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C++ PROJECT: “BEATBYTE”

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BEATBYTE – A Piano Game in C++ using SFML

Introduction:

BeatByte is an interactive **piano simulation game** developed using **C++** and **SFML**. It allows users to play musical notes virtually using their keyboard.

Purpose & Objectives:

The main goal of **BeatByte** is to create a virtual piano that provides **realistic sound feedback** while being intuitive and easy to use. It aims to make music learning accessible and enjoyable for everyone.

Features of This Code:

- ✓ Plays piano sounds when keys are pressed.
- ✓ Displays a visual piano keyboard.
- ✓ Uses SFML for handling graphics and audio.

Technology Used:

- **Programming Language:** C++
- **Graphics & Audio Library:** SFML
- **Development Environment:** Visual Studio

CODE

```
#include <SFML/Graphics.hpp>
#include <SFML/Audio.hpp>
#include <unordered_map>
#include <vector>
#include <string>
#include <iostream>

int main() {
    sf::RenderWindow window(sf::VideoMode(650, 300), "SFML Piano");

    // Load font
    sf::Font font;
    if (!font.loadFromFile("../Fonts/arial.ttf")) {
        std::cerr << "Error: Could not load font!" << std::endl;
        return -1;
    }

    // Load sound buffers
    std::unordered_map<sf::Keyboard::Key, sf::Sound> sounds;
    std::vector<std::string> notes = {
        "../Music/C_s.wav", "../Music/D_s.wav", "../Music/F_s.wav",
        "../Music/G_s.wav", "../Music/Bb.wav", "../Music/C_sl.wav",
        "../Music/D_sl.wav", "../Music/C.wav", "../Music/D.wav",
        "../Music/E.wav", "../Music/F.wav", "../Music/G.wav",
        "../Music/A.wav", "../Music/B.wav", "../Music/C1.wav",
        "../Music/D1.wav", "../Music/E1.wav", "../Music/F1.wav"
    };

    std::vector<sf::Keyboard::Key> keys = {
        sf::Keyboard::W, sf::Keyboard::E, sf::Keyboard::T,
        sf::Keyboard::Y, sf::Keyboard::U, sf::Keyboard::O,
        sf::Keyboard::P, sf::Keyboard::A, sf::Keyboard::S,
        sf::Keyboard::D, sf::Keyboard::F, sf::Keyboard::G,
        sf::Keyboard::H, sf::Keyboard::J, sf::Keyboard::K,
        sf::Keyboard::L, sf::Keyboard::V, sf::Keyboard::B
    };
}
```



```

std::vector<std::string> keyLabels = { "W", "E", "T", "Y",
    "U", "O", "P", "A", "S", "D", "F", "G", "H", "J", "K",
    "L", "V", "B" };

std::vector<sf::SoundBuffer> buffers(notes.size());
std::unordered_map<sf::Keyboard::Key, sf::RectangleShape> keyShapes;
std::unordered_map<sf::Keyboard::Key, sf::Text> keyTexts;

int keyWidth=40, keyHeight=200, blackKeyWidth=30, blackKeyHeight=120;

// Black key positions
std::unordered_map<sf::Keyboard::Key, float> blackKeyPositions = {
    {sf::Keyboard::W, 75}, {sf::Keyboard::E, 125}, {sf::Keyboard::T, 225},
    {sf::Keyboard::Y, 275}, {sf::Keyboard::U, 325}, {sf::Keyboard::O, 425},
    {sf::Keyboard::P, 475}
};

// White key positions
std::unordered_map<sf::Keyboard::Key, float> keyPositions = {
    {sf::Keyboard::A, 50}, {sf::Keyboard::S, 100}, {sf::Keyboard::D, 150},
    {sf::Keyboard::F, 200}, {sf::Keyboard::G, 250}, {sf::Keyboard::H, 300},
    {sf::Keyboard::J, 350}, {sf::Keyboard::K, 400}, {sf::Keyboard::L, 450},
    {sf::Keyboard::V, 500}, {sf::Keyboard::B, 550}
};

// Load sounds and create keys
for (size_t i = 0; i < notes.size(); ++i) {
    if (!buffers[i].loadFromFile(notes[i])){
        std::cerr<<"Error loading: "<<notes[i]<<std::endl;
        return -1;
    }
    sounds[keys[i]].setBuffer(buffers[i]);

    sf::RectangleShape key;
    bool isBlackKey=blackKeyPositions.find(keys[i])!=blackKeyPositions.end();

```

```

if (isBlackKey) {
    key = sf::RectangleShape(sf::Vector2f(blackKeyWidth, blackKeyHeight));
    key.setPosition(blackKeyPositions[keys[i]], 50);
    key.setFillColor(sf::Color::Black);
}
else {
    key = sf::RectangleShape(sf::Vector2f(keyWidth, keyHeight));
    key.setPosition(keyPositions[keys[i]], 50);
    key.setFillColor(sf::Color::White);
}
key.setOutlineThickness(3);
key.setOutlineColor(sf::Color::Black);
keyShapes[keys[i]] = key;

// Add key labels
sf::Text text;
text.setFont(font);
text.setString(keyLabels[i]);
text.setCharacterSize(20);
text.setFillColor(isBlackKey ? sf::Color::White : sf::Color::Black);
text.setStyle(sf::Text::Bold);
text.setPosition(key.getPosition().x + (key.getSize().x - text.getLocalBounds().width) / 2,
    key.getPosition().y + key.getSize().y - 30);
keyTexts[keys[i]] = text;
}

while (window.isOpen()) {
    sf::Event event;
    while (window.pollEvent(event)) {
        if (event.type == sf::Event::Closed)
            window.close();

        if (event.type == sf::Event::KeyPressed && sounds.find(event.key.code) != sounds.end())
        {
            if (sounds[event.key.code].getStatus() != sf::Sound::Playing) {
                sounds[event.key.code].play();
            }
            keyShapes[event.key.code].setFillColor(sf::Color::Cyan);
        }
        if (event.type == sf::Event::KeyReleased && keyShapes.find(event.key.code) != keyShapes.end())
        {
            if (blackKeyPositions.find(event.key.code) != blackKeyPositions.end())
            {
                keyShapes[event.key.code].setFillColor(sf::Color::Black);
            }
        }
        else {
            keyShapes[event.key.code].setFillColor(sf::Color::White);
        }
    }
}

```

```
window.clear(sf::Color(191, 190, 207));
```

```
// Draw white keys first
```

```
for (const auto& pair : keyShapes) {  
    if (blackKeyPositions.find(pair.first) == blackKeyPositions.end()) {  
        window.draw(pair.second);  
    }  
}
```

```
// Draw black keys on top
```

```
for (const auto& pair : keyShapes) {  
    if (blackKeyPositions.find(pair.first) != blackKeyPositions.end()) {  
        window.draw(pair.second);  
    }  
}
```

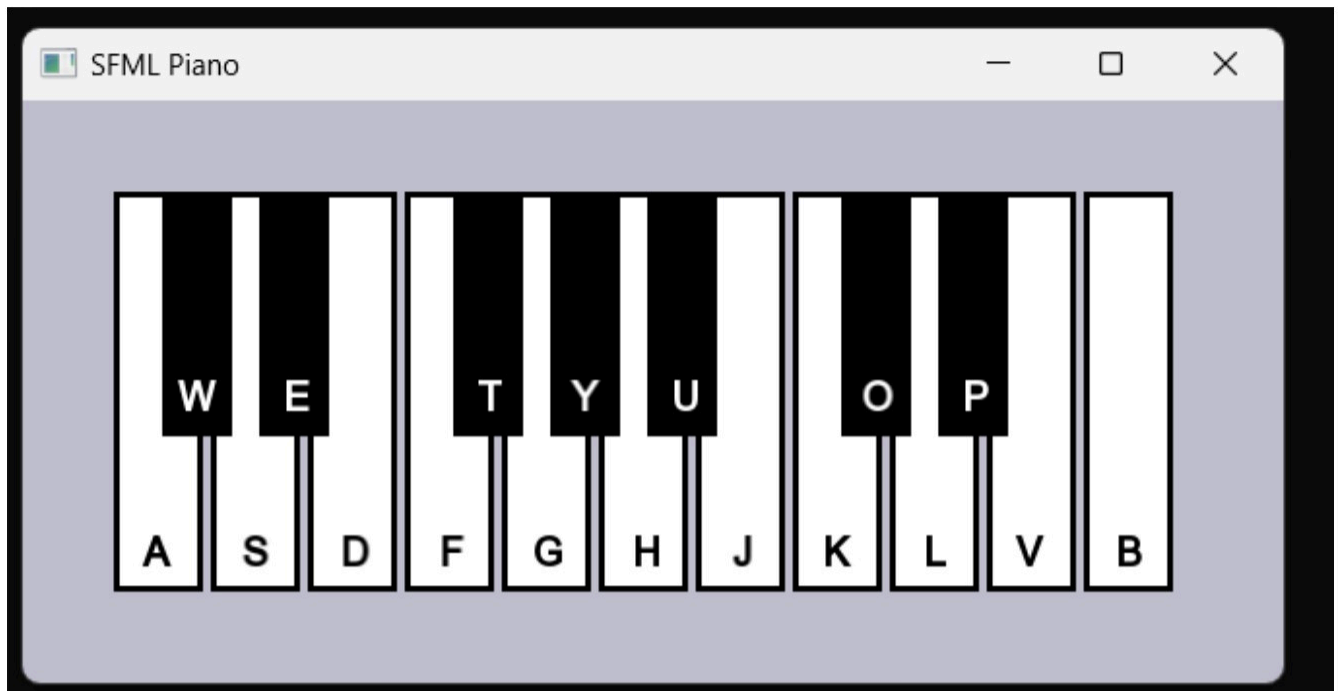
```
// Draw labels
```

```
for (const auto& pair : keyTexts) {  
    window.draw(pair.second);  
}
```

```
    window.display();  
}
```

```
    return 0;  
}
```


OUTPUT



EXPLANATION OF CODE

1. Include Necessary Libraries

- **SFML/Graphics.hpp**: Used for rendering the graphical window and drawing shapes (piano keys).
- **SFML/Audio.hpp**: Used for loading and playing sound files (piano notes).
- **unordered_map**: Used for efficient key-value lookups (mapping keys to sounds and key shapes).
- **vector**: Used for storing lists of notes, keys, and other elements.
- **string**: Used for handling file paths and labels.
- **iostream**: Used for error logging.

2. Create the Main Window

```
sf::RenderWindow window(sf::VideoMode(650, 300), "SFML Piano");
```

Creates a 650×300 pixel window titled "SFML Piano";

3. Load Font for Key Labels

```
// Load font
sf::Font font;
if (!font.loadFromFile("../Fonts/arial.ttf")) {
    std::cerr << "Error: Could not load font!" << std::endl;
    return -1;
}
```

- Loads a font (arial.ttf) for displaying key labels.
- If the font file is missing, the program prints an error and exits.

4. Define Notes and Corresponding Keyboard Keys

Define the Sound File Paths

```
// Load sound buffers
std::unordered_map<sf::Keyboard::Key, sf::Sound> sounds;
std::vector<std::string> notes = {
    "../Music/C_s.wav", "../Music/D_s.wav", "../Music/F_s.wav",
    "../Music/G_s.wav", "../Music/Bb.wav", "../Music/C_s1.wav",
    "../Music/D_s1.wav", "../Music/C.wav", "../Music/D.wav",
    "../Music/E.wav", "../Music/F.wav", "../Music/G.wav",
    "../Music/A.wav", "../Music/B.wav", "../Music/C1.wav",
    "../Music/D1.wav", "../Music/E1.wav", "../Music/F1.wav"
};
```


Map Notes to Keyboard Keys

```
std::vector<sf::Keyboard::Key> keys = {  
    sf::Keyboard::W, sf::Keyboard::E, sf::Keyboard::T,  
    sf::Keyboard::Y, sf::Keyboard::U, sf::Keyboard::O,  
    sf::Keyboard::P, sf::Keyboard::A, sf::Keyboard::S,  
    sf::Keyboard::D, sf::Keyboard::F, sf::Keyboard::G,  
    sf::Keyboard::H, sf::Keyboard::J, sf::Keyboard::K,  
    sf::Keyboard::L, sf::Keyboard::V, sf::Keyboard::B  
};
```

Define Key Labels

```
std::vector<std::string> keyLabels = { "W", "E", "T", "Y",  
    "U", "O", "P", "A", "S", "D", "F", "G", "H", "J", "K",  
    "L", "V", "B" };
```

5. Create Piano Keys

```
int keyWidth=40,keyHeight=200,blackKeyWidth=30,blackKeyHeight=120;  
  
// Black key positions  
std::unordered_map<sf::Keyboard::Key, float> blackKeyPositions = {  
    {sf::Keyboard::W,75},{sf::Keyboard::E,125},{sf::Keyboard::T,225},  
    {sf::Keyboard::Y,275},{sf::Keyboard::U,325},{sf::Keyboard::O,425},  
    {sf::Keyboard::P,475}  
};  
  
// White key positions  
std::unordered_map<sf::Keyboard::Key, float> keyPositions = {  
    {sf::Keyboard::A,50},{sf::Keyboard::S,100},{sf::Keyboard::D,150},  
    {sf::Keyboard::F,200},{sf::Keyboard::G,250},{sf::Keyboard::H,300},  
    {sf::Keyboard::J,350},{sf::Keyboard::K,400},{sf::Keyboard::L,450},  
    {sf::Keyboard::V,500},{sf::Keyboard::B,550}  
};
```

6. Load Sounds and Create Key Shapes

- Loads sounds into **sf::SoundBuffer** and associates them with **sf::Sound**.
- Creates white and black keys and positions them correctly.
- Assigns labels to keys.

7. Main Game Loop

```
while (window.isOpen()) {
    sf::Event event;
    while (window.pollEvent(event)) {
        if (event.type == sf::Event::Closed)
            window.close();

        if(event.type==sf::Event::KeyPressed && sounds.find(event.key.code) != sounds.end())
        {
            if(sounds[event.key.code].getStatus() != sf::Sound::Playing) {
                sounds[event.key.code].play();
            }
            keyShapes[event.key.code].setFillColor(sf::Color::Cyan);
        }
        if(event.type == sf::Event::KeyReleased && keyShapes.find(event.key.code) != keyShapes.end())
        {
            if(blackKeyPositions.find(event.key.code) != blackKeyPositions.end())
            {
                keyShapes[event.key.code].setFillColor(sf::Color::Black);
            }
            else {
                keyShapes[event.key.code].setFillColor(sf::Color::White);
            }
        }
    }

    window.clear(sf::Color(191, 190, 207));
}
```

Summary

- This **SFML piano program** uses **graphical rendering** and **audio playback**.
- It **maps keyboard keys** to corresponding piano notes.
- It provides **visual and audio feedback** when keys are pressed.
- **White and black keys** are drawn correctly.

Songs Played

1) Happy Birthday

A S A F D
A S A G F
A K H F D S
U H F G F

2) Tum Hi Ho

J G H
G H J G H
T H G
T D T D S D

3) Sa Re Ga Ma

A S D F G H J K
K J H G F D S A