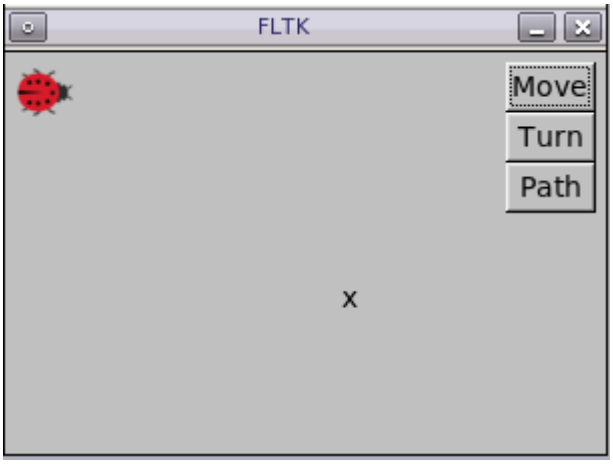
Lab2 - FLTK

Demo:



click here to download mp4

Describe assignment:

Use FLTK/FLUID to demonstrate control of a small image (e.g. bug)

Lab goals: Explore the use of constructors and a array of object pointers

- Loading the image (read section 9.6)
  - Buttons to allow user to make image move, turn, and/or follow a path.
  - Add default contructor to class to set initial position and direction
  - Declare/define a global object to place in FLTK Box
  - Instead of storing image data directly in executable, load from png file
- Array of ojects (read section 9.10)
  - Create 4 images facing in the four directions (N,E,S,W)
  - Create array to hold pointers to these images
  - Copies of images are not allowed (read section 13.5)
- Turning the image
  - In the "turn" button callback, cycle through the 4 images
  - Redraw the parent (window) after each
  - Use local static variable which will remember its previous value
  - equencing the path of image
- Create button to walk the image through some predetermined path

- Create array of characters such as "mmt" that means "move, move, turn"
- Each click of the path button reads next character from string
- Use local variable to remember last character processed

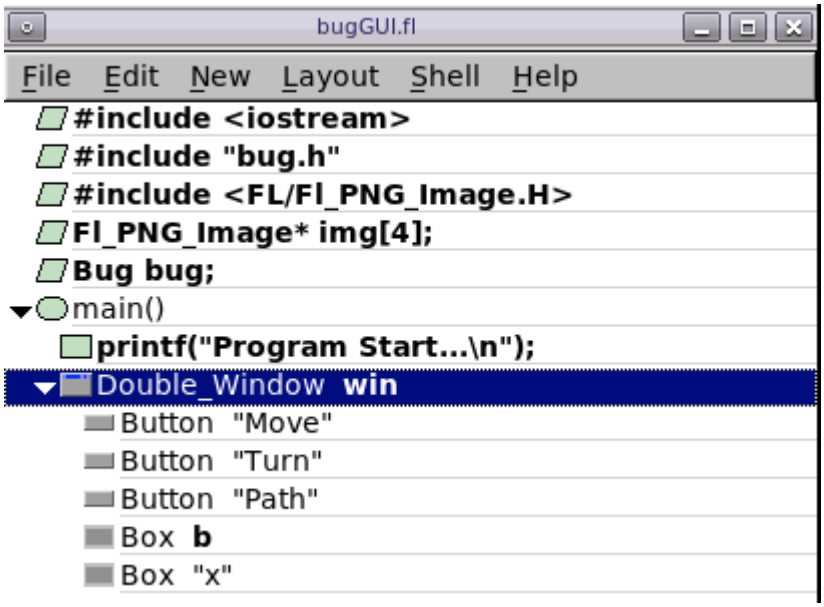
How to create 4 images facing in the four directions (N,E,S,W)

```
$ convert bugN.png -rotate 90 bugE.png
```

How to program FLTK with FLUID?

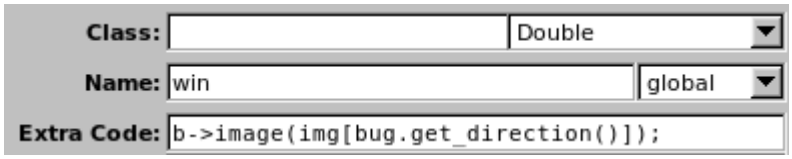
> *FLTK official documents: [Programming with FLUID]*
>
> *JSLinux: [https://bellard.org/jslinux/vm.html?url=alpine-x86-xwin.cfg&mem=1024&graphic=1&w=1200&h=800]*
>
> ```
> login to sync: `xhost + && vflogin ACCOUNT`
> ```

1. Right click mouse in JSLinux, then choose "FLDev"
2. Create bugGUI.fl file by using FLDev interface:



- Create Declaretion:
  - #include
  - #include <FL/Fl_PNG_Image.h>
  - #include <bug.h>
  - Fl_PNG_Image* img[4]; // Create an an array to hold Fl_PNG_Image pointer.
  - Bug bug; // Create an Bug instance as global variable

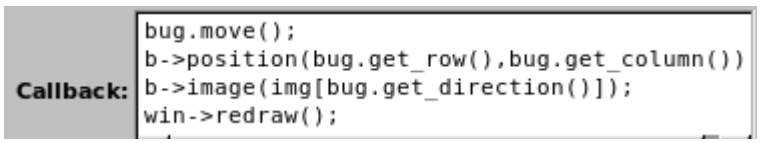
- Create main() enterpoint:
- Create Double_Window under/inside main():
  - Create a Box to hold images
  - Create 3 buttoms letting user change position/direction of the images



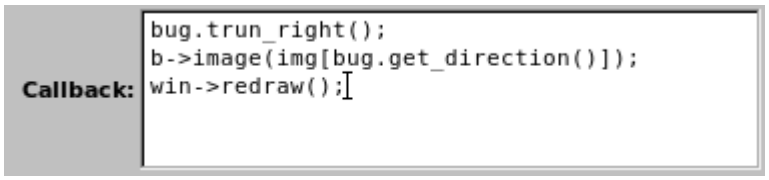
3. Creating & Setting Box to hold the images:
   - Name: b
   - Extra Code:

```
![boxGUI_b]
(https://github.com/AmberFu/CS124_DataStructure_usingCpp/blob/main/Assignments/pic/bugGU
raw=true)
```

4. Creating & Setting each buttom:
   - MOVE: move one unit follow by direction.



   - TURN: turn right for each click.



   - PATH: follow the path to the end point.

```
bug.path();
b->image(img[bug.get_direction()]);
b->position(bug.get_row(),bug.get_column())
win->redraw();
```

Create bug.cpp and bug.h:

bug.h

```
#include <iostream>

using namespace std;

const int NORTH = 0;
const int EAST = 1;
const int SOUTH = 2;
const int WEST = 3;
const int WINDOW_X_MAX = 300;
const int WINDOW_Y_MAX = 200;
const int destinationX = 150;
const int destinationY = 100;

class Bug
{
public:
   Bug();
   int get_column() const;
   int get_row() const;
   int get_direction() const;
   void trun_right();
   void move();
   void path();
   void go_east(int);
   void go_west(int);
   void go_north(int);
   void go_south(int);
   int destDiff_x();
   int destDiff_y();
private:
   int direction; // 0: North, 1: East, 2: South, 3: West
   int y_position; // 0 - 200
   int x_position; // 0 - 300
};
```

bug.cpp

```
#include <cmath>
#include "bug.h"

Bug::Bug()
{
   y_position = 0;
   x_position = 0;
   direction = 1;
}

int Bug::get_column() const
```

```
{
   return y_position;
}

int Bug::get_row() const
{
   return x_position;
}

int Bug::get_direction() const
{
   return direction;
}

// TURN
void Bug::trun_right()
{
        if (direction >= 3){
                direction = 0;
        }else{
                direction++;
        }
}

// MOVE
void Bug::move()
{
        if (direction == NORTH && y_position != 0)
                y_position--;
        else if (direction == EAST && x_position != WINDOW_X_MAX)
                x_position++;
        else if (direction == SOUTH && y_position != WINDOW_Y_MAX)
                y_position++;
        else if (direction == WEST && x_position != 0)
                x_position--;
}

// PATH:
void Bug::go_south(int dest){
        direction = 2; // 0: North, 1: East, 2: South, 3: West
        // if destanation is large than 5, move faster ( move 5 unit a time)
        if (std::abs(dest) <= 5){
                y_position += 1;
        }else{
                y_position += 10;
        }
}

void Bug::go_north(int dest){
        direction = 0; // 0: North, 1: East, 2: South, 3: West
        // if destanation is large than 5, move faster ( move 5 unit a time)
        if (std::abs(dest) <= 5){
```

```
                y_position -= 1;
        }else{
                y_position -= 10;
        }
}

void Bug::go_east(int dest){
        direction = 1; // 0: North, 1: East, 2: South, 3: West
        // if destanation is large than 5, move faster ( move 5 unit a time)
        if (std::abs(dest) <= 5){
                x_position += 1;
        }else{
                x_position += 10;
        }
}

void Bug::go_west(int dest){
        direction = 3; // 0: North, 1: East, 2: South, 3: West
        // if destanation is large than 5, move faster ( move 5 unit a time)
        if (std::abs(dest) <= 5 || dest <= -5){
                x_position -= 1;
        }else{
                x_position -= 10;
        }
}

int Bug::destDiff_x(){
        return x_position - destinationX;
}

int Bug::destDiff_y(){
        return y_position - destinationY;
}

void Bug::path()
{
        int side_of_dest_x = destDiff_x();
        int side_of_dest_y = destDiff_y();
        if (side_of_dest_x < 0){
                go_east(side_of_dest_x);
        }else if (side_of_dest_x > 0){
                go_west(side_of_dest_x);
        }else{
                if (side_of_dest_y > 0){
                        go_north(side_of_dest_y);
                }else if (side_of_dest_y < 0){
                        go_south(side_of_dest_y);
                }else{
                        return;
                }
        }
}
```

- Create .cxx and .h files:

  `$ fluid -c xxx.fl`

- How to complile bug.cpp with bugGUI.cxx?

  `$ g++ bug.cpp bugGUI.cxx -o bug -lfltk -lXext -lX11 -lm`

  OR use:

  ```
    $ g++ bugGUI.cxx bug.cpp -o bug `fltk-config --cxxflags --ldflags --use-images`
  ```

- test program:

  `$ ./bug`

How to make video in JSLinux?

```
$ ffmpeg -video_size 300x200 -framerate 1 -f x11grab -t 20 -i :0.0 -crf 0 -preset ultrafast -c:v libx264rgb bug.mp4
```