Oregon Game Project Challenge
Oregon's Third Annual Youth Game Programming Competition

2010 Design Concept Document

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ogpc 3.0 – a TechStart program affiliated with OUS and presented by Best Buy

TechStart Education Foundation Oregon University System BEST BUY

Game Concept

Quick Links:

1. Introduction

Our Health & Wellness themed game concept is centered on disease prevention of a parasite that has plagued mankind for ages, the parasite that causes malaria. Malaria is as old as mankind itself, and it has been published that malaria has killed half the people who have ever lived on this planet (Priyadarshi). Today it still kills about 2 million people per year, most of them children. In comparison, that is equivalent to a child dying every 30 seconds (WHO), or seven jumbo jets full of children crashing every day over the course of a year. This is a tragedy we cannot afford to ignore. It is a social, economical, and health problem particularly indigenous in tropical countries. Recently the parasite has spread to further regions and threatens to continue to spread, has become more entrenched, and has developed drug resistance. Consequently cure options are increasingly limited and in coming years, malaria will strike up to a half billion people (Priyadarshi). Approximately half of the world's population is at risk of malaria, particularly those living in lower-income countries (WHO).

Our goal is to develop a video game to help in the fight against this terrible disease. The game's protagonist, Zippy, a Red Cross Volunteer, enlightens players about disease prevention techniques and new drug therapies and how they work in infected people. Furthermore he gives tips how to play the game to help with ease-of-use. The game instructs the players about how they can get involved in different organizations by donating or volunteering for the malaria cause, while providing a fun, engaging, interesting, and challenging game play. We plan to donate this video game to the Bill Gates and Belinda Foundation. We hope the visibility of this game will encourage more people, both young and old, to get involved to help save more lives.

To develop knowledge for this game we traveled to the Malaria Drug Discovery Laboratory, located at the Department of Veterans Affairs Medical Center, Oregon Health and Science University, Portland, Oregon. We also visited the Oregon Translational Research and Drug Development Institute (ORTRADI), located within Portland State University (PSU). We also did a lot of on-line research.

2. Background and Game Premise

2.1 Research performed on this season's OGPC theme

VA Malaria Drug Discovery Laboratory
Oregon Translational Research and Drug Development Institute (ORTRADI)
Online Malaria research

2.2 Aspects of theme to be incorporated into game design

There are there (3) Main aspects of this game

1. Malaria disease prevention (IRS - Internal Residual Spray, set-up PermaNets, drain stagnant water pits, and more)
2. Malaria disease treatment (Combat malaria inside the human host)
3. Malaria disease education (Awareness, volunteer, donation, organizations)

3. Game Features

3.1. Game Genre

Mixture of adventure/action, strategy, and simulation

3.2. Description of Game Play and Game Goals

3.2.1. How goals and game play relate to them

Its overall goal is to educate and illustrate via a mixture of adventure/action, strategy, and simulation and how horrible and devastating is the disease known as malaria. It has plagued mankind for ages, and kills millions each year. The player, as a Red Cross volunteer in a tropical region, works to save lives through disease prevention and administration of medication. There are two main aspects to the game:

1. Working as a red cross volunteer in a village located in a tropical region (e.g. Africa) to prevent disease
   (Strategy/simulation)
2. Working as a Red Cross nanobot inside the body of the human host to eliminate parasites and cure the person
   (Action/adventure)

In the village, the player's main goal is disease prevention to thwart the spread of malaria by taking action in different forms. The player hangs up mosquito bed netting, and uses an indoor residual spray (IRS) to protect the insides of the huts. However people are most vulnerable outside their huts (homes). The Red Cross volunteer practices disease prevention by draining stagnant water to prevent more mosquitoes from breeding, and uses a special environmentally safe bug spray to kill them mosquitoes directly.

The other portion of game play is when a person is infected, the Red Cross volunteer must provide medicine. When such medication is injected, the player takes the form of a nanobot to help deliver the injected drug and destroy the parasites inside the body. The player attempts to save the person by killing the parasites, and seeks to do so before the parasite infection reaches its next stage. If the player cannot save the person, the infected person will die, lowering the population counter by one.

Levels:

The game levels are introduced in the infected host portion of game play. The malaria parasite has different stages in its life cycle in the human host (liver and blood stage). The game implements these stages as levels. The parasite exhibits different behavior in different stages. In liver stage, the 10 or so transferred parasites, can reproduce or lie dormant (as hypnozoites) for up to years. However the player is only given a limited time to eradicate the parasite. This level is considered easier one of the two.

If the parasites are not eliminated in the liver stage, after reproducing and greatly increasing its numbers, it will burst from the liver cells into the bloodstream, causing severe infection. The parasites not only infiltrate and infect red blood cells, but will eventually burst open the cell, releasing even more parasites. This level is the more difficult stage due to the sheer numbers of parasites.

To make the game fun, the player, as the nanobot, must use the different technologies in the nanobot to try to eradicate the parasites before they can reach the next stage. The nanobot is equipped with a small electric shock to target and destroy parasites, micro-missiles containing drugs that kill parasites, and drug waves that eradicate any parasites within a radius of the nanobot.

3.2.2. **Game Goals:**

In summary the game goals and strategies are as follows:

Disease Awareness (Malaria Info Page and links):

- To educate the player about malaria
- To give opportunities for the player to donate or volunteer

Village Disease Prevention (as Zippy the Red Cross volunteer person):

- To help protect the homes in a typical village from malaria by providing bed nets for each and every hut.
- Spraying the walls of each hut with Indoor Residual Spray (IRS).
- Dredging the stagnant water to prevent mosquitoes from breeding.
- Injecting medication into infected villagers.

Human host Disease Treatment (as Zappy the Red Cross nanobot):

- Eliminate the malaria parasites and sleeper cells (hypnozoites) in liver stage.
- Eliminate the malaria parasites in second blood stage. Prevent them from infecting new blood cells.
- Destroy infected sick red blood cells before they burst and release more parasites.
- Refrain from destroying healthy blood cells.

Community Health Bar Function:

This is our current community health function and will likely be subject to change
Let k be any constant, with different values of k1, k2, k3, k4, k5, and k6. We will determine these values as the game comes together. This function is important as brings together many aspects of the video game.

Note I.C. = Initial Condition of Community Health (CH) which is 10% (Still TBD)
This is due to the stagnant water, breeding ground of mosquitoes
"+" = Increases Community Health (which is a good thing)
"-" = Decreases community health (which is undesirable)

```
CH  = 10% + k1*(Nets) + k2*(spray)
      - stagnant water (presence of sets the I.C.)
      + water drained
      - Infect (adult)
      - 2*(child or pregnant woman)
      + 1*(cured adult)
      + 4*(cured child or pregnant woman)
      - k6*(mosquito population)
```

Funding Bar Function:

Our Funding Bar is constantly growing. When disease prevention tools are bought, funding goes down. The funding bar provides limits to the player from buying too many tools.

Note: Funding increases over time from donations.

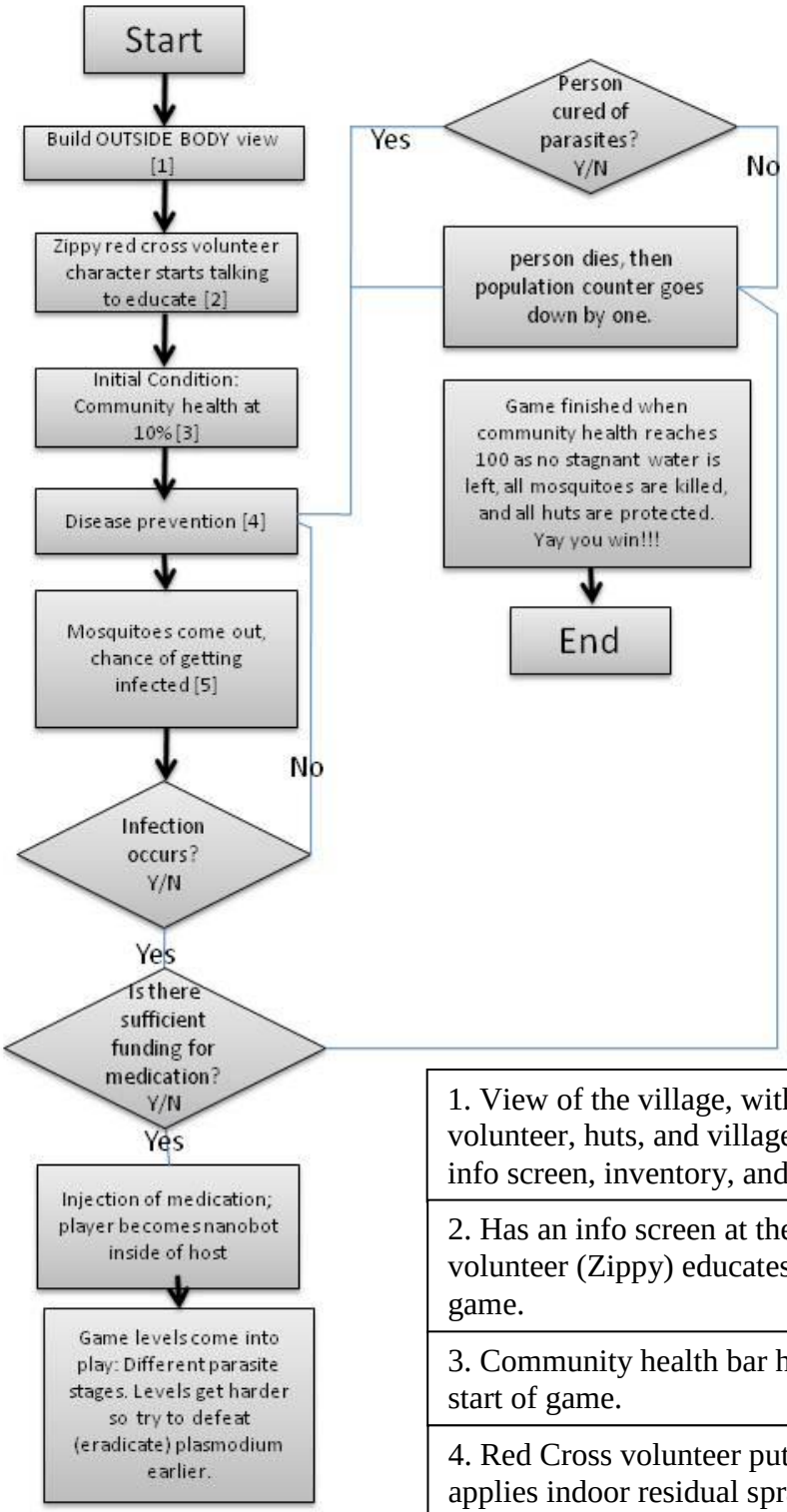
```
Funding  = Funding + 0.2*(time)
      - spray can purchase
      - spray used
      - bed net purchase
      - stagnant water dredged
```

Scoring Function:

Our scoring function tells the player how well he or she did. The maximum amount of points a player could get is 180 points. Every time a person dies, ten points are subtracted from 180. When everyone in the village dies, the player receives no points.

```
Scoring = 180 – 10*(# of deaths)
```

3.2.3. **Game Play Flowchart**



1. View of the village, with player as Red Cross volunteer, huts, and villagers. Also contains minimap, info screen, inventory, and health bars.
2. Has an info screen at the bottom, where Red Cross volunteer (Zippy) educates player about malaria and game.
3. Community health bar has initial condition of 10% at start of game.
4. Red Cross volunteer puts up mosquito bed netting, applies indoor residual spray (IRS), drains stagnant water to prevent mosquitoes from breeding, and uses an environmentally safe bug spray to kill them directly.
5. Mosquitoes have a statistically random chance of infecting people when they touch them.

3.3. **Key features**

Some of the key features of our game (still under development) are:

- Zippy – Red Cross volunteer person practicing malaria disease prevention in a rural African Community
- Zappy - Red Cross nanobot battling malaria parasites inside the human host
- Malaria - A deadly disease that is caused by a parasite called Plasmodium Falciparum. The game has an educational center to show players more information about the disease, and how to volunteer and/or donate funds to organizations involved in the war against malaria.
- Mosquitoes - Insects that carry malaria parasite
- Mini-map - Illustrates where player (Red Cross person) is located in the village
- Radar - Illustrates where player (Red Cross nanobot) is located in the human host
- Red Blood Cells - cells the parasite attack (infiltrate and infect) and the Nanobot must save
- Liver Cells - cells the parasite attack (infiltrate and infect) and the Nanobot must save
- IRS – Internal Residual Spray that could be sprayed inside huts to protect the villagers from mosquitoes
- Mosquito bedding nets - Nets that could be set up around beds inside houses to protect the villagers from mosquitoes.
- Villagers - The people Zippy must save from malaria. If a villager becomes infected, they will change color (flash red) to indicate illness. They must be treated immediately.
- Electricity, drug missiles, and light bombs - The weapons the Red Cross nanobot uses to combat the Plasmodium Falciparum parasite in the body. Some are realistic weapons, and some are made up for fun to increase the excitement of game play. This is still under development as our ideas have changed a lot how to approach this.
- Community Health Bar - The overall health of the community, depending on how many people are sick, how many people are healthy, how many huts have been sprayed with IRS, how many bedding nets have been set up, how much stagnant water there is left, and how many mosquitoes there are. Please see Community Health function for more information.
- Death Counter - Shows how many people have died.
- Funding Health bar - The amount of money Zippy has at his disposal to buy tools and treatment options to combat mosquitoes and malaria. Increases with donations and decreases with purchases.

3.4. **Target Audience**

There is no intended age limit to this game, but due to content will likely appeal to mature elementary school children to adult age range. The goal is to address a general audience who like action-packed, adventurous, and interactive games. There are no explosions and bangs, but the game provides some special effects, but more importantly, a topic, plot, and game play relating to malaria where the war is a very real one. The player as a Red Cross volunteer is burdened with saving the lives of the villagers by disease prevention and disease treatment. As the player does so, they eradicate their own malaria unawareness. To take this one step further, the game will have built-in educational malaria fact-sheet, which will truthfully highlight how dire the malaria threat is to humanity. It is very somber eye-opener reality. Still more, the player will be pointed to resources to how and where they can participate and help make a real-life difference in this war.

3.5. **Game Technical Details**

The game play area will feature an angled view (slightly isometric) of a rural African village and a top-level view of a human liver and bloodstream plasmodium parasite left cycle stage. We thought these two different views would give the player a greater contrast between the two game modes. The angled and the top-level views also make it easier to implement a minimap compared to a horizontal view.

There are six views (in the African village):

1. One to hold the game play area
2. One to hold the mini-map
3. One for the informative typing text window
4. One for the sidebar inventory, which holds the player's disease prevention tools
5. One to hold the health bars.

1. Controls:

Move up (Move to the top)

Move right across the screen

Move down (Move to the bottom)

Move left across the screen

Light bomb (only in body)


Move up (Move to the top)


Move right across the screen


Move backwards (Move to the bottom)


Move left across the screen

Using and selecting tools(Outside body)/shooting electricity (in body)

RIGHT CLICK	Shoot drug missile (only in body)

1. A minimap is implemented to display the overall landscape. Minimap is a second *view* of the entire screen (entire African Village or entire infected bloodstream segment) in a small area. It uses *views* to display the whole screen in a small section. Similarly a radar minimap will be introduced to show the location of player and parasites in the human host.

2. Has an info screen at the bottom to display information about malaria. The regular container to hold the text will be created by a view, and the command to draw the text is *draw_text_ext*. The animated talking Red Cross volunteer will be synced with the text as it scrolls out onto the screen.

3. Has two health bars displaying community health and amount of available funding to purchase tools. A population counter will reflect number of deaths. These will be developed using GML code. GML must be used as we have more the one health bar connected to several global variables.

4. You can spray and set up bed nets in huts in the African village to reduce the risk of mosquito bites and you can exterminate malaria using specialized drug delivery mechanisms inside the body.

5. Has an inventory that uses independent view declaration and *view_visible* command to be visible or invisible.

3.6. **Concept Art**

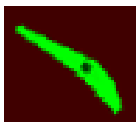
Figure 1: Loading Screen

Figure 2: Splash Screen

Figure 3: Front End

Figure 4: Rural African Village

Zippy, Red Cross Volunteer



Plasmodium Falciparum in the liver

Plasmodium Falciparum in the blood

Figure 5: Game Characters

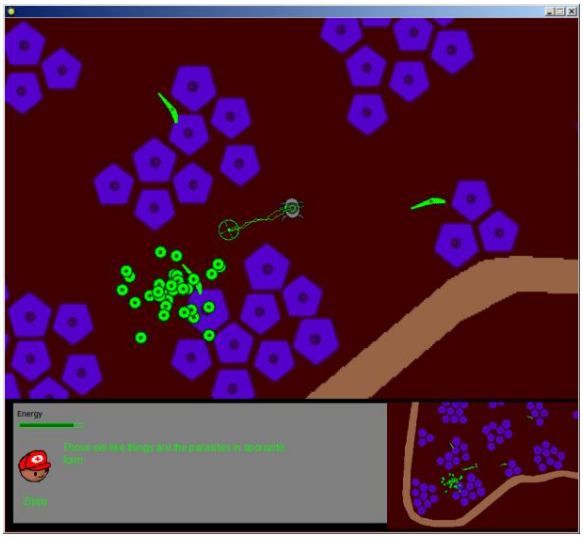


Figure 6: Liver Stage

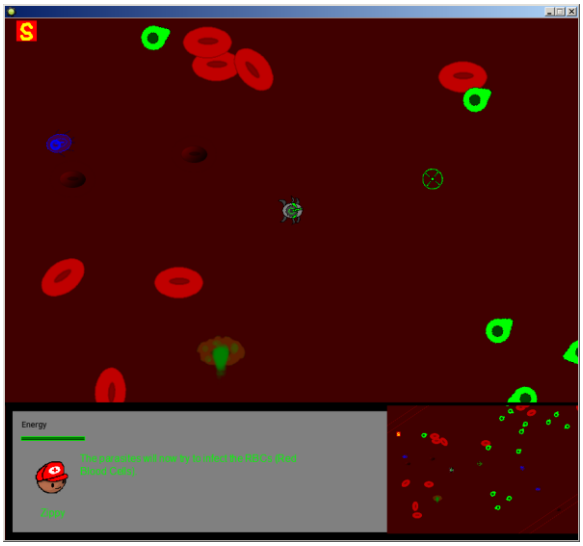


Figure 7: Blood Stage

4. References

Priyadarshi, Dr. Nitish. "History of Global Killer- Malaria. ." *American Chronicle*. Web. 30 Mar. 2009.

WHO (World Health Organization), http://www.who.int/mediacentre/factsheets/fs094/en/

5. Miscellaneous Info

5.1. Research references

VA Malaria Drug Discovery Research Lab:

Meeting contacts: Dr. Jane Kelly, Dr. Michael Riscoe, Dr. Isaac Forquer, Dr. Rolf Winter
Position: Researchers
Learned about: The life cycle of malaria, how malaria kills its host, and how their new drug works. Viewed actual parasites under microscope, how parasites are cultured, how drugs are tested *in vitro*.
Website: Appears not available (outside to public) as this is a U.S. government research laboratory
Below: Some field trip pictures taken at this site:

OTRADI (Oregon Translational Research and Drug Development Institute)

Meeting contacts: Dr. Marty Smilkstein, Dr. Patricia Beckmann
Position: Medical doctor, Researchers
Website: http://www.otradi.org
Learned about: Life of typical rural African villagers, disease prevention, drugs used to prevent and treat malaria, statistics about malaria, equipment to test clinical libraries, conformal microscopy, more about life cycle of malaria.
Below: Some field trip pictures taken at this site:

Walter and Eliza Hall Institute of Medical Research

Website: http://www.wehi.edu.au/

What we did: Collaborated with them to use their video about the malaria life cycle in our game.

Below: Some video screenshots:

5.2. Website Research

Internet (learned about the malaria parasite, cures for it, mosquitoes, chemicals to kill it, etc.)

Just a few posted below as a reference.

(1) Portland scientists report major advance in fight against malaria

By Dennis Peck, The Oregonian

April 08, 2009, 9:09PM

http://www.oregonlive.com/news/index.ssf/2009/04/portland_scientists_report_maj.html

(2) Shown on next page (too large to fit on this page)

VOA News - New Compound Boosts Effectiveness of Malaria Drugs - Microsoft Internet Explorer

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New Compound Boosts Effectiveness of Malaria Drugs

By Jessica Berman
Washington
09 April 2009

Scientists might have developed a new weapon in the fight against malaria - a compound that when used in combination with existing drugs boost their effectiveness against the tropical illness.

For years, the drugs chloroquine and quinine have been front line treatments for malaria, a mosquito-borne illness that causes between 1.5 and 2 million deaths each year. According to the World Health Organization, more than 90 percent of deaths occured in Sub-Sahara Africa, mostly among children.

Judith, a four-year-old displaced girl, receives medical treatment for severe malaria as her mother keeps watch, in Goma, eastern Congo (File)

Malaria occurs when a person is bitten by a mosquito that carries the parasite. But the malaria parasite has become resistant to chloroquine and quinine. And newer drugs, including artemisinin, are becoming less effective.

Jane Kelly, a senior researcher at the U.S. Veterans Affairs Medical Center in Portland, Oregon, who led the research, says that in many areas it is difficult to monitor how people take anti-malaria drugs because of poor health care systems.

"Like in Africa, for instance, because the health infrastructure is not the same as in this country [i.e., the United States], so you would just go to a clinic and maybe you would get some medicines and then you go home [and] you take one for a day, and then you come back," she said.

Malaria parasites cause disease by invading red blood cells where they feed on an oxygen-carrying protein called hemoglobin. Anti-malaria drugs work by keeping the parasite from neutralizing a toxic byproduct of digestion.

But Kelly says the parasite gains the upper hand when anti-malarial drugs are taken sporadically. She says the parasite expels the drugs, causing resistance to medications.

Kelly and her colleagues have developed a compound that appears to block the ability of the parasite to expel anti-malarial drugs.

She says the compound readily cured drug-resistant malaria in laboratory dogs. The compound seems to boost the effectiveness of several drugs that fight malaria, including chloroquine and artemisin. But Kelly says researchers still not entirely sure why the compound works.

"Some of it is because that our drug will go in and then it will bind [to] that component [protein] that's trying to spit out all the other drugs," continued Kelly. "And in this way, that protein is occupied so it will not spit out the other drugs anymore."

Kelly says more animal testing is necessary before human trials can begin.

A paper describing the scientists' work is published this week in the journal *Nature*.

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