The Harkonnen are Attacking!

RTOS Project

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Intro

Basic idea:

To model the physics behind a simple mechanics problem, with some environmental inputs that will affect the physics, with inputs from our SDK affecting the system and with the physical state represented in graphics and LEDs on our SDK.

One of the great advantages to our use of the SDK to simulate physics is that we can have ideal conditions (and thereby avoid "real physics" when it would be very difficult (e.g. friction that complicates things); instant response to inputs; configurable gravity, mass, forcing capability, etc).

The basic challenge:

> Using the slider, force a platform left or right to try to bounce a Harkonnen Mass (hereafter: HM) higher and higher in your "canyon" (the LCD screen), until it leaves the top of the screen and presumably is then more of a problem for the Harkonnen fleet, hovering just out of sight above us. More kinetic energy is imparted by your platform's Holtzman field if you pulse the field by hitting the left button within a short interval before impact on the platform and holding it long enough for the bounce moment—but the enhanced shield can only stay active for a short time before it must be inactive for a period of time (which it automatically enters when the button is released). If the HM hits the platform without a shield enhancement at a sufficient vertical speed, the mass will lose some momentum but will still bounce upwards thanks to the normal shield. If the mass hits your platform's shield (normal or enhanced) at too small a vertical speed, it drops right through your shield, hits your platform (at the bottom of the screen), and you lose. Also if you miss an HM altogether with your platform, the debris from the impact on the ground will render you defenseless to Harkonnen ground troops who will follow the bombardment. The right button is used for automatically-aimed laser defense, which can only be used a limited number of times in the game but will obliterate the current HM. When an HM is either shield-ejected or laser-exploded, if the Harkonnens have any remaining then a new mass is immediately dropped into our defensive zone without changing the platform's position and velocity. The winning condition is surviving all of the dropped masses via shield ejection or laser explosion before the moving platform is destroyed or a ground impact occurs. The construction of the platform allows it to bounce off of the canyon walls.

Link to Github

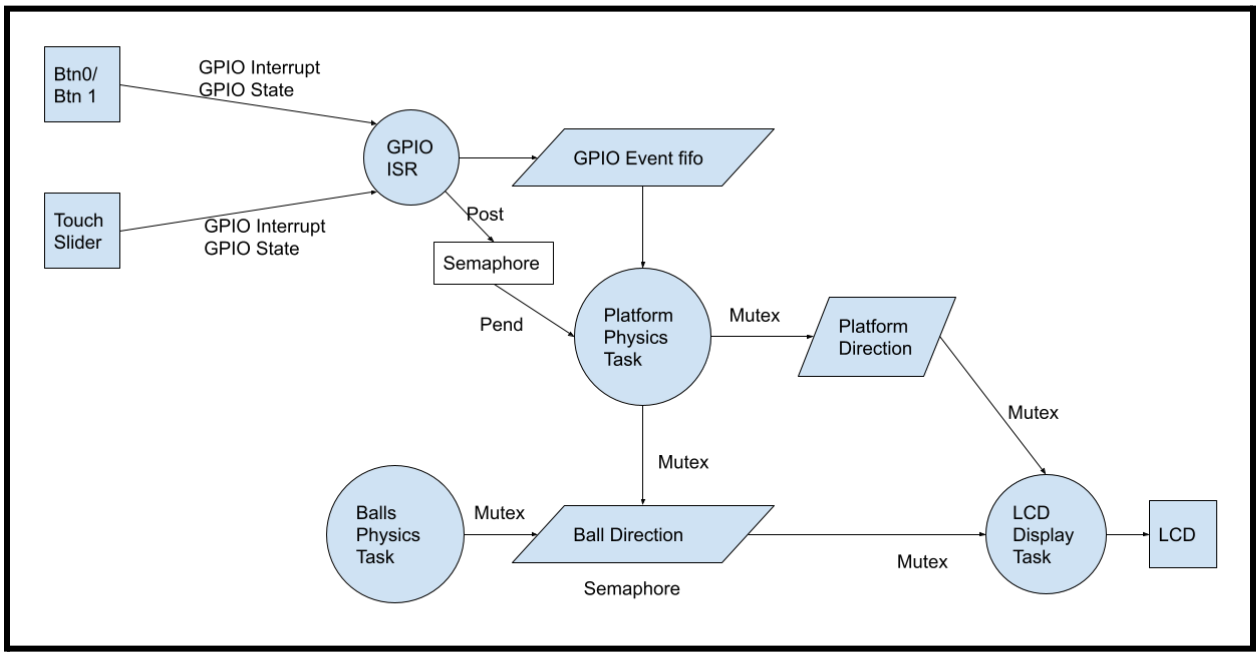
https://github.com/SamuelDiaz970/SDiaz_RTOS_Project

Week 1: Planning

Time Estimates

Estimate	Actual
Read project description: 20 minutes	20 minutes
Task Diagram: 1 hour	20 minutes
Unit test Plan: 10 min	10 minutes
Project Stands Statement: 15 minutes	2 minutes
Effort numbers: 30 min	10 minutes
Scope Items: 1 hour	30 minutes
Risk: 10 minutes	10 minutes

Task Diagram



Test Plan

- One of the sections I would like to test the communication between the **Platform Direction** and the **LCD Display Task**
- I also like to test the interaction between **Ball Direction** and **LCD Display Task**

Project Stands Statement

This week I thought through and documented the planning for this project, putting together a task diagram and writing two cutting points for unit testing.

Summary Effort & Estimate Numbers

I have completed 5% of my currently scoped, estimated work (4 / 30 hr) in 66% of the initially estimated time. (3 of 30hr). The best guess of my say/do ratio is 62%, so to unbias my estimates after this class, I may want to multiply my estimates by 1.61 (100%/62%)

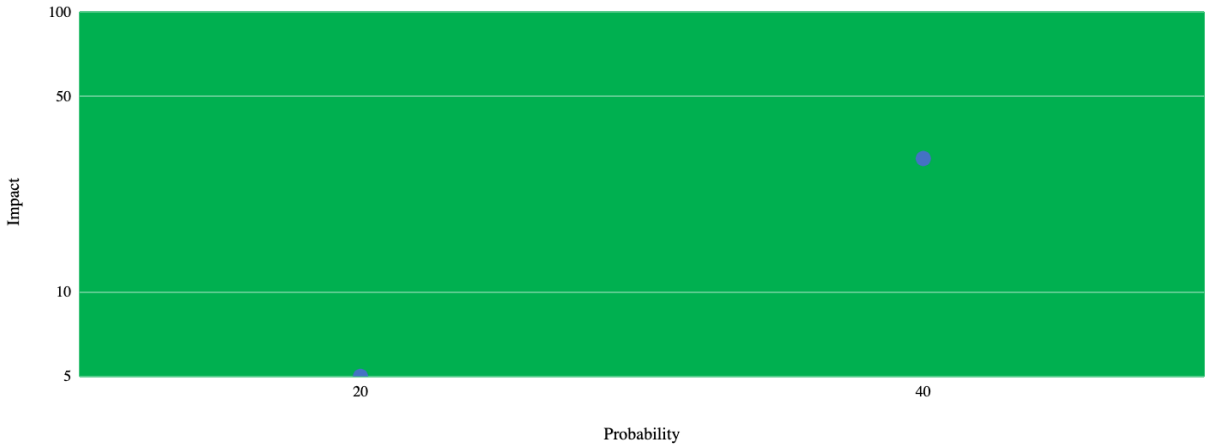
No scope changes to report at the current time.

Scope Items

Work Items	Estimated Time (hr)	Actual Time(hr)	Status	Summary Statements
Task Diagram	1	0.5	Complete	Task Diagram consist of all tasks that I considered adding and implementing. More tasks may still be added/removed as the project progresses.
Unit Test Plan	1		In Progress	I wrote two "cut" areas to test.
Overall Planning Document	1		In Progress	The overall document contains all my estimates and plans. I plan on updating this document weekly. I plan on updating it every week.
Create Skeleton Code	2		Not Started	
Create Task Structures and Global Variables	1		Not Started	
Build LCD Task	2		Not Started	
Build Platform Physics Task	3		Not Started	
Build Balls Physics Task	3		Not Started	
Build Mutex, Semaphore, Event Flags	1		Not Started	
Unit Test 1: Input to Physics Task and fifos	3		Not Started	
Unit Test 2: Physics Task to LCD	3		Not Started	
Unit Test 3: Ball Task to LCD	3		Not Started	
Debugging	3		Not Started	
Final Functionality and Testing	3		Not Started	
Total	30	0.5		

Risk

Item	P	I	Risk (P*I)	Recognized	Mitigated/ Resolved	ROAM	How
Task Diagram being incorrect	20	5	100	11-Mar-22		O	Planning and Implementation often don't align perfect
LCD Example task not working	40	30	1200	12-Mar-22		O	I will be attending office hours to make sure this isn't an obstacle



Week 2: Planning

Time Estimates

Estimate	Actual
Read project description: 20 minutes	20 minutes
Task Diagram: 1 hour	20 minutes
Unit test Plan: 10 min	10 minutes
Project Planning: 1 hr	1 hour

Test Plan

Testing Type	Cutting Point	Test Name	Status	Summary
Unit	Platform Direction -> LCD Display Task	Correct display of platform on LCD.	In Progress	The platform Direction buffer has been setup, the interaction between the display and that hasn't been coded
Unit	Ball Direction -> LCD Display Task	Correct display of platform on LCD.	Not Run	
Unit	GPIO Interrupt -> GPIO Event fifo	Event fifo gets updated from button press	Not Run	
Unit	GPIO Interrupt -> GPIO Event fifo	Button Press queues a timed boost		
Unit	GPIO Interrupt -> GPIO Event fifo	Event fifo gets updated from	Not Run	

		slider		
Unit	Platform Physics -> Platform Direction	Physics updating Platform velocity and position	Not Run	
Unit	Platform Physics -> Ball Direction	Platform Physics updating ball direction after a collision	Not Run	
Unit	Ball Physics -> Ball Direction	Physics updating Ball velocity and position	Not Run	
Unit	BallPhysics -> Ball Direction	Ensure working collisions between the ball and platform		
Unit	End Game	Ensure end game can be reached	Not Run	

Project Stands Statements

As of this week I was able to debug my issue of the LCD not displaying anything. I put together a skeleton code and most of the defines (for tasks, queues, and flags) have been implemented.

Summary Effort & Estimate Numbers

I have completed 20% of my currently scoped, estimated work (6 / 30hr) in 60% of the initially estimated time (5 of 30 hr). My best guess of my say/do ratio is 90%, so to unbias my estimates after this class, I may want to multiply my estimates by 2 to be safe.

No scope changes to report at the current time.

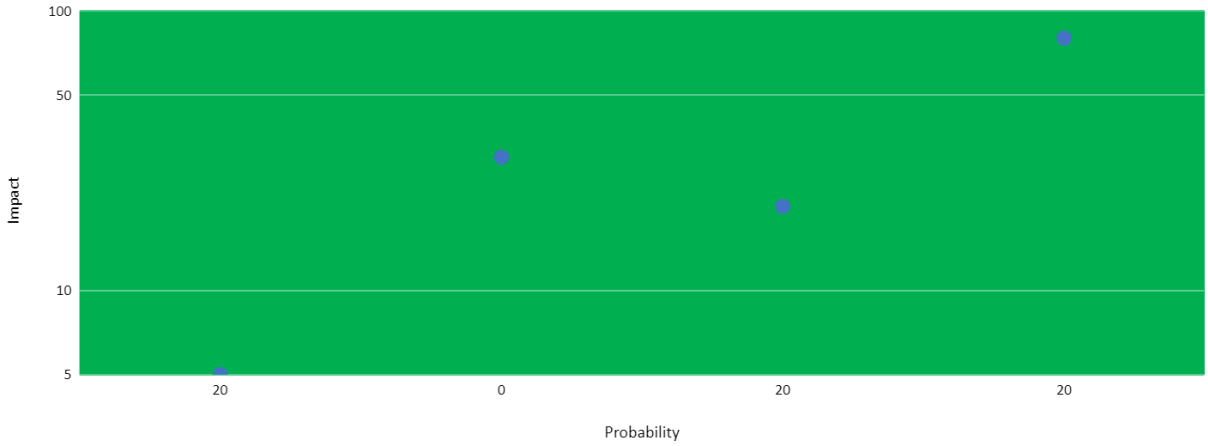
Scope Items

Work Items	Estimated Time (hr)	Actual Time(hr)	Status	Summary Statements
Task Diagram	1	0.5	Complete	Task Diagram consist of all tasks that I considered adding and implementing. More tasks may still be added/removed as the project progresses.
Unit Test Plan	1	1	In Progress	I wrote two "cut" areas to test.
Overall Planning Document	1	2	In Progress	The overall document contains all my estimates and plans. I plan on updating this document

				weekly. I plan on updating it every week.
Create Skeleton Code	2	1	Complete	Finished skeleton code with empty tasks and queues.
Create Task Structures and Global Variables	1	0.5	Complete	Defined variables for tasks and queues.
Build LCD Task	2	0.5	in Progress	Debugged LCD not displaying issue
Build Platform Physics Task	3		Not Started	
Build Balls Physics Task	3		Not Started	
Build Mutex, Semaphore, Event Flags	1		Not Started	
Unit Test 1: Input to Physics Task and fifos	3		Not Started	
Unit Test 2: Physics Task to LCD	3		Not Started	
Unit Test 3: Ball Task to LCD	3		Not Started	
Final Debugging	3		Not Started	
Final Functionality and Testing	3		Not Started	
Total	30	5.5		

Risk

Item	P	I	Risk (P*I)	Recognized	Mitigated/ Resolved	ROAM	How
Task Diagram being incorrect	20	5	100	11-Mar-22		O	Planning and Implementation often don't align perfect
LCD Example task not working	0	30	0	12-Mar-22	Resolved	R	I solved debugged my error
I will not have enough help to make progress during the break	20	20	400	18-Mar-22		O	I will be sure to hit up the slack as soon as I encounter an obstacle to try to get to the problems as early as possible
I will not be motivated to make progress on the project during break	20	80	1600	19-Mar-22		M	I have scheduled "work hours" to complete the work I have to do



Week 3: Planning

Time Estimates

Estimate	**Actual**
Unit test Plan: 10 min	10 minutes
Project Statement: 3 min	3 min
Scope Items: 10 min	10 min
Risk: 10 min	10 min

Test Plan

Testing Type	Cutting Point	Test Name	Status	Summary
Unit	Platform Direction -> LCD Display Task	Correct display of platform on LCD.	Pass	
Unit	Ball Direction -> LCD Display Task	Correct display of platform on LCD.	Not Run	
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from button press	In Progress	The button GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag
Unit	GPIO Interupt -> GPIO Event fifo	Button Press queues a timed boost	In Progress	The button GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag for a timed boost
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from slider	In Progress	The slider GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag to edit the slider stats

Unit	Platform Physics -> Platform Direction	Physics updating Platform velocity and position	Not Run	
Unit	Platform Physics -> Ball Direction	Platform Physics updating ball direction after a collision	Not Run	
Unit	Ball Physics -> Ball Direction	Physics updating Ball velocity and position	Not Run	
Unit	BallPhysics -> Ball Direction	Ensure working collisions between the ball and platform		
Unit	End Game	Ensure end game can be reached	Not Run	

Project Stands Statements

As of this week, I have been working on the user input; making sure that these interrupt inputs flip the right flags and trigger the event flags I'm looking for. I've been working with the buttons and slider, and have been able to confirm that they are triggering the correct interrupts. I'm finishing the implementation of the tests.

Summary Effort & Estimate Numbers

I have completed 28% of my currently scoped, estimated work (8.5 / 30 hr) in 100% of the initially estimated time. (8.5 of 30hr). The best guess of my say/do ratio is 100%, so to unbias my estimates after this class, I may want to multiply my estimates by 2 to be safe.

No scope changes to report at the current time.

Scope Items

Work Items	Estimated Time (hr)	Actual Time(hr)	Status	Summary Statements
Task Diagram	1	0.5	Complete	Task Diagram consist of all tasks that I considered adding and implementing. More tasks may still be added/removed as the project progresses.
Unit Test Plan	1	1	Complete	I wrote two "cut" areas to test.
Overall Planning Document	1	2	In Progress	The overall document contains all my estimates and plans. I plan on updating this document weekly. I plan on updating it

				every week.
Create Skeleton Code	2	1	Complete	Finished skeleton code with empty tasks and queues.
Create Task Structures and Global Variables	1	0.5	Complete	Defined variables for tasks and queues.
Build LCD Task	2	0.5	Complete	Debugged LCD not displaying issue
Build Platform Physics Task	3	1	In Progress	Working on triggering correct flags from input
Build Balls Physics Task	3		Not Started	
Build Mutex, Semaphore, Event Flags	1	1	In Progress	Working on getting these working with the user inputs
Unit Test 1: Input to Physics Task and fifos	3	1	In Progress	Have been able to get Input, confirming right flags with unit tests
Unit Test 2: Physics Task to LCD	3		Not Started	
Unit Test 3: Ball Task to LCD	3		Not Started	
Final Debugging	3		Not Started	
Final Functionality and Testing	3		Not Started	
Total	30	8.5		

Risk

Item	P	I	Risk (P*I)	Recognized	Mitigated/ Resolved	ROAM	How
Task Diagram being incorrect	20	5	100	11-Mar-22		O	Planning and Implementation often don't align perfect
LCD Example task not working	0	30	0	12-Mar-22	Resolved	R	I solved debugged my error
I will not have enough help to make progress during the break	20	20	0	18-Mar-22	Resolved	R	I was able to figure out my own bugs during break
I will not be motivated to make progress on the project during break	20	80	0	19-Mar-22	Resolved	R	I put a few hours of work into the project during break
I am not familiar with the Glib Library	20	50	1000	1-Apr-22		O	I will go into office hours to get tips of how to have the best framerate
I do not know how to make the "settings" portable	50	10	500	1-Apr-22		O	I will go into offfice hours to get pointers on how to implent the given settings.

with my code							

Week 4: Planning

Time Estimates

Estimate	**Actual**
Unit test Plan: 10 min	10 minutes
Project Statement: 3 min	3 min
Scope Items: 10 min	10 min
Risk: 10 min	10 min

Test Plan

Testing Type	Cutting Point	Test Name	Status	Summary
Unit	Platform Direction -> LCD Display Task	Correct display of platform on LCD.	Pass	
Unit	Ball Direction -> LCD Display Task	Correct display of platform on LCD.	Not Run	
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from button press	In Progress	The button GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag
Unit	GPIO Interupt -> GPIO Event fifo	Button Press queues a timed boost	In Progress	The button GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag for a timed boost
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from slider	In Progress	The slider GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag to edit the slider stats
Unit	Platform Physics -> Platform Direction	Physics updating Platform velocity and position	Not Run	
Unit	Platform Physics -> Ball Direction	Platform Physics updating ball direction after a collision	Not Run	
Unit	Ball Physics -> Ball Direction	Physics updating Ball velocity and position	Not Run	

Unit	BallPhysics -> Ball Direction	Ensure working collisions between the ball and platform		
Unit	End Game	Ensure end game can be reached	Not Run	

Project Stands Statements

As of this week, I have not been able to put in as much work as I would have liked to, as I am still in the same position as last week. Although, I do plan on mitigating the risk of falling behind by catching up this weekend and doing double the work this week.

Summary Effort & Estimate Numbers

I have completed 28% of my currently scoped, estimated work (8.5 / 30 hr) in 100% of the initially estimated time. (8.5 of 30hr). The best guess of my say/do ratio is 100%, so to unbias my estimates after this class, I may want to multiply my estimates by 2 to be safe. I will have to do more work this week but no rescope is needed.

No scope changes to report at the current time.

Scope Items

Work Items	Estimated Time (hr)	Actual Time(hr)	Status	Summary Statements
Task Diagram	1	0.5	Complete	Task Diagram consist of all tasks that I considered adding and implementing. More tasks may still be added/removed as the project progresses.
Unit Test Plan	1	1	Complete	I wrote two "cut" areas to test.
Overall Planning Document	1	2	In Progress	The overall document contains all my estimates and plans. I plan on updating this document weekly. I plan on updating it every week.
Create Skeleton Code	2	1	Complete	Finished skeleton code with empty tasks and queues.
Create Task Structures and Global Variables	1	0.5	Complete	Defined variables for tasks and queues.
Build LCD Task	2	0.5	Complete	Debugged LCD not displaying issue
Build Platform Physics Task	3	1	In Progress	Working on triggering correct flags from input
Build Balls Physics Task	3		Not Started	

Build Mutex, Semaphore, Event Flags	1	1	In Progress	Working on getting these working with the user inputs
Unit Test 1: Input to Physics Task and fifos	3	1	In Progress	Have been able to get Input, confirming right flags with unit tests
Unit Test 2: Physics Task to LCD	3		Not Started	
Unit Test 3: Ball Task to LCD	3		Not Started	
Final Debugging	3		Not Started	
Final Functionality and Testing	3		Not Started	
Total	30	8.5		

Risk

Item	P	I	Risk (P*I)	Recognized	Mitigated/ Resolved	ROAM	How
Task Diagram being incorrect	20	5	100	11-Mar-22		O	Planning and Implementation often don't align perfect
LCD Example task not working	0	30	0	12-Mar-22	Resolved	R	I solved debugged my error
I will not have enough help to make progress during the break	20	20	0	18-Mar-22	Resolved	R	I was able to figure out my own bugs during break
I will not be motivated to make progress on the project during break	20	80	0	19-Mar-22	Resolved	R	I put a few hours of work into the project during break
I am not familiar with the Glib Library	20	50	1000	1-Apr-22		O	I will go into office hours to get tips of how to have the best framerate
I do not know how to make the "settings" portable with my code	50	10	500	1-Apr-22		O	I will go into offfice hours to get pointers on how to implent the given settings.
I have fallen behind on work	100	30	3000	1-Apr-22		O	I will be putting in extra hours this weekend to catch up

Week 5: Planning

Time Estimates

Estimate	Actual
Unit test Plan: 10 min	10 minutes
Project Statement: 3 min	3 min
Scope Items: 10 min	10 min
Risk: 10 min	10 min

Test Plan

Testing Type	Cutting Point	Test Name	Status	Summary
Unit	Platform Direction -> LCD Display Task	Correct display of platform on LCD.	Pass	Platform direction is displayed correctly with both "sticky platform" and "bounce velocity loss" working
Unit	Ball Direction -> LCD Display Task	Correct display of platform on LCD.	Pass	Balls hit surfaces correctly
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from button press	Pass	Button Presses queue the correct actions
Unit	GPIO Interupt -> GPIO Event fifo	Button Press queues a timed boost	In Progress	The button GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag for a timed boost
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from slider	Pass	Slider works correctly with platform
Unit	Platform Physics -> Platform Direction	Physics updating Platform velocity and position	Pass	Platform moves correctly with physics
Unit	Platform Physics -> Ball Direction	Platform Physics updating ball direction after a collision	In Progress	Working on fixing clipping bug when ball hits platform with a boost
Unit	Ball Physics -> Ball Direction	Physics updating Ball velocity and position	Pass	Ball physics are updated and displayed correctly
Unit	BallPhysics -> Ball Direction	Ensure working collisions between the ball and platform	Pass	Ball and platform interaction works fine when no boost.
Unit	End Game	Ensure end game	In Progress	Implemented end game

		can be reached		conditions, haven't tested.

Project Stands Statements

As of this week, I picked up my slack from last week and was able to get almost everything working. The couple things I have left is getting the boost working 100% as well as the end game conditions.

Summary Effort & Estimate Numbers

I have completed 80% of my currently scoped, estimated work (24 / 30 hr) in 83% of the initially estimated time. (20 of 30hr). The best guess of my say/do ratio is 100%, so to unbias my estimates after this class, I may want to multiply my estimates by 1.2 to be safe. I think I am on good track to the end of the semester.

No scope changes to report at the current time.

Scope Items

Work Items	Estimated Time (hr)	Actual Time(hr)	Status	Summary Statements
Task Diagram	1	0.5	Complete	Task Diagram consist of all tasks that I considered adding and implementing. More tasks may still be added/removed as the project progresses.
Unit Test Plan	1	1	Complete	I wrote two "cut" areas to test.
Overall Planning Document	1	3	In Progress	The overall document contains all my estimates and plans. I plan on updating this document weekly. I plan on updating it every week.
Create Skeleton Code	2	1	Complete	Finished skeleton code with empty tasks and queues.
Create Task Structures and Global Variables	1	0.5	Complete	Defined variables for tasks and queues.
Build LCD Task	2	1	Complete	Debugged LCD not displaying issue
Build Platform Physics Task	3	2	Complete	Working on triggering correct flags from input
Build Balls Physics Task	3	2	Complete	Worked on adding one ball, getting that to work, then many
Build Mutex, Semaphore, Event Flags	1	1	Complete	These have been working so far with my code.

Unit Test 1: Input to Physics Task and fifos	3	2	Complete	User input has been working as planned
Unit Test 2: Physics Task to LCD	3	2	Complete	Physics task correctly updates variables for the LCD.
Unit Test 3: Ball Task to LCD	3	2	Complete	Ball task correctly updates variables for the LCD.
Final Debugging	3	2	In Progress	Working on adding fixing inconsistencies with the boost and the end game.
Final Functionality and Testing	3		Not Started	
Total	30	20		

Risk

Item	P	I	Risk (P*I)	Recognized	Mitigated/ Resolved	ROAM	How
Task Diagram being incorrect	20	5	100	11-Mar-22	A	A	I have accepted that it was incorrect at first but I have then been making changes to it to reflect my code.
LCD Example task not working	0	30	0	12-Mar-22	Resolved	R	I solved debugged my error
I will not have enough help to make progress during the break	20	20	0	18-Mar-22	Resolved	R	I was able to figure out my own bugs during break
I will not be motivated to make progress on the project during break	20	80	0	19-Mar-22	Resolved	R	I put a few hours of work into the project during break
I am not familiar with the Glib Library	20	50	0	1-Apr-22	Resolved	R	I was able to do research and find something that works for me
I do not know how to make the "settings" portable with my code	50	10	0	1-Apr-22	Resolved	R	I will go into offfice hours to get pointers on how to implent the given settings.
I have fallen behind on work	100	30	0	1-Apr-22	Resolved	R	I put in extra hours this week to catch up and even got a little ahead.
I will not be able to fix my platform boost bug	20	20	400	15-Apr-22	O	O	I will go into offfice hours to get pointers.

Week 6: Planning

Time Estimates

Estimate	Actual
Unit test Plan: 10 min	10 minutes
Project Statement: 3 min	3 min
Scope Items: 10 min	10 min
Risk: 10 min	10 min

Test Plan

Testing Type	Cutting Point	Test Name	Status	Summary
Unit	Platform Direction -> LCD Display Task	Correct display of platform on LCD.	Pass	Platform direction is displayed correctly with both "sticky platform" and "bounce velocity loss" working
Unit	Ball Direction -> LCD Display Task	Correct display of platform on LCD.	Pass	Balls hit surfaces correctly
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from button press	Pass	Button Presses queue the correct actions
Unit	GPIO Interupt -> GPIO Event fifo	Button Press queues a timed boost	In Progress	The button GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag for a timed boost
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from slider	Pass	Slider works correctly with platform
Unit	Platform Physics -> Platform Direction	Physics updating Platform velocity and position	Pass	Platform moves correctly with physics
Unit	Platform Physics -> Ball Direction	Platform Physics updating ball direction after a collision	In Progress	Working on fixing clipping bug when ball hits platform with a boost
Unit	Ball Physics -> Ball Direction	Physics updating Ball velocity and position	Pass	Ball physics are updated and displayed correctly
Unit	BallPhysics -> Ball Direction	Ensure working collisions between the ball and platform	Pass	Ball and platform interaction works fine when no boost.
Unit	End Game	Ensure end game	Pass	Implemented end game

		can be reached		conditions, haven't tested.

Project Stands Statements

As of this week, I was able to add the end game conditions. I'm working on an edge case bug on the Button 1, the laser blaster. The couple things I have left is getting the boost working 100%.

Summary Effort & Estimate Numbers

I have completed 90% of my currently scoped, estimated work (27 / 30 hr) in 83% of the initially estimated time. (22 of 30hr). The best guess of my say/do ratio is 122%, so to unbias my estimates after this class, I will not edit my last commitment of hours to this project. I might have to rescope if I cannot get some bugs fixed.

No scope changes to report at the current time.

Scope Items

Work Items	Estimated Time (hr)	Actual Time(hr)	Status	Summary Statements
Task Diagram	1	0.5	Complete	Task Diagram consist of all tasks that I considered adding and implementing. More tasks may still be added/removed as the project progresses.
Unit Test Plan	1	1	Complete	I wrote two "cut" areas to test.
Overall Planning Document	1	3	Complete	The overall document contains all my estimates and plans. I plan on updating this document weekly. I plan on updating it every week.
Create Skeleton Code	2	1	Complete	Finished skeleton code with empty tasks and queues.
Create Task Structures and Global Variables	1	0.5	Complete	Defined variables for tasks and queues.
Build LCD Task	2	1	Complete	Debugged LCD not displaying issue
Build Platform Physics Task	3	2	Complete	Working on triggering correct flags from input
Build Balls Physics Task	3	2	Complete	Worked on adding one ball, getting that to work, then many
Build Mutex, Semaphore, Event Flags	1	1	Complete	These have been working so far with my code.

Unit Test 1: Input to Physics Task and fifos	3	2	Complete	User input has been working as planned
Unit Test 2: Physics Task to LCD	3	2	Complete	Physics task correctly updates variables for the LCD.
Unit Test 3: Ball Task to LCD	3	2	Complete	Ball task correctly updates variables for the LCD.
Final Debugging	3	2	In Progress	Working on adding fixing inconsistencies with the boost and the end game.
Final Functionality and Testing	3	2	In Progress	Working on playing the whole game with as little bugs as possible
Total	30	22		

Risk

Item	P	I	Risk (P*I)	Recognized	Mitigated/ Resolved	ROAM	How
Task Diagram being incorrect	20	5	100	11-Mar-22	A	A	I have accepted that it was incorrect at first but I have then been making changes to it to reflect my code.
LCD Example task not working	0	30	0	12-Mar-22	Resolved	R	I solved debugged my error
I will not have enough help to make progress during the break	20	20	0	18-Mar-22	Resolved	R	I was able to figure out my own bugs during break
I will not be motivated to make progress on the project during break	20	80	0	19-Mar-22	Resolved	R	I put a few hours of work into the project during break
I am not familiar with the Glib Library	20	50	0	1-Apr-22	Resolved	R	I was able to do research and find something that works for me
I do not know how to make the "settings" portable with my code	50	10	0	1-Apr-22	Resolved	R	I will go into offfice hours to get pointers on how to implent the given settings.
I have fallen behind on work	100	30	0	1-Apr-22	Resolved	R	I put in extra hours this week to catch up and even got a little ahead.
I will not be able to fix my platform boost bug	20	20	400	15-Apr-22	O	O	I will go into offfice hours to get pointers.

Final Submission

Test Plan

Testing Type	Cutting Point	Test Name	Status	Summary
Unit	Platform Direction -> LCD Display Task	Correct display of platform on LCD.	Pass	Platform direction is displayed correctly with both "sticky platform" and "bounce velocity loss" working
Unit	Ball Direction -> LCD Display Task	Correct display of platform on LCD.	Pass	Balls hit surfaces correctly
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from button press	Pass	Button Presses queue the correct actions
Unit	GPIO Interupt -> GPIO Event fifo	Button Press queues a timed boost	Pass	The button GPIO event triggers a interrupt, but am currently implementing how to confirm an event flag for a timed boost
Unit	GPIO Interupt -> GPIO Event fifo	Event fifo gets updated from slider	Pass	Slider works correctly with platform
Unit	Platform Physics -> Platform Direction	Physics updating Platform velocity and position	Pass	Platform moves correctly with physics
Unit	Platform Physics -> Ball Direction	Platform Physics updating ball direction after a collision	Pass	Working on fixing clipping bug when ball hits platform with a boost
Unit	Ball Physics -> Ball Direction	Physics updating Ball velocity and position	Pass	Ball physics are updated and displayed correctly
Unit	BallPhysics -> Ball Direction	Ensure working collisions between the ball and platform	Pass	Ball and platform interaction works fine when no boost.
Unit	End Game	Ensure end game can be reached	Pass	Implemented end game conditions, haven't tested.

The following functional tests were displayed during the demo:

- End Game:
    - Victory when ejecting all of the balls
    - Loss when a ball passes through the bottom barrier
- When accelerating the platform towards a wall, the platform will hit the wall and return with a lesser speed.
- When the boost button is pressed, the ball will increase in velocity

Project Stands Statements

To finish the project, I was able to fix clipping bugs, the boost not working, and the lazer not working. Everything turned out to work pretty well. The only thing I would add would be some improvements to the user interface; make it a bit more pretty. Internally, I would allow it to be more scalable and be able to apply the configuration numbers that were provided in the writeup. I just had too much trouble getting something to work initially, so I decided to use simple units in reference to how many pixels were available.

Summary Effort & Estimate Numbers

I have completed 99% of my currently scoped, estimated work (29 / 30 hr) in 83% of the initially estimated time. (24 of 30hr). The best guess of my say/do ratio is 125%, I feel pretty comfortable with my scoping because I got what I wanted done with a little wiggle room.

Scope Items

Work Items	Estimated Time (hr)	Actual Time(hr)	Status	Summary Statements
Task Diagram	1	0.5	Complete	Task Diagram consist of all tasks that I considered adding and implementing. More tasks may still be added/removed as the project progresses.
Unit Test Plan	1	1	Complete	I wrote two "cut" areas to test.
Overall Planning Document	1	3	Complete	The overall document contains all my estimates and plans. I plan on updating this document weekly. I plan on updating it every week.
Create Skeleton Code	2	1	Complete	Finished skeleton code with empty tasks and queues.
Create Task Structures and Global Variables	1	0.5	Complete	Defined variables for tasks and queues.
Build LCD Task	2	1	Complete	Debugged LCD not displaying issue
Build Platform Physics Task	3	2	Complete	Working on triggering correct flags from input
Build Balls Physics Task	3	2	Complete	Worked on adding one ball, getting that to work, then many
Build Mutex, Semaphore, Event Flags	1	1	Complete	These have been working so far with my code.
Unit Test 1: Input to Physics Task and fifos	3	2	Complete	User input has been working as planned

Unit Test 2: Physics Task to LCD	3	2	Complete	Physics task correctly updates variables for the LCD.
Unit Test 3: Ball Task to LCD	3	2	Complete	Ball task correctly updates variables for the LCD.
Final Debugging	3	2	Complete	Working on adding fixing inconsistencies with the boost and the end game.
Final Functionality and Testing	3	4	Incomplete	Was not able to use the config data in the writeup
Total	30	24		

Analysis of my Solution

I was not able to get Segger working on my system. Although I could tell I was getting good performance because the game was smooth to play at a nice framerate.

As far as code space goes, I used about 500 lines of code and commented appropriately.

My physics was a lot simpler than what was described in the writeup, which made it a lot easier to debug and I believe, operate a lot smoother. I just used two dimensions, X and Y, and only calculated position, velocity and acceleration for everything. I wanted to add mass and energy to the objects but that was a stretch goal. Some limitations that I had to deal with initially were when to update the physics in relation to the LCD refreshing. My solution was to sync when they happened (with an identical delay time) and then I messed with the refresh rate of the screen until I got something I was happy with.

It was a delicate balance of finding a good range. Everything that is uploaded to github now are the recommended settings. You can play with the defines although I would only increment/decrement in units of 0.1. It is sensitive to the global unit of 1 pixel.

If I were to work on this for two more weeks, I would improve the user interface and make it work better with custom user settings that are easily scalable. Right now, the game works well on it’s own platform, but if custom settings are to be added, I would have to do some tweaking.