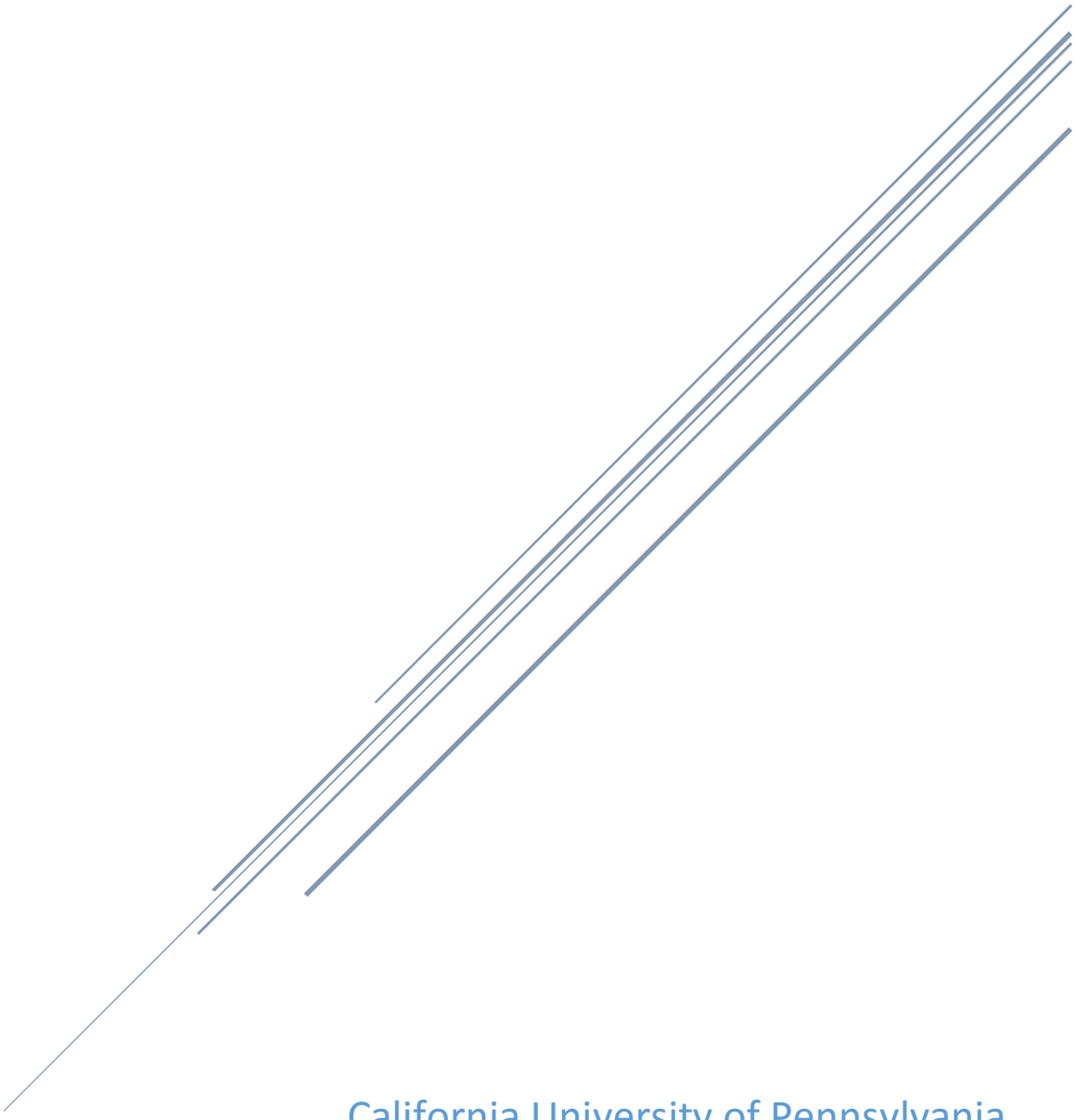
REPITILE SYSTEM

Alex Bioni Seth Law Wesley Norris Scott Sheppard



California University of Pennsylvania
CSC 490 – Senior Project I

Instructors Comments

Table of Contents

Abstract

Many people have adopted reptiles as household pets, but they require some specific care. Our project will be essentially a self-regulatory system for reptile and amphibian tanks. The system, based on a Raspberry Pi, will use temperature and humidity sensors to monitor each side of the tank to ensure that the proper humidity levels and temperatures are being met. Configuration files can be created so the system is configurable for any type of reptile or amphibian. The software for the system will be written to interface with temperature and humidity sensors to monitor the tank via the Raspberry Pi. The system will also be able to adjust humidity and temperature by controlling the intensity of heating bulbs, a heating pad, and a misting system accordingly. The role of this document is to lay the foundation for every aspect of this project.

Introduction

In 2011, the United States Association of Reptile Keepers commissioned a report that detailed the modern U.S. reptile market. The report estimated that 4.7 million U.S. households owned 13.6 million pet reptiles [1]. Modern science has allowed for domestic captive breeding of reptiles resulting in highly desired traits and color patterns, making owning a reptile more appealing. The American Pet Products Association estimated that in 2010, reptile owners purchased nearly $1.7 billion worth of ancillary products [1].

Reptiles require certain care. New reptile owners often don't realize the implications of reptiles being ectothermic, or cold blooded [2]. This means they need a properly heated environment. Making sure that reptiles are getting the right amount of heat is more important than most new reptile owners understand. For example, snakes need some extra heat after eating because it helps them digest their food. Reptiles need so much attention to the amount of heat they need that most owners are forced to build their own system to take care of their reptiles.

Not all reptiles require the same care. High humidity plays an important role in the care of some reptiles, while others require no need to monitor humidity. For snakes, if the humidity is too high it can cause the snake to get a fungal infection, cause bacterial growth, or cause a mold problem with the substrate. Humidity that is too low can cause the snake to "bad shed" or develop heath issues such as poor appetite or a respiratory infection.

We plan to make an all-in-one, self-regulatory system that will help ease the stress of building your own system and provide pet owners with a simple interface to monitor their reptile's vivarium.

Background

Reptiles are considered a pet that require minimal but special care. Depending on the specific reptile, the proper environment needs to be established. Heat, humidity, and light are the three main factors that need to be regulated when caring for reptiles.

Heat is what keeps reptiles functional. Reptiles are ectothermic, relying on heat to control and maintain their body temperature. Wild reptiles are able to move naturally to areas with the temperature they need, but household reptiles are confined and depend on their owner to provide the source of heat. Reptile owners are suggested to spend some time researching their pet in order to gain an understanding of its natural habitat. [3]

Humidity can be one of the most challenging aspects for new reptile owners as not all reptiles require the same amount of humidity. As discussed previously, reptiles do not do well adapting to new environments and therefore their tank humidity must be consistent with their native environment. Reptiles living in tropical or sub-tropical regions need the most attention when it pertains to humidity. For example, a tropical snake owner must maintain humidity within the vivarium consistent with its native higher humidity environment. This higher humidity is necessary for when the snake sheds their skin [4].

Light is necessary for a reptile's environment. Ultraviolet light is typically what reptile owners use to provide their reptiles with light. Reptiles can become stressed without access to light that models a day and night cycle. Also, using ultraviolet light on reptiles will give the reptile's vitamin D3. Vitamin D3 is produced when you are in contact with the sun. It provides the reptiles with calcium [3].

We plan to make a system powered by a microcontroller that utilizes sensors and light bulbs to regulate, maintain, update and display the current conditions of the three aforementioned factors inside the environment. Since different reptiles require different living conditions, our system can be configured by the user via templates they create or the ones we provide.

Objective of Project

Due to the high costs associated with ancillary products required for reptiles, the aim of the RePitile system it to reduce the stresses associated with building and managing a heat/light/humidity system and provide users with a clean, friendly interface to accurately monitor. Instead of having to buy heat lamps, radiant heat panels, florescent bulbs, or ultraviolet lights, our RePitile system will have all those included and configured with the system.

Constituents / Team Details & Dynamics

Our team is going to use the Agile methodology for this project, with each person taking a management-like role for their specific phase. Seth Law is the leader for the requirements phase, Alex Bioni leads the analysis phase, Scott Sheppard leads the design phase, and Wesley Norris leads the implementation phase. Stories will be made for each of the later phases to keep track of progress. Stand up meetings will be held semi-regularly (adjusting for scheduling conflicts, etc.) to discuss current progress and what needs to be accomplished next. Pair programming will be used so that each member can gain familiarity with the documents, and later on the code base and how the software interacts with the hardware and vice versa. This will also increase the likelihood of finding faults early on with both documents and code.

Application Domain

The application domain of the project is in the area of pet care and management, specifically for use with reptiles. Proper domain knowledge consists of what type of environment is required for specific reptiles, how to find and interpret that information, and how it is traditionally controlled by non-automated tank systems.

Project Context

For many types of reptiles, they are required to have a specific living environment with carefully observed temperatures, humidity, and/or light. This project is designed to suit the needs of these animals by providing a common interface to adjust and track the living conditions inside of the tank.

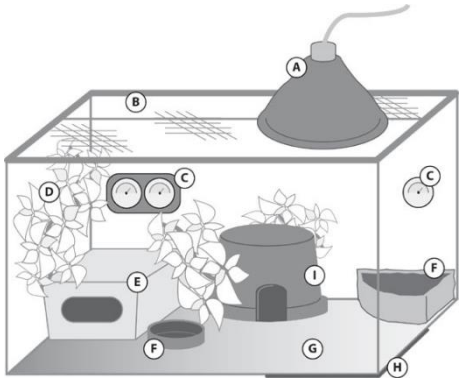


Figure 1: A Typical Reptile Habitat Setup [5]

A typical tank for many reptiles is very close to Figure 1. Our system differs by automating the observation of the tank environment and adjust the heat (A and H), humidity (C), and light (A) to keep a consistent climate.

Initial Business Model

Our initial business model is to provide a reptile care system for tanks that will aid in pet management. This is enticing for the consumer because it simplifies the amount of work required to care for their reptile. This system would be separate from the tank itself and designed to be at least semi-modular to fit a variety of different tank styles.

Operational Environment:

Our system is designed to run indoors, set up on or next to a reptile tank. The various sensors and regulatory equipment will be set up inside of the tank or right above it, depending on the specific hardware part.

Description of Data Sources:

The RePitile system receives data from two main sources: configuration files and sensors. The configuration files provide the temperature, humidity, and lighting data for the system to set for the tank. The sensors provide the real-time information about the current conditions in the tank which will prompt a response from the system to regulate it if need be.

Use Case Diagrams:

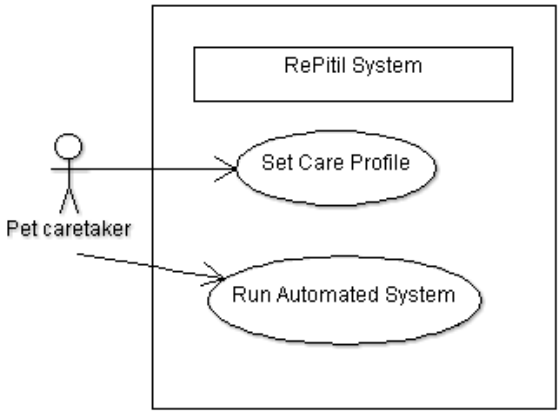


Figure 2: Initial Use Case Diagram

This initial Use Case Diagram (UCD) shows the two simplest interactions for the user, labeled as “Pet Caretaker” in the Diagrams. The first interaction allows the user to set a care profile for the system to use as parameters. The second is to start the Automated system. This is the main driving force of the program that keeps the habitat within a hospitable climate for the pets.

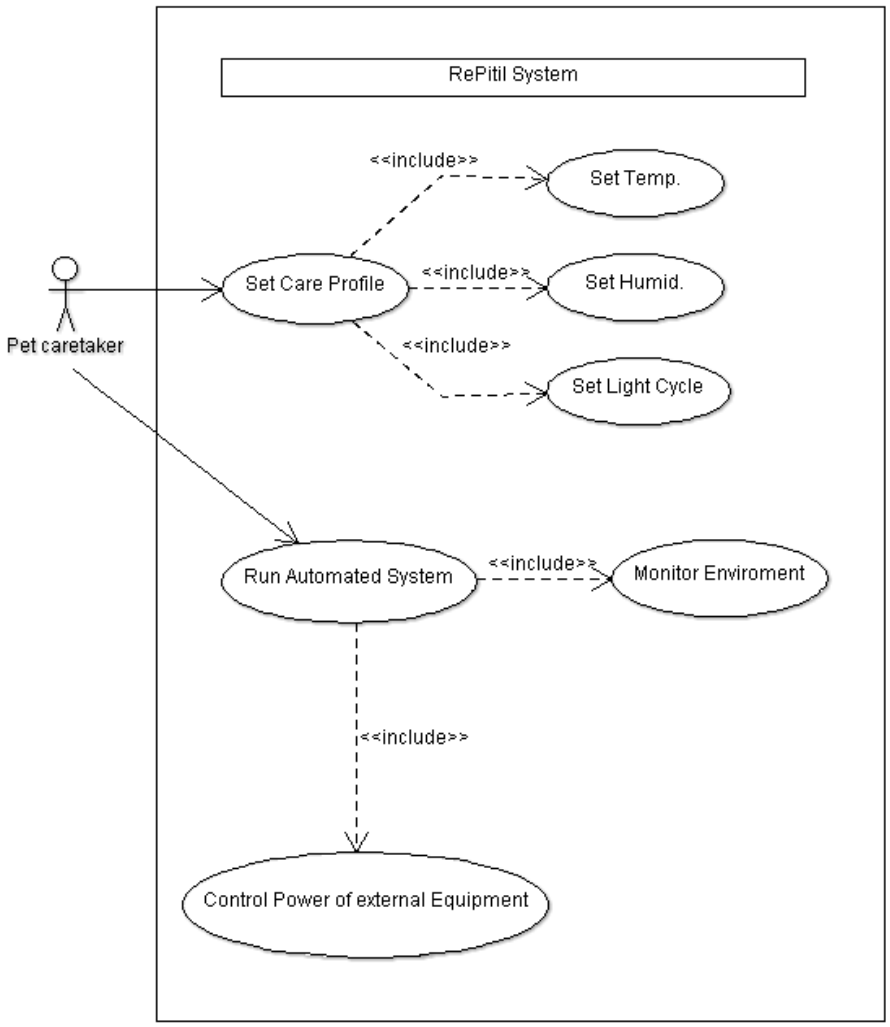


Figure 3: Use Case Diagram – First Expansion

This second UCD shows two expansions, the first is showing specifics for what parameters are set for the care profile, namely temperature range, humidity range, and parameters for a daylight cycle. It also expands the functions of the automated system into two broad categories, monitoring the environment, this will include reading measurements from the connected sensors, and controlling the power of external equipment. This will be the part that controls the variables in the environment to keep it in a comfortable zone for the pet.

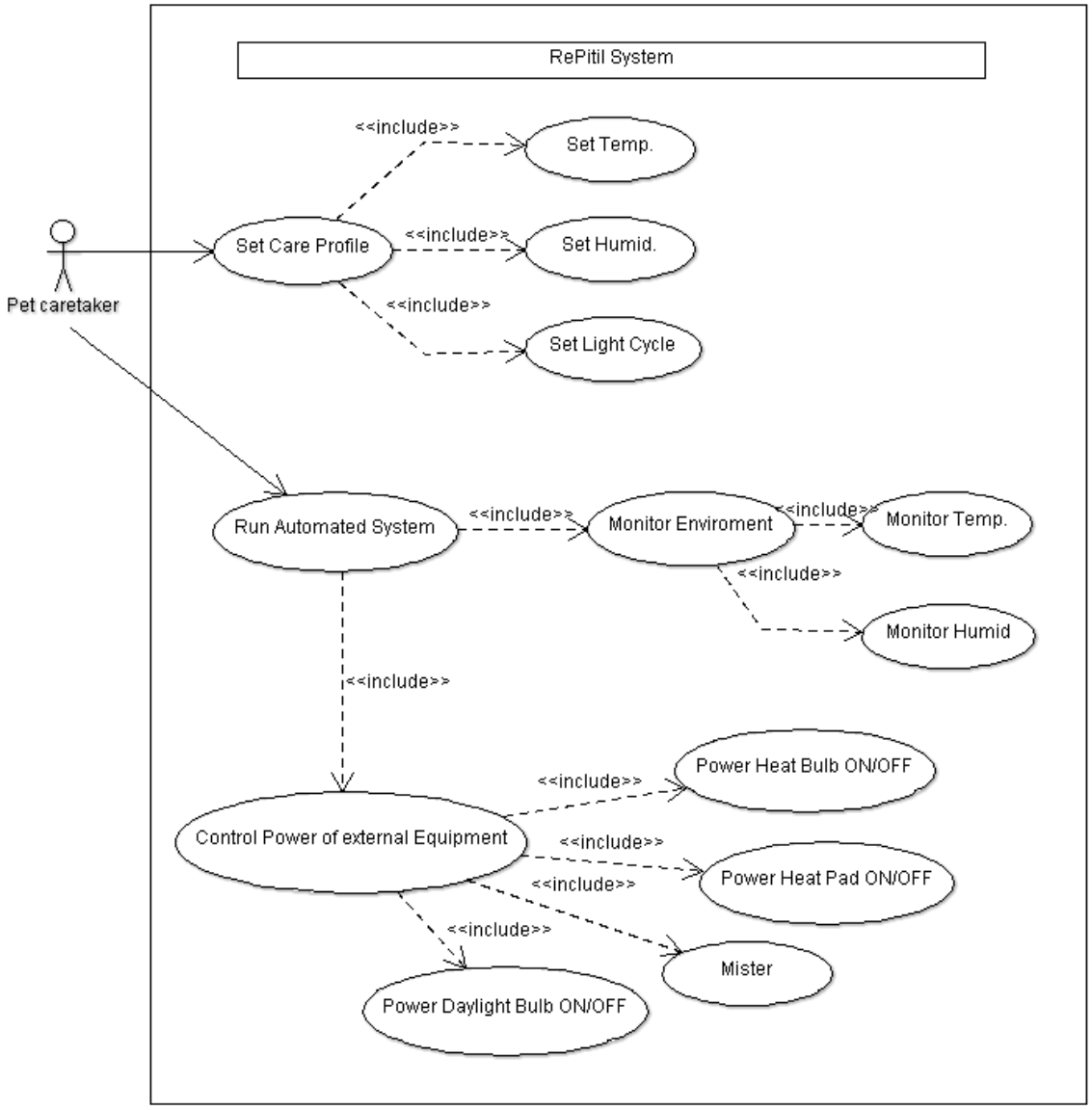


Figure 4: Use Case Diagram – Second Expansion

Here the UCD is expanded upon again, showing what parameters are being measured by the environment monitor, and to show what devices would be used to control the environment. This devices include a daylight bulb, a UV bulb for radiant heat, a heating pad for more directed heat, and a mister to increase tank humidity.

Initial Requirements

Functional:

The RePitile system has the following functional requirements:

1. Able to retrieve the temperature for different regions of the tank.
2. Able to retrieve the relative humidity for the entire tank.
3. Able to control temperature by adjusting one or more heat source.
4. Able to control humidity by adjusting a humidity source.
5. Able to control the light level by adjusting a light source.
6. Able to load configuration files to set the proper temperature and humidity levels.
7. Allow modification or creation of configuration files to fit specific environmental needs.

These requirements are vital to the proper functionality of the system as a whole to ensure that the tank stays at the proper conditions for the reptile enclosure.

Nonfunctional:

The RePitile system has the following nonfunctional requirements:

1. A housing unit for the entire system.
2. Clean, user-friendly interface.
3. User interface to use graphics
4. Cable management solution for safety.
5. Casing to house the Raspberry Pi.

These requirements are not required for the system to function correctly, but are useful to the product in other ways.

Documentation:

Testing/Revisions

2017/10/10

- Changed requirement to allow multiple heating devices.
- Altered abstract to better reflect project.

2017/10/14

- Added Use Case Diagram and Expansions

Technical Glossary

Ambient temperature – the typical conditions inside the environment

Ancillary product – provides appropriate support to necessary elements i.e. dirt, plants, food etc.

Bad shed – a shedding issue that arises in reptiles that can be caused by improper care

Configuration file – a template that the RePitile can read in and use to adjust environment

Ectothermic – the scientific term for a cold-blooded animal

Heat bulbs – a specialty UV/Infrared lightbulb that emits a controllable amount of heat

Heat pad – a device which attaches to the environment that enables the reptile to thermo-regulate

Microcontroller – a integrated circuit that uses a microprocessor to control and interface with other devices

Sub-tropical Regions – the region bordering the tropical region. Also called the temperate region.

Thermoregulation – the process by which core internal body temperature is maintained

Tropical Regions - the region of the Earth close to the equator between the tropics of Cancer and Capricorn

Vivarium – the specific environment that houses the reptile/amphibian

Team Details

Requirements – Seth Law

- Proof reading of document
- Additions to abstract
- Introduction section

Analysis – Alex Bioni

- Background section
- Additional introduction material
- References

Design - Scott Sheppard

- Use case diagrams
- Document formatting
- Testing and revisions

Implementation - Wesley Norris

- Functional and nonfunctional requirements
- Application domain section
- Operational environment, description of data sources

Table of Figures

References

[1] A. H. Collis and R. N. Fenili, "The Modern U.S. Reptile Industry," Georgetown Economics Service, LLC, 2011.

[2] "Common mistakes new snake owners make – Avoid all 5," pet-snakes.com, 2009. [Online]. Available: http://pet-snakes.com/new-snake-owners-mistakes-avoid. [Accessed 10 October 2017].

[3] L. McLeod, "Providing Heat and Light for Pet Reptiles," The Spruce, 2 May 2017. [Online]. Available: https://www.thespruce.com/reptiles-light-and-heat-1237231. [Accessed 11 October 2017].

[4] "Regulating humidity for pet snakes," Pet_snakes.com, 2011. [Online]. Available: http://pet-snakes.com/regulating-humidity-pet-snakes. [Accessed 9 October 2017].

[5] Drs. Foster & Smith Educational Staff, "a habitat leogecko drawing," Doctors Foster and Smith, [Online]. Available: http://www.drsfostersmith.com/images/articles/a-habitat-leogecko-drawing.jpg. [Accessed 13 October 2017].

Workflow Authentication

Alex Bioni: _____

Date: _____

Seth Law: _____

Date: _____

Wesley Norris: _____

Date: _____

Scott Sheppard: _____

Date: _____