SAVITRIBAI PHULE PUNE UNIVERSITY

A PRELIMINARY PROJECT REPORT ON

ANIMAL WELFARE USING MACHINE LEARNING

SUBMITTED TOWARDS THE
PARTIAL FULFILLMENT OF THE REQUIREMENTS OF

BACHELOR OF ENGINEERING (Computer Engineering)

BY

Shraddha Dhawale	B120054280
Yashasvi Dadhe	B120054270
Richa Yadav	B120054491

Under The Guidance of

Prof. PRIYANKA MAKKAR

Prof. ASHWINI JEWALIKAR

DEPARTMENT OF COMPUTER ENGINEERING
Pune Institute of Computer Technology
Sr.No 27,Pune-Satara Road,Dhankawdi,Pune,Maharashta 411043

Pune Institute of Computer Technology
DEPARTMENT OF COMPUTER ENGINEERING

CERTIFICATE

This is to certify that the Project Entitled

ANIMAL WELFARE USING MACHINE LEARNING

Submitted by

Shraddha Dhawale	B120054280
Yashasvi Dadhe	B120054270
Richa Yadav	B120054491

is a bonafide work carried out by Students under the supervision of Prof.Priyanka Makkar and it is submitted towards the partial fulfillment of the requirement of Bachelor of Engineering (Computer Engineering) Project.

Prof. Priyanka Makkar
Internal Guide
Dept. of Computer Engg.

Prof. Girish Potdar
H.O.D
Dept. of Computer Engg.

Abstract

We all have come across this situation wherein we find an injured animal lying deserted and find ourselves helpless as we do not know what should be done or are in a hurry to reach somewhere. Because of this the animal is left suffering. Hence, we plan to design an Android application which will locate the injured animals location and suggest the nearest animal welfare NGO. The user will send the report to the suggested NGO and the NGO will send an ambulance to rescue the animal. Also, a feature will be provided which will diagnose the illness of the injured animal, with the help of symptoms provided by user, using Machine Learning. This will be useful for providing first-aid treatment to pet as well as stray animals.

The application all in all will focus on helping animals in every way possible. The application will have other features including analysis report, news feed, discussion forum, list of registered NGOs.

Acknowledgments

It gives us great pleasure in presenting the preliminary project report on ***'ANIMAL WELFARE USING MACHINE LEARNING'****.*

I would like to take this opportunity to thank my internal guide ***Prof. Priyanka Makkar*** *for giving me all the help and guidance I needed. I am really grateful to them for their kind support. Their valuable suggestions were very helpful.*

I am also grateful to ***Prof. Girish Potdar****, Head of Computer Engineering Department, Pune Institute of Computer Technology for his indispensable support, suggestions.*

In the end our special thanks to ***Mr.Aziz Jiwani*** *for providing various resources such as laboratory with all needed software platforms, continuous Internet connection, for Our Project.*

Shraddha Dhawale
Yashasvi Dadhe
Richa Yadav
(B.E. Computer Engg.)

INDEX

List of Figures

List of Tables

CHAPTER 1

SYNOPSIS

1.1 PROJECT TITLE

ANIMAL WELFARE USING MACHINE LEARNING

1.2 PROJECT OPTION

Sponsored

1.3 INTERNAL GUIDE

Prof. Priyanka Makkar

1.4 SPONSORSHIP AND EXTERNAL GUIDE

Mr.Aziz Jiwani(PICT Alumnus)

1.5 TECHNICAL KEYWORDS (AS PER ACM KEYWORDS)

1. I. Computing Methodologies
    (a) I.2 Artificial Intelligence
        i. I.2.6 Learning
            A. Concept learning
            B. Knowledge acquisition

1. K. Computing Milieux
    (a) K.4 Computers and Society
        i. K.4.2 Social Issues
            A. Abuse and crime involving computers
            B. Assistive technologies for persons with disabilities Employment
            C. Handicapped persons/special needs

1. H. Information Systems
    (a) H.3 Information Storage and Retreival

i. H.3.1 Content Analysis and Indexing

A. Dictionaries

B. Indexing methods

i. H.3.3 Information search and retreival

A. Information Filtering

B. Clustering

1. C. Computer Systems and organisations

(a) C.5 Compute System and Implementation

i. C.5.5 Servers

1. G. Mathematics of Computing

(a) G.2 Discrete Mathematics

i. G.2.2 Graph Theory

A. Graph Algorithm

B. Graph Labelling

C. Path and Circuit Problems

1.6 PROBLEM STATEMENT

Stray animals are left helpless when injured on roads because a common man is reluctant to go through the time-consuming process of finding out and talking to each and every NGO if it can provide any ambulance service. We aim to remove this reluctance by providing a user-friendly platform so that a common man can report an injury to the nearest available NGO at the click of a button. We also aim to extend functionality of this platform to recommend a home-remedy for ailing pets with the help of Machine Learning Algorithm

1.7 ABSTRACT

- We all have come across this situation wherein we find an injured animal lying deserted and find ourselves helpless as we do not know what should be done or

are in a hurry to reach somewhere. Because of this the animal is left suffering. Hence, we plan to design an Android application which will locate the injured animals location and suggest the nearest animal welfare NGO. The user will send the report to the suggested NGO and the NGO will send an ambulance to rescue the animal. Also, a feature will be provided which will diagnose the illness of the injured animal, with the help of symptoms provided by user, using Machine Learning. This will be useful for providing first-aid treatment to pet as well as stray animals.

The application all in all will focus on helping animals in every way possible. The application will have other features including analysis report, news feed, discussion forum, list of registered NGOs.

1.8 GOALS AND OBJECTIVES

- To provide a platform to ease out access to NGOs for individuals encountering injured animals.
- To help NGOs reach out to such animals faster.
- To provide NGOs with an application for systematic and organized storing of records.
- To help Animal Welfare Board of India analyze obtained data to keep a check on the registered NGOs and also determine areas that are more prone to animal injuries and take necessary actions.

1.9 RELEVANT MATHEMATICS ASSOCIATED WITH THE PROJECT

Let S be the solution set

$S = \{s, e, X, Y, DD, NDD, F, S_c, F_c\}$

s is the start state.

e is the end state.

X = set of inputs

Y = set of outputs

DD = Deterministic data

NDD = Non-Deterministic data

F = set of functions

Sc = Success case

Fc = Failure case

For client side app

s = start state for a new user who will do one-time registration

$X = \{X1, X2\}$

$X1 = \{name, emailid, mobileno\}$

Initially,

$\{name, emailid, mobileno\} \in \{\}$

$Afterregistering,$

$name = ([a-z][A-Z])+$

$emailid = ([a-z][A-Z][0-9][@.])+$

$mobileno = [0-9]+$

$X2 = \{typeanimal, status, description\}$

$typeanimal = \{cat, dog, cattle, others\}$

$status = \{dead, alive\}$

description = ([a-z][A-Z][0-9])+

$Y = \{timestamp, location, mobileno.ofnearestNGO\}$

$F = \{F1, F2, F3, F4, F5, F6\}$

$F1 = \{F1A, F1B, F1C, F1D, F1E\}$

F1A = Function to validate mobile no. of user

F1B = Function to save registered users information at the server side

F1C = Function to send user a message about successful/failed registration

F1D = Function to navigate to a vets location

F1E = Function to drag and drop a button to specify animals location

F2 = Function to find location using Google maps API

F3 = Function to send status, type of animal, description and location to the server

F4 (server side) = Function to calculate nearest

NGO and send its location and mobileno. to client side application

F5 (server side) = Function to forward all information to NGO side application

F6 = Function to notify user that animal has been taken care of.

For NGO side app:

s = permanent logging-in of an NGO

Initially,

$X = \{NGOname, NGOpwd\} \in \{\}$

NGOname =([a-z][A-Z])+

NGOpwd = ([a-z][A-Z][0-9][@-?])+

F1 = Function to navigate to animals location using Google maps API

DD = list of all NGOs and Vets

NDD = nearest NGO with respect to animals location and its timestamp

Sc = nearest NGO has been contacted

Fc = Network failure, nearest NGO has not been contacted

MATHEMATICAL MODEL FOR DISEASE DIAGNOSIS:

Let S be the system of solutions such that

S = $\{s, e, X, Y, DD, NDD, Fc, Sc\}$

Where,

- s = start state

  = On-click function opened the diagnosis page

- e = end state

  = Diagnosis page closed

- X = set of inputs

  = $\{X1, X2\}$

  $Where,$

  $X1 = typeofanimal$

  $X2 = \{x1, x2, ...xn / 1 < n < nmax\}$

  $Nmax = maximumnumberofsymptomssettobeaccepted.$

- Y = set of outputs

  = $\{Y1, Y2\}$

  $Where,$

  $Y1 = \{xi / ibelongstosetofillnesses\}$

  $= setofpossibleillnesses$

  $Y2 = \{xi / ibelongstosetoftreatments\}$

  $= suggestedtreatments$

- DD = deterministic data

  (1) Number of symptoms

  (2) Type of animal

- NDD = non-deterministic data

  (1) Id3 algorithm is NP-complete = optimality is non-deterministic

  (2) Accuracy of the diagnosed illness and treatment

- Sc = Success Case

  (1) Illness diagnosed with more than 60(2) Treatment found and displayed.

- Fc = Failure Case

  (1) Illness could not be diagnosed

  (2) Treatment not found

  (3) Over-fitting

1.10 NAMES OF CONFERENCES / JOURNALS WHERE PAPERS CAN BE PUBLISHED

- International Conference on Electrical,Electronics and Computer Science(ICEES)
- AICEE

1.11 REVIEW OF CONFERENCE/JOURNAL PAPERS SUPPORTING PROJECT IDEA

1.Igor Kononenko University of Ljubljana Faculty of Computer and Information Science Trzaska 25, 1001 Ljubljana, Slovenia,"Machine Learning for Medical Diagnosis: History, State of the Art and Perspective",Elseveir,2001

2.Vili Podgorelec, Peter Kokol, Bruno Stiglic, Ivan Rozman University of Maribor FERI, Smetanova 17, SI-2000 Maribor, Slovenia,"Decision trees: an overview and their use in medicine",Journal of Medical Systems,2002

Chapter 2

Technical Keywords

2.1 AREA OF PROJECT

Applied Computing

Our project mainly aims at solving problems faced by masses in day-to-day life that is not being able to help treat injured animals due to lack of resources,time and information.

2.2 TECHNICAL KEYWORDS

1. I. Computing Methodologies
    (a) I.2 Artificial Intelligence
        i. I.2.6 Learning
            A. Concept learning
            B. Knowledge acquisition

1. K. Computing Milieux
    (a) K.4 Computers and Society
        i. K.4.2 Social Issues
            A. Abuse and crime involving computers
            B. Assistive technologies for persons with disabilities Employment
            C. Handicapped persons/special needs

1. H. Information Systems
    (a) H.3 Information Storage and Retreival
        i. H.3.1 Content Analysis and Indexing
            A. Dictionaries
            B. Indexing methods
        i. H.3.3 Information search and retreival
            A. Information Filtering
            B. Clustering

1. C. Computer Systems and organisations
    (a) C.5 Compute System and Implementation
        i. C.5.5 Servers

1. G. Mathematics of Computing
    (a) G.2 Discrete Mathematics
        i. G.2.2 Graph Theory
            A. Graph Algorithm
            B. Graph Labelling
            C. Path and Circuit Problems

Chapter 3

Introduction

3.1 PROJECT IDEA

- We are empowering common man who encounters an injured animal and animal welfare NGOs with a tool so that animal related injuries are easily reported and well taken care of in time.

3.2 MOTIVATION OF THE PROJECT

- Our motivation for doing this project is to bridge the gap between needy injured animals and helpful prompt NGOs with the help of our Computer Science knowledge.

3.3 LITERATURE SURVEY

- Igor Kononenko University of Ljubljana Faculty of Computer and Information Science Trzaska 25, 1001 Ljubljana, Slovenia,"Machine Learning for Medical Diagnosis: History, State of the Art and Perspective",Elseveir,2001

  Description : Comparison of algorithms with respect to the appropriateness for developing applications in medical diagnostic and prognostic problems has been done and among the compared algorithms only decision tree builders are able to select the appropriate subset of attributes.

- Vili Podgorelec, Peter Kokol, Bruno Stiglic, Ivan Rozman University of Maribor FERI, Smetanova 17, SI-2000 Maribor, Slovenia,"Decision trees: an overview and their use in medicine",Journal of Medical Systems,2002

  Description : This paper explains how the decision tree algorithm works and its application in medical diagnosis. It provided a better understanding of Machine Learning and Decision Tree algorithms.

Chapter 4

Problem Definition and scope

4.1 PROBLEM STATEMENT

Stray animals are left helpless when injured on roads because a common man is reluctant to go through the time-consuming process of finding out and talking to each and every NGO if it can provide any ambulance service. We aim to remove this reluctance by providing a user-friendly platform so that a common man can report an injury to the nearest available NGO at the click of a button. We also aim to extend functionality of this platform to recommend a home-remedy for ailing pets with the help of Machine Learning Algorithm.

4.1.1 Goals and objectives

- To provide a platform to ease out access to NGOs for individuals encountering injured animals.
- To help NGOs reach out to such animals faster.
- To provide NGOs with an application for systematic and organized storing of records.
- To help Animal Welfare Board of India analyze obtained data to keep a check on the registered NGOs and also determine areas that are more prone to animal injuries and take necessary actions.

4.1.2 Statement of scope

- The application will be scalable to reach out to all animal welfare NGOs present in the country.
- Routing information of the ambulance can be shown.
- Symptom based illness and treatment prediction.

4.2 SOFTWARE CONTEXT

- Reporting animal injury to the nearest NGO at the click of a button of your smart phone.

4.3 METHODOLOGIES OF PROBLEM SOLVING AND EFFICIENCY ISSUES

- We have chosen Decision tree method of classification and will be implementing ID3 algorithm to diagnose the illness of the animals. Various symptoms of a particular disease form the attributes. Diseases share some symptoms in common with other diseases however combination of some symptoms could be used to differentiate the disease as some symptoms in combination are peculiar to certain diseases. The entire dataset will be assigned classes according to the severity of the disease. The classes will be - very low, low, moderate, high, very high.
- The ID3 algorithm is NP-complete problem because we cannot determine if the tree that will be formed would be optimal or not. Decision-tree learners can create over complex trees that do not generalise well from the training data which is known as over-fitting. Mechanisms such as pruning are necessary to avoid this problem.

4.4 OUTCOME

- Reporting animal injury to nearest calculated NGO.

- Illness diagnosis and recommendation of home remedy based on symptoms

4.5 APPLICATIONS

- The system will be deployed at the smartphones of NGO employees and other users who encounter injured animals.

4.6 HARDWARE RESOURCES REQUIRED

Sr. No.	Parameter	Minimum Requirement	
1	CPU Speed	2 GHz	All the syst
2	RAM	3 GB	Android Studio requires mi
3	Android Phone	Gingerbread or higher Android versions	Application is to

Table 4.1: Hardware Requirements

4.7 SOFTWARE RESOURCES REQUIRED

Platform :

1. Android SDK
2. 64 bit Windows operating system

Chapter 5

Project Plan

5.1 PROJECT ESTIMATES

5.1.1 Reconciled Estimates

5.1.1.1 Cost Estimate

5.1.1.2 Time Estimates

5.1.2 Project Resources

Project resources [People, Hardware, Software, Tools and other resources] based on Memory Sharing, IPC, and Concurrency derived using appendices to be referred.

- People- Various people are involved in making this project a complete project.
- Shraddha Dhawale
- Richa Yadav
- Yashasvi Dadhe
- Aziz Jiwani
- Hardware and Software- Hardware involves the phones which would be majorly used at the end for interacting with the potential customers or people on a general basis. About software, various tools and APIs would be used to support the product.

- Hardware

  Laptop/Desktop Machines with atleast

- RAM: 2GB
- HDD : 500 GB
- Processor : Intel Pentium
- Android Phone

- Software

- Windows 7 and above
- Linux operating system

- Tools- All the APIs and development tools needed

- Google Maps APIs to find locations
- Android Studio

5.2 RISK MANAGEMENT W.R.T. NP HARD ANALYSIS

This section discusses Project risks and the approach to managing them.

5.2.1 Risk Identification

For risks identification, review of scope document, requirements specifications and schedule is done. Answers to questionnaire revealed some risks. Each risk is categorized as per the categories mentioned in [**?**]. Please refer table 5.1 for all the risks. You can refereed following risk identification questionnaire.

1. One of the biggest risks involved in the system is not having a net connection at all in the user's smartphone.

2. Another risk is that of the fake reports being submitted.

3. The user interface should be as friendly as possible so that end users keep using the app

5.2.2 Risk Analysis

The risks for the Project can be analyzed within the constraints of time and quality

ID	Risk Description	Probability	Impact		
			Schedule	Quality	Overall
1	No internet connection available	Medium	Low	High	High
2	Fake report submission 2	Low	Low	High	High

Table 5.1: Risk Table

Probability	Value	Description
High	Probability of occurrence is	$> 75\%$
Medium	Probability of occurrence is	$26 - 75\%$
Low	Probability of occurrence is	$< 25\%$

Table 5.2: Risk Probability definitions [**?**]

Impact	Value	Description
Very high	$> 10\%$	Schedule impact or Unacceptable quality
High	$5 - 10\%$	Schedule impact or Some parts of the project have low quality
Medium	$< 5\%$	Schedule impact or Barely noticeable degradation in quality Low Impact on schedule or Quality can be incorporated

Table 5.3: Risk Impact definitions [**?**]

5.3 PROJECT SCHEDULE

5.3.1 Project task set

Major Tasks in the Project stages are:

- Task 1: Ideation Phase.
- Task 2: Integrating various technologies and dividing the work.
- Task 3: APIs and Tools testing and usage.
- Task 4: Development of own modied or newtools.
- Task 5: Mobile Application Development.

5.3.2 Task network

Project tasks and their dependencies are noted in this diagrammatic form.

5.3.3 Timeline Chart

A project timeline chart is presented. This may include a time line for the entire project. Above points should be covered in Project Planner as Annex C and you can mention here Please refer Annex C for the planner

5.4 TEAM ORGANIZATION

The project is being worked upon by a team of 6 people (2 project internal guide, 1 external guide and 3 project developers). Each project developer is aware how the entire project works. This is majorly possible due to the group size being small. Distribution of work has been done, now the tools available are being tested. It is decided to keep the team structure exible throughout the project. Every project developer is subjected to equal contribution throughout the project, right from documentation to development. Refer table in Management reporting for further contribution details.

5.4.1 Management reporting and communication

Mechanisms for progress reporting and inter/intra team communication are identified as per assessment sheet and lab time table.

Chapter 6

Software requirement specification (SRS is to be prepared using relevant mathematics derived and software engg. Indicators in Annex A and B)

6.1 INTRODUCTION

6.1.1 Purpose and Scope of Document

The purpose of the document is to collect and analyze all assorted ideas that have-been discussed. We shall try to predict and sort out how would this product help people, leading to a easier life. This documentation helps to get a better understanding of the product on an overall basis, outline concepts which would be developed later,and help to discard concepts we are just considered for time being purposes.In short, the purpose of this document is to give a detailed view of our product, its parameters and goals. This document describes the projects target audience and its user interface, hardware and software requirements. It defines how our client, team and audience see the product and its functionality. It even assists the developers in the Software Development Life Cycle(SDLC) processes.

6.1.2 Overview of responsibilities of Developer

- Suggesting ideas for improvements, new proposals if they are feasible.
- Working in coordination with other developers, analysts and guides.
- Produced detailed specifications and write programs.
- esting the product in controlled and real environment.
- Preparation of manual and documentations.
- Maintain different systems.

6.2 USAGE SCENARIO

This section provides various usage scenarios for the system to be developed.

6.2.1 User profiles

The profiles of all user categories are described here.

- User:Who encounters an injured animal and submits animal injury report to the NGO.
- Server: Finds the nearest NGO and notifies the nearest NGO
- NGO employee: Sends ambulance service
- Pet Owner: Gives the symptoms of the ill pet
- Server: Diagnose illness and suggest home remedy for it

6.2.2 Use-cases

All use-cases for the software are presented. Description of all main Use cases using use case template is to be provided.

Sr No.	Use Case	Description	Actors	Assumptions
1	Log-in	User logs into the application	User	User is authentic
2	Report Submission	Animal injury report is submitted	User	Report is genuine

Sr No.	Use Case	Description	Actors	Assumptions
1	Nearest NGO	Nearest NGO is found out	Server	Stable net connection
2	Nearest NGO	Nearest NGO is notified	Server	Net connection available
3	Register	NGO employee registers	Employee	Authentic employee
4	Send ambulance	Ambulance is sent to the location	Employee	Ambulance is available

Sr No.	Use Case	Description	Actors	Assumptions
1	Symptom Diagnosis	Symptoms are given by pet owner	Pet owner	Available net connection
2	Suggesting remedy	Home remedy for illness is suggested	Server	Server is not down

Table 6.1: Use Cases

6.2.3 Use Case View

Use Case Diagram. Example is given below

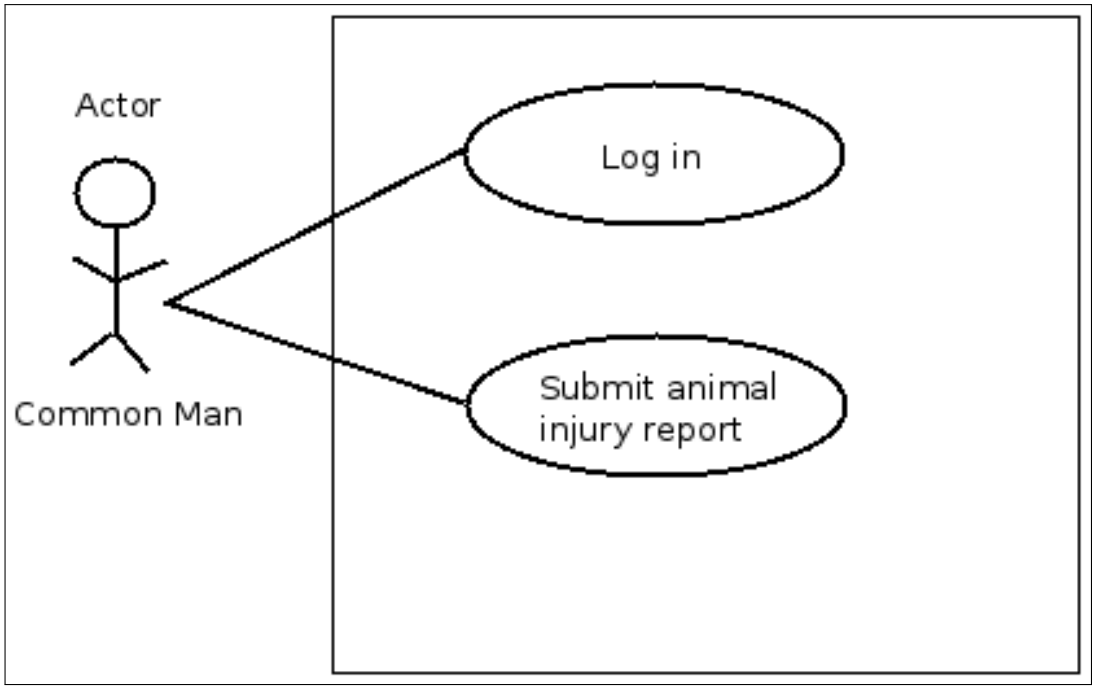


Figure 6.1: Use case diagram1

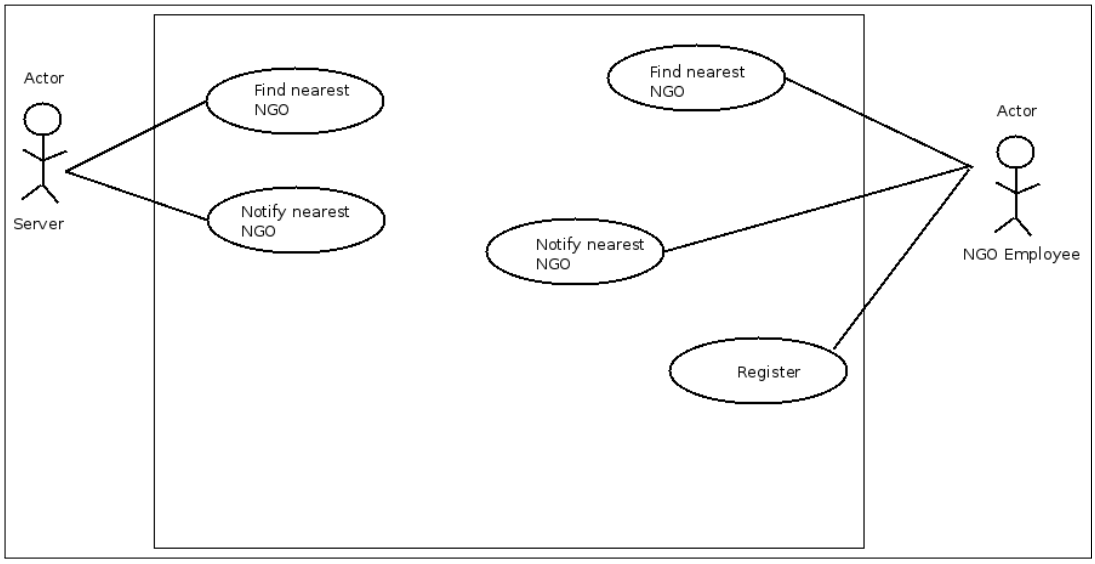


Figure 6.2: Use case diagram2

6.2.4 Activity Diagram:

- The Activity diagram represents the steps taken.

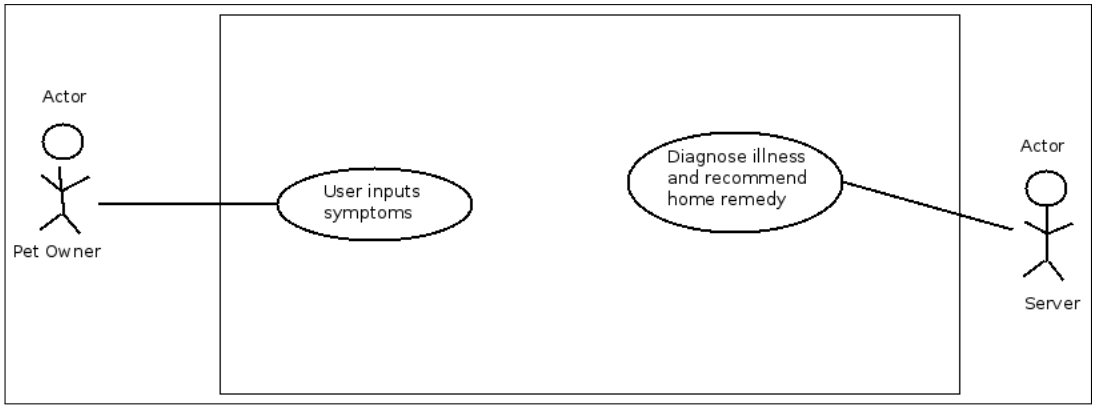


Figure 6.3: Use case diagram3

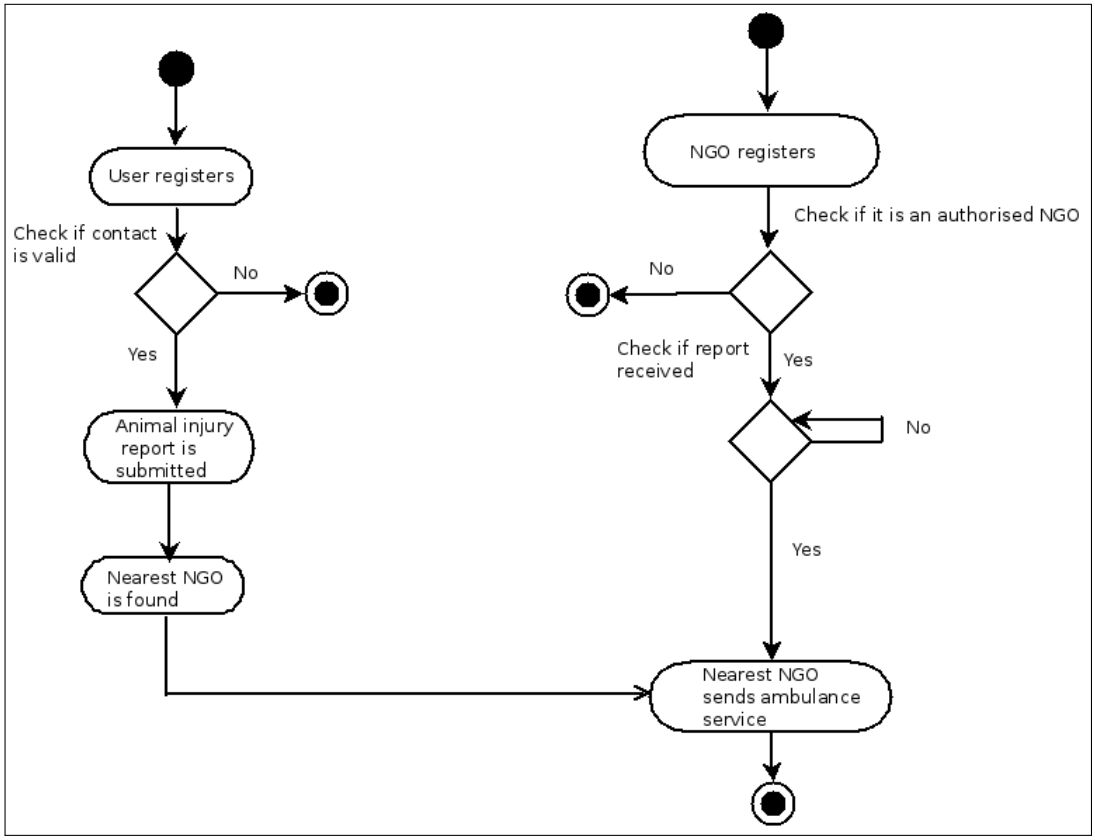
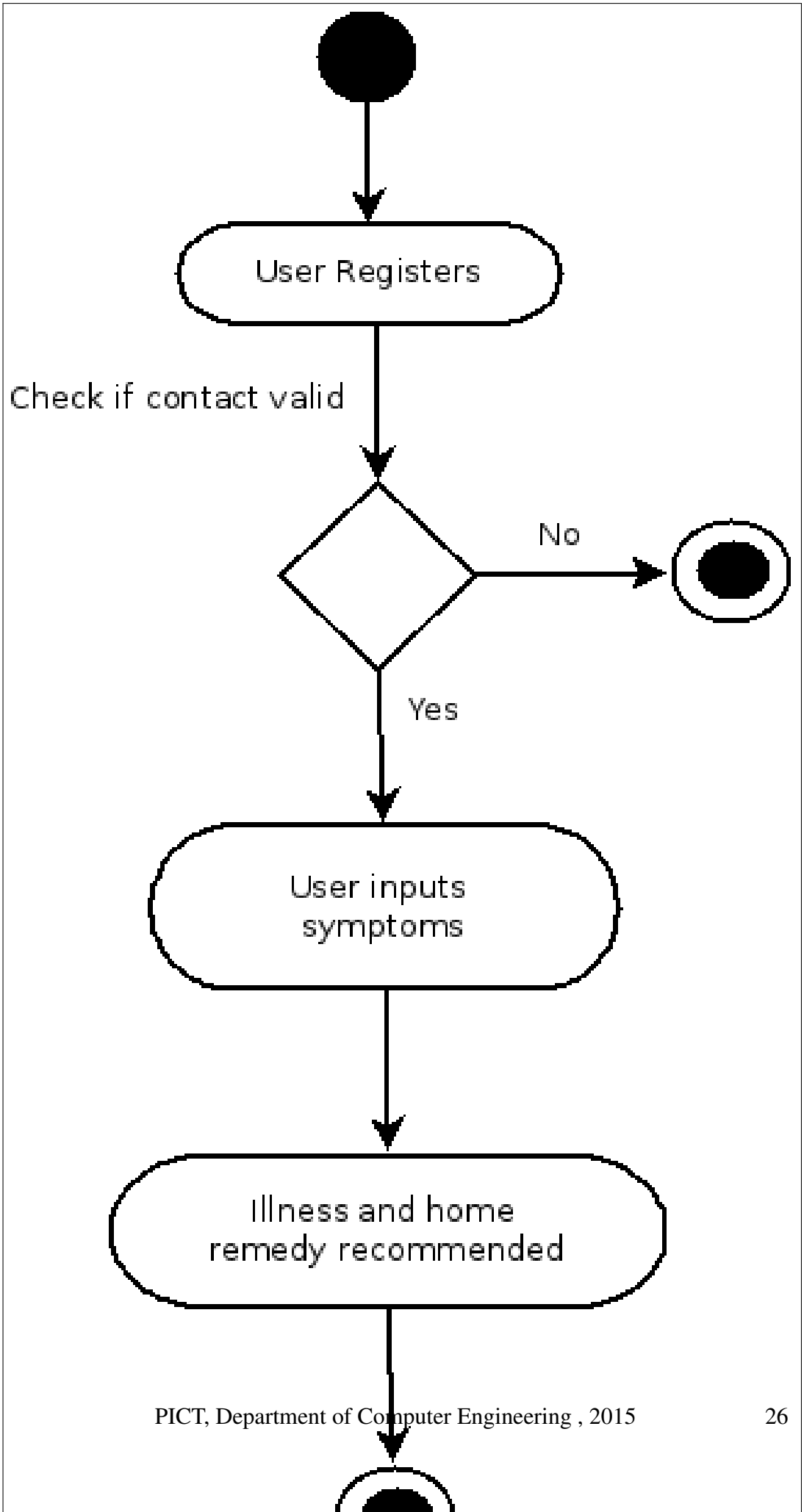


Figure 6.4: Activity diagram1

6.2.5 Non Functional Requirements:

- Interface Requirements
- Performance Requirements
- Software quality attributes such as availability [related to Reliability], modi-


User Registers
Check if contact valid
No
Yes
User inputs
symptoms
Illness and home
remedy recommended

fiability [includes portability, reusability, scalability] , performance, security, testability and usability[includes self adaptability and user adaptability]

6.2.6 State Diagram:

State Transition Diagram

Fig.6.8 example shows the state transition diagram. The states are represented in ovals and state of system gets changed when certain events occur. The transitions from one state to the other are represented by arrows.

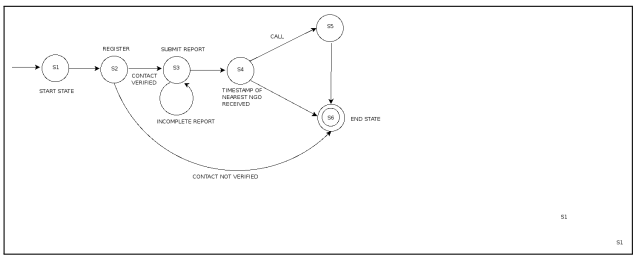


Figure 6.6: State transition diagram for user

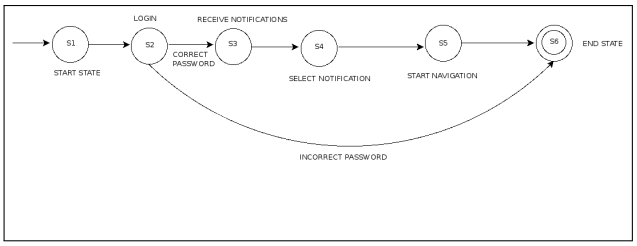


Figure 6.7: State transition diagram for NGO

6.2.7 Design Constraints

Any design constraints that will impact the subsystem are noted.

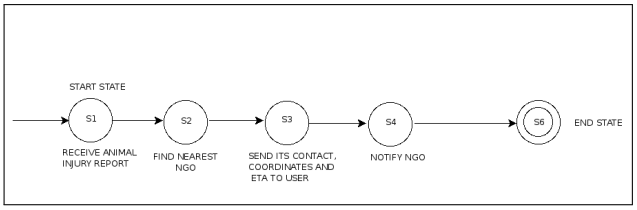


Figure 6.8: State transition diagram for Server

6.2.8 Software Interface Description

The software interface(s)to the outside world is(are) described. The requirements for interfaces to other devices/systems/networks/human are stated.

- Network Connection
- Android Smartphone
- Web browser
- Mobile Applications

Chapter 7

Detailed Design Document using Appendix A and B

7.1 BLOCK DIAGRAM

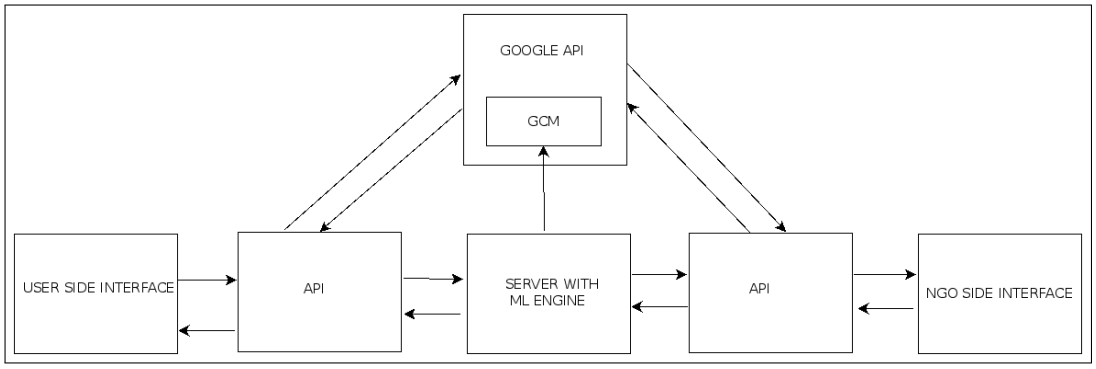


Figure 7.1: Block diagram

7.2 DESCRIPTION

The Android Application at user and NGO side forms the user-side and NGO-side interface respectively. An API is needed to bridge the gap between user's/NGO's and system's understanding. It is a set of routines, protocols and functions that are defined as a part of our system and are mapped to appropriate actions taken by user on the GUI.

As we are developing a location-based service , our API seeks help of GOOGLE API to find location, ETA and also to navigate.

GCM service enables the server to send data to Android Application.So, a server will first request for GCM's service to send data from it to Android Application at user/NGO end.

Chapter 8

Summary and Conclusion

- In conclusion, we can sum up that the problem faced by many individuals in treating or helping injured animals will be solved. Our application will be helpful to not stray animals but also for pets. The location of the pet will be specified by the user with the help of GPS and will be notified to the suggested NGO. Only those NGOs that are registered under the Animal Welfare Board of India will be allowed to register in our application.

  The disease diagnosis feature will greatly help users in figuring out if an animal is ill or injured. The decision tree algorithm which will be used to implement it will be looked upon for overfitting with the help of pruning.

  The application will be user-friendly and aim at reducing the steps for contacting the NGOs as much as possible for faster treatment of animals.

Chapter 9

References

- Daniel J. Abadi, Samuel R. Madden, Nabil Hachem, A survey on location based application development for Android platform IEEE March 2015
- Shih-Hao Hung;Dept. of Comput. Sci. Inf. Eng., Nat. Taiwan Univ., Taipei, Taiwan ;Yong-Wei Chen;Jeng-Peng Shieh ”Creating Pervasive, Dynamic, Scalable Android Applications” IEEE July 2013
- JiongXie, Shu Yin, XiaojunRuan, Zhiyang Ding, Yun Tian, James Majors, Adam Manzanares, and Xiao Qin Research on Mobile Location Service Design Based on Android IEEE Sept 2009.

Chapter 10

Laboratory assignments on Project Analysis of Algorithmic Design

- To develop the problem under consideration and justify feasibilty using concepts of knowledge canvas and IDEA Matrix.
  Refer [**?**] for IDEA Matrix and Knowledge canvas model. Case studies are given in this book. IDEA Matrix is represented in the following form. Knowledge canvas represents about identification of opportunity for product. Feasibility is represented w.r.t. business perspective.

I	D	E	A
Increase	Drive	Educate	Accelerate
Improve	Deliver	Evaluate	Associate
Ignore	Decrease	Eliminate	Avoid

Table 10.1: IDEA Matrix

- Project problem statement feasibility assessment using NP-Hard, NP-Complete or satisfy ability issues using modern algebra and/or relevant mathematical models.

- input x,output y, y=f(x)

- A decision problem C is NP-complete if:

C is in NP, and

Every problem in NP is reducible to C in polynomial time.

- Our decision tree algorithm optimality is non-deterministic but the solution can be solved in polynomial time.

- For single-attribute, multi-way splits on A discrete variables, the time to build a tree for N items is O(A^2N).
  $If all V-ary splits are binarized, this becomes O(d^2N) where d is the dimensionality.$
  $Thus, there is potentially a large payoff for pre-processing to reduce dimensionality$

Chapter 11

Laboratory assignments on Project Quality and Reliability Testing of Project Design

It should include assignments such as

- Use of divide and conquer strategies to exploit distributed/parallel/concurrent processing of the above to identify object, morphisms, overloading in functions (if any), and functional relations and any other dependencies (as per requirements). It can include Venn diagram, state diagram, function relations, i/o relations; use this to derive objects, morphism, overloading
- Use of above to draw functional dependency graphs and relevant Software modeling methods, techniques including UML diagrams or other necessities using appropriate tools.
- Testing of project problem statement using generated test data (using mathematical models, GUI, Function testing principles, if any) selection and appropriate use of testing tools, testing of UML diagram's reliability. Write also test cases [Black box testing] for each identified functions. You can use Mathematica or equivalent open source tool for generating test data.
- Additional assignments by the guide. If project type as Entreprenaur, Refer [**?**],[**?**],[**?**], [**?**]

Chapter 12

Project Planner

Using planner or alike project management tool.

Chapter 13

Plagiarism Report

Plagiarism report