CS102	**Spring 2014/2015**	Project Group	2C
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~ Physics Simulation ~

Master Minds

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Criteria	TA/Grader	Instructor
Presentation		
Overall		

User Interface Report

(Revised Version)

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1. Introduction

Turkish education system is very much dependent on students memorizing physics formulas without fully understanding the logic behind them. As students of Turkish education system we used to have hard time comprehending the subjects of physics. We would like to aid our fellow students who came after us by improving their ability to visualize physical problems. Therefore, we have considered this physics simulation program which includes the topics that are the hardest to understand for students. For example:

Kepler's Law

Motion of the Water Waves

Collisions

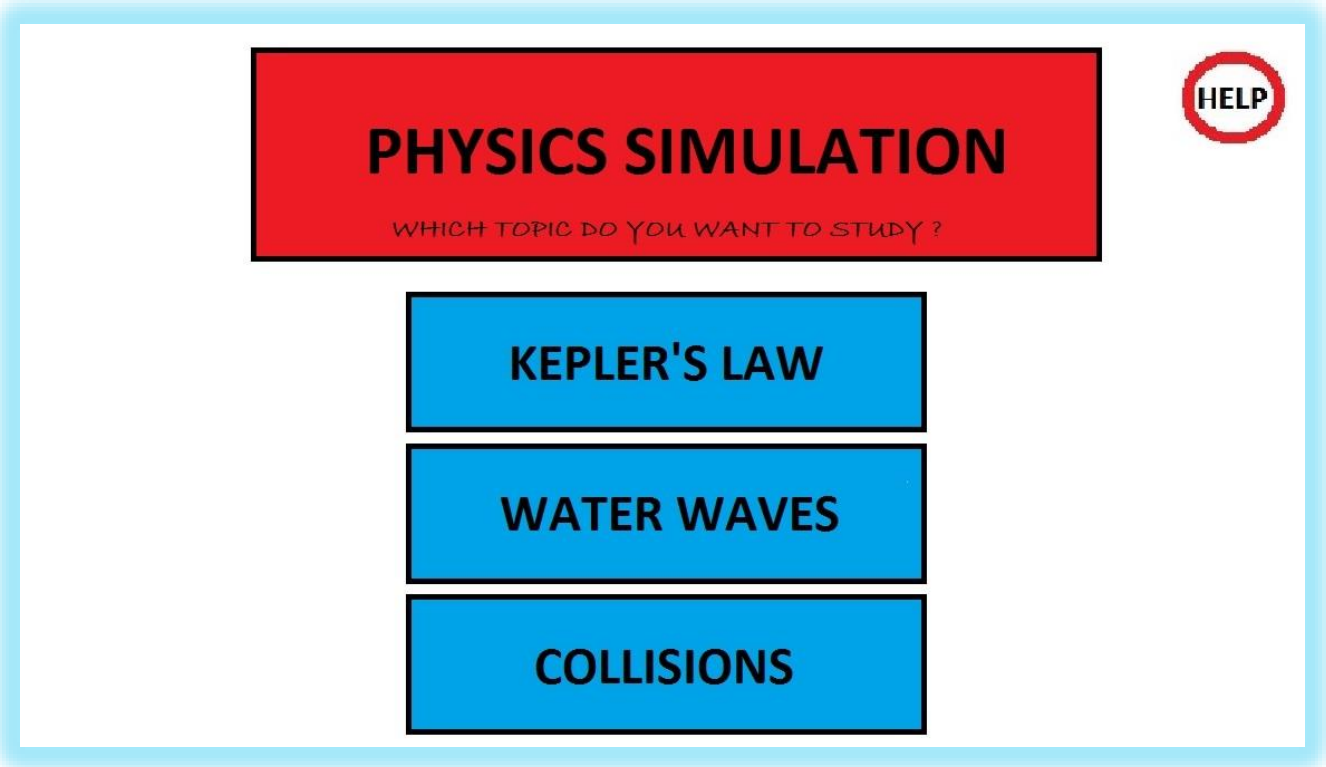
So far, we have chosen these topics because they are considered as the topics that are the most crucial to be visualized. The program could be more comprehensive in future if the time will be enough.

2. Interface Details

Every screen that user navigates while using the program will be explained from general to specific and we identify the buttons with numbers on the screen.

Note: Since it is a Windows program, user can close it by pressing X top-right corner of the screen.

2.1 Welcome Screen

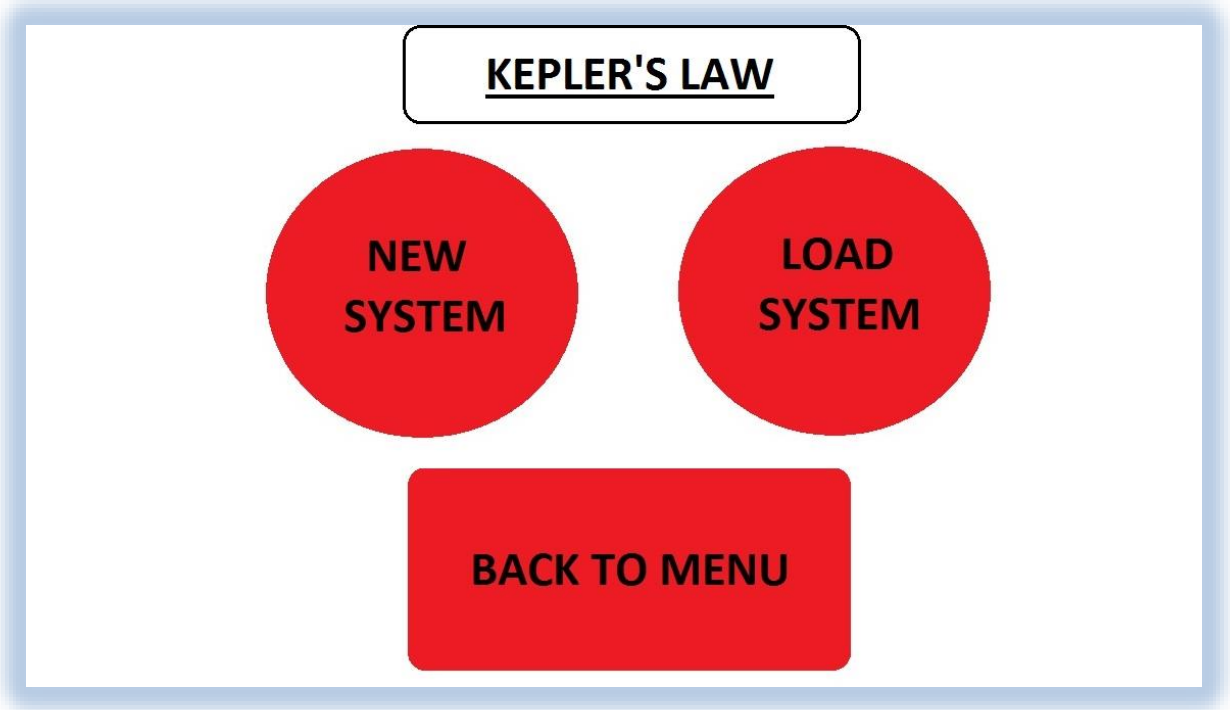


User selects one of the three options which he/she wants to study.

Note: Help section provides 3 options similarly to the welcome screen. Whichever user choses after clicking help, program provides helpful information and formulas about that section.

2.2 Study Screens

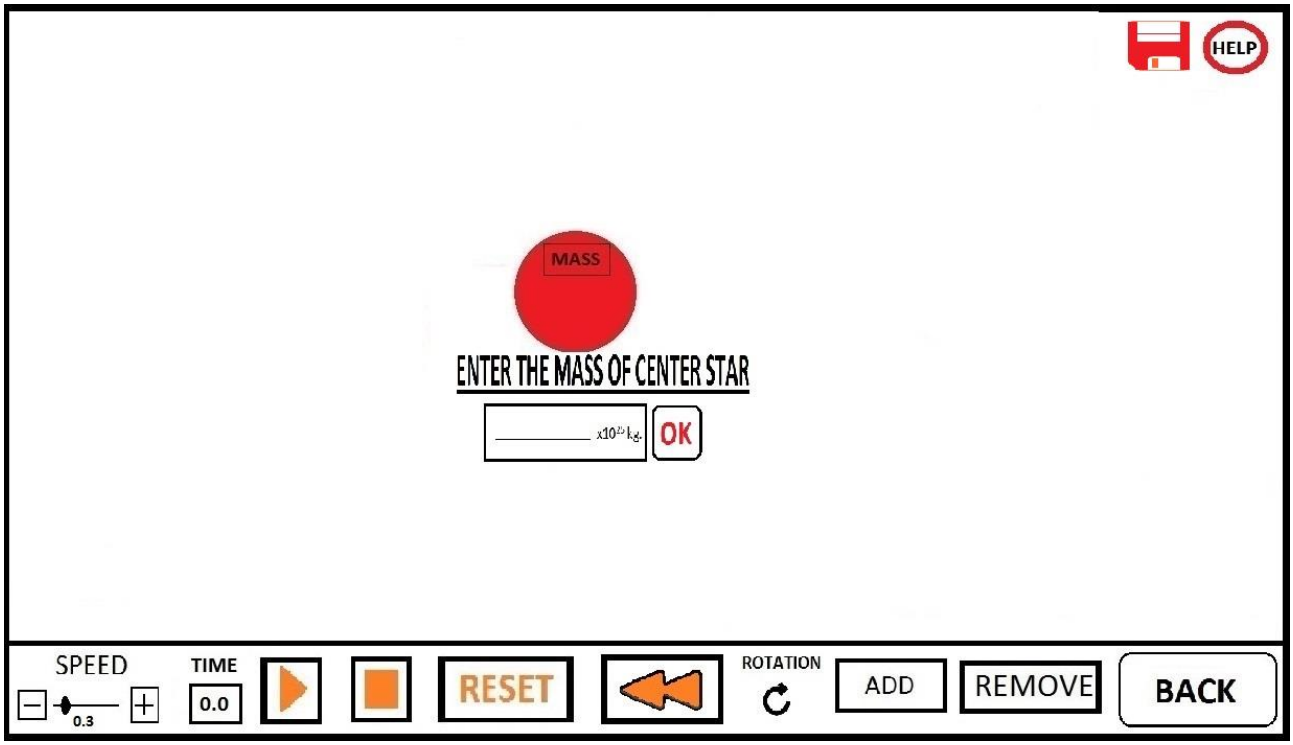
2.2.1 Kepler's Law



When user selects Kepler's Law, program provides 3 options.

2.2.1.1 New System

User needs to enter the mass of the center star to begin.



(1) Speed Adjustment: It speeds up or slows down the system and user can see the rate of slowing down or speeding up.

(2) Time: It is basically a stopwatch that counts how many second and split-second.

(3) / button: Sets planets to the motion or freezes the screen.

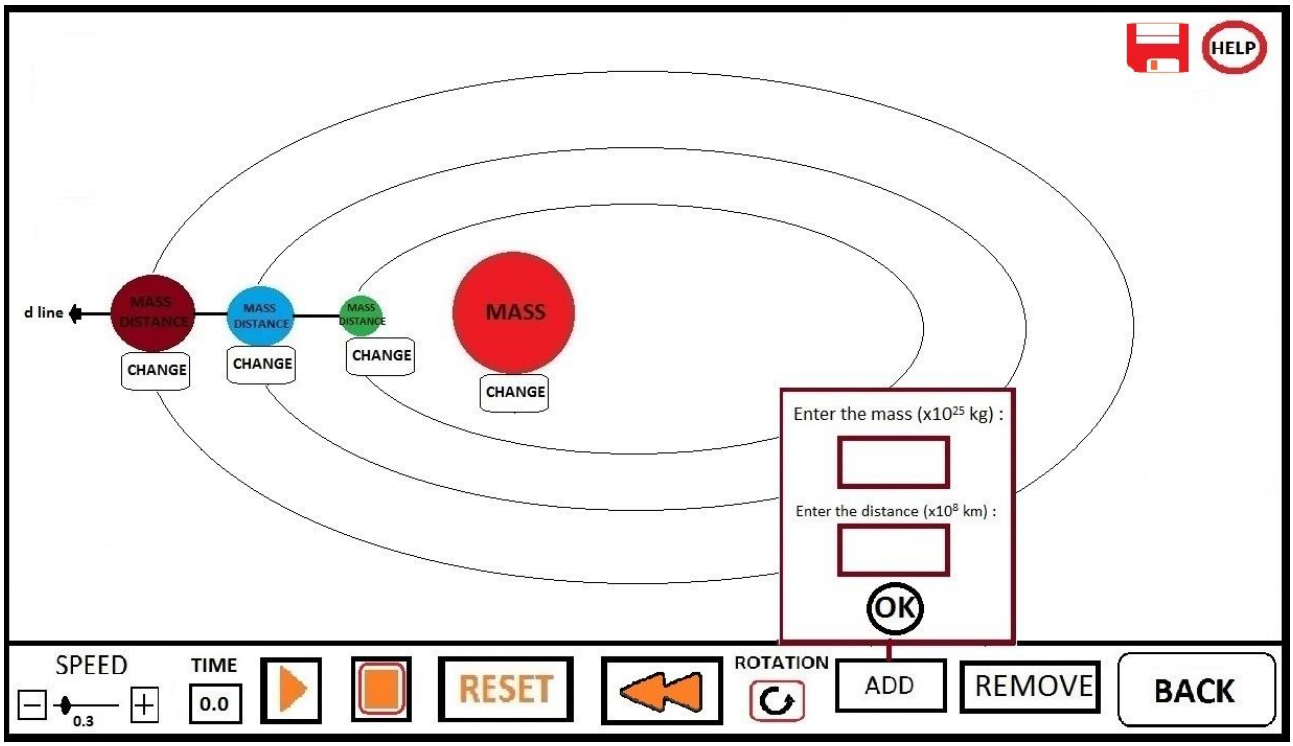
(4) button: Sets system to the default configuration and user can change planets' mass and distances.

(5) Reset button: Clears all entered information.

(6) button: When user clicks this, system runs reverse in order and icon near the reverse button shows the rotation of the planets.

(7) Add button: Adds a new planet to the system.

User has to enter information at a small dialog window about the new planet which are mass of the planet and distance from the center star.



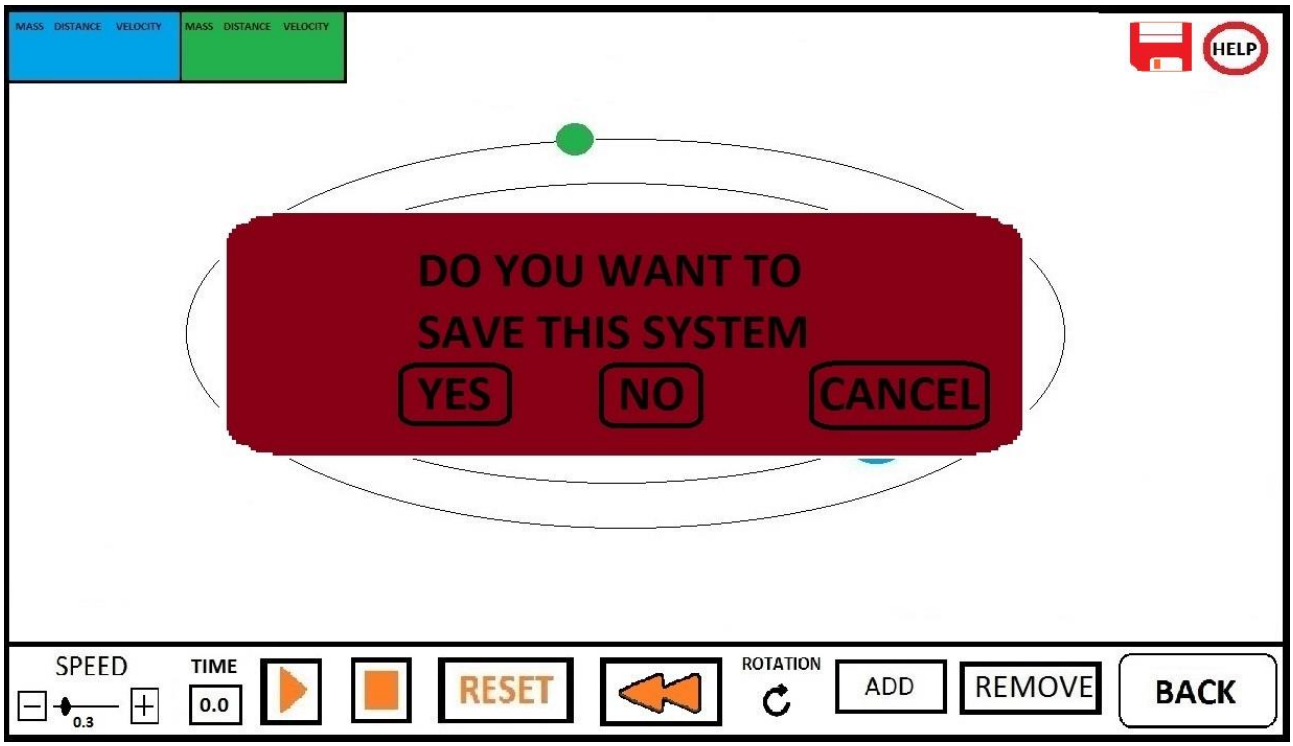
(8) Remove button: Removes a planet from the system.

User first clicks to remove button then click the planet(s) to remove it from the system. If the user wants to remove more than one planet, user basically clicks every planet that s/he wants to remove. For exiting removing mode, user clicks remove button again.

(9) Change button: User can change the mass of the center star and planets. This option is visible when system is at stop state.

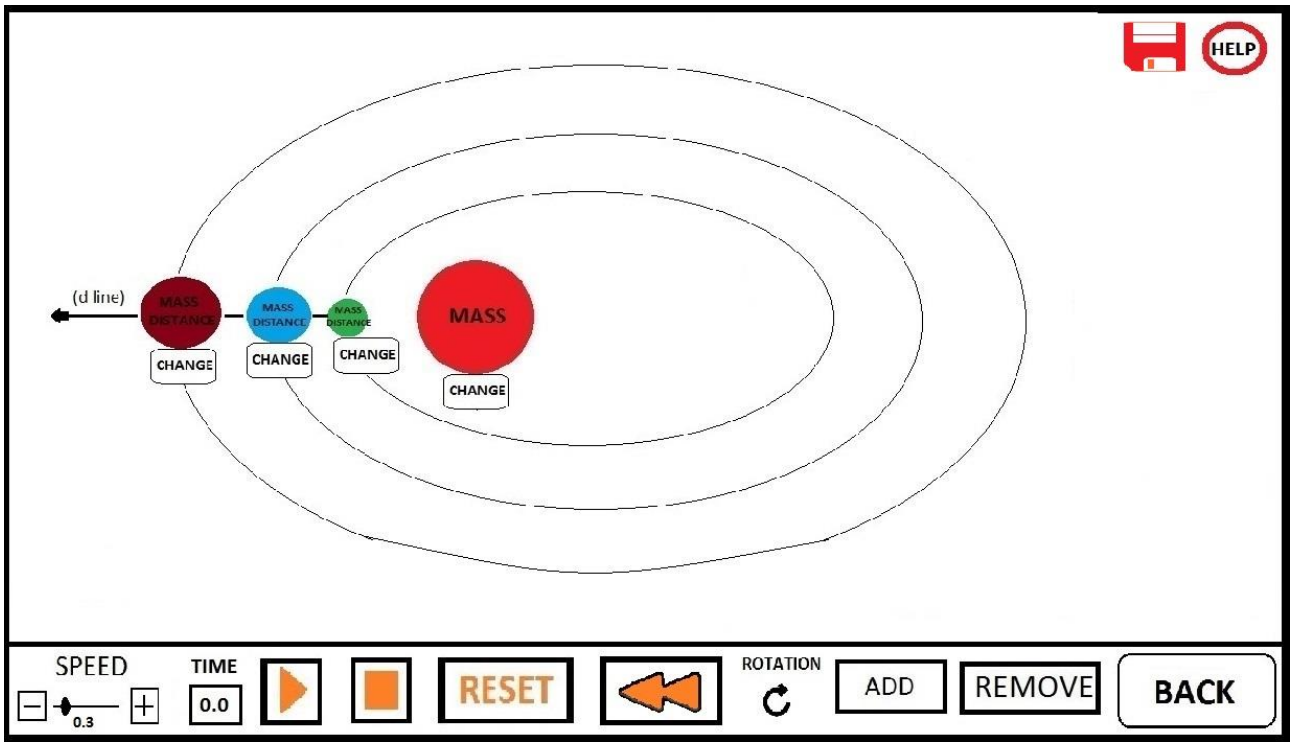
(10) Back button: When user clicks the back button program asks to user "Do you want to save this system?" If so saves the simulation as a template to be used in future.

(11)  button: To save the simulation user clicks it.

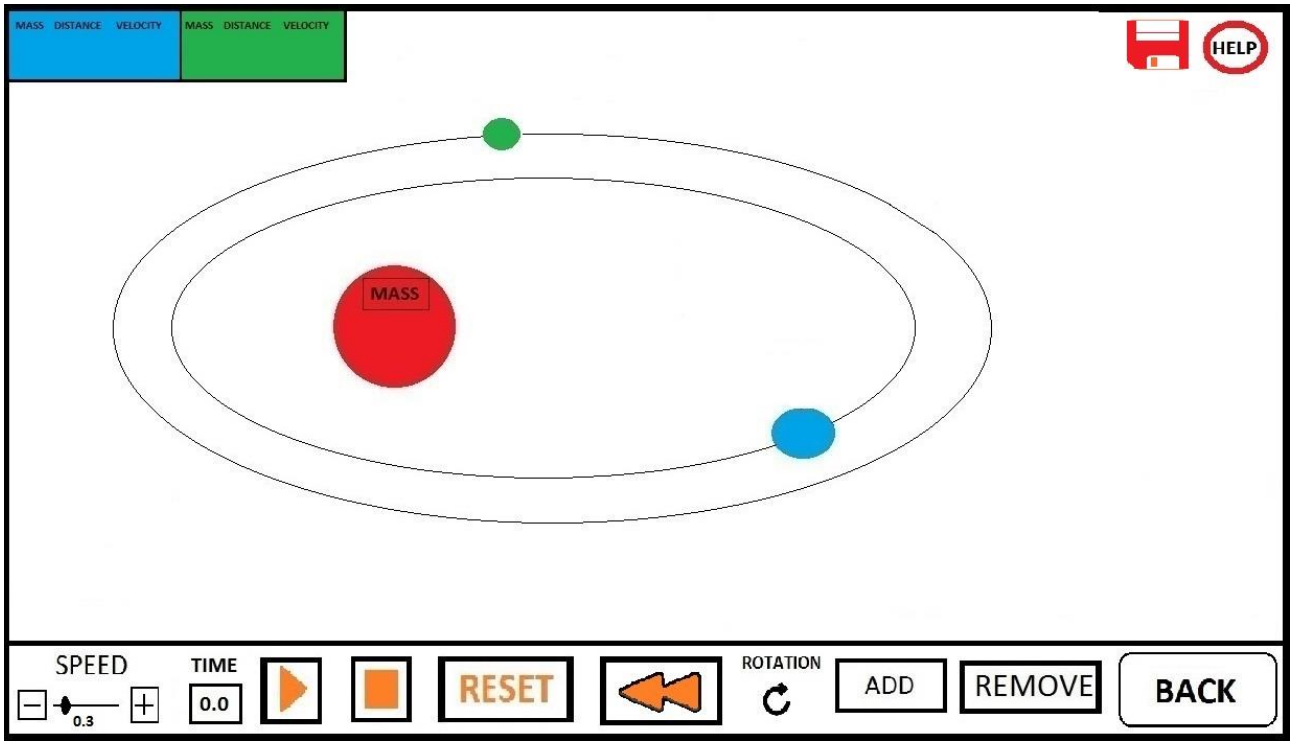


Note: Every time (a) planet(s) added or removed, all planets begin their periods at line d and system recalculate after steps (6), (7), (8).

Note: Since every planet on the system affects every other, given certain values, it is possible to one planet to become other's satellite anyway.



Note: System shows current velocity and distance from the center star while the planets are in motion. The values are shown in boxes top of the screen.

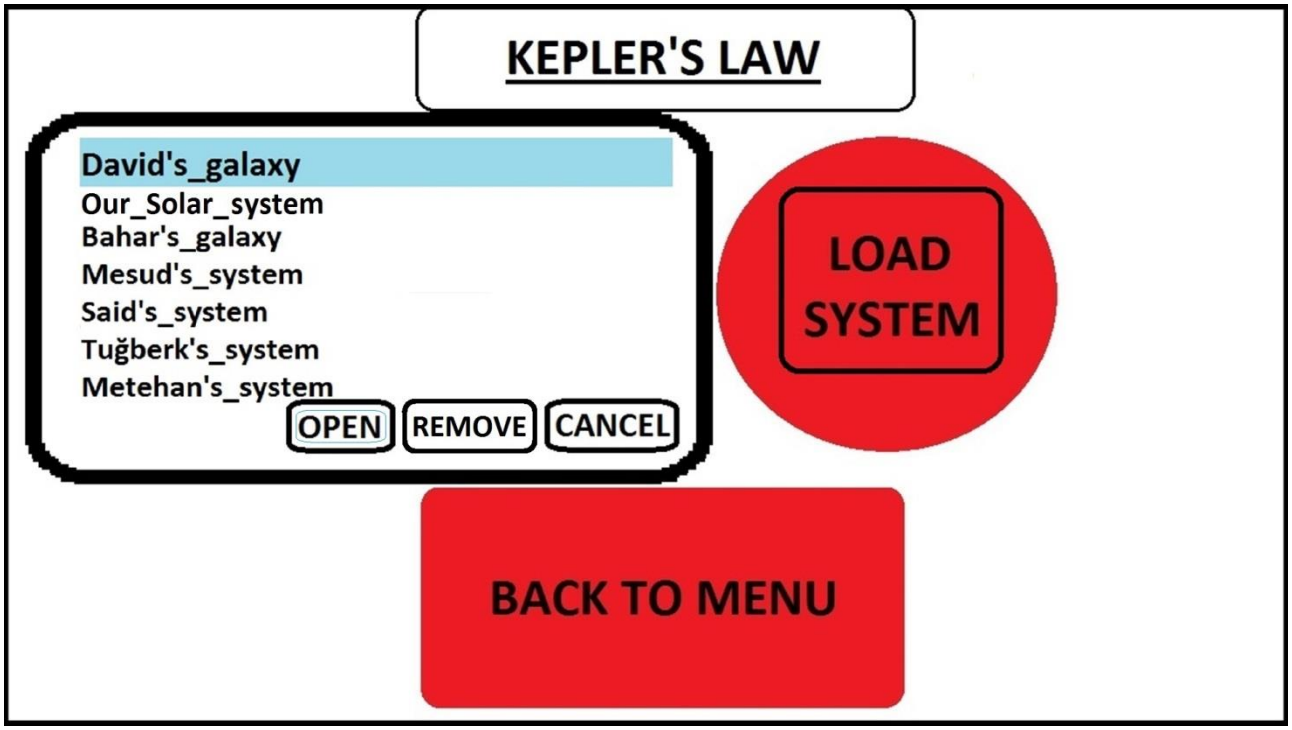


Note: Maximum number of planets is 8 because our solar system has 8 planets.

Note: Help section includes information about our Solar System, formulas.

Note: If the time will be sufficient, we are planning to add more complicated features like changing the rotation of the desired planet, black holes, comet, meteor and multiple center stars.

2.2.1.2 Load System



User sees the saved systems and clicks on one of them. Then the rest is similar to new screen.

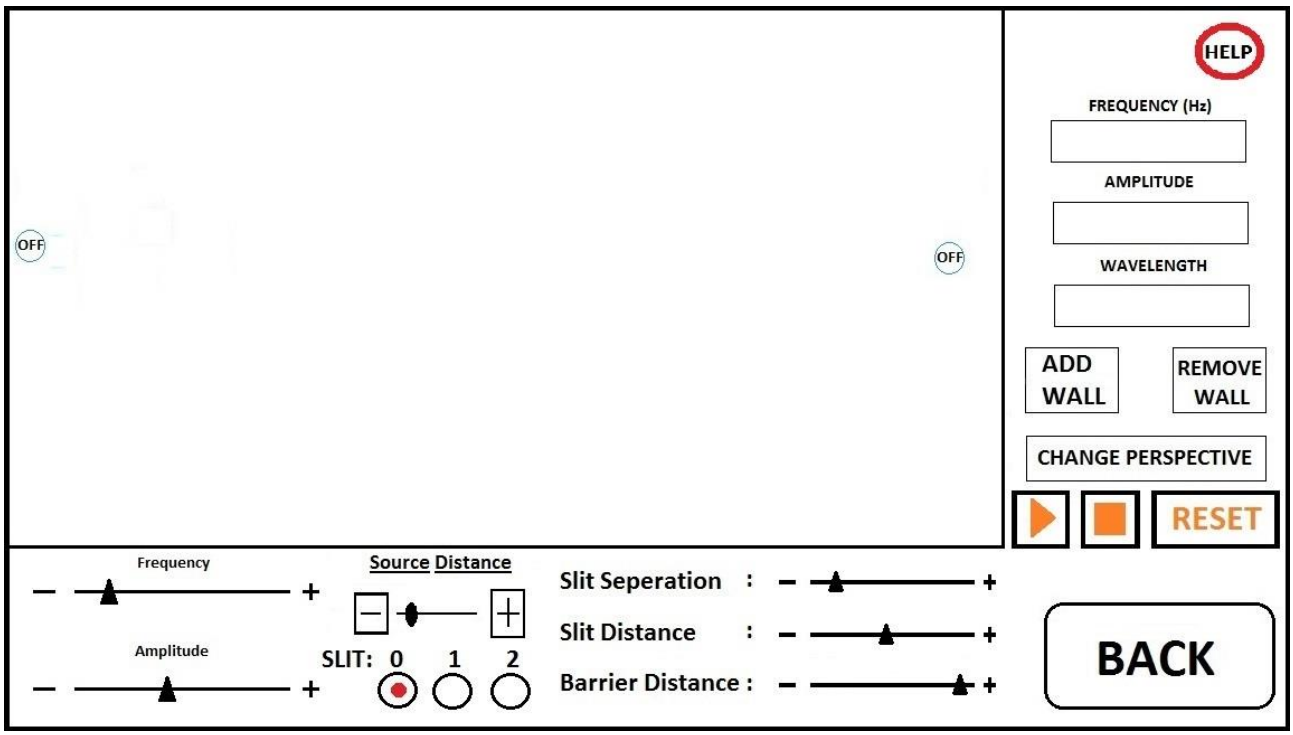
Note: There is a template of our Solar System embedded in the load system option.

2.2.1.3 Back to Menu

Returns user to the Welcome Screen.

2.2.2 Motion of the Water Waves

Program welcomes to user with a default simulation. Sources are not opened.



(1) On - Off button: Changes the state of the source.

(2) Frequency and Amplitude button: Can decrease or increase the quantity of frequency and amplitude.

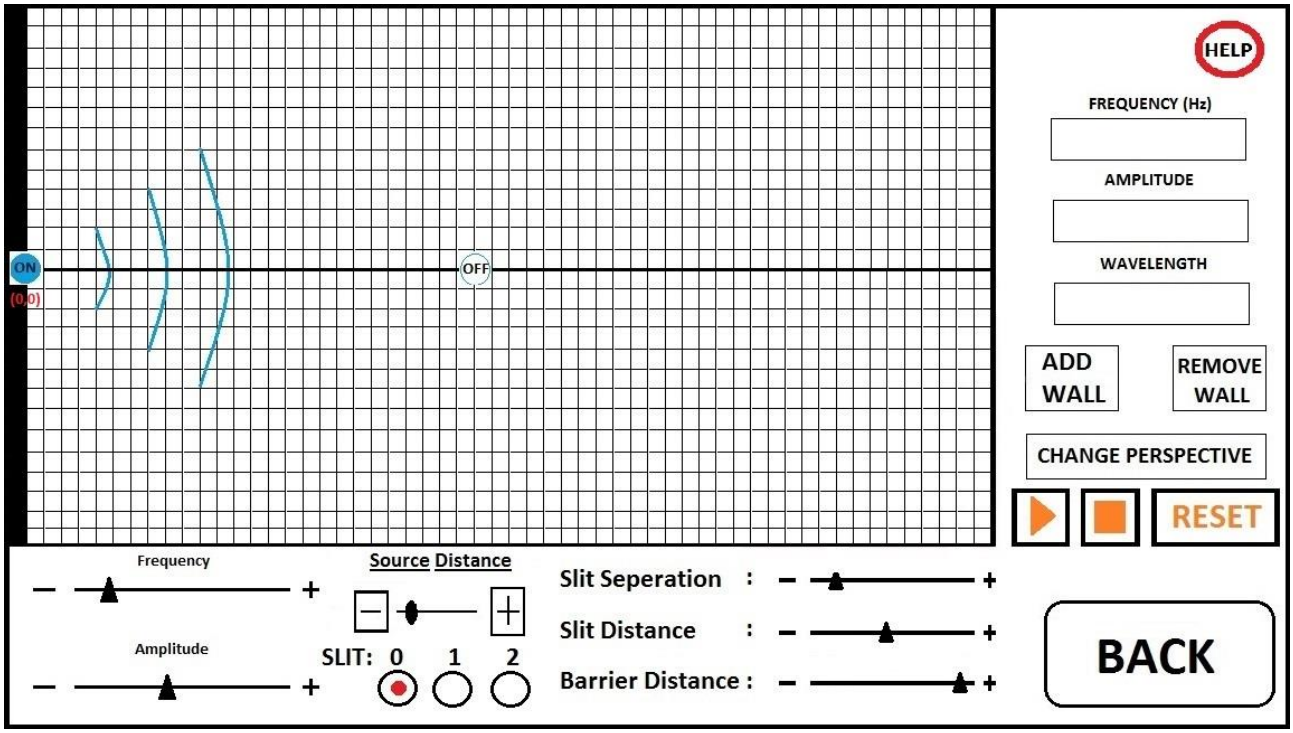
(3) Boxes: User can see the exact values of frequency, amplitude and wavelength. Also user can change all the values except wavelength. Value of the wavelength cannot be changed by the user because its value is calculated by the system.

(4) / button: If the system is at pause state when user clicks it source(s) which is (are) on begin(s) to make waves. If the system is already playing and user clicks this button then it freezes the screen to better observation. If user wants to change the size and location of the obstacle, the system needs to be paused and user can change the location and size of the obstacle by using mouse. (This shapes replaces with each other according to state of the system.)

(5) button: Turns off the sources and makes the water motionless. If there is any obstacle added in the system, they remain in their same position and size also the values shown in the boxes remain same.

(6) Reset button: Clears all entered information.

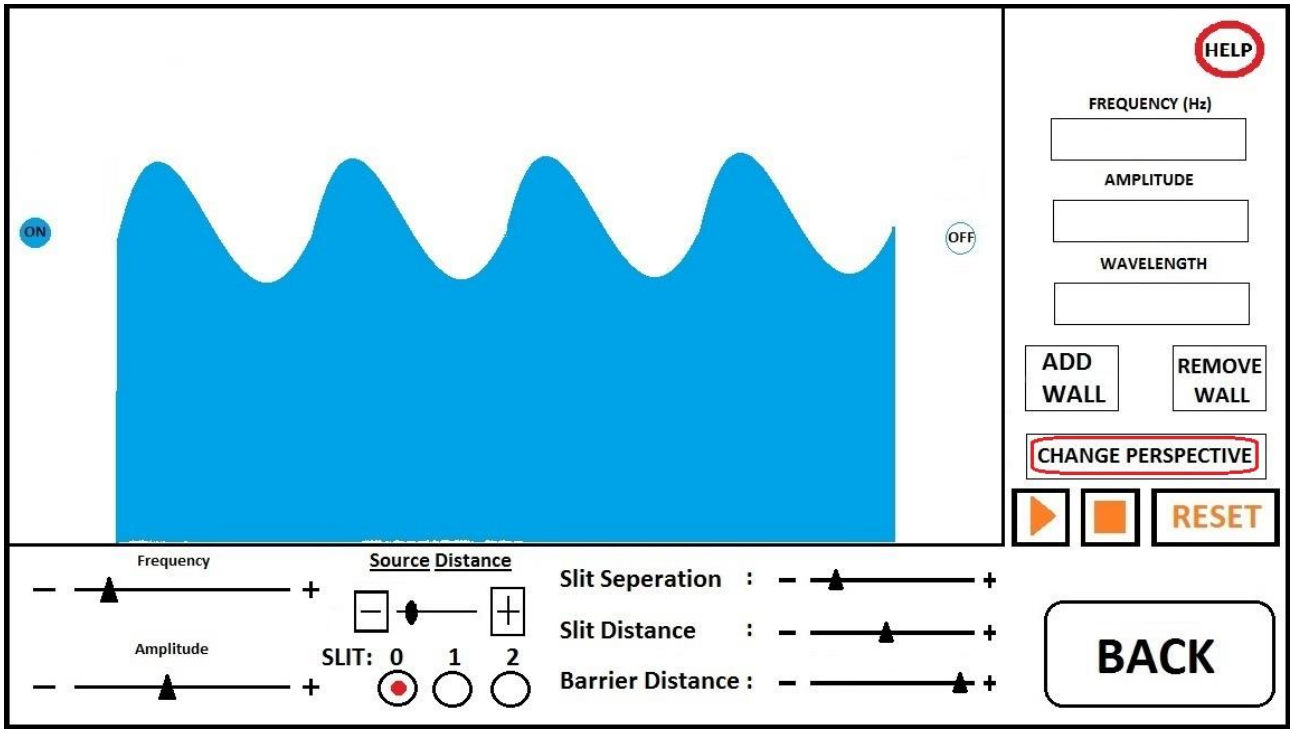
(7) Add Wall button:



After clicking this button, user clicks a point in the grid while holding the left click user moves the mouse and wherever user releases left click, there will be an obstacle created between these two points. Changing size and location of the obstacle is explained in (4).

(8) Remove wall: User clicks to remove wall button first then the wall he/she wants to dis-appear.

(9) Change Perspective button: User can change viewing perspective from top to side or vice-versa.



(10) Source Distance Adjustment: While left source is stable at (0, 0), right source can move on the x-axis. Since water waves are circular, y-axis location of two sources do not change anything on the simulation.

(11) Slit Options: User has 3 options which are no barrier, one or two slits.

(12) Slit distance adjustment: User can slide the cursor left or right to increase or decrease the slit distance in the given interval.

(13) Barrier distance adjustment: User can slide the cursor left or right to increase or decrease the distance between source and the barrier in the given interval.

(14) Slit Separation: User can slide the cursor left or right to increase or decrease the slit separation in the given interval.

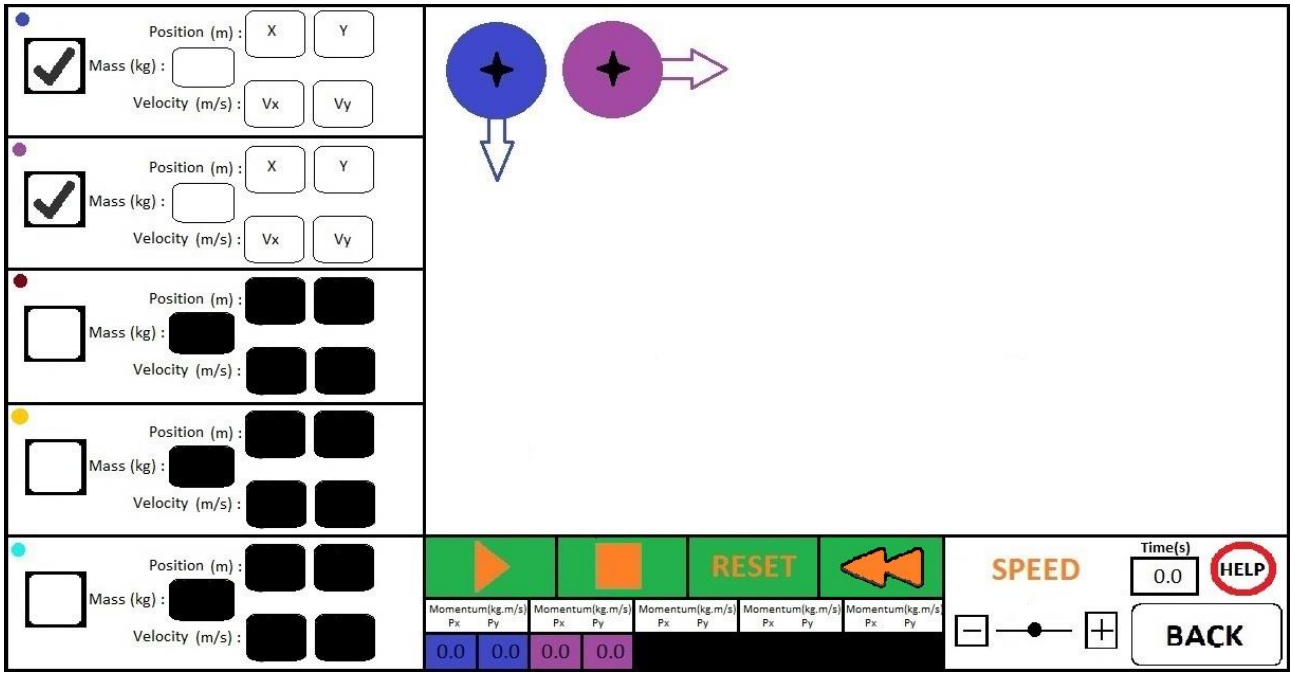
Note: As a group we determined to exclude saving function for this part of the program because setting a simulation is easy and quick enough, so saving option is not necessary.

Note: Although slit experiments are widely known by high school students, they will be explained in help section.

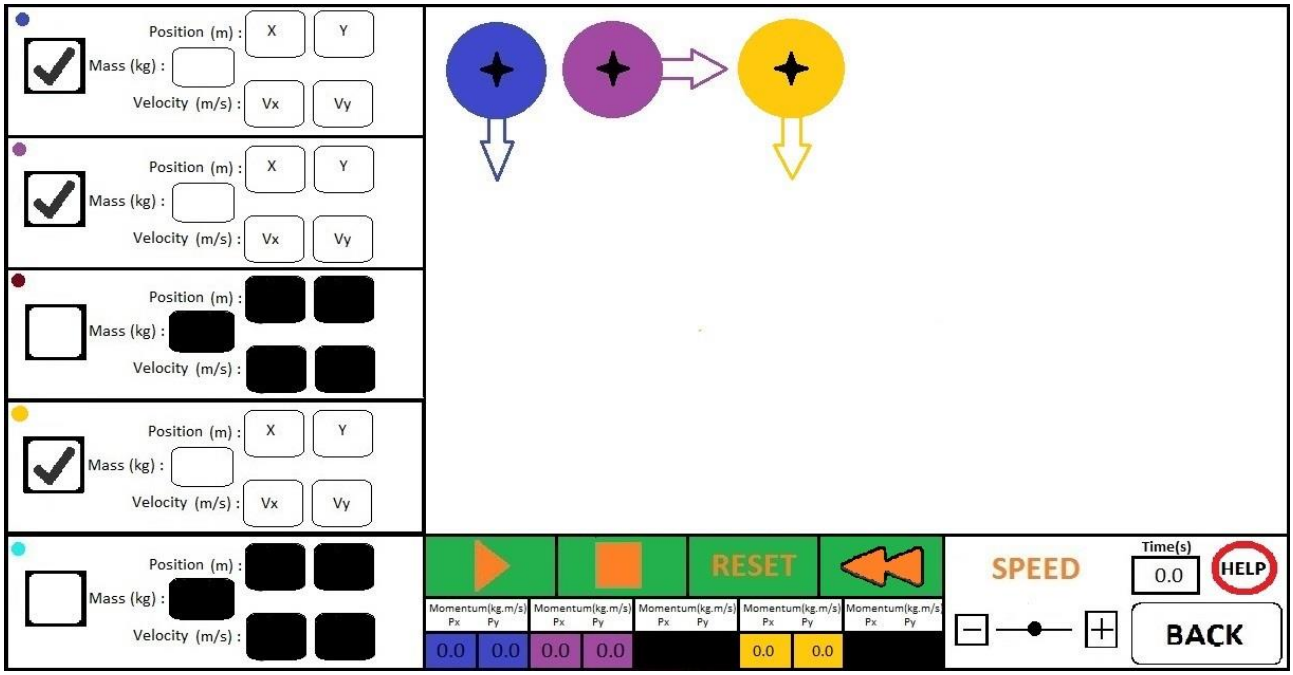
Note: Since the period of the water waves takes a short time, desirable situation can occur very often. Therefore, it is unnecessary to make simulation run reverse in order.

2.2.3 Collisions

Program welcomes to user with a default simulation.



When user marks checkbox, simulation adds the new objects to the area. Meanwhile, user enters the mass, position and velocity vector. (Coordinate system for this section is the same as water waves section.)User can add objects by using mouse as well as in water waves for adding wall. User provide the velocity vector via entering the x and y component of the velocity vector. Maximum objects number is 5 because we want to show the logic behind this topic and for this even 3 objects are enough. We think that more than 5 objects get the simulation more complicated.

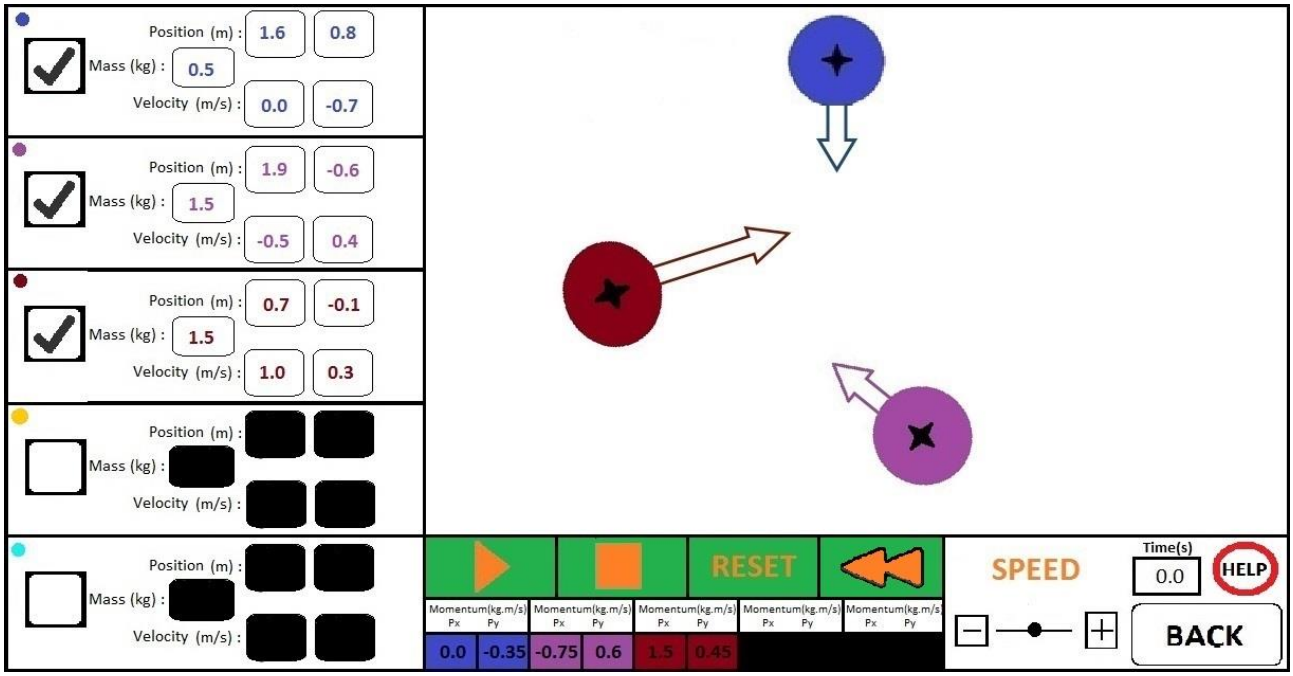


(1) ▶ / ⏸ button: Starts the simulation at least two objects that information about objects already provided. Freezes the simulation to better observation. If user wants to change the objects' velocity, mass or position, the system needs to be paused and changes are made by using menu on the left.

(2) ■ button: Clears all entered information.

(3) Speed Adjustment: It speeds up or slows down the system and user can see the rate of slowing down or speeding up.

(4) ⏪ Button: When user clicks this, system runs reverse in order.



Note: As a group we determined to exclude saving function for this part of the program because setting a simulation is easy and quick enough, so saving option is not necessary.

Note: When objects meet edge of screen, obviously, they bounce back according to formulas.

Note: Since volume is not relevant for collision, we decided to not to make sizes of the objects proportional to their mass.

3. Summary & Conclusions

All high school students are obligated to know physics but knowing something and memorizing the formulas are very different things. We know the importance of learning the logic and we want the others to have a better chance to comprehend physics better. Actually there are some programs on the internet about some physics issues but they do not feature these topics altogether. And most of them require internet connection without requirement of the internet the program can be easily used in the classrooms. If we had such a program back then we probably would not experience the difficulties we are experiencing now. We will provide this facility to ones who came after us.

We are still planning to add Projectile Motion if the time will be sufficient. Also, we tried to keep things simple while preparing our User Interface Report. We believe keeping the interface simple is very important because people who will use this program are students and teachers so we do not want to confuse them.