IUBAT – International University of Business Agriculture and Technology

Project Report

Project Name: Dengue Awareness Simulation

Course Code: CSE-455

Course Name: Computer Graphics

Submitted To:

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Introduction

Interactive computer-generated images are a new and effective way to convey information and educate people on many topics. They facilitate learning by bridging the literacy and age gap by turning complex information into clear action. This tool is particularly useful in health promotion, where interactive animations can improve public understanding by simulating real-life situations and preventing disability. Digital media literacy can convey important messages about prevention, symptoms and management. The project aims to create an interactive graphic design to educate people about influenza, focusing on prevention and mosquito life on ice.

Problem Analysis

Dengue fever affects millions of people worldwide, especially in tropical regions such as Bangladesh where the climate is suitable for mosquitoes. Urban growth, climate change and poor sanitation are major problems. Despite measures such as spraying, pesticides and education, the disease persists. Lack of participation and lack of use of simple learning tools limit the effectiveness of traditional methods.

Interactive animations address these challenges by:

• Demonstrating how stagnant water serves as mosquito breeding grounds. • Teaching preventive actions like removing standing water and using mosquito nets. • Providing simple, colorful visuals that are accessible to children and illiterate populations.

Limitations of Existing Solutions

Traditional advertising in Bangladesh has relied on posters, pages and videos. While these methods have some success, they are ineffective and do not appeal to the young or less educated. Limited exposure, low retention rates and inadequate focus on performance metrics further hinder their success.

Solution Overview

This project proposes an OpenGL-based interactive animation that visually represents mosquito behavior, breeding in stagnant water, and the transmission of dengue. The design incorporates:

- **Real-life Scenarios**: Simulated scenes of human presence near stagnant water and mosquito activity.
- **Vivid Visuals**: Bright and engaging colors to attract attention.

• **Interactivity**: User-driven animations paired with educational messages.

Addressing Requirements

• **Ease of Use**: Simple animations ensure accessibility for all age groups, making it inclusive.
• **Educational Impact**: Emphasizes preventive measures and highlights dengue symptoms. • **Future Expansion**: Features like quizzes or additional scenarios can be incorporated later.

Technical Framework

The animation leverages C++ with OpenGL for graphical rendering. The primary components include:

1. **Mosquito Simulation**
    - Models mosquito movement toward humans and breeding behavior in stagnant water.
    - Highlights risks like uncovered water containers.
2. **Human Interaction**
    - Animates a human figure to demonstrate vulnerability to mosquito bites.
3. **Educational Content**
    - Displays warnings and preventive tips when user-triggered events occur.

Code Flow

1. Initialize the OpenGL window and set up the environment.
2. Render static background elements (sky, ground, trees).
3. Draw key objects, such as a water container.
4. Animate mosquitoes and simulate interactions with the human figure.
5. Display educational messages based on user inputs.

Relevance to Bangladesh

This simulation aligns with digital awareness campaigns in Bangladesh, offering a visual and interactive approach that transcends literacy barriers. Key benefits include:

• Promoting awareness about dengue prevention, such as removing stagnant water and using mosquito nets.
• Tailoring the tool for schools and community programs to educate a wide audience. • Enhancing outreach efforts through visual storytelling and interactive engagement.

Educational institutions and community centers can combine this simulation with discussions and real-world demonstrations to amplify its impact on raising awareness.

Source Code

```
#include <GL/glut.h>

#include <iostream>

#include <cmath>

#include <vector>

#include <string>

#include <cstdlib>

#include <ctime>


struct Mosquito {

 float x, y;

 bool isBiting;

 float targetX, targetY;

};


std::vector<Mosquito> mosquitoes;
float waterLevel = -0.6f;

bool dengueTransmission = false;

bool mosquitoesActive = false;


void getRandomBiteLocation(Mosquito &mosquito) {

 mosquito.targetX = 0.35f + static_cast<float>(rand()) / (static_cast<float>(RAND_MAX /
(0.45f - 0.35f)));
```

```
 mosquito.targetY = -0.1f + static_cast<float>(rand()) / (static_cast<float>(RAND_MAX / (-
0.5f + 0.1f)));

 }


void displayText(float x, float y, const std::string &text) {

 glRasterPos2f(x, y);

 for (char c : text) {

 glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18, c);

 }

 }


void drawCircle(float cx, float cy, float r, int num_segments) {

 glBegin(GL_TRIANGLE_FAN);

 glVertex2f(cx, cy);

 for (int i = 0; i <= num_segments; i++) {

 float angle = 2.0f * M_PI * float(i) / float(num_segments);

 float x = r * cosf(angle);
 float y = r * sinf(angle);

 glVertex2f(cx + x, cy + y);

 }

 glEnd();

 }
```

```
void drawMosquito(const Mosquito &mosquito) {
glColor3f(0.0f, 0.0f, 0.0f);
 drawCircle(mosquito.x, mosquito.y, 0.02f, 20);

 glBegin(GL_LINES);
 glVertex2f(mosquito.x, mosquito.y);
 glVertex2f(mosquito.x + 0.05f, mosquito.y + 0.05f);
glVertex2f(mosquito.x, mosquito.y);
 glVertex2f(mosquito.x - 0.05f, mosquito.y + 0.05f);
glVertex2f(mosquito.x, mosquito.y - 0.02f);
glVertex2f(mosquito.x + 0.03f, mosquito.y - 0.07f);
glVertex2f(mosquito.x, mosquito.y - 0.02f);
glVertex2f(mosquito.x - 0.03f, mosquito.y - 0.07f);
glEnd();
 }

void drawHuman() {
 glColor3f(1.0f, 0.8f, 0.6f);
 drawCircle(0.4f, -0.1f, 0.05f, 20);

 glColor3f(0.0f, 0.0f, 1.0f);
 glBegin(GL_LINES);
```

```
 glVertex2f(0.4f, -0.15f);
 glVertex2f(0.4f, -0.5f);
 glVertex2f(0.4f, -0.2f);
 glVertex2f(0.3f, -0.35f);
 glVertex2f(0.4f, -0.2f);
 glVertex2f(0.5f, -0.35f);
 glVertex2f(0.4f, -0.5f);
 glVertex2f(0.35f, -0.7f);
 glVertex2f(0.4f, -0.5f);
 glVertex2f(0.45f, -0.7f);
 glEnd();

 if (dengueTransmission) {
 glColor3f(1.0f, 0.0f, 0.0f);
 displayText(0.5f, -0.2f, "Dengue Virus Transmitted!");  }
 }
void drawTree() {
 glColor3f(0.5f, 0.35f, 0.05f);
glBegin(GL_QUADS);
 glVertex2f(-0.9f, -0.8f);
 glVertex2f(-0.85f, -0.8f);
 glVertex2f(-0.85f, -0.2f);
 glVertex2f(-0.9f, -0.2f);
```

```
 glEnd();


 glColor3f(0.0f, 0.5f, 0.0f);
 drawCircle(-0.875f, 0.0f, 0.3f, 30);
drawCircle(-0.975f, 0.15f, 0.25f, 30);
drawCircle(-0.775f, 0.15f, 0.25f, 30); }


void drawBucket() {
 glColor3f(0.5f, 0.5f, 0.5f);
 glBegin(GL_QUADS);
 glVertex2f(-0.5f, -0.8f);
 glVertex2f(-0.3f, -0.8f);
 glVertex2f(-0.3f, -0.4f);
 glVertex2f(-0.5f, -0.4f);
 glEnd();
 glColor3f(0.0f, 0.0f, 1.0f);
glBegin(GL_QUADS);
 glVertex2f(-0.5f, -0.8f);
glVertex2f(-0.3f, -0.8f);
glVertex2f(-0.3f, waterLevel);
glVertex2f(-0.5f, waterLevel);
glEnd();
 }
```

```
void drawSun() {
 glColor3f(1.0f, 1.0f, 0.0f);
drawCircle(0.7f, 0.7f, 0.1f, 20); }

void drawCloud(float x, float y) {
glColor3f(1.0f, 1.0f, 1.0f);
drawCircle(x, y, 0.1f, 20);
drawCircle(x + 0.1f, y, 0.1f, 20);
drawCircle(x - 0.1f, y, 0.1f, 20); }

void drawBird(float x, float y) {
 glColor3f(0.0f, 0.0f, 0.0f);
 glBegin(GL_LINES);
 glVertex2f(x, y);
 glVertex2f(x + 0.05f, y + 0.05f);
glVertex2f(x, y);
 glVertex2f(x - 0.05f, y + 0.05f);
glEnd();
 }

void display() {
 glClear(GL_COLOR_BUFFER_BIT);
```

```
glBegin(GL_QUADS);

glColor3f(0.0f, 0.7f, 1.0f);

glVertex2f(-1.0f, 1.0f);

glVertex2f(1.0f, 1.0f);

glColor3f(0.0f, 0.5f, 0.0f);

glVertex2f(1.0f, -1.0f);

glVertex2f(-1.0f, -1.0f);

glEnd();


drawSun();

drawCloud(0.5f, 0.8f);
drawCloud(-0.5f, 0.9f);

drawTree();

drawHuman();

drawBucket();


for (const Mosquito &mosquito : mosquitoes) {

drawMosquito(mosquito);

}


if (dengueTransmission) {

glColor3f(1.0f, 0.0f, 0.0f);
```

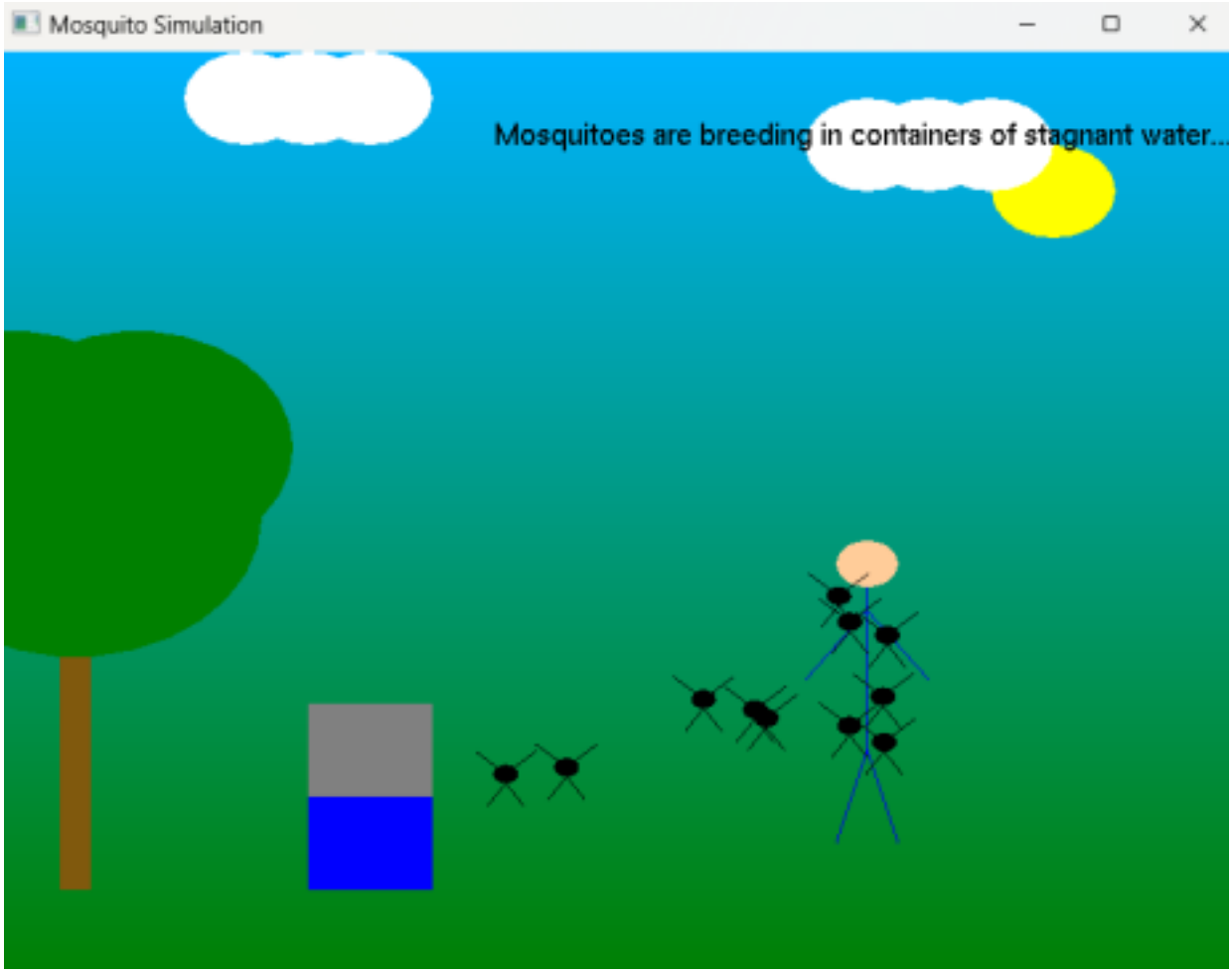
```
 displayText(-0.2f, 0.8f, "Mosquito is biting the human!");

 } else {

 glColor3f(0.0f, 0.0f, 0.0f);

 displayText(-0.2f, 0.8f, "Mosquitoes are breeding in containers of stagnant water...");  }


 glutSwapBuffers();

 }


void timer(int value) {

 if (mosquitoesActive) {

 if (mosquitoes.empty() || rand() % 50 == 0) {
 mosquitoes.push_back({-0.4f, -0.6f, false, 0.0f, 0.0f});

getRandomBiteLocation(mosquitoes.back());

 }


 for (auto &mosquito : mosquitoes) {

 if (!mosquito.isBiting) {

 mosquito.x += (mosquito.targetX - mosquito.x) * 0.02f;

mosquito.y += (mosquito.targetY - mosquito.y) * 0.02f;


 if (abs(mosquito.x - 0.4f) < 0.05f && abs(mosquito.y + 0.1f) < 0.05f) {

mosquito.isBiting = true;

 dengueTransmission = true;
```

```
}

}

}

}


glutPostRedisplay();

glutTimerFunc(16, timer, 0);

}


void handleKeypress(unsigned char key, int x, int y) {

if (key == 'b' || key == 'B') {
mosquitoesActive = true;

}

}


int main(int argc, char **argv) {

srand(time(0));


glutInit(&argc, argv);

glutInitDisplayMode(GLUT_DOUBLE | GLUT_RGB);

glutInitWindowSize(800, 600);
```

```
 glutCreateWindow("Mosquito Simulation");


glClearColor(0.0f, 0.7f, 1.0f, 1.0f);


 glutDisplayFunc(display);
 glutKeyboardFunc(handleKeypress);
 glutTimerFunc(16, timer, 0);


 glutMainLoop();
 return 0;
}
```

Here is the Simulation:

When you press the ‘b’ button / 'b' key activates mosquito movement and interaction with the human.
Here is the Simulation:



Discussion

This simulation effectively addresses key aspects of dengue prevention, including:

- **Risks of Stagnant Water**: Illustrating how stagnant water serves as a breeding ground for mosquitoes.
- **Preventive Measures**: Promoting practices like proper water management and the use of mosquito nets or repellents.
- **Accessible Communication**: Simplifying critical health information through user friendly and interactive animations.

Interactive animations serve as an impactful medium for raising awareness. They break down complex health concepts into visually engaging content, making it accessible to diverse demographic groups. By fostering a deeper understanding, the simulation encourages individuals to actively participate in dengue prevention efforts.

Conclusion

Interactive graphics present an innovative and practical approach to tackling public health issues. This project demonstrates how engaging visuals can complement traditional awareness campaigns, especially in regions with limited resources. By providing clear, actionable guidance on dengue prevention, this tool has the potential to significantly improve community health outcomes.

Future developments, such as integrating the simulation into mobile applications and offering multi-language support, could enhance its reach and ensure its effectiveness across diverse audiences.