribute to the reduction of poverty.

- Technical Support- In general, technical support provides help regarding specific problems with a product or service, rather than providing training, provision, or customization of the product, or other support services, in this application technical support teams play a vital role.

2.4 Operating Environment

<Describe the environment in which the software will operate, including the hardware platform, operating system and versions, and any other software components or applications with which it must peacefully coexist.>

The Operating environment for an animal intrusion system is listed below.

- Operating system: Windows, Linux, and Mac

OBJECT DETECTION:

We have used a pre-trained COCO model which is trained with MaskRCNN. The model trained in the present article was based on the Mask R-CNN implementation by Matterport using the Keras application programming interface. As requirements, Python, TensorFlow and Keras were named. The model was pre trained on the MS COCO dataset, and was used with transfer learning, i.e., the weights from the former training were used as starting values. To further train the model for the more specific situation to find animals in the given recording setting, the reading of training data and the model configurations needed to be adapted.

ALERT SYSTEM:

For messaging or recorded call alerts we use Twilio. Twilio Messaging is an API to send and receive SMS, MMS, OTT messages globally. It uses intelligent sending features to ensure messages reliably reach end users wherever they are.

USER INTERFACE:

The user interface for this project is done using the tkinter. Tkinter is a graphical user interface (GUI) module for Python. We can make desktop apps with Python. We can make windows, buttons, show text and images amongst other things.Tk and Tkinter apps can run on most Unix platforms.

Design and Implementation Constraints

<Describe any items or issues that will limit the options available to the developers. These might include corporate or regulatory policies; hardware limitations (timing requirements, memory requirements); interfaces to other applications; specific technologies, tools, and databases to be used; parallel operations; language requirements; communications protocols; security considerations; design conventions or programming standards (for example, if the customer's organization will be responsible for maintaining the delivered software).>

- The animal recognition is completely on the basis of image processing, in case of damage in a camera, this might cause an issue.
- Is dependant on the accuracy of the model

- Recognizing all the animals is not possible in this case

2.5 User Documentation

<List the user documentation components (such as user manuals, online help, and tutorials) that will be delivered along with the software. Identify any known user documentation delivery formats or standards.>

1. Description Document:
Gives a detailed overview of the product with all the services offered by the product. End-users read this document and decide if this is the product he/she is looking for or not. And it gives the end-user better exposure regarding the project.
2. Installation and Setup:
The Installation and setup stage has detailed information on installing, setting up the product, and stuff like that to operate the product.
3. Product / User Manual:
It gives the normal functions of the product with illustrated examples. It has all the information about the project.

2.6 Assumptions and Dependencies

<List any assumed factors (as opposed to known facts) that could affect the requirements stated in the SRS. These could include third-party or commercial components that you plan to use, issues around the development or operating environment, or constraints. The project could be affected if these assumptions are

incorrect, are not shared, or change. Also identify any dependencies the project has on external factors, such as software components that you intend to reuse from another project, unless they are already documented elsewhere (for example, in the vision and scope document or the project plan).>

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3. External Interface Requirements

3.1 User Interfaces

<Describe the logical characteristics of each interface between the software product and the users. This may include sample screen images, any GUI standards or product family style guides that are to be followed, screen layout constraints, standard buttons and functions (e.g., help) that will appear on every screen, keyboard shortcuts, error message display standards, and so on. Define the software components for which a user interface is needed. Details of the user interface design should be documented in a separate user interface specification.>

The prototype model or app can be introduced to the stakeholders for understanding the product in a better way. The user interface for this project is done using the tkinter. Tkinter is a graphical user interface (GUI) module for Python. We can make desktop apps with Python. We can make windows, buttons, show text and images amongst other things.Tk and Tkinter apps can run on most Unix platforms.

3.2 Hardware Interfaces

<Describe the logical and physical characteristics of each interface between the software product and the hardware components of the system. This may include the supported device types, the nature of the data and control interactions between the software and the hardware, and communication protocols to be used.>

We have kept the hardware requirements to minimum to minimise the complexity of the system and also to make the project economically feasible.

1. **Main System**
   The computer's required specification will depend on the number of optical sensors it needs to handle.
   In our case the system's specification was:
   - Ram : 16 GB
   - Intel core i7 10th gen
   - Nvidia Geforce MX250

   This system was enough for a single optical sensor and a single thread program but in real time scenario, we will require multiple optical sensors that will execute a multithreaded program since we will be working with multiple cameras.A main frame like system would be ideal to handle the same.

2. **Optical Sensor:**
   Basic camera trap features:

- Still resolution: 30MP
- Video resolution: 4K
- Video length: Up to 180 seconds Data storage:
- SD or SDHC up to 32GB
- LCD: Yes
- Power: AA batteries

- Wireless: Yes/No

3.3 Software Interfaces

<Describe the connections between this product and other specific software components (name and version), including databases, operating systems, tools, libraries, and integrated commercial components. Identify the data items or messages coming into the system and going out and describe the purpose of each. Describe the services needed and the nature of communications. Refer to documents that describe detailed application programming interface protocols. Identify data that will be shared across software components. If the data sharing mechanism must be implemented in a specific way (for example, use of a global data area in a multitasking operating system), specify this as an implementation constraint.>

The software requirements for this animal intrusion detection system is listed below:

1. **Twilio**

Twilio is a messaging API to send and receive SMS, MMS, OTT messages globally. It uses intelligent sending features to ensure messages reliably reach end users wherever they are.

2.MATTERPORT:

This is an implementation of Mask R-CNN on Python 3, Keras, and TensorFlow. The model generates bounding boxes and segmentation masks for each instance of an object in the image.

3..TKINTER:

The user interface for this project is done using the tkinter. Tkinter is a graphical user interface (GUI) module for Python. We can make desktop apps with Python. We can make windows, buttons, show text and images amongst other things.Tk and Tkinter apps can run on most Unix platforms**.**

4.PYTHON:

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language

3.4 Communications Interfaces

<Describe the requirements associated with any communications functions required by this product, including e-mail, web browser, network server communications protocols, electronic forms, and so on. Define any pertinent message formatting. Identify any communication standards that will be used, such as FTP or HTTP. Specify any communication security or encryption issues, data transfer rates, and synchronization mechanisms.>

The communication interface plays a vital role in this project, with the help of the "alert" module we will alert the farmers, users,and the forest authority people

4. System Features

<This template illustrates organizing the functional requirements for the product by system features, the major services provided by the product. You may prefer to organize this section by use case, mode of operation, user class, object class, functional hierarchy, or combinations of these, whatever makes the most logical sense for your product.>

4.1 Animal Detection and recognition

This feature enables the system to detect an animal in the input frame and also recognize the animal if it is trained to recognize that particular animal

4.1.1 Description and Priority

The system is continuously looking for any kind of intrusion and especially the animals it has been trained to recognize, detection and recognition of animals is the utmost priority of the system.

4.1.2 Stimulus/Response Sequences

- The appearance of any moving object or animal in the frame
- The appearance of specific species of animals which the system is trained for detection, recognition, and alert.

4.1.3 Functional Requirements

REQ-1: There needs to be an optical device that sends data to the system about the environment

REQ-2: The model needs to be trained to recognize specific species of animals

4.2 Alert feature

This feature enables the system to alert the user with intel regarding intrusions if there are any.

4.2.1 Description and Priority

With successful detection of recognition of an animal in the system, the system alerts the user with the information. This feature is the sole objective of the project so it is a high priority feature

4.2.2 Stimulus/Response Sequences

- The appearance of an animal in the frame which is recognizable to the model which sends the signal to the alert module to intimate the user

4.2.3 Functional Requirements

REQ-1: Any kind of audio and visual feedback to get the attention of the user

REQ-2: Extra information on the kind of animal intrusion that occurred. e.g: The place where the intrusion has happened and also the kind of animal

5. Other Nonfunctional Requirement

5.1 Performance Requirements

<If there are performance requirements for the product under various circumstances, state them here and explain their rationale, to help the developers understand the intent and make suitable design choices. Specify the timing relationships for real-time systems. Make such requirements as specific as possible. You may need to state performance requirements for individual functional requirements or features.>
The system should work in real-time. Real-time monitoring is important, any kind of delay in feedback is a failure of the purpose of the system.

The system must be interactive and the delays involved must be fewer.So in every action-response of the system, there are no immediate delays.

5.2 Safety Requirements

<Specify those requirements that are concerned with possible loss, damage, or harm that could result from the use of the product. Define any safeguards or actions that must be taken, as well as actions that must be prevented. Refer to any external policies or regulations that state safety issues that affect the product's design or use. Define any safety certifications that must be satisfied.>

If there is extensive damage to a wide portion of the cameras due to catastrophic failure the recovery method restores a past copy of the database that was backed up to archival storage (typically tape) and reconstructs a more current state by reapplying or redoing the operations of committed transactions from the backed up a log, up to the time of failure

5.3 Security Requirements

<Specify any requirements regarding security or privacy issues surrounding use of the product or protection of the data used or created by the product. Define any user identity authentication requirements. Refer to any external policies or regulations containing security issues that affect the product. Define any security or privacy certifications that must be satisfied.>

The security requirements for this project would mainly be concerned with animal detection and recognition, the standard security policies should be maintained properly

5.4 Software Quality Attributes

<Specify any additional quality characteristics for the product that will be important to either the customers or the developers. Some to consider are: adaptability, availability, correctness, flexibility, interoperability, maintainability, portability, reliability, reusability, robustness, testability, and usability. Write these to be specific,

quantitative, and verifiable when possible. At the least, clarify the relative preferences for various attributes, such as ease of use over ease of learning.>

Maintainability -The technical support team must maintain the product safely and properly

Portability - Irrespective of the operating system, the software can able to do its job/function.

Availability -If the internet service gets disrupted while sending information to the server, the information can be sent again for verification.

Usability -As the system is easy to handle and navigates in the most expected way with no delays. In that case, the system program reacts accordingly and transverses quickly between its states. The animal intrusion detection system should satisfy the maximum number of farmers and other stakeholders

6.Other Requirements

<Define any other requirements not covered elsewhere in the SRS. This might include database requirements, internationalization requirements, legal requirements, reuse objectives for the project, and so on. Add any new sections that are pertinent to the project.>

Gps could be integrated with the software.

When the animal is heading towards the forest or near it, using proximity it should be able to sense and alert the farmers and authority people to track the location, movements and activities of the animal with the help of a camera and GPS

Appendix A: Glossary

<Define all the terms necessary to properly interpret the SRS, including acronyms and abbreviations. You may wish to build a separate glossary that spans multiple projects or the entire organization, and just include terms specific to a single project in each SRS.>

Appendix B: Analysis Models

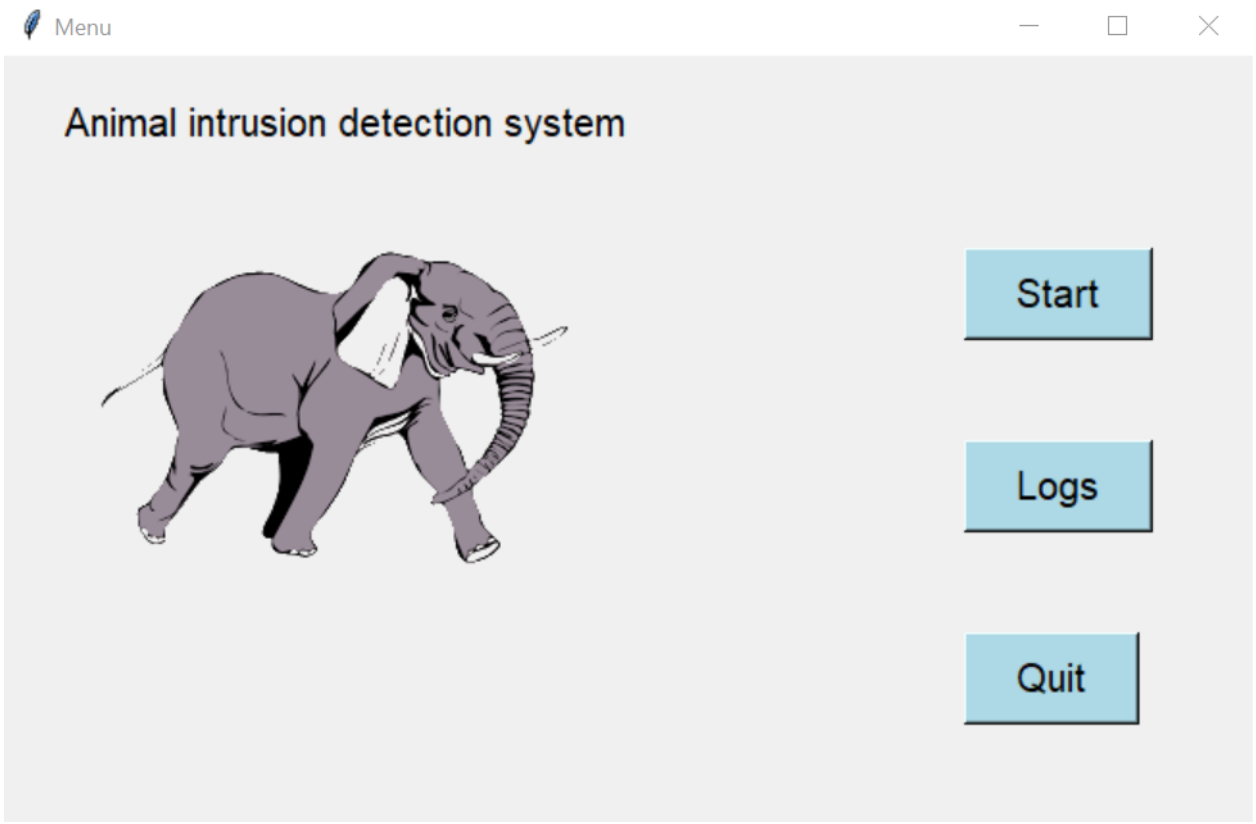
<Optionally, include any pertinent analysis models, such as data flow diagrams, class diagrams, state-transition diagrams, or entity-relationship diagrams.>

Appendix C: Issues List

< This is a dynamic list of the open requirements issues that remain to be resolved, including TBDs, pending decisions, information that is needed, conflicts awaiting resolution, and the like.>

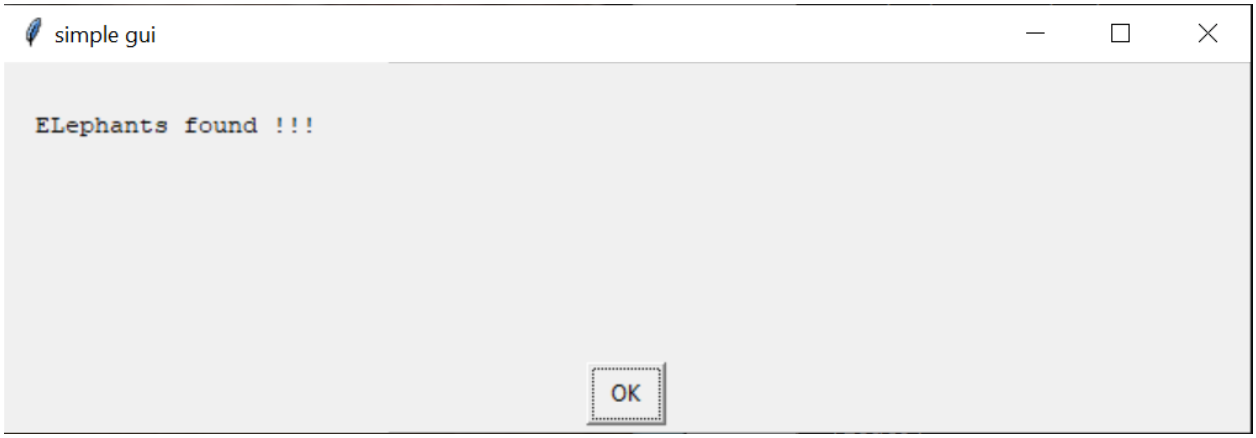
SCREENSHOTS:

USER INTERFACE OF THE SYSTEM:

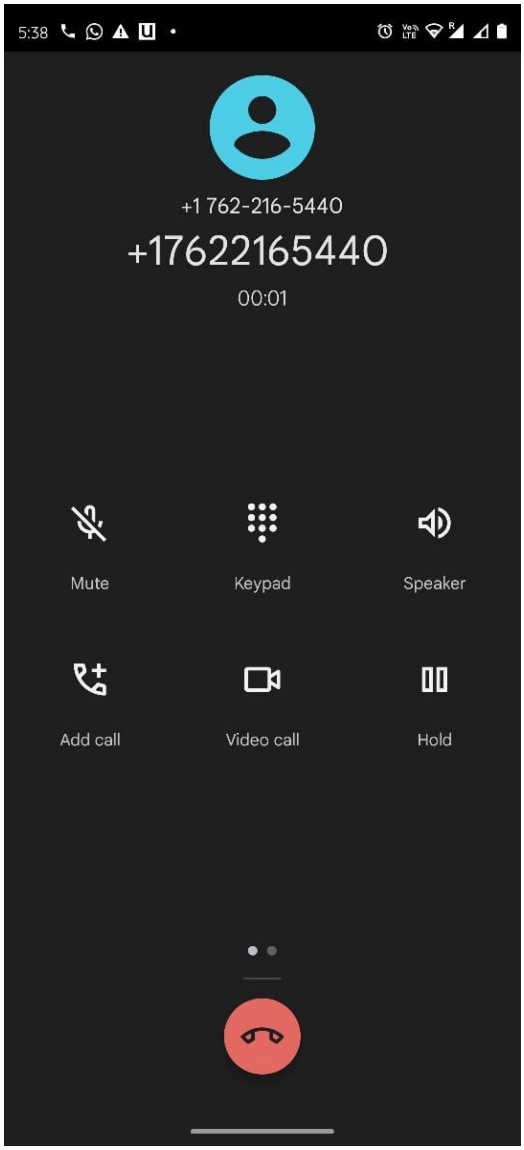


ELEPHANT DETECTION:

ALERT MESSAGE- SIMPLE GUI:



PHONE CALL FROM TWILIO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+1 762-216-5440
+17622165440
00:01
Mute
Keypad
Speaker
Add call
Video call
Hold
