

# Team 2 Goofy Lights Editor

## CS-383

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April 9, 2017

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## 1 About this Project

This project is a alteration of the Tower Lights Project done in previous semesters for Cs 383 at the University of Idaho. The end goal of this project is to create an editor for the Goofy Glasses. goofy glasses are a creation of the University of Idaho computer science department, goofy glasses are normal sun glasses, with RGB LED lighting, and a transmitter to send and receive data to turn the LED's on each pair of glasses on or off, as well as change the color the glasses are currently displaying. The editor we (team 2) are creating will be able to set specific coloring patterns for all of the goofy glasses at once. The general idea behind this is to create a grid with individual squares, where each square represents a single pair of goofy glasses. The user will then be able to create frames, and make a slide show of frames, and transmit the data from the slide show to the goofy glasses to create a scene.

## 2 Design process

The general outline of the development process can be simplified into three basic steps. Our first order of business was to start developing back-end functionality for the use cases specified (see appendix). Secondly, we created a basic GUI template to visualize layout, and speculate where extra functionality may be needed. Lastly, our focus was placed on integrating the back-end functionality we created with the GUI to bring everything together.

### 2.1 Problems encountered

Some of the issues we have encountered as a team are presented below. Originally we created a set of global variables, that almost every function would need access to such as, row#, col#, and RGB data. This worked great for testing purposes, but has created scoping issues for future updates. We are currently working on changing all of the global variables previously mentioned into local variables. We are currently working on altering our existing functions to deal with this scope change from global to local. We also originally created a RGB type, and are now altering

this to an already existing Qt RGB type called QColor. Lastly, we are currently considering data flow, and how data will be used by our goofy lights editor we have discussed creating some data flow diagrams to help visualize this process.

### 3 Figures

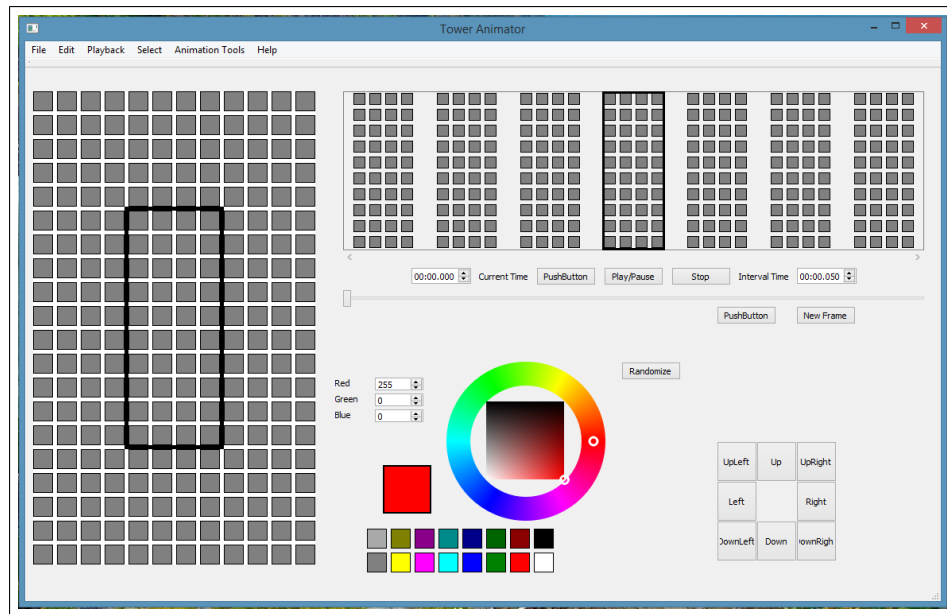


Figure 1: Original GUI design from previous tower lights project

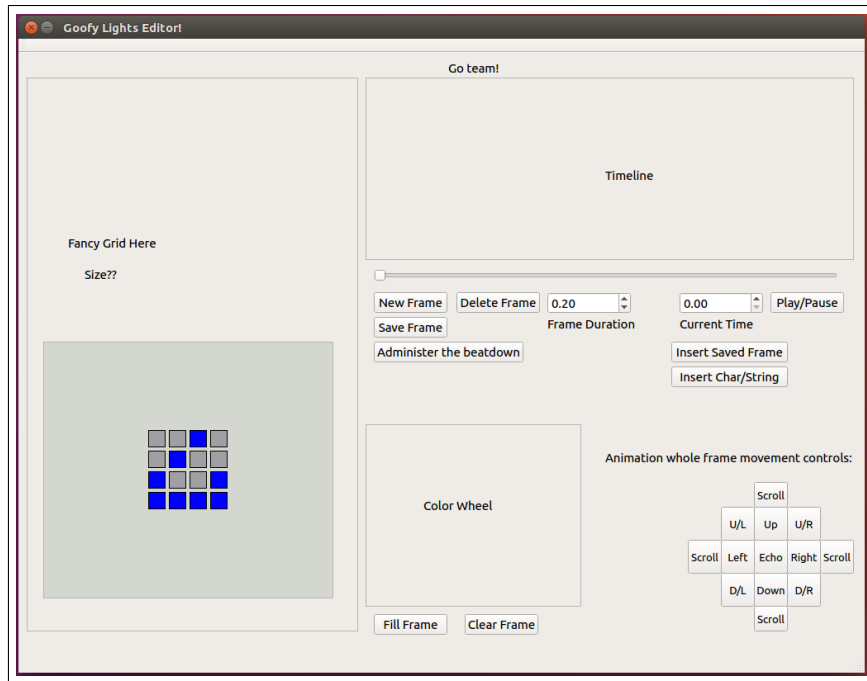


Figure 2: Our initial GUI after first sprint

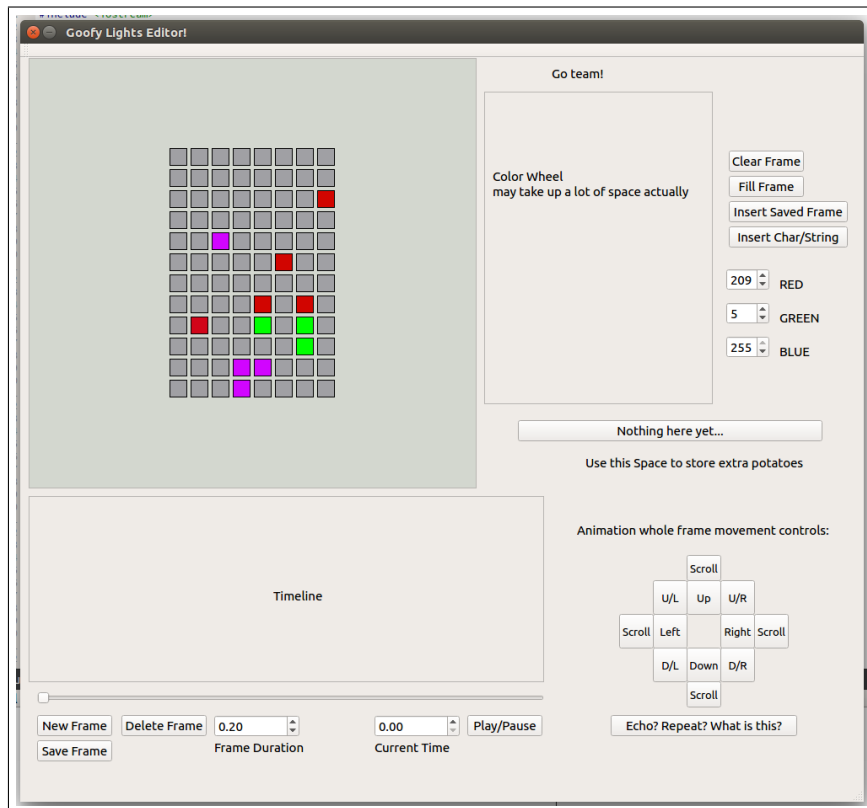


Figure 3: GUI after second sprint, RGB functionality added

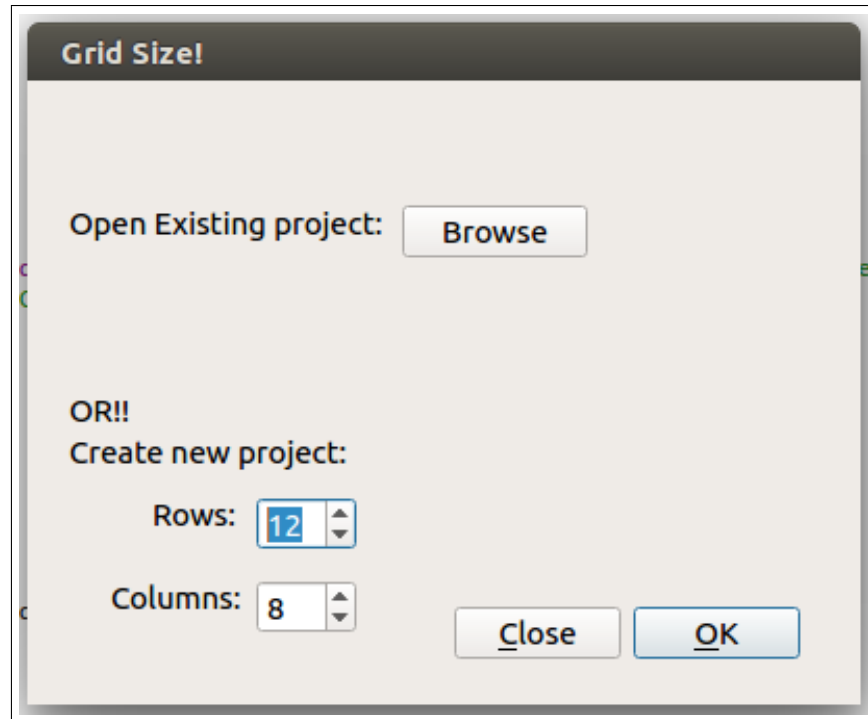


Figure 4: Grid size selection dialog added

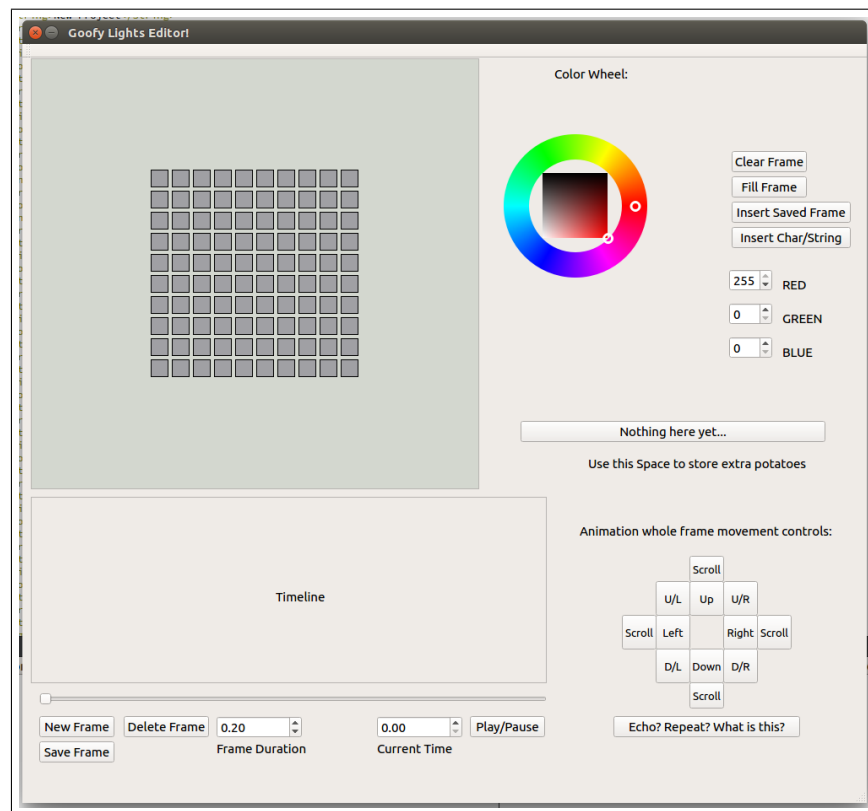


Figure 5: Color wheel added in sprint 3

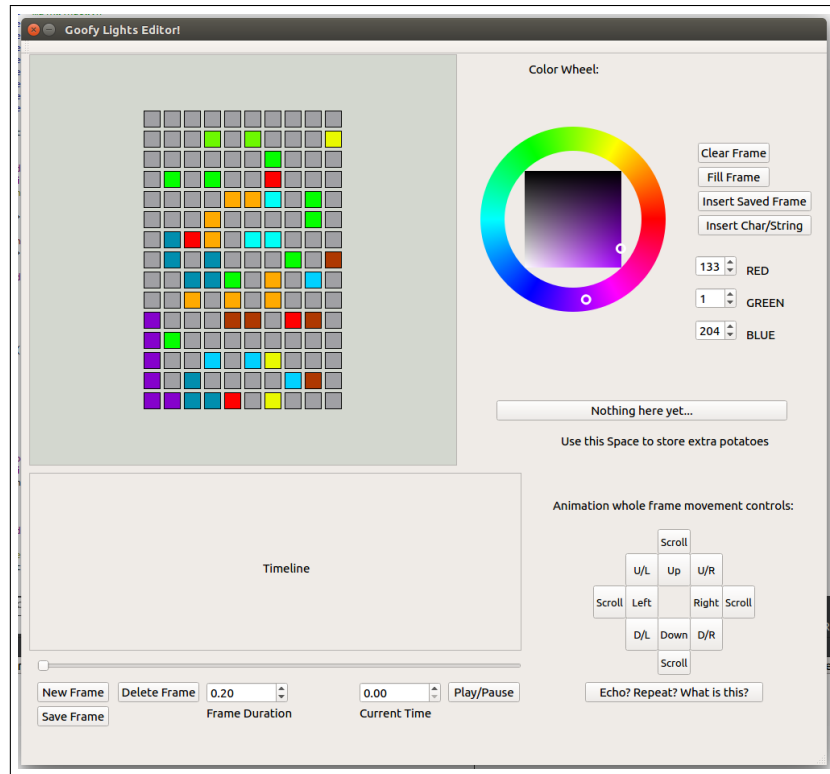


Figure 6: Color wheel demo

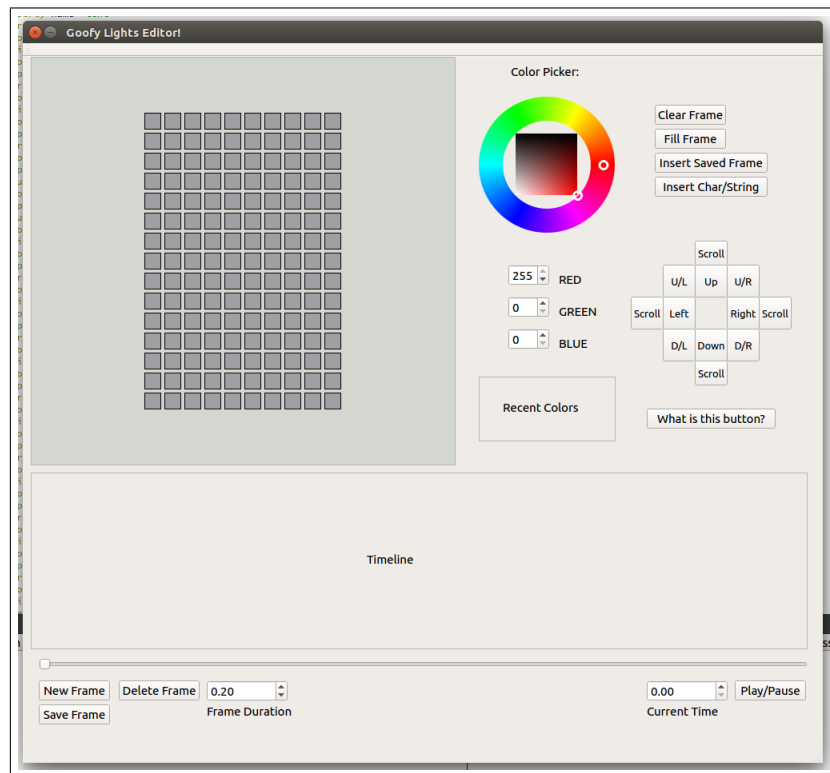


Figure 7: Control buttons moved in sprint 3

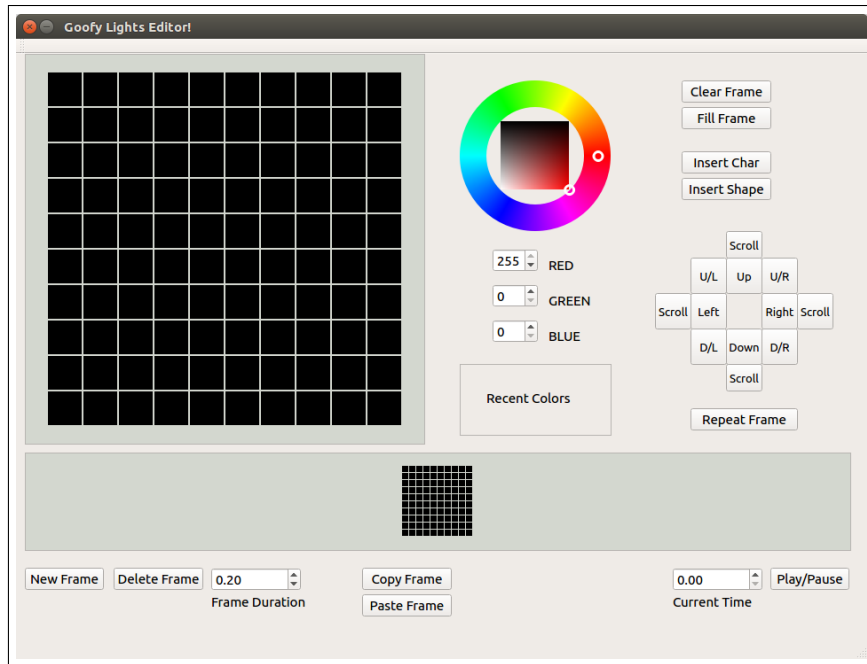


Figure 8: Timeline implemented. Default squares now black

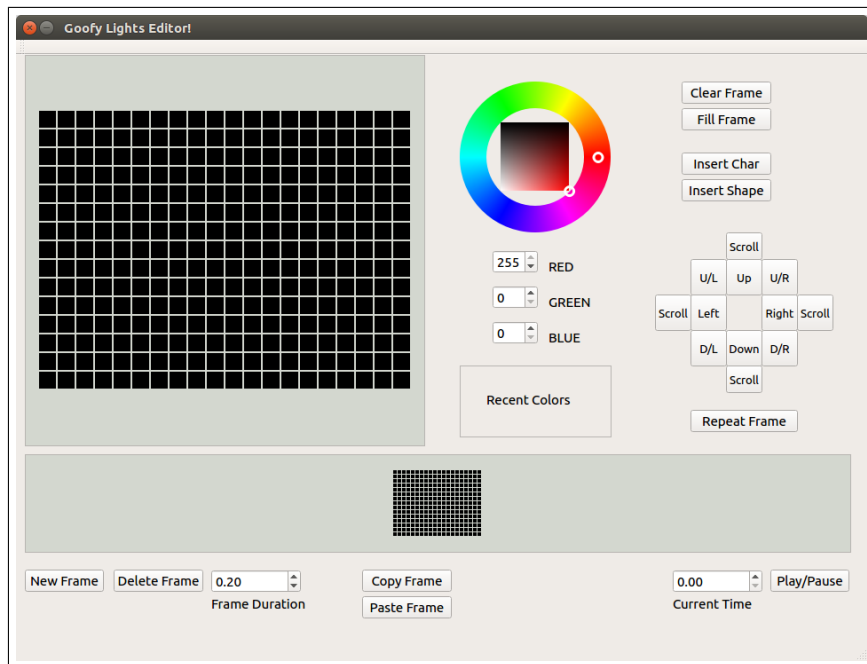


Figure 9: Grid size demo 15x20

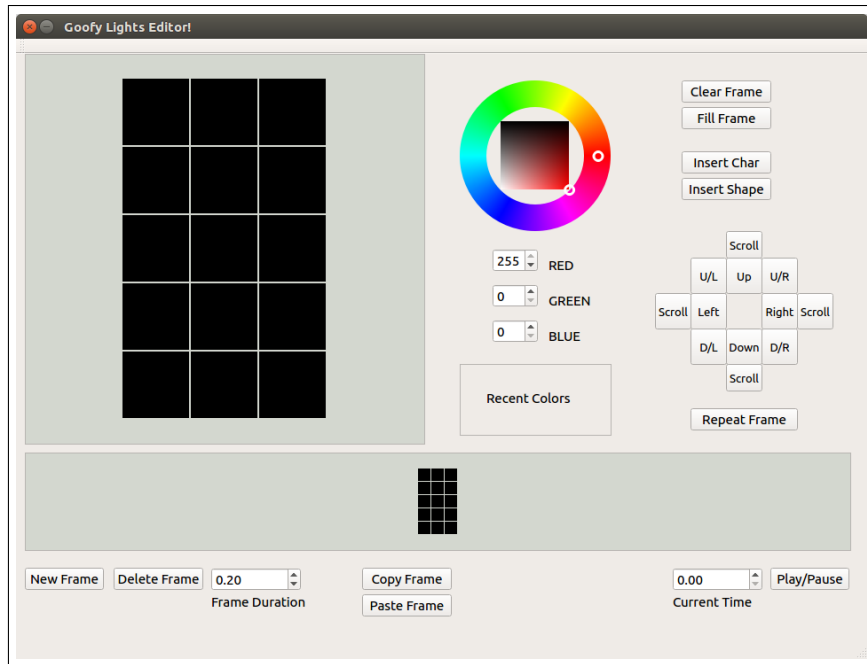


Figure 10: Grid size demo 5x3

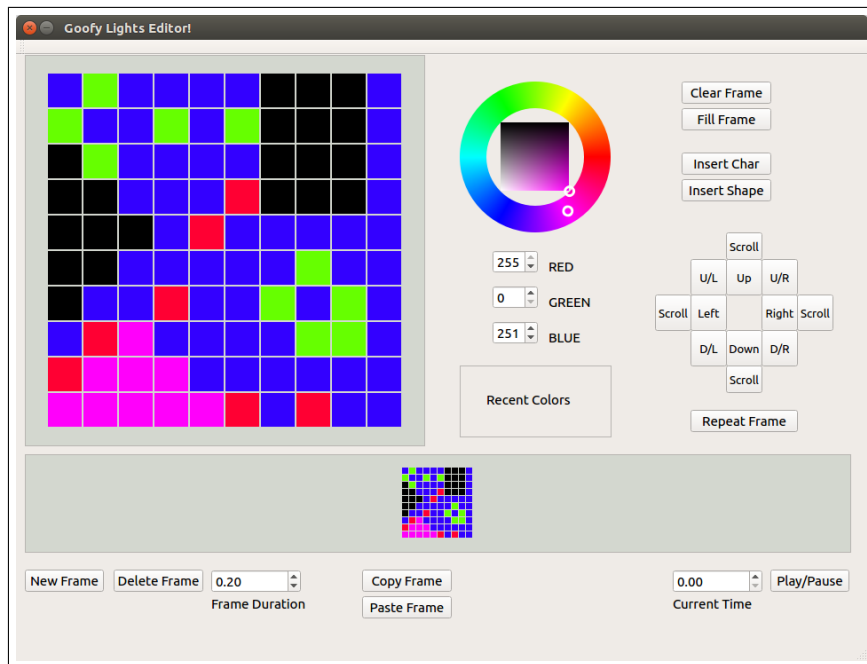


Figure 11: GUI usage demo at the end of sprint 3



### 3.1 Timeline

---

Rough timeline, revision #2  
Starting March 30th (Thursday)

Week 1: (completed)

- 1) Rough out GUI
- 2) Create data structure
- 3) Start file manipulation functions
- 4) Make something to look at (pretty colors)

Week 2:

Sprint 2:

- 1) Add Row/Column data to Framedata
  - 2) Delete attached RGB structures
  - 3) Copy Framedata
  - 4) Retrieve frame x
  - 5) Fix RGB bug
  - 6) Update frame x
- //finish by TUESDAY???

Week 3:

Sprint 3:

SOLIDIFY GUI LAYOUT (buttons, sliders, sizes)  
Start filling out the functionality of buttons

Week 4:

Sprint 4:

Finish all functionality  
Add extra features  
Start final documentation

Week 5:

Final sprint??

System testing, find bugs, hopefully something works mostly  
Update UML diagrams  
Polish final documentation

---

## 4 UML Diagrams

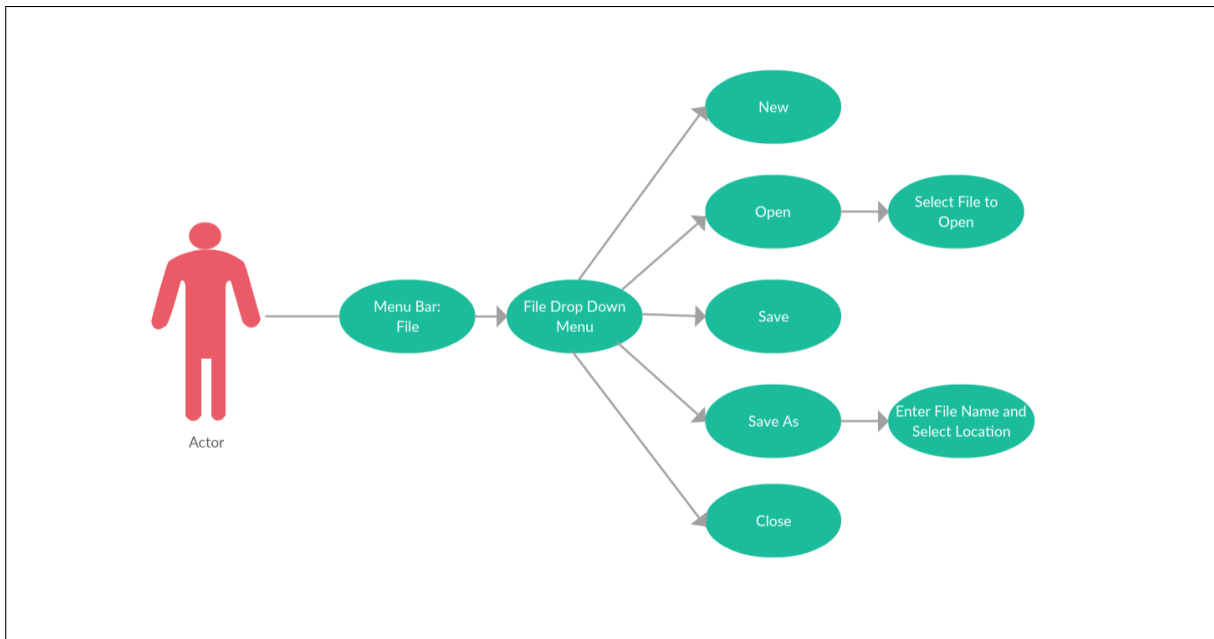


Figure 12: File manipulation

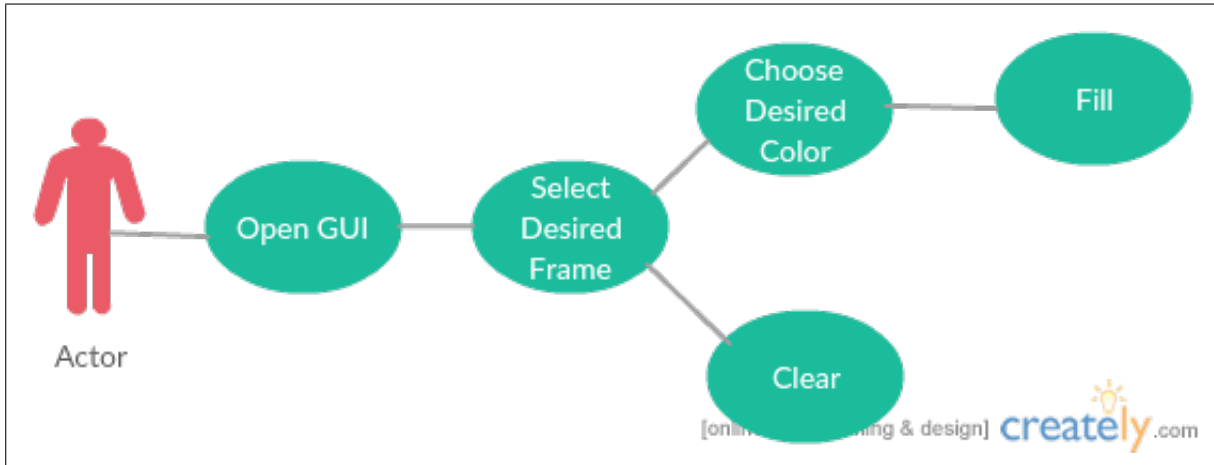


Figure 13: Fill or clear frame with current color

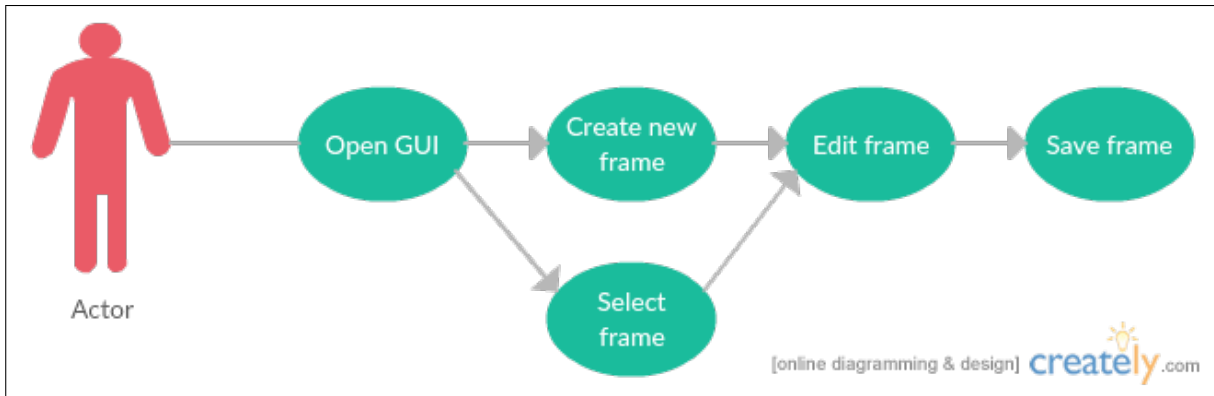


Figure 14: Save/copy current frame for re-use in animation

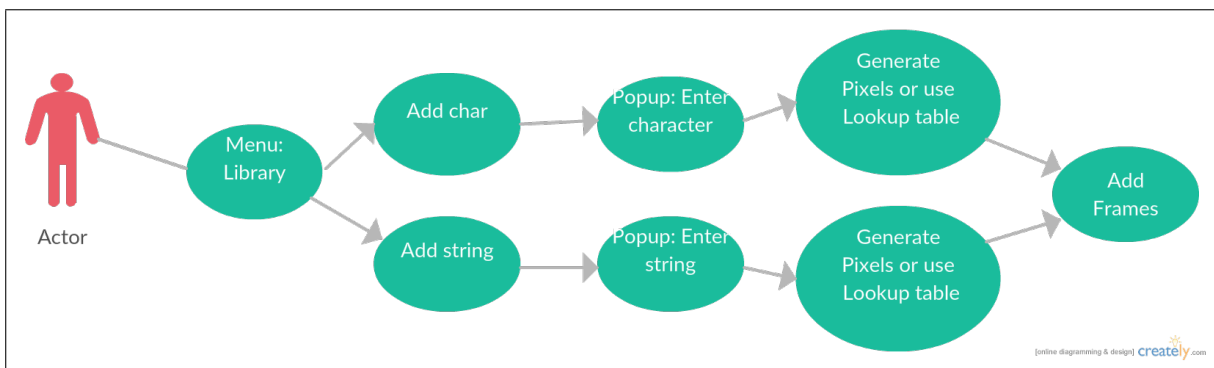


Figure 15: Add char/string from predefined set

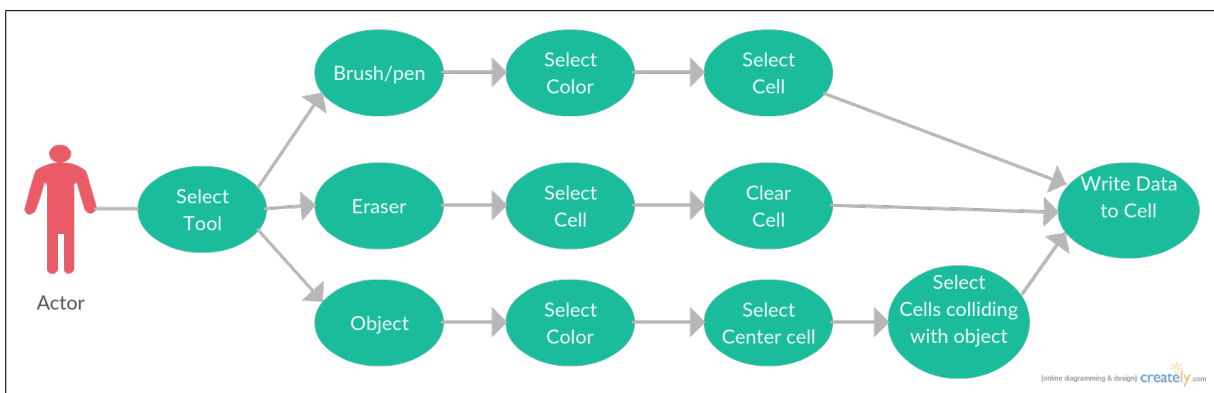


Figure 16: Add a pixel in any position in any color

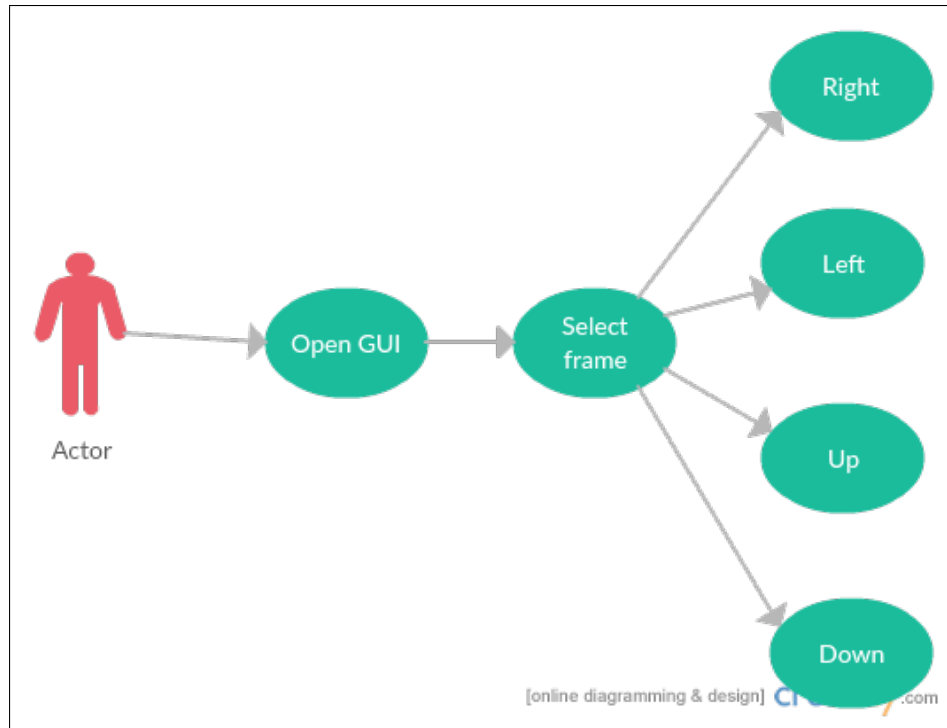


Figure 17: Move everything in frame 1 pixel in a direction

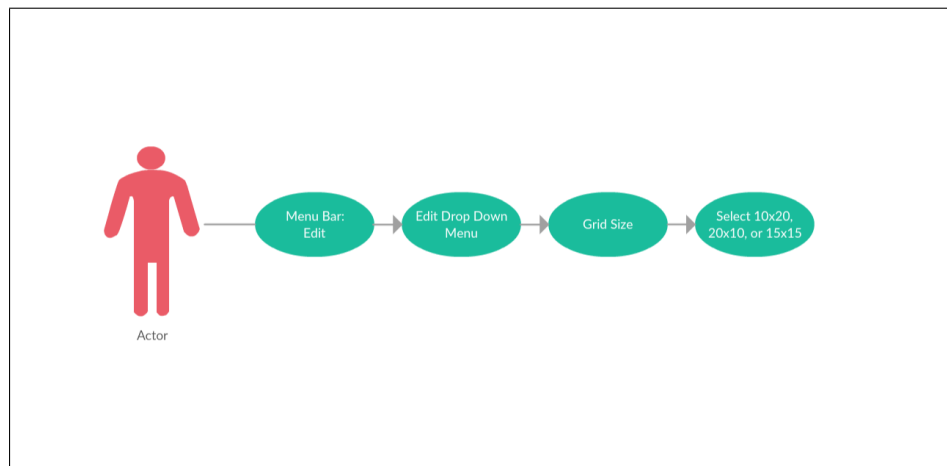


Figure 18: Choose grid size for the file

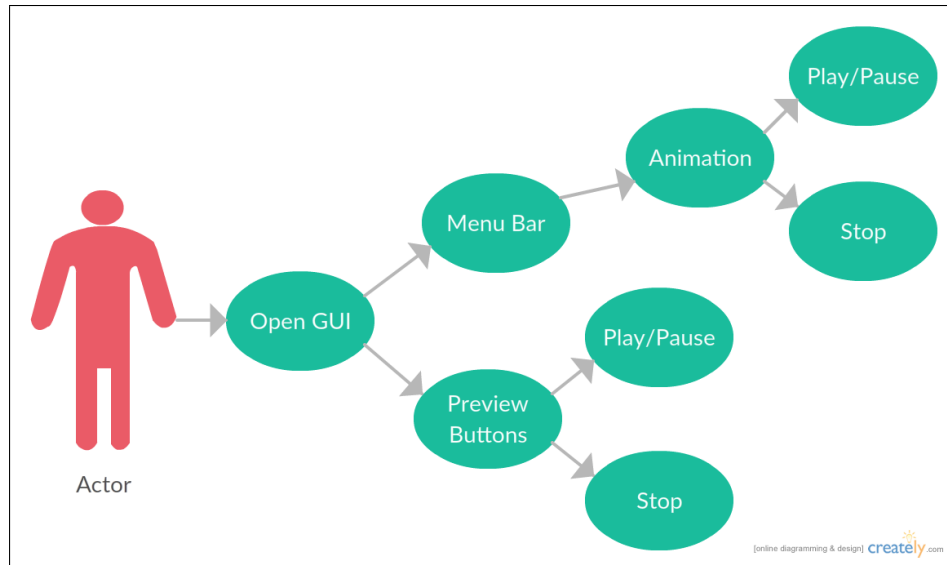


Figure 19: Preview play/pause/stop animation

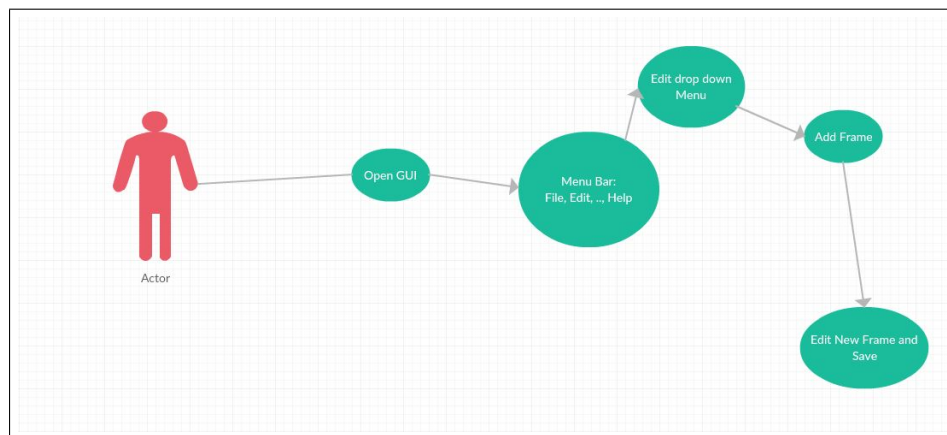


Figure 20: Create new frame

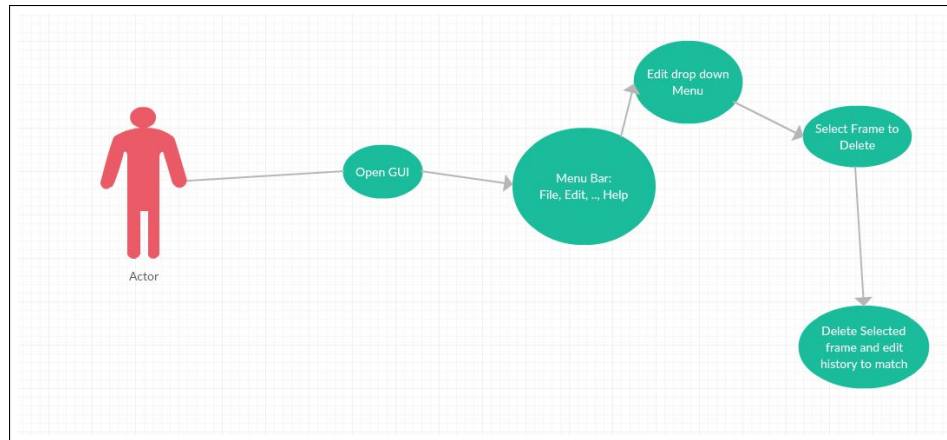


Figure 21: Delete a frame

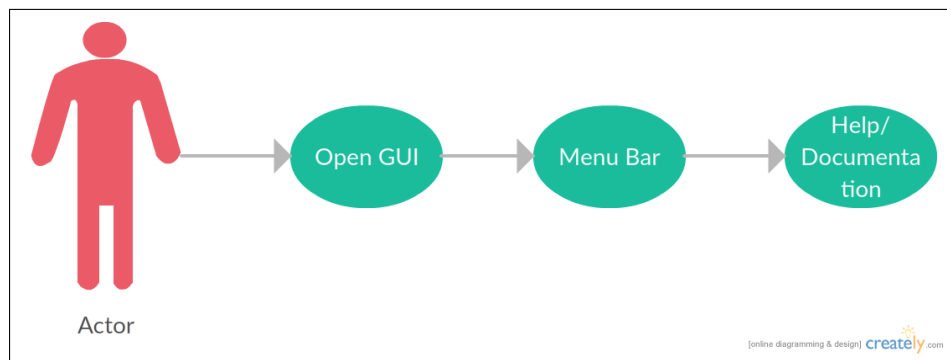


Figure 22: Open help/documentation text

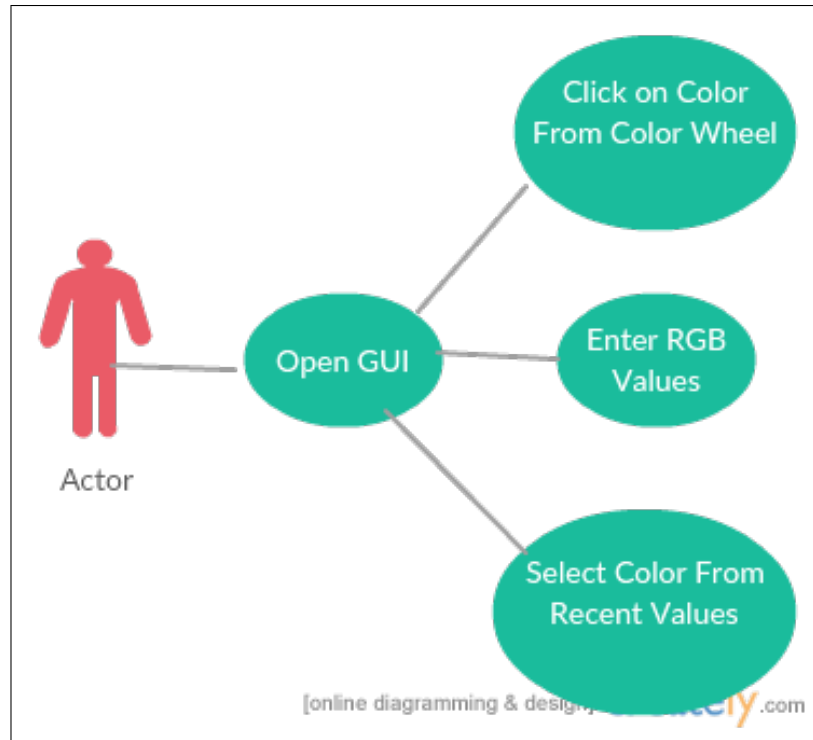


Figure 23: Chose a color on the colorwheel

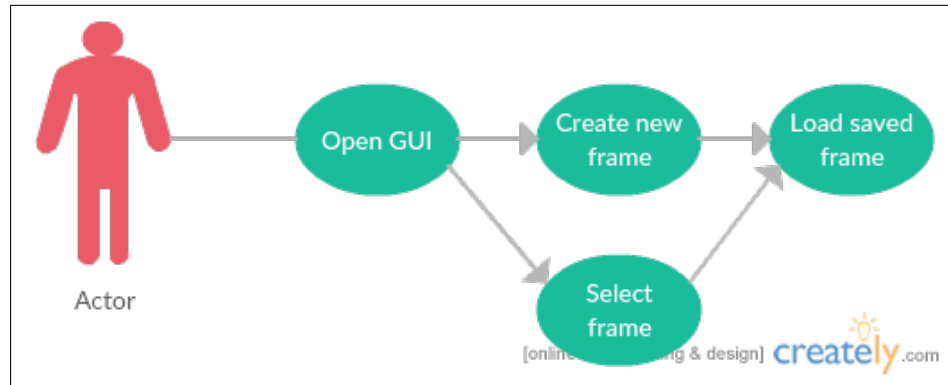


Figure 24: Insert a saved frame

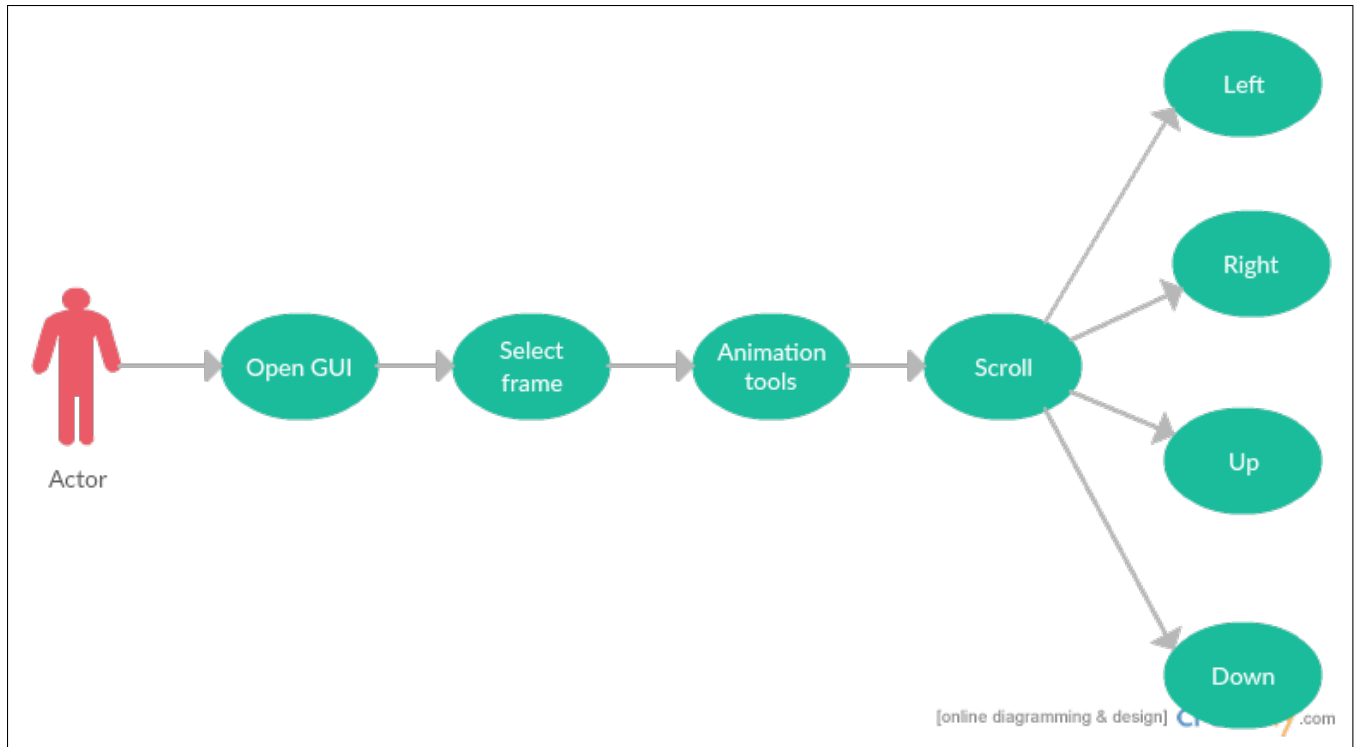


Figure 25: Scroll everything across entire frame



## 5 Files

### 5.1 main.cpp file

---

```
#include <iostream>
#include "mainwindow.h"
#include <QApplication>

#include "framestructure.h"
#include "FrameList.h"
#include "FrameManipulation.h"
#include "FileOperations.h"
#include <globals.h>
#include <sizedialog.h>

int G_COL = 0; //initialize globals -P
int G_ROW = 0;
double G_SCALE = 0;

int G_RED = 255;
int G_GREEN = 0; //fixed -P
int G_BLUE = 0;
int G_RED_RIGHT = 0;
int G_GREEN_RIGHT = 0;
int G_BLUE_RIGHT = 0;

int G_FRAMECOUNT = 0; //hah -P

long FrameIDCount = 0;

// creates the dynamic RGB array
t_RGB** create_RGB(int r, int c);

int main(int argc, char *argv[])
{
    QApplication a(argc, argv);
    //LET'S GET IT STARTED -P
    SizeDialog dialog1;
    dialog1.setWindowFlags(Qt::Window | Qt::WindowTitleHint | Qt::CustomizeWindowHint);
    //You will NOT exit this window your way -P
    dialog1.setModal(true); //YOU SHALL NOT CLICK OUTSIDE OF THIS WINDOW -P
    dialog1.exec(); //execute pls -P

    //read in a file here probably -P

    MainWindow w;
    w.show();

    // linked list test
    std::cout << "FrameList testing" << std::endl;
```

```

t_RGB ** rgb_data;

t_FrameData FrameData; // Local frame data
FrameList frames(G_ROW, G_COL); // linked list for frame data. r c for print function

//Frame 0
// Generate new rgb_data array
rgb_data = create_RGB(G_ROW, G_COL);

// fill rgb_data for Frame 0
unsigned short color = 0; // arbitrary data
for (int i = 0; i < G_ROW; i++){
    for (int j = 0; j < G_COL; j++){
        rgb_data[i][j].R = color++;
        rgb_data[i][j].G = color++;
        rgb_data[i][j].B = color++;
    }
}
FrameData.ID = FrameIDCount++;
FrameData.duration = 123;
FrameData.data = rgb_data;
frames.AddTail(FrameData); // add this frameData to linked list
rgb_data = NULL; // disconnect this pointer from rgb_data

// next frame Frame 1
// Generate new rgb_data array
rgb_data = create_RGB(G_ROW, G_COL);

// fill rgb for Frame 1
color = 100; // arbitrary increment to make data different
for (int i = 0; i < G_ROW; i++){
    for (int j = 0; j < G_COL; j++){
        rgb_data[i][j].R = color++;
        rgb_data[i][j].G = color++;
        rgb_data[i][j].B = color++;
    }
}
FrameData.ID = FrameIDCount++;
FrameData.duration = 212;
FrameData.data = rgb_data;
frames.AddTail(FrameData);
rgb_data = NULL; // disconnect this pointer from rgb_data

// next frame Frame 2
rgb_data = create_RGB(G_ROW, G_COL);
FrameData.ID = FrameIDCount++;
FrameData.duration = 214;
FrameData.data = rgb_data;
fillFrame2(FrameData, 21, 32, 45);
frames.AddTail(FrameData);

// copyFrame Test Frame 3

```

```
t_FrameData newFrame;
rgb_data = create_RGB(G_ROW, G_COL);
newFrame.ID = FrameIDCount++;
newFrame.duration = 217;
newFrame.data = rgb_data;
copyFrame(newFrame, FrameData);
frames.AddTail(newFrame);

// std::cout << "Now printing frames" << std::endl;
// frames.PrintNode();
FrameList frameList;
FileOperations::LoadFromFile("autofill.proj", &frameList);
frameList.PrintNode();
FileOperations::SaveToFile(frames, "autofill.proj");

frames.DeleteList();
std::cout << "Program end" << std::endl;
return a.exec();
}
```

---

## 5.2 FrameList.h file

---

```
/* Tim Sonnen      Lab #5
 * 9/24/2015
 *
 * FrameList.h
 * Class that holds a linked list
 */

#ifndef LINK_H
#define LINK_H

#include <iostream>
#include "framestructure.h"
class FrameList{
private:
    struct Node{
        t_FrameData FrameData;
        struct Node *next;
        struct Node *prev;
    };
    typedef struct Node* NodePtr;

    NodePtr head;
    NodePtr tail;
    int row, col;
    int count;

public:
    // Constructor
    FrameList(int r, int c){
        head = NULL;
        row = r;
        col = c;
        count = 0;
    }

    // Constructor for empty FrameList
    FrameList(){
        head = NULL;
        row = 0;
        col = 0;
        count = 0;
    }

    // Destructor
    ~FrameList(){
        FrameList::DeleteList();
    }
    // Add a node onto the end of the linked list.
    void AddTail(t_FrameData x);

    // Function will call DeleteNode for every item in the Linked List, and delete
```

```

// the head node until all items in the linked list have been deleted.
void DeleteList();

// Delete the first node in the list.
void DeleteNode();

// Add node at position x
// 0 will be the first node. 1 would be the 2nd node in the list.
void AddNode_Middle(t_FrameData x, int pos);

// Delete node at position x in the list
// If pos == 0 this refers to the head node, and
// If pos == count - 1 this refers to the tail node.
void DeleteNode_Middle(int pos);

// retrieve node at given position x.
// If pos == 0 this refers to the head node and,
// If pos == count - 1 this refers to the tail node.
t_FrameData * RetrieveNode_Middle(int pos);

// Return the first node found in the list
t_FrameData FirstNode();

// Advance one node in the list
int AdvanceList();

// Get the row count
int GetRowCount();

// Get the column count
int GetColCount();

// Output the values in the nodes, one integer per line.
void PrintNode();

//Returns a value if the list is empty
int IsEmpty();

// Return a count of the number of nodes in the list.
int Size();

// Updates frame data
void UpdateNode(t_FrameData d, int position);
};
#endif

```

---

### 5.3 FrameList.cpp file

---

```
/* Tim Sonnen      Lab #4
 * 9/25/2015
 *
 * FrameList.cpp
 *
 */

#include <iostream>

#include "FrameList.h"
#include "framestructure.h"

using namespace std;

/* Add an item to the end of the list*/
void FrameList::AddTail( t_FrameData n ){
    NodePtr p;

    //Allocate the node
    p = new Node;
    p->FrameData = n;
    p->next = NULL;

    //Check if the list is empty
    if(head == NULL ){
        head = p;
        tail = p;
        p->prev = NULL;
    }
    else{
        // next/prev pointers
        tail -> next = p;
        p -> prev = tail;

        // update tail pointer
        tail = p;
    }
    this->count++;
}

/*Function to delete all the entries in the Linked List upon program termination */
void FrameList::DeleteList(){
    while (head != NULL)
    {
        DeleteNode();
    }
}

/*Deletes the first node in the list*/
void FrameList::DeleteNode(){
    NodePtr p = head;
```

```

if( p == NULL){
    /*Nothing. Error case.*/
    return;
}
else{
    head = p->next;
    p->next = NULL;
    if (head != NULL)
        head->prev = NULL; //this is causing a seg fault when I close -P
    // Delete Attached RGB structure here
    delete p;
}
this->count--;
}

void FrameList::AddNode_Middle(t_FrameData x, int pos){
    // indexing scheme to start at 0 to n where n == items in linked list
    // Node 0 is the head of the list while node (count - 1) is the tail
    int tempCount = 0;

    NodePtr current = head;
    NodePtr insert = new Node;
    insert -> FrameData = x;
    insert -> next = NULL;
    insert -> prev = NULL;

    if (head == NULL)
    {
        head = insert;
    }

    else if (pos == 0)
    {
        insert -> next = head;
        insert -> prev = NULL;
        head -> prev = insert;
        head = insert;
        this->count++;
        return;
    }
    else
    {
        while (tempCount != pos-1 && current != NULL)
        {
            current = current -> next;
            tempCount++;
        }
        insert -> next = current -> next;
        // Adjustment of previous pointer for addition of node x
        if (current -> next != NULL)
        {
            NodePtr p = current -> next;
            p -> prev = insert;
        }
    }
}

```

```

    }
    // else if current -> next == null then insert == null above

    // Adjustment of prev pointer for node added at position x
    current -> next = insert;
    insert -> prev = current;

    this->count++;
    return;
}
}

void FrameList::DeleteNode_Middle(int pos){

    if (head == NULL){
        // Error list is empty, do nothing and return.
        return;
    }

    NodePtr current = head;

    if (pos == 0){
        // Delete the head node.
        head = current -> next;
        if (head != NULL)
            head -> prev = NULL;
        // Delete Attached RGB structure here
        delete(current);
        this->count--;
        return;
    }

    for (int i = 0; current != NULL && i < pos - 1; i++){
        current = current -> next;
    }

    if (current == NULL || current -> next == NULL){
        // the position given is greater than total number of nodes in the list.
        return;
    }

    // if this point has been reached and the function has not returned, current -> next
    // holds
    // the node to be deleted from the list.
    NodePtr p = current -> next -> next;
    // Adjustment of previous pointers.
    p -> prev = current;
    // Delete Attached RGB Structure here
    delete (current -> next);
    current -> next = p;
    this->count--;
    return;
}
}

```



```

// Added function to search the lined list for node at position x
// same indexing scheme as before, passing 0 to this function refers to the head
// passing count - 1 to this function refers to the tail.
t_FrameData * FrameList::RetrieveNode_Middle(int pos){
    int tempCount = 0;
    t_FrameData *rtnVal = NULL;
    NodePtr temp = head;

    if (pos == 0)
    {
        // return pointer to the head node's FrameData.
        if (head == NULL)
        {
            // no pointer to return Error.
            return NULL;
        }
        else
        {
            *rtnVal = head -> FrameData;
            return rtnVal;
        }
    }
    else
    {
        while (tempCount != pos && temp != NULL)
        {
            tempCount++;
            temp = temp -> next;
        }

        if (temp != NULL)
        {
            // Just checking to make sure no bounds have been crossed.
            *rtnVal = temp -> FrameData;
            return rtnVal;
        }
        else
        {
            return NULL;
        }
    }
}

/*Returns the first node in the list */
t_FrameData FrameList::FirstNode(){
    return head->FrameData;
}

/* Advance one node through the list */
int FrameList::AdvanceList(){
    this->head = this->head->next;

    /* If we are out of the list return 0, else return 1 */
    if (this->head == NULL)

```

```

        return 0;
    else
        return 1;
}

/* Get the row count */
int FrameList::GetRowCount(){
    return this->row;
}

/* Get the column count */
int FrameList::GetColCount(){
    return this->col;
}

/*Returns if the list is empty or not*/
int FrameList::IsEmpty(){
    if(head == NULL){
        return 1;
    }
    else{
        return 0;
    }
}

void FrameList::PrintNode(){
    NodePtr p = head;
    /* sample output
       ID: 0 Dur: 123
       0,1,2 : 3,4,5 : 6,7,8 :
       9,10,11 : 12,13,14 : 15,16,17 :
       18,19,20 : 21,22,23 : 24,25,26 :
       27,28,29 : 30,31,32 : 33,34,35 :
       36,37,38 : 39,40,41 : 42,43,44 :
    */

    while(p != NULL){
        cout << "ID: " << p->FrameData.ID << "\tDur: " << p->FrameData.duration << endl;
        for (int i = 0; i < row; i++) {
            for (int j = 0; j < col; j++) {
                cout << p->FrameData.data[i][j].R << "," << p->FrameData.data[i][j].G
                    << "," << p->FrameData.data[i][j].B << " : ";
            }
            cout << endl;
        }
        cout << endl;
        p = p->next;
    }
}

int FrameList::Size(){
    return this->count;
}

```

```

void FrameList::UpdateNode(t_FrameData d, int position)
{
    int pcount = 0;
    NodePtr current = head;
    NodePtr temp = new Node;
    NodePtr old;
    temp -> FrameData = d;
    temp -> next = NULL;
    if (position == 0)
    {
        if (head == NULL)
            head = temp;
        else if (head -> next == NULL)
        {
            head = temp;
            delete current;
        }
        else
        {
            old = current;
            current = current -> next;
            temp -> next = current;
            delete old;
        }
    }
    else
    {
        current = current -> next;
        pcount++;
        while (pcount != position-1)
        {
            current = current -> next;
            pcount++;
        }
        temp -> next = current -> next -> next;
        old = current -> next;
        current -> next = temp;
        delete old;
    }
    return;
}

```

---

## 5.4 FrameManipulation.h file

---

```
#ifndef FRAMEMANIPULATION_H
#define FRAMEMANIPULATION_H

#include "framestructure.h"

// Directions
#define D_UP      1
#define D_DWN    2
#define D_LEFT   3
#define D_RIGHT  4
#define D_UP_L   5
#define D_UP_R   6
#define D_DWN_L  7
#define D_DWN_R  8

// Return codes
#define SUCCESSFUL 0
#define ERROR      1

// Prototypes

// creates a RGB Array and returns a pointer to it.
t_RGB** create_RGB(int r, int c);

// Takes original frame and returns a new copy of it
int copyFrame(t_FrameData &copyFrame, t_FrameData origFrame);

// translates from by a given direction
int translateFrame(t_FrameData d, int direction);

// Fills given frame with color
int fillFrame(t_FrameData &d, t_RGB rgb_fill);
int fillFrame2(t_FrameData &d, unsigned short r, unsigned short g, unsigned short b);

#endif // FRAMEMANIPULATION_H
```

---

## 5.5 FrameManipulation.cpp file

---

```
#include "FrameManipulation.h"
#include <iostream>
#include "globals.h"

// Function creates a 2d memory element of the RGB struct then passes back the pointer
// to it.
t_RGB** create_RGB(int r, int c)
{
    t_RGB** arr = new t_RGB*[r];
    for(int i = 0; i < r; ++i)
        arr[i] = new t_RGB[c];
    return arr;
}

// creates a RGB Array and returns a pointer to it.
t_RGB** create_RGB(int r, int c);

// Takes original frame and returns a new copy of it
// Frame must be declared and rgb_data array must already be allocated
int copyFrame(t_FrameData &copyFrame, t_FrameData origFrame)
{
    // Error checking
    if (origFrame.data == NULL)
        return ERROR;

    int i, j; // loop control

    //Fill rgb_data with data from FrameData
    for (i = 0; i < G_ROW; i++) {
        for (j = 0; j < G_COL; j++) {
            copyFrame.data[i][j] = origFrame.data[i][j];
        }
    }

    return SUCSESSEFUL;
}

// translates from by a given direction
int translateFrame(t_FrameData d, int direction)
{
    int i = 0; //counters
    int j = 0;
    t_RGB *temp; //Temp variable for row that is pushed out of the frame
    t_RGB emptyRGB;
    emptyRGB.B = 0;
    emptyRGB.G = 0;
    emptyRGB.R = 0;
```

```

//Condition for up, up left, and up right. Uses recursion for left and right
translation
if(direction == D_UP || direction == D_UP_L || direction == D_UP_R){
    temp = d.data[0];
    for(i = 0; i < G_ROW-1; i++){
        d.data[i] = d.data[i+1];
    }
    d.data[i] = temp;
    for(int j = 0; j < G_COL; j++){
        d.data[i][j] = emptyRGB;
    }
    if(direction == D_UP_L)
        translateFrame(d, D_LEFT);
    if(direction == D_UP_R)
        translateFrame(d, D_RIGHT);
}

//Condition for down, down left, and down right. Uses recursion for left and right
translation
if(direction == D_DWN || direction == D_DWN_L || direction == D_DWN_R){
    temp = d.data[G_ROW-1];
    for(i = G_ROW-1; i > 0; i--){
        d.data[i] = d.data[i-1];
    }
    d.data[i] = temp;
    for(j = 0; j < G_COL; j++){
        d.data[i][j] = emptyRGB;
    }
    if(direction == D_DWN_L)
        translateFrame(d, D_LEFT);
    if(direction == D_DWN_R)
        translateFrame(d, D_RIGHT);
}

//Condition for left transition
if(direction == D_LEFT){
    for(i = 0; i < G_ROW; i++){
        for (j = 0; j < G_COL-1; j++){
            d.data[i][j] = d.data[i][j+1];
        }
    }
    for(i = 0; i < G_ROW; i++){
        d.data[i][j] = emptyRGB;
    }
}

//Condition for right transition
if(direction == D_RIGHT){
    for(i = 0; i < G_ROW; i++){
        for (j = G_COL-1; j > 0; j--){
            d.data[i][j] = d.data[i][j-1];
        }
    }
    for(i = 0; i < G_ROW; i++){
        d.data[i][j] = emptyRGB;
    }
}

```

```

    }
}

return SUCSSESFUL;
}

// Fills given frame with color
int fillFrame(t_FrameData &d, t_RGB rgb_fill)
{
    int i, j; // loop control

    // Error checking
    if (d.data == NULL)
        return ERROR;

    //Fill data
    for (i = 0; i < G_ROW; i++) {
        for (j = 0; j < G_COL; j++) {
            d.data[i][j] = rgb_fill;
        }
    }

    return SUCSSESFUL;
}

int fillFrame2(t_FrameData &d, unsigned short r, unsigned short g, unsigned short b)
{
    t_RGB rgb;
    rgb.R = r;
    rgb.G = g;
    rgb.B = b;

    // error check if over bounds for type short
    if (r > 255 || g > 255 || b > 255)
        return ERROR;

    return fillFrame(d, rgb);
}

```

---

Other files here