Simulation of Physics in Python

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Abstract: Physics is the study of objects, motion, dynamics, kinematics where the students have to learn difficult formulas. Projectile fly without air resistance swings at specific angles, orbits are always circular, and no more than two particles move together at any same time. These are the main aspects of physics because you are trying to learn the basic laws of nature. As compared to the real world it is far more complicated to study, students have to learn these laws and have to apply them to complex problems. [2] In modern advances, computers make it possible to perform extremely lengthy and complex calculations in a negligible amount of time and period. These days, computers offer the best method for applying the basic laws of nature to complex and realistic physical systems. Using a computer program for simulations plays a crucial part in modern science and engineering. A program that simulates the model of the behaviour of a physical system is called Computer Simulation.[3]

Keywords:- Swings, Kinematics, Projectile fly.

I. INTRODUCTION

One of the best ways to learn gravitational force is by using the Euler-Cromer Method in a computer code. [2] Suppose, for example, suppose if we wanted to study the orbit of a planet around the star. We need to program the gravitational force between the planet and the star just requires a few mathematical steps. We have used PyQt5 to design the UI of our project. It is specifically used for designing the pages with different toolboxes present in the PyQt5 that makes the user easily interfacing with their choice of UI. Let's us begin with the mathematical steps First step: the negative sign of gravitational force indicates that it is always attractive. Second step: mass of the star multiplies by mass of the planet. We use a distance-vector in our program to calculate the distance between the star and planet.[4] The gravitational constant is a universal constant. It remains constant on every planet in the solar system.

The VPython (short for Visual Python) packages are used to address the problem with visualization. Force helps an object with weight to change its velocity from the initial state to the final state i.e., to accelerate. Another Definition of force is that it is a push or pull. Force is a vector quantity. The SI unit of Force is Newton and it is represented by F. Gravitational force is equal to the force that the earth exerts on you. [3]A steady or near the surface of the earth, the gravitational force is equal to the weight of the person. The equation for the gravitational force is one of the biggest successes in physics. It explains to us how fast the moon rotating around the earth. It plays an important role in launching any satellite in space without studying the gravity it is impossible. Also, it has been seen that it helps us to find the dark matter, black holes.

We have designed a program where we have created a simulation in physics with the help of the VPython package. Here, we have done research on different motions. Python is a language that most of the developers prefer as it has a different library where the functions are pre-defined in them. Someone using a Python program to run on your Python system can therefore be a difficult task. Another problem in the Python interpreters is that they do not produce very efficient machine code, so Python programs tend to run rather slowly necessitating the use of add-on packages for heavy-duty computation. [1] It has been created for learning simulation and visualization. For creating animated graphics or interactive user controls we need to use the VPython (Visual Python) package is to address this last deficiency. This VPython package provides a very easy interface to a 3D graphics library, along with some different types of functions for handling vectors and animation.

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II. RELATED WORK

In our report survey, we have come across different students from elementary school level to high school. They have problems in learning physics because they are not able to visualize the distance between stars and planets. At exams, they are not able to make the correct figures due to which they are not able to get marks on their paper. Many Students get failed only in physics subject. Their many problems in physics especially in gravitational force in the solar system.[5] Learning the solar system is very complicated for anyone without visualizing it. There is much software present in the modern world but they are limited only to a specific planet.

We have also done research in colleges where we have seen that even the students from science and engineering are unable to draw a correct distance of a planet from a star. They get confused between the sun and moon rotation around the different planets. In geography also they have studied the solar system but they are not able to visualize the planets in real scenarios where in past years the scientist has given us the formulas to calculate the distance between the earth and another planet.[6] For calculating the average distance between two planets, the Planets and other websites assume the orbits are coplanar in nature. Then subtract the average radius of the inner orbit r1 of the first planet, from the average radius of the outer orbit, r2 of the second planet.

III. METHODOLOGY

In our project we have made an approach to solve the problems of the students who are trying to learn the physics and geography. We have used the computer programming knowledge to tackle the problem of the student who are facing the problem of learning their difficult subjects.[9] Our main objective was to make the students to interact with their difficult subjects with their way of ease learn. Objectives of our projects are:

- Using the distance vector to calculate the distance between the star and planet.

- We will subtract the distance vector of the star and the planet irrespective of their position in the solar system.

- We used a R hat vector which gives the direction of the gravitational force.

- Then we made the UI of our project by using the PyQt5 library.

- Finally, we have made the project with coding in python using the VPython library.

- It will make the student more interactive towards learning the physics and geography.

- It will also help the teachers to improve their method of teaching in schools and colleges.

- By using the concept of Euler-Cromer method in computer-aid system has been easy way of learning.

- We can also use Euler-Cromer for the projectile motion of different objects in the solar system.

- Thus, the scope of this project is not only limited to the simulation of physics in solar system we can also add another feature of physics in the future models.
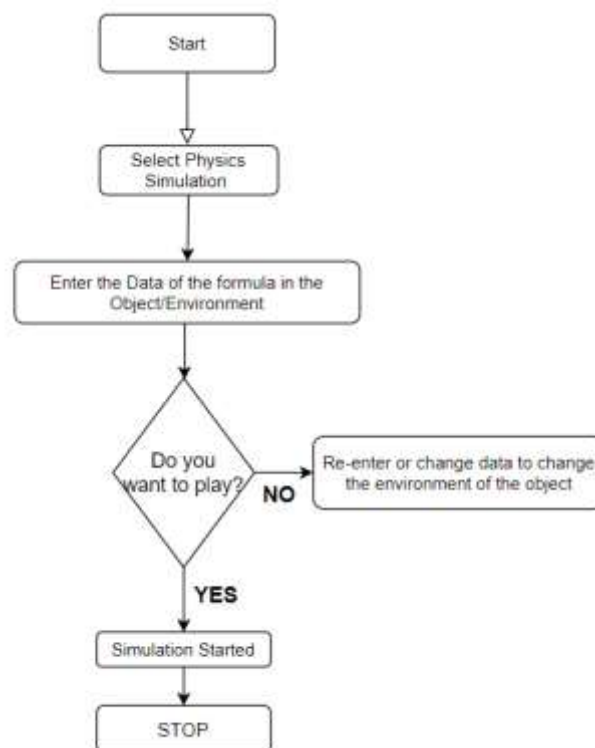
Our approach to solving this problem is by making software, which is suitable for every-one. The user before going for physics simulation, the user can learn about that topic by providing a link below the topic. The software provides 3D animation to try to simulate real scenarios, so users can understand the topic with proper depth. The software also provides the result of the simulated scenario.[10] First, we try to make a UI which is user friendly where the students can interact with the software easily. The second main aspect of the project is that it helps the students to learn the physics software without having any internet connection. Formulas can be created by the user. Students can change the different values in the solar system and try to simulate the project as per their needs.[4]

IV. IMPLEMENTATION PLAN

By using the distance vector to calculate the distance between the star and the planet. Where we have seen the planet revolve around the star in an elliptical path. Revolving around the star, the planet tends to unfollow their path of rotation. Thus, we have checked that the different scenarios where the planet can state in their orbit when revolving around the star.
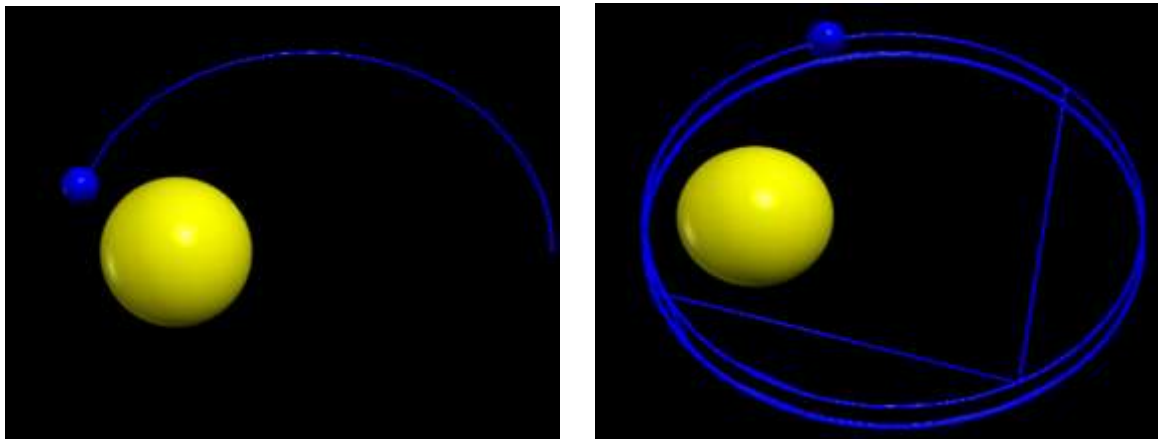
Thus, finally by using the python in-built packages we have implemented or project in python.

V. RESULTS AND DISCUSSION

In this project, with the help of python in-built packages we have built our project. We have found that these way of learning makes the student more interactive towards the learning of the physics subject. It also helped many students of schools and colleges. Students that are not having internet connection can still access this way of learning. Earlier it has been that many students find difficult to learn physics. Using the modern ICT tools have boosted the growth of learning. Thus, we have carried out simulation in physics very efficiently and quickly with the help of python in-built packages.

VI. CONCLUSION

We have come across the different cases of problems in physics, especially in gravitational force. Thus, we have concluded that with the help of python and its different packages. We can do visualization of different objects in the projectile motion; we can also use gravitational force to calculate the force exerted by the star on the different planets in the solar system. We have used the VPython package in Python to visualize this object. This package an in-built function that makes the different shapes easily in the 3d format of the object. We have created the UI using the PyQt5 package to make it easily understandable to the user. Hence, we have done our project through python successfully.

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