UNIVERSITY OF „ALEXANDRU IOAN CUZA” IAȘI

Faculty of Computer Science

BACHELOR'S THESIS

Survive

proposed by

Ioana Parfene

Session: *july, 2021*

Coordinator

Lect. Dr. Alex Mihai Moruz

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Contents

Introduction

Survive is a take on the game **Survive - Wilderness survival**[1] by **Juuso Hietalathi**[2].

Motivation

My favourite **programming direction** discovered in University has been **game development**. As an avid **lifelong player**, I have always brushed away the idea of **pursuing** it as more than a **hobby**. The practice is still quite **uncommon** in the **courses** and **career paths** found in Romania.

Throughout **college**, I managed to obtain some sort of **game system assignment** for the majority of the **mandatory projects** I had. The **Game Design**[3] course created by my **coordinator** was the reason I finally decided to take it seriously and choose a **game** for my **Bachelor's Thesis**.

My favourite games belong to the **survival, strategy** and **simulation** genres. I have been playing **Survive - Wilderness survival** for many years, even though I enjoy **PC games** much more. My **interest** and its **complexity** made it an **attainable, good choice** for my **Thesis**.

Gameplay Description

Survive a long, challenging, resource-scarce **journey** back to the main road after getting lost in the woods on a rainy day. **Forage** for wood, berries, water and vines. **Hunt, fish, rest, cook** and **craft** campfires, weapons, traps, bandages and clothing insulators.

Travel, take different turns and make **strategic** choices in order to reach civilization before it is too late. Balance **hunger, temperature, thirst, health** and inventory to avoid **starvation, hypothermia, dehydration and illness**.

Stay alive or **permanently lose** the game and start over!

Requirements

The **project** must be an **Android** application with an interface that recognizes **one finger screen touch**. It should be easy to **download** and to **install** on a **mobile device**.

The **player** should be allowed to **pause, resume, save** and **quit** the game quickly. **Exiting** has to lead to **discarding** unsaved **progress** and **dying** must result in a **game over**, as one of the main design characteristics is **permanent death**(the player loses for good, **no second chances**).

The **project** must offer the **medium difficulty gameplay** with the original **objective**: **surviving** a long track back to a main road after getting lost in the woods. The **mechanics** ought to include **sleeping, crafting, item manipulation, collecting resources, travel,**

fire starting and **traps**. The **time progression, status bars** and **items** should be relatively **similar** to the original.

Approach

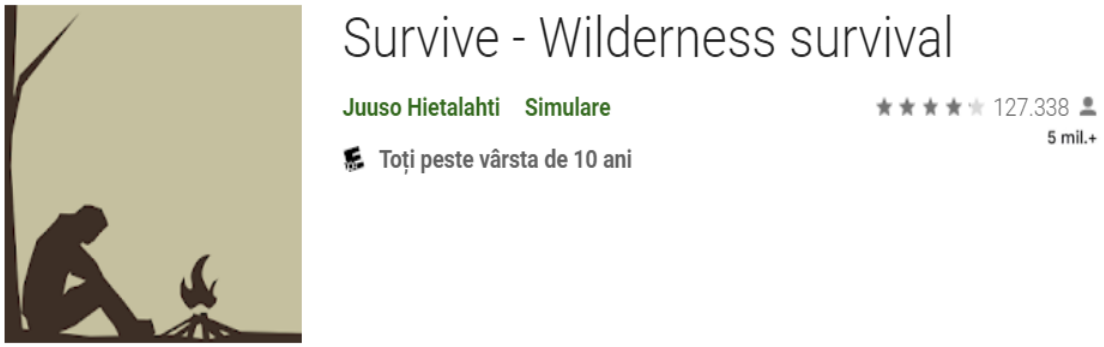
I chose to **implement** the game using **Python**, as I am very comfortable with it.

I tried to use **PyGame**[5] for the **GUI**, until I realized that it is not suited for **mobile applications**, so I switched the progress to **Kivy**[6], a cross-platform Python framework.

I approached **loading/saving** with the Python module **Pickle**[7] and the Android **executable** was made with **Buildozer**[8].

Related Work

Survive - Wilderness survival[1](*Fig.(a)*) is a **mobile game** originally developed by **Juuso Hietalahti**[2]. It has more than 5 **million downloads** and a 4 **star rating** from over 127.000 people. The main genre is **Survival**, mixed with **Strategy, Crafting** and **Simulation**. It has an **age restriction** for people under 10 years old. The engine used is **Unity** and the language is **C#**.



(a) **App Store Game Banner**

Juuso Hietalathi[2] is a **game developer** from **Finnland**. He started working on the project during a 24 hour **Game Design Contest**, where he **won first place** for his **idea** and **rough implementation**. It was so successful that he **continued development** with the intention of **selling** it. Many years later, the **game**(*Fig.(b)*) has **millions of downloads** and there is an **Android** and **iOS remake** in the works.

(b) **App Store Game Cover**

Contribution

The **thought process** leading to my **choice of project** contained many questions and requirements. It had to be a **game** in my favourite genres, **reasonable to implement** in one **semester** and full of **learning** potential.

My decision, **"Survive - Wilderness survival"** turned out to have many **positives**. Almost **everything** is **new to me** in terms of implementation: the **platform**, the **genres**, the **gameplay**. I have never made an **Android Application** before, so I got to **experiment** with many new routes of **game** design and development. It was very **versatile** in terms of **languages** and **game engines**, so I could choose to be as **comfortable** or as **challenged** as I wanted to be.

This **game** is **not new** to me. I **played** it before, it's the simplest **survival game** I have ever enjoyed. I had **tester insight**, I got to be the **target audience** for the project I was implementing. My **contribution** to the concept can be found in all the **differences** between the **original** and **my** development **journeys**.

Time Frame

I did not spend **two years** designing a game from **scratch**, I spent **three months guessing** the steps someone else made, **analysing** why they made them and why they **succeeded**. I had a lot **less time** to complete a different set o **tasks**.

Design Stages

My **design decisions** were made as a result of a **two-step process**. **Replaying** the original game as many times as possible in order to **gather data** and guess what values were originally used, and **comparing** it to what I could or what I would rather **prefer** doing.

Technologies

The **original game** is implemented in **Unity**(a game engine) with **C#**. I used **Python** and a **library**, leaving me a lot of **GUI elements** to make from **scratch**. This helped me a lot in my goal to **learn** as much as possible about the **basics**.

The **original** developer **designed** a game from **scratch**, with an **engine** that allowed a lot of freedom and **readily** implemented code, in the span of **2 years**. I took the role of **data analyst, tester, target audience** and **core back-end programmer** for **three months**, in a **different language**.

Game Design

1.1 Methodology

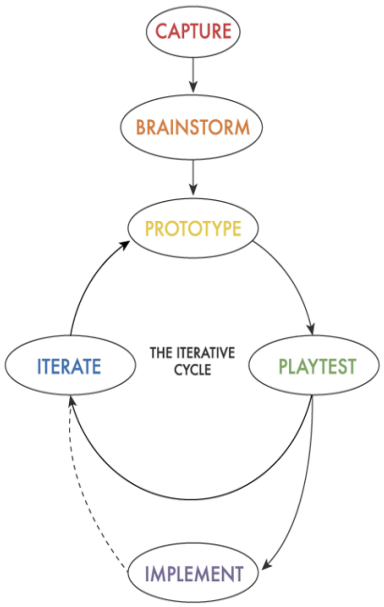
My **approach** resembled **Iterative Game Designing** the most. **Trying new things, testing, discarding** and **completely changing directions** was the only way I could **advance** towards my **main goal**, as I was implementing an **already existing game** just by **guessing** how it works.

I used a **different language** and **no engine**. The first 3 weeks of the **development** were centered around **PyGame**, a cross-platform collection of modules for User Interfaces. I chose it because I had **experience** with it and I was **comfortable**. Unfortunately, it was **not suited** for **Android** applications, so I had to **discard everything** and **start from scratch** with **Kivy**, a framework I had never used before.

I was constantly trying to juggle the **back-end** and **front-end** integration, I couldn't tell how many **iterations** I would need and I had no way of **predicting** many problems in **advance**.

I believe that this **methodology** made me aware of what I don't know. I didn't stick to a topic's **specifics** and I didn't force myself to stop and **plan ahead** too much. It was **less rigid** and **more freeing** and **experimental**.

As a result, I am much more **aware** of what **technologies exist** and how they **intertwine** to **solve a problem**, even if I don't know how they **work**. It taught me what my **minuses** are, what **kind of problems** exist and **where to look** for answers.



(a) **Iterative Game Design**

1.2 User Interface

The **design** of the **User Interface** is meant to **resemble the original** one in terms of **screen layout**, but the **design** and **some button placements** were changed to suit my **preferences** and the **resources available**.

1.2.1 Screen Navigation Architecture

The **player** should be able to have the **same screen navigation experience** as it would with the **original game**.

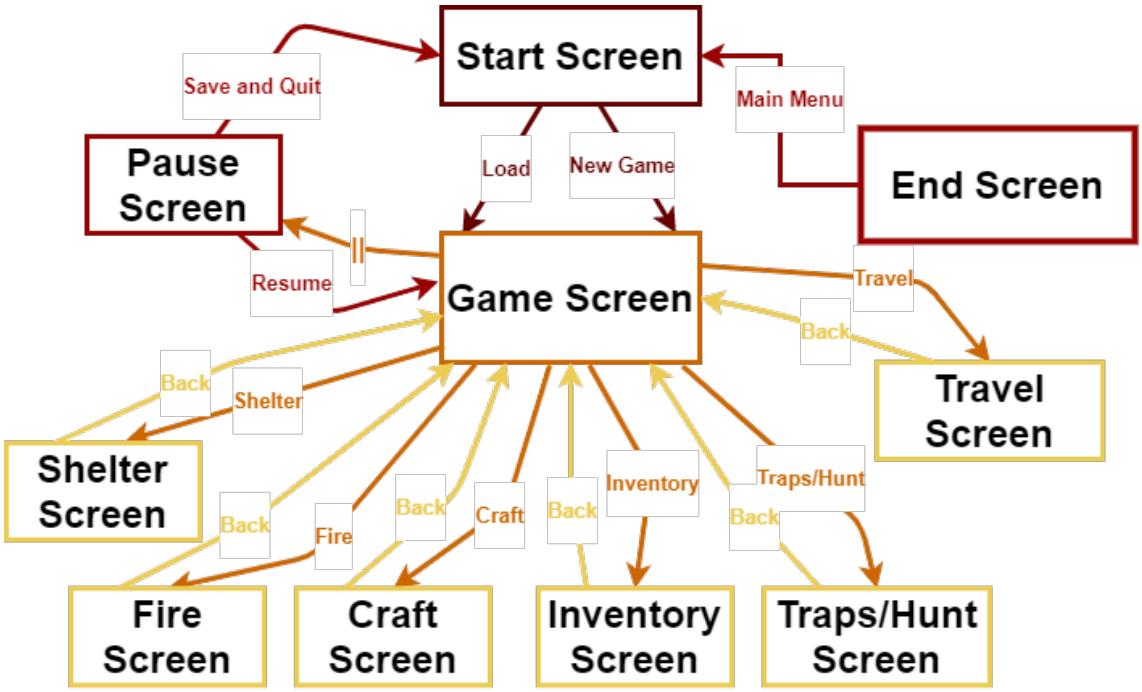


Figure 1.1: **Screen Navigation**

1.2.2 Screens

The entire **game** can be played with a simple **screen press**, **no scrolling** needed(including the inventory). There are **Pop Up** screens with **instructions** and **explanations** when necessary.

Main Menu and Pause Screens

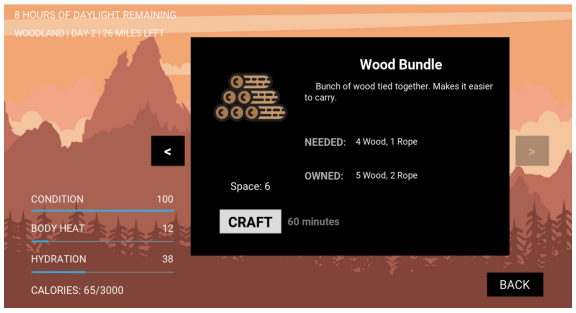
(a) **Main Menu Screen**

(b) **Pause Screen**

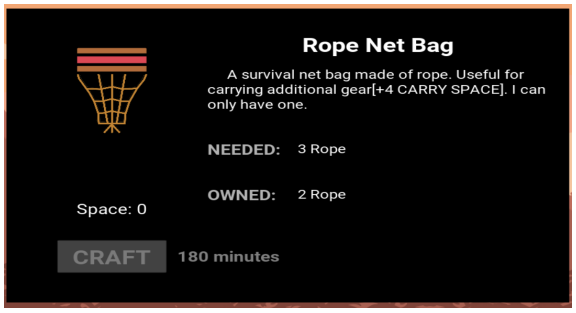
Game Menu Screen

(c) **Game Menu Screen**

Crafting Menu Screen



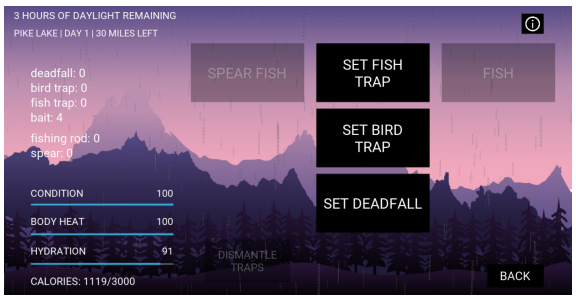
(d) **Crafting Menu Screen 1**



(e) **Crafting Menu Screen 2**

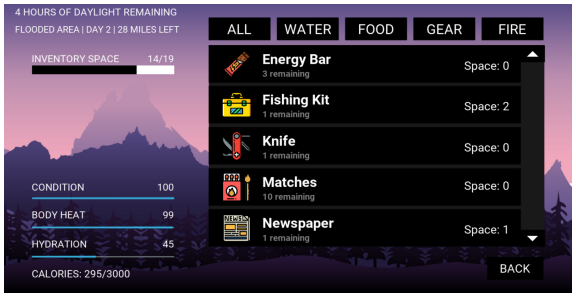
Shelter and Traps Screens

(f) **Shelter Screen**

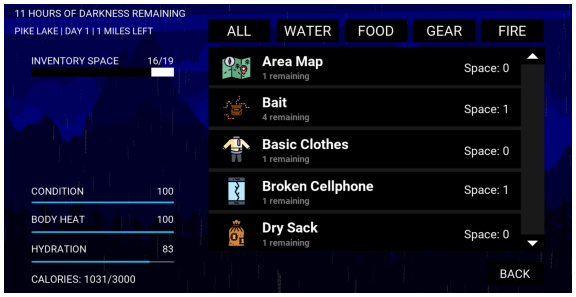


(g) **Traps Screen**

Inventory Screen

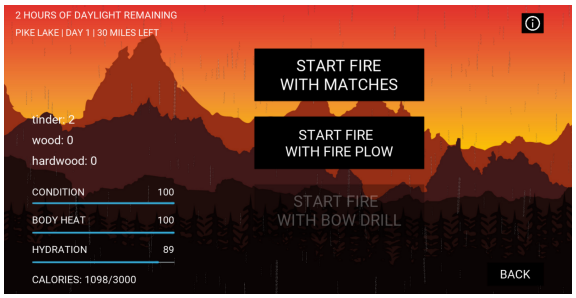


(h) **Inventory Screen 1**

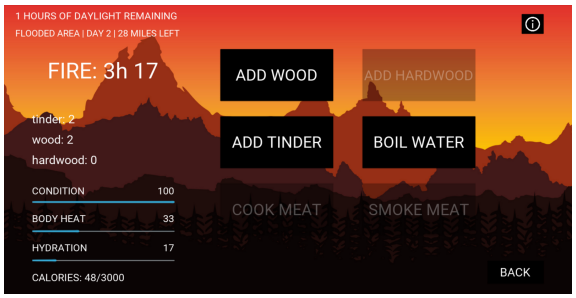


(i) **Inventory Screen 2**

Fire Screen

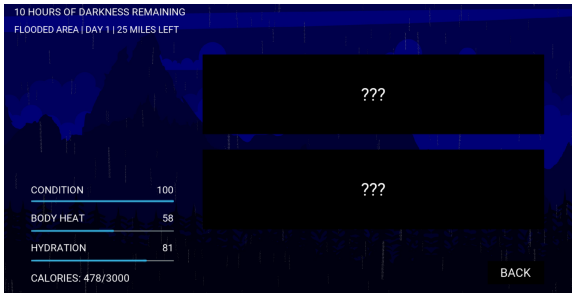


(j) **Fire Screen 1**

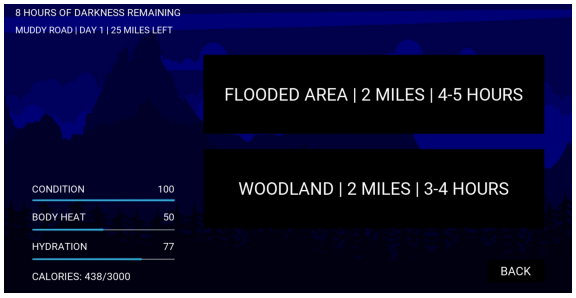


(k) **Fire Screen 2**

Travel Screen



(l) **Travel Screen**



(m) **Travel Screen with Flashlight**

End Screen

(n) **Win Screen**

(o) **Loss Screen**

Gameplay

2.1 Objective

The main goal is **SURVIVING**: away from the **forest** and back to **civilization**.

2.1.1 Environment

The **player** starts the game and immediately gets bombarded with **information** about its surroundings. At the **Pike Lake**, in the **middle of the woods**, **early afternoon**, during **heavy rain** that has covered the car tire tracks...with no easy way out in sight. It has no choice but to find a way to **survive**.

The **time, day, location, status bars, weather** and **remaining miles** to safety are visible on the **main screen**, ready for strategy planning.

2.1.2 Time

The **game time** is one hour for every 3 real minutes. Instant actions such as **sleeping, travelling, crafting** and **exploring** take 2 seconds for any specified amount of time required for them.

The game is designed to offer the player enough time to **think, strategise** or **peruse** the inventory while taking no time in **advancing** the **story line**. Just like chess, an advanced **"speedrun"** can be completed in 5 minutes, while a **thought-out**(but poorly played) round can take up one hour and a half with no bore or frustration from the player.

2.1.3 Weather

At the beginning, the **main character** is secluded by **rain**. The screen displays a ".gif" raindrop file and any action away from the car can swiftly lead to an **abrupt ending**. The car acts as a **shelter** that allows the game to still **start strong** and create the sense of urgency in order to set the **mechanics, objectives** and **priorities** for the player.

The lake is the **only** location that completely removes the **body heat depletion**. After leaving the lake, **rain** will be the worst enemy against avoiding hypothermia and death. The user will learn that **sleeping** with surrounding warmth and **preparing for travelling** the next day is the best way to spend the night. Another tutorial-like benefit is showcasing that **clean, safe water** can be collected using a **raincatcher**, while the locations' existing sources are **dirty**.

The **weather** also acts as an incentive to **explore** the very first day, which serves many purposes: teaching the **mechanic**, showing that **resources** are **not limited**, exemplifying the **status bar loss** during actions and making the player realize that Pike Lake **resources** are exclusive to it and extremely **important** to have for the rest of the **gameplay**. A **raining session** is anywhere between 8 and 72 hours. The **cool down** is 5 to 24 hours.

2.1.4 Day Time

The best time to **travel** and execute any **action** away from the current base is while it's **sunny**. There are **24 hours** in a game day, 12 of daylight of 12 with darkness.

The player **can't see** the next possible **travel locations** without a **flashlight**. Trying to **explore, collect wood** and **set traps** will mainly result in **failure**. A flashlight can only be obtained while exploring at the Pike Lake. The item can **never** be found again after that and may even **break**.

Heat depletes rapidly at **night**, especially during **rain**, a combination that will mostly result in game **loss**. The best night strategies are keeping a **lit fire, sleeping, crafting,** using **inventory items** and **planning to take off** first thing in the morning.

2.1.5 Shelter

There is **warmth** from the **car** at the beginning of the game. Future locations require **fire** to at least stop the **heat** from dropping, which is next to that area's **place of rest** and **settlement**, also known as the **shelter**.

The player may **sleep** the nights away or **build a raincatcher** from a **trash bag** in order collect **clean water**.

2.1.6 Locations

The **initial location** of the player is at **Pike Lake**. If it travels, it can **never return** again, as it is headed to the main **road**, in the opposite direction.

There are 5 other **location types**(*Table 2.1*) that serve as an **environment template**. The **player** may encounter the same kind of area **multiple times**, each with different faults and benefits. One may offer **water, certain resources** and **animals**, while the **road** to another could be **walked faster**.

Locations	Pike Lake	Flooded Area	Muddy Road	Muddy Area	Path	Woodland

Table 2.1: **Game Locations**

2.2 Status Bars

There are 4 **values** to keep an eye on: **Condition, Body Heat, Hydration** and **Calories**. All of them can go **below** 0, signifying that the player is on its last breath. **Calories** do not lead to **death**, as a person can **realistically** go weeks **without food**, but the **game ends** when any of the others reach -15%.

2.2.1 Condition

Condition is a value that can be mostly **left alone**. It improves **slightly** during the day if it's not maxed out already. Its main purpose arises in times of desperation.

The **player** may find itself in a **dire situation**, with only **dirty water**, **nearing death thirst** and **no way** to swiftly **start a fire**. Drinking it would offer a way out **once or twice**(*Table 2.2*), but more is mainly **luck**. **Spoiled meat** could offer the necessary **calories** to travel the **last miles** fast as to not die of thirst, **raw meat** could be near **expiring**.

There is a slight **timely increase**, as well as **bandages** to fix **travel** and **hypothermia wounds**, but **Condition** is mostly an end game **gamble**.

Item	Bandages	Raw Meat	Spoiled Meat	Unsafe Water Bottle
Condition	20	[-70, -30]	[-90, -50]	[-60, 0]

Table 2.2: **Values** of **Condition** Changing **Items**

2.2.2 Body Heat

There are 5 factors that influence **heat depletion**: **Shelter**(S), **Rain**(R), **Day Time**(D), **Clothing**(C) and **Fire**(F).

If the current location is **Pike Lake**, the player only **loses heat** if it **explores** or **travels**. That is the **only** time **shelter** is available. It can be **raining**, it can be **day or night** and the **fire** can be **lit** or not. The player **starts off** with a set of **clothing**, but it can be torn for **pieces of cloth**.

The **table** below(*Table 2.3*) shows all the remaining **factor combinations** and the **values** they influence **Body Heat** with every **hour**. Each "N" preceding a factor **letter**(mentioned above) signifies **"not"**, so "NS" would be no shelter. The code **"NSRNDCF"** reads as "**no shelter, rain, no day**(night)**, clothing**(player has it)**, fire**(is lit)" and depletes **heat** by -3 for each **hour** that the game is in that state.

NSRDCF	NSNRDCF	NSRNDCF	NSRDNCF
-2	30	-3	-4,5
NSRDCNF	**NSNRNDCF**	**NSNRDNCF**	**NSNRDCNF**
-3,5	25	28	0,5
NSRNDNCF	**NSRNDCNF**	**NSRDNCNF**	**NSNRNDNCF**
-4,5	-8	-6	23
NSNRNDCNF	**NSNRDNCNF**	**NSRNDNCNF**	**NSNRNDNCNF**
-4,5	0	-9,5	-6

Table 2.3: Game **Hourly Heat Loss** Codes and Values

2.2.3 Hydration

Hydration is the most **obvious** and **mediocre** status to look after. The player **starts** with several **bottles** of liquid and it can also collect more using **empty bottles** found at **Pike Lake**.

Building a raincatcher, collecting from **water sources**(Pike Lake, Muddy Areas and Flooded Areas) and finding **edible berries**(*Table 2.4*) exploring are the ways to **get water**.

Item	Safe Water Bottle	Unsafe Water Bottle	Squirrel Juice	Soda Bottle	Edible Berries
Hydration	25	25	25	25	5

Table 2.4: **Values** of **Hydtration** Changing **Items**

2.2.4 Calories

The player **can't die** from **calorie loss**, but they are needed for **travelling**, as going below 400 adds 2 **extra hours** to the **length** of the journey.

Item	Energy Bar	Crickets	Maggots	Soda Bottle	Edible Berries	Squirrel Juice
Calories	150	100	50	300	100	100

Table 2.5: A. **Values** of **Calorie** Changing **Items**

Item	Smoked Jerky	Can of Peas	Edible Plant Part	Raw Meat	Spoiled Meat	Cooked Meat
Calories	300	300	50	400	200	800

Table 2.6: B. **Values** of **Calorie** Changing **Items**

2.3 Inventory

The **Inventory** has a **space**(not weight) **capacity** that be increased with **extra carry items** that are crafted or owned from the beggining. If the **space limit** is **exceeded**, then the player **can't travel**.

There are **interesting ways** of going around this, such as **throwing stuff out**(the cellphone is useless and take 1 space point), crafting **compact items** from more voluminous ones(Wood Bundles), crafting **carry items**(Rope Net Bag, Pouch) and keeping **destructibles intact** until the **resulting resources** are needed, as they usually take **more space**.

2.3.1 Items

The **Inventory** holds all of the player's **items** and allows their **manipulation**(Eating, Drinking, Throwing Out, Destruction).

There are 5 categories: **All**(A), **Gear**(G), **Fire**(Fi), **Food**(Fo) and **Water**(Wa) for **easy navigation**, as seen in Table 2.7.

Item	Space	Throw	Category	Items Obtained From Destruction
Area Map	**0.0**	**Yes**	**A, G, Fi**	**Tinder**
Backside Of A Paper	**1.0**	**Yes**	**A, G**	**Tinder**
Bait	**0.34**	**Yes**	**A, G**	**-**
Bandages	**1.0**	**Yes**	**A, G**	**Tinder**
Basic Clothes	**0.0**	**No**	**A, G**	**Piece of Cloth, Torn Clothes**
Birch Bark	**1.0**	**Yes**	**A, Fi**	**Tinder**
Bow Drill	**2.0**	**Yes**	**A, Fi**	**-**

Broken Cellphone	**1.0**	**Yes**	**A, G**	**-**
Can of Peas	**1.0**	**Yes**	**A, Fo**	**-**
Cattail Plant	**1.0**	**Yes**	**A, Fo**	**Edible Plant Part, Plant Fiber, Tinder**
Cooked Meat	**1.0**	**Yes**	**A, Fo**	**-**
Crickets	**0.34**	**Yes**	**A, Fo**	**Bait**
Dead Bird	**3.0**	**Yes**	**A, Fo**	**Raw Meat**
Dead Fish	**1.0**	**Yes**	**A, Fo**	**Raw Meat**
Dead Hare	**4.0**	**Yes**	**A, Fo**	**Raw Meat, Bait, Hare Skin**
Dry Sack	**0.0**	**Yes**	**A, G**	**-**
Duct Tape	**0.0**	**Yes**	**A, G**	**Rope**
Edible Berries	**1.0**	**Yes**	**A, Fo, Wa**	**Bait**
Edible Plant Part	**1.0**	**Yes**	**A, Fo**	**-**
Empty Bottle	**1.0**	**Yes**	**A, Wa**	**-**
Empty Can	**0.0**	**No**	**A, G**	**-**
Energy Bar	**0.0**	**No**	**A, Fo**	**Bait**
Fire Plow	**1.0**	**Yes**	**A, Fi**	**-**
First Aid Kit	**2.0**	**Yes**	**A, G**	**First Aid Book, Bandages, Pouch**
First Aid Manual	**1.0**	**Yes**	**A, G**	**Backside of Paper**
Fishing Hook	**0.34**	**Yes**	**A, G**	**-**
Fishing Kit	**2.0**	**Yes**	**A, G**	**Empty Can, Rope, Fishing Hook**
Fishing Rod	**3.0**	**Yes**	**A, G**	**Wood, Rope, Fishing Hook**
Flashlight	**2.0**	**Yes**	**A, G**	**-**
Hardwood	**4.0**	**Yes**	**A, Fi**	**Wood**
Hare Skin	**1.0**	**Yes**	**A, G**	**-**
Knife	**0.0**	**No**	**A, G**	**-**
Maggots	**0.34**	**Yes**	**A, Fo**	**Bait**
Matches	**0.0**	**Yes**	**A, Fi**	**-**
Newspaper	**1.0**	**Yes**	**A, G**	**Tinder**
Piece of Cloth	**1.0**	**Yes**	**A, G**	**Bandages**
Plant Fiber	**1.0**	**Yes**	**A, G**	**Rope**
Pouch	**0.0**	**No**	**A, G**	**-**
Raw Meat	**1.0**	**Yes**	**A, Fo**	**Bait**
Rope	**0.34**	**Yes**	**A, G**	**-**

Rope Net Bag	**0.0**	**Yes**	**A, G**	**-**
Safe Water Bottle	**2.0**	**No**	**A, Wa**	**Empty Bottle**
Smoked Jerky	**1.0**	**No**	**A, Fo**	**Bait**
Soda Bottle	**2.0**	**No**	**A, Fo, Wa**	**Empty Bottle**
Spoiled Meat	**3.0**	**Yes**	**A, Fo**	**-**
Squirrel Juice	**1.0**	**No**	**A, Fo, Wa**	**Empty Bottle**
Tinder	**0.34**	**Yes**	**A, Fi**	**-**
Torn Clothes	**0.0**	**No**	**A, G**	**-**
Trash Bag	**0.0**	**Yes**	**A, G**	**Rope**
Unsafe Water Bottle	**2.0**	**No**	**A, Wa**	**Empty Bottle**
Utility Belt Bag	**0.0**	**Yes**	**A, G**	**-**
Wires	**0.34**	**Yes**	**A, G**	**Rope**
Wood	**3.0**	**Yes**	**A, Fi**	**Tinder**
Wood Bundle	**6.0**	**Yes**	**A, Fi**	**Wood**
Wooden Spear	**1.0**	**Yes**	**A, G**	**Wood**

Table 2.7: **Inventory Items**

2.3.2 Spoilage

There are certain **items**(*Table 2.8*) that can **spoil**. **Trap prey** only lasts a **couple of hours** after **death**, when it turns into **Spoiled Meat**.

The only meat **preservation** method is drying it at the **fire** to make **Smoked Jerky**.

Item	Raw Meat	Cooked Meat	Dead Hare	Dead Fish	Dead Bird
Hours Until Spoilage	**15**	**24**	**24**	**8**	**14**

Table 2.8: **Items That Spoil and Freshness Durations**

2.4 Fire

The **fire** screen has the most **complex** process from the **player's perspective**(*Figure 2.1*). It is the **best asset** against **rain** and **night temperatures**.

The **best strategy** is collecting **wood** during the **day** and using it to start a **fire** at **night**, when the player can **sleep** or **prepare** to go to the **next location** at dawn.

Fire allows for **water boiling** and **meat processing**, such a **cooking** and **drying** to avoid **Condition loss**.

There needs to be **tinder** and one type of **tool** to **start a fire**. It is **maintained** with **tinder, wood** or **hardwood**.

2.4.1 Fire Starting

The **fire starting tools**(*Table 2.9*) have a fire starting **success rate**(the **Matches** work all the time, the **Fire Plow** works in 30% of the **cases**). They can also be **destroyed** while being used(the **Matches** are completely used up, the **Bow Drill** has a 3% chance of **breaking**).

Fire Tools	Success Rate	Destruction Rate
Matches	**100%**	**100%**
Bow Drill	**50%**	**3%**
Fire Plow	**30%**	**6%**

Table 2.9: **Fire starting Tools and Quality**

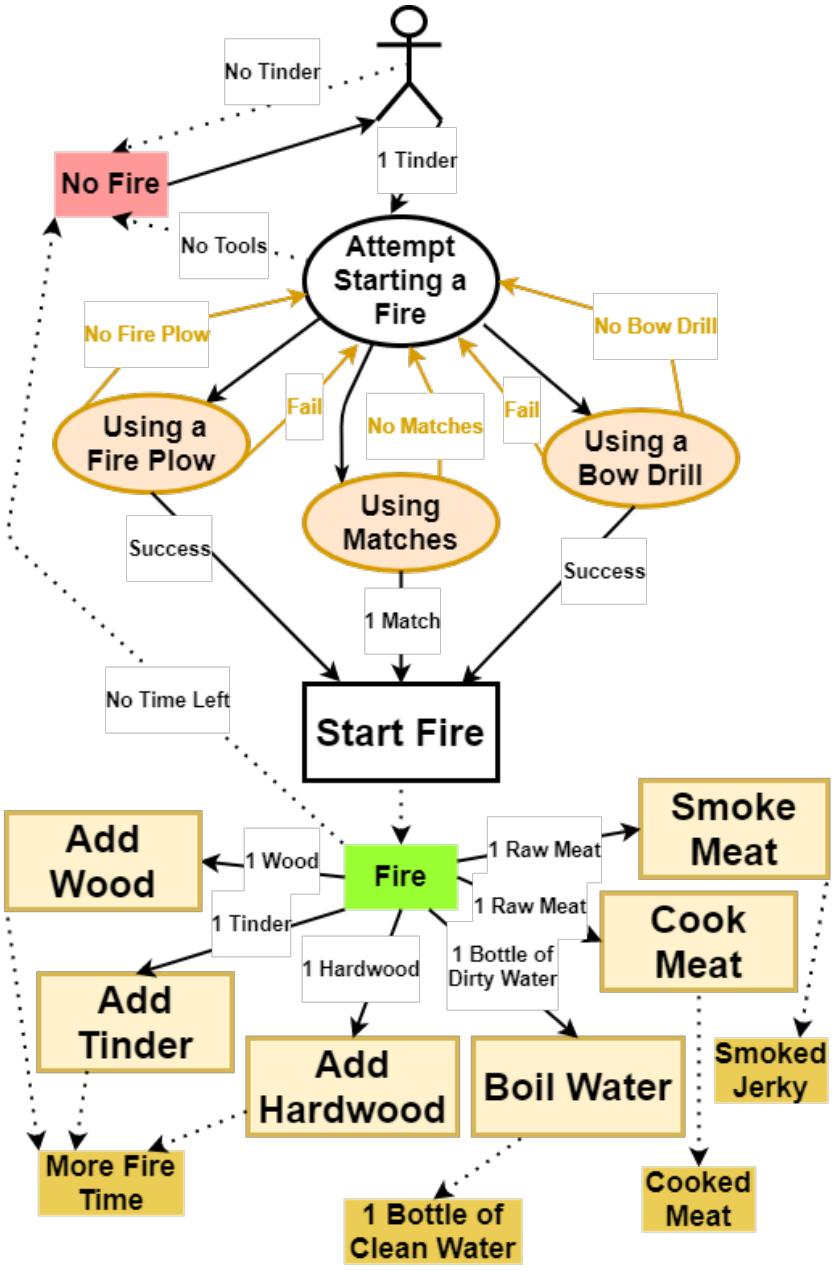


Figure 2.1: **Fire Screen Process**

2.5 Crafting

Creating **complex** items is displayed as **crafting**, while **breaking** them apart to get **parts** can be done in the **inventory**. Making something new takes **time** and **place** near the **fire**, so it can be done at **night** with no **Body Heat loss**.

The **table** below(*Table 2.10*) showcases all the **items** that can be **created**, the **time** needed, the **resources** and their **descriptions**. There can **only** be **one** of a certain device in the **inventory**(Fire Plow, Bow Drill).

Crafting can help with **Inventory Management** in many ways. There are **bags** for **extra space**(Pouch) or **creations** that are **more compact** than their **loose parts**(Wood Bundle, Rope).

Item	Crafting Duration	Crafting Resources	Description
Fire Plow	**30 minutes**	**Wood**	**"A primitive tool for starting a fire. Rubbing two sticks together should produce an ember. I can only have one."**
Bow Drill	**30 minutes**	**Rope, Hardwood**	**"A primitive tool for starting a fire. Using the bow drill requires some skill and plenty of patience. I can only have one."**
Fishing Rod	**30 minutes**	**2 Ropes, Fishing Hook, Wood**	**"A survival fishing rod made of stick, rope, and a hook. Good enough to catch a fish. I can only have one."**
Wooden Fishing Hook	**60 minutes**	**Wood**	**"A fishing hook. Sharp end."**
Rope	**30 minutes**	**Piece Of Cloth**	**"Piece of rope. Useful for many purposes in a survival situation. Each piece of rope requires 1/3 unit of carry space."**
Wooden Spear	**30 minutes**	**Hardwood**	**"It's a wooden spear with a pretty sharp tip. Better than bare handed hunting. I can only have one."**
Rope Net Bag	**180 minutes**	**3 Ropes**	**"A survival net bag made of rope. Useful for carrying additional gear[+4 CARRY SPACE]. I can only have one."**
Pouch	**120 minutes**	**Hare Skin, Rope**	**"A small pouch. I can carry stuff in it. I can have a couple of these.[+1 CARRY SPACE]"**
Wood Bundle	**60 minutes**	**4 Woods, Rope**	**"Bunch of wood tied together. Makes it easier to carry."**

Table 2.10: **Craftable Items**

2.6 Location Specific Actions

2.6.1 Exploring

Each time the player arrives **somewhere new**, the game takes the **location type** and uses its **"Number of Resources"** interval(*Table 2.11*) to **randomize** how many resources to **create**.

Location	Pike Lake	Flooded Area	Muddy Road	Muddy Area	Path	Woodland
Number Of Resources	{3, 6}	{3, 6}	{9, 11}	{7, 9}	{8, 10}	{6, 8}

Table 2.11: **Amount** of **Resources** at a **Location Type**

Each **location type** has some **items** and their **probability to be randomized** in the **current** place's **"Available Explorables"** list(*Table 2.12*).

Resource/Location	Flooded Area	Muddy Road	Muddy Area	Path	Woodland
Wood	-	20%	35%	-	-
Cattail Plant	-	-	-	24%	28%
Maggots	17%	-	-	29%	38%
Crickets		14%	23%	33%	28%
Cattail Plant	45%	-	-	-	-
Edible Berries	-	22%	12%	14%	6%
Plant Fiber	38%	9%	23%	-	-
Birch Bark	-	24%	7%	-	-

Table 2.12: **Chance** of **Item Finding** at Certain **Locations**

Pike Lake has some **exclusive** items that are **very useful** for the **gameplay**, as it can only be visited **once**, at the beginning.(*Table 2.13*).

Item	Flash Light	Wires	Empty Bottle	News Paper	Duct Tape	Fishing Kit	Matches	First Aid Kit
%	15%	25%	10%	15%	9%	8%	8%	10%

Table 2.13: **Chance** of **Finding** an **Item** at **Pike Lake**

2.6.2 Getting Wood

Wood can't be collected at **Pike Lake**, in order to promote **Exploring** for **new players** and because the **car** acts as a **shelter**. There is **no limit** at any locations, the player only has the **night** without a **flaslight** to worry about.

2.6.3 Getting Water

Clean water can be obtained through a **raincatcher**, but **dirty water** can be collected from locations that have it as a **resource**(*Table 2.14*).

Location	Pike Lake	Flooded Area	Muddy Road	Muddy Area	Path	Woodland
Dirty Water Source	Yes	Yes	No	Yes	No	No

Table 2.14: **Location Types Water Resources**

2.6.4 Setting Traps and Catching Fish

Traps have their own **screen** that allows **building and dismantling**. The **amount** that can be made of each is **infinite** if the resources are there, so the **chance** gets **better** with each **new one**(*Table 2.15*). **Fish** can be caught with a **spear**(5%) or **fished**(8%).

Traps	Hourly Trap Rate	Prey	Prey Resources	Building Resources
Deadfall	2%	Hare	3 Raw Meats, Bait, Hare Skin	Rope, Wood, Bait
Fish Trap	3%	Fish	1 Raw Meat	Rope, Wood, Bait
Bird Trap	4%	Bird	2 Raw Meats	Rope, Wood, Bait

Table 2.15: **Traps**

2.7 Travel

Travelling to a location requires an **inventory** below the **space threshold**. The **number** of travel hours is **randomized** from the specific **interval**.

If the player has less than 400 calories, 2 **extra hours** are added to the **trip**. The location **choices** are **not visible** at night without a **flashlight**(*Table 2.16*).

Location	Miles	Hours	Water Source
Pike Lake	3	{4, 5}	Yes
Flooded Area	2	{4, 5}	Yes
Muddy Road	2	{3, 4}	No
Muddy Area	2	{3, 4}	Yes
Path	3	{3, 4}	No
Woodland	2	{3, 4}	No

Table 2.16: **Travel Information**

Implementation

3.1 Technologies

3.1.1 Kivy

Kivy[6] is a **cross-platform framework** that allowed me to build the game as an **Android application**. The **relationship** between **Kivy** and **Python** reminds me heavily of the one between **CSS/HTML** and **PHP**. Placing **Widgets** in ".kv" files feels like building a **web site**. My **text-based, screen-heavy** game took **thousands** of lines of **Kivy** code.

3.1.2 Pickle

Pickle[7] is a **Python** module used for **serializing object structures**. I used it to implement **saving, loading** and **pausing** on a **Game State object** that holds all the **information** about the **gameplay**.

3.1.3 Buildozer

Buildozer[8] is a tool that packages **mobile** applications. I used it to create the **Android executable** for the game. It requires **Linux** for compilation, so I shared the code between **Ubuntu** and **Windows** via **Github** in order to use it.

3.2 Integration

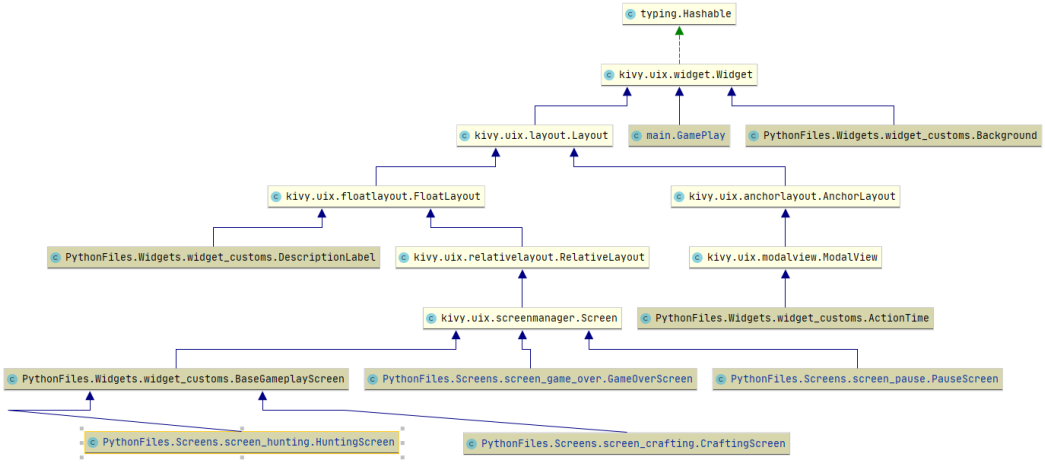


Figure 3.1: **Piece of Kivy and Python Integration Architecture**

Python makes use of **Kivy Widgets** in order to create **UI elements**. This can be seen in *Figure 3.1*, which contains a piece of **integration architecture**(with most elements discarded to fit).

3.2.1 Kivy Using Kivy Files

Kivy code can be written in both ".kv" and ".py" files. *Listing 3.1* displays a piece of code that adds a **Button Widget** and an **Image Widget**(a "pause" symbol) to three selected **screens**.

The language's **structure** resembles **HTML**. It allows for compact code as **multiple screens** can share the same **Widgets**. The "root.show_info()" line calls the "show_info()" **method** of the **parent object** found in a ".py" file. The "on_release" line allows behaviour addition and makes the button **responsive**. The **image** is added on top and does not **interfere** with the **functionality** of the **button**.

```
<FireScreen, HuntingScreen, ShelterScreen>:
    FloatLayout:
        Button:
            pos_hint:{"x": 0.91, "y": 0.90}
            size_hint: 0.04, 0.07
            background_color: 0.0, 0.0, 0.0, 1.0
            bold: True
            font_size: self.height*0.5
            text: ""
            on_release:
                root.show_info()
        Image:
            source: "GraphicFiles/info.png"
            size_hint: 0.026, 0.054
            pos_hint:{"x": 0.917, "y": 0.908}
            allow_stretch: True
```

Listing 3.1: **Kivy** Implementation of the **Pause Button**

3.2.2 Kivy Using Python Files

Widgets can be **implemented** in ".py" files as well. **"ModalView"** creates a **Pop Up** the size of the current window. The code in *Listing 3.2* implements a **"ModalView"** that displays an **"action execution"** text and **closes** after a second("Building...", "Sleeping...").

```
class ActionTime(ModalView):

    def __init__(self, text, **kwargs):
        super(ActionTime, self).__init__(**kwargs)

        # Set the specific text for the action
        self.ids.action_time_label.text = text

        # Call dismiss_view after one second
        Clock.schedule_once(self.dismiss_view, 1)

    def dismiss_view(self, dt):
        self.dismiss()
```

Listing 3.2: **Kivy** Implementation of the**Action Execution Pop Up**

Listing 3.3 **showcases** the piece of code that **changes** the **background** picture to reflect the **time** of the day.

```
1  class Background(Widget):
2      """ Class for changing the background during the day """
3
4      # The path to background image
5      this_source = StringProperty("GraphicFiles/night.png")
6
7      def change_background(self, *args):
8          """ Change background after the day period """
9          # Total game hours that have passed
10         game_hours = init.game_state.game_time / 60
11         # The current day of the game
12         init.game_state.current_game_day = int(game_hours / 24 + 1)
13         # Game hours that have passed in the current day
14         game_hours_today = game_hours % 24
15
16         # Change background image path based on the time of the day
17         if game_hours_today < 2:
18             self.this_source = "GraphicFiles/dawn.png"
19         if game_hours_today < 7:
20             self.this_source = "GraphicFiles/orange.png"
21         elif game_hours_today < 10:
22             self.this_source = "GraphicFiles/purple.png"
23         elif game_hours_today < 12:
24             self.this_source = "GraphicFiles/sunset.png"
25         else:
26             self.this_source = "GraphicFiles/night.png"
```

Listing 3.3: **Kivy** Implementation of the **Background Change**

3.3 Testing

The **project** was **manually** tested after each **iteration**. The nature of the game allows for extremely **fast playthroughs**, as each action takes **one second** in real time. This was a **best case** scenario, as each feature could be **tested** in a matter of at most **several minutes**. Testing **automation** was not really needed.

3.3.1 Quality Assurance

As far as I am concerned, there are **no bugs** remaining. The addition of the **rain** ".gif" **animation** makes the **game** take a minute to **open** on **mobile devices** after the first installation, but the application is very **responsive** otherwise. **"Speedruns"** can cause **occasional** lags of 2-3 seconds, but **fast gameplay** poses no problems.

3.3.2 Playtesting

The **application** was **tested** by friends, family and other students. As I was implementing an already **successful game**, I didn't really have many **difficulties** with the **mechanics** and **gameplay design** choices. However, there are things that I **changed** to **my liking** and I made sure to **cater** to all the **complaints** and **suggestions**.

Conclusion

Making this **game** was a very **gratifying** and **fulfilling** experience. I succeeded to **implement** all of the **mechanics** and **features** of the original game's **medium difficulty** gameplay. The application can be **downloaded** and **played** on **Android** mobile devices.

The **user** can **pause, resume, save** and **quit** the game with no negative impact on the **time progression** and the **permanent death** feature. The **environment** has all the original **locations** and **resources**. **Sleeping, crafting, travel, traps** and **hunting** were also fully implemented. All the **inventory items** can be manipulated and used in the intended ways. **Exploration** and **resource gathering** have similar, if not identical chance **values**.

The **graphical interface** has **bright colours** and **beautiful backgrounds**. The **screen structure** is similar, but the **design** was tweaked to my liking. I did not, however, manage to implement a **sound** system.

I chose to make the **game** in **Python** because I have done this before and I was **comfortable** with it. I am glad I took the time to make a lot of the **GUI** elements from **scratch** and learn about **integration**, but I will not do this again. I cherish the **knowledge**, but I have gained enough **confidence** to use **game engines** from now on.

In **conclusion**, all of the primary **objectives** of the **project** have been **achieved**.

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