ROLLER COASTER

Problem Statement

The Experiment is based on Law Of Conservation of Energy principle.

We need to measure Kinetic Energy and Potential Energy of an object at various points in the path and show that the energy is conserved.

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We will be measuring kinetic energy and potential energy of a car at each point on an inclined plane.

For calculating the kinetic energy and potential energy we will be measuring the velocity and height of the car at each point.

Kinetic Energy and potential Energy of the car at a point are given as,

Kinetic Energy $=\frac{1}{2}Mv^2$; $v=\frac{ds}{dt}$

Potential Energy $=Mgh$

Where M - Mass of the car,

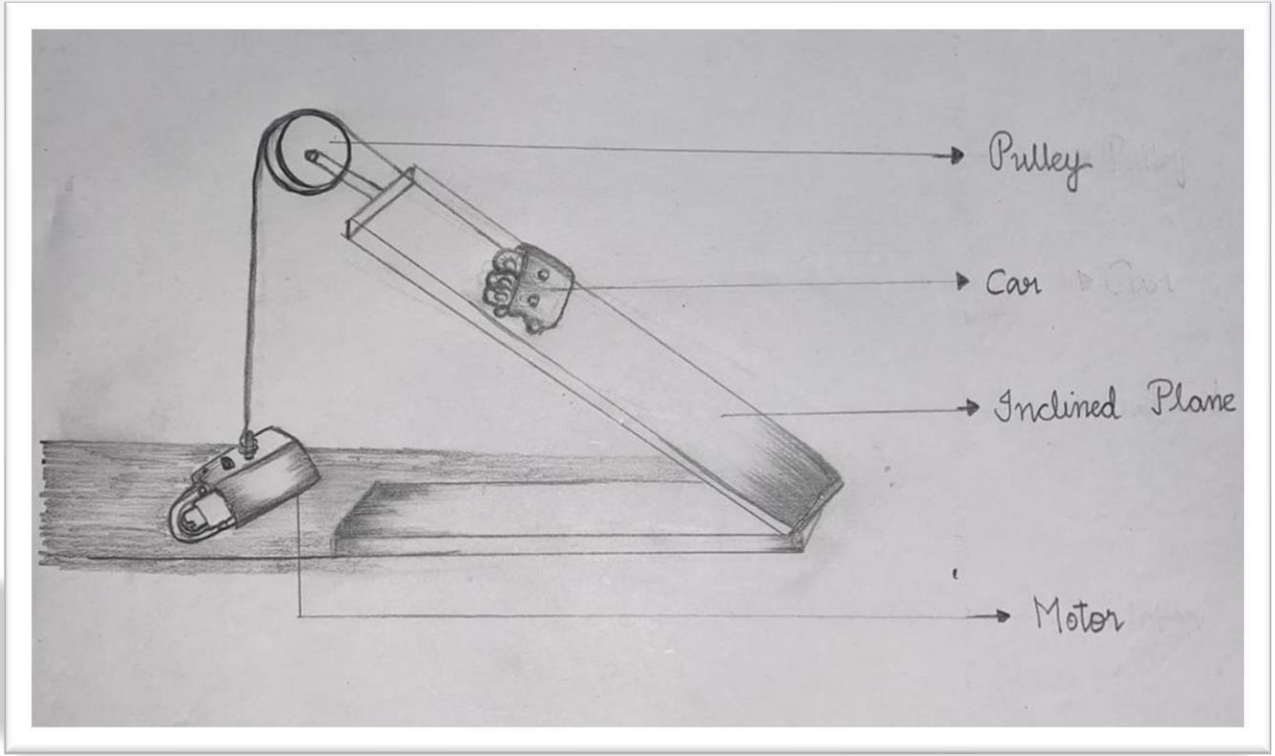
v – Velocity of the car at a point

g – Gravitational Constant

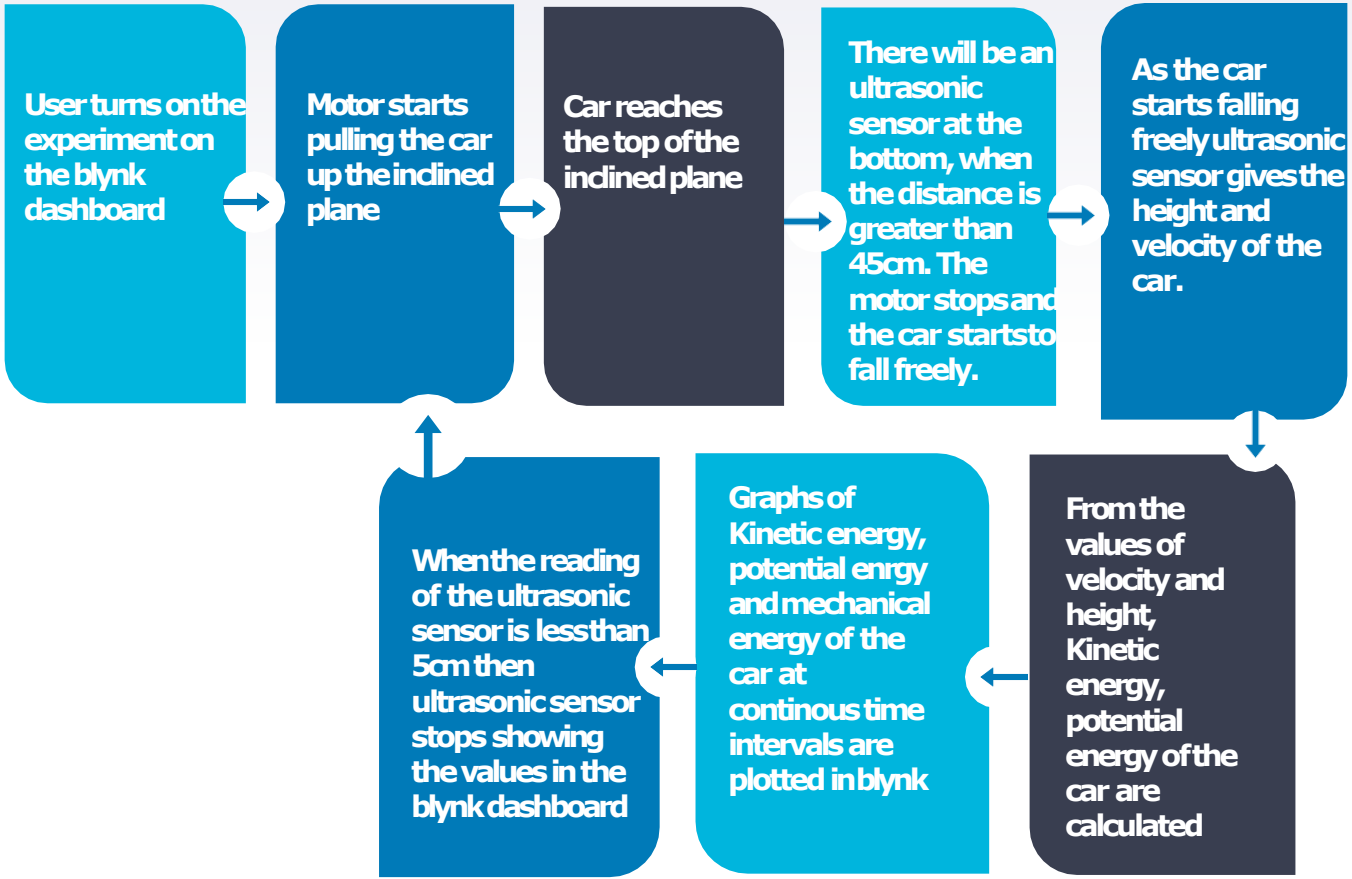
h – Height of the object

We should show that KE+PE =Constant at every point.

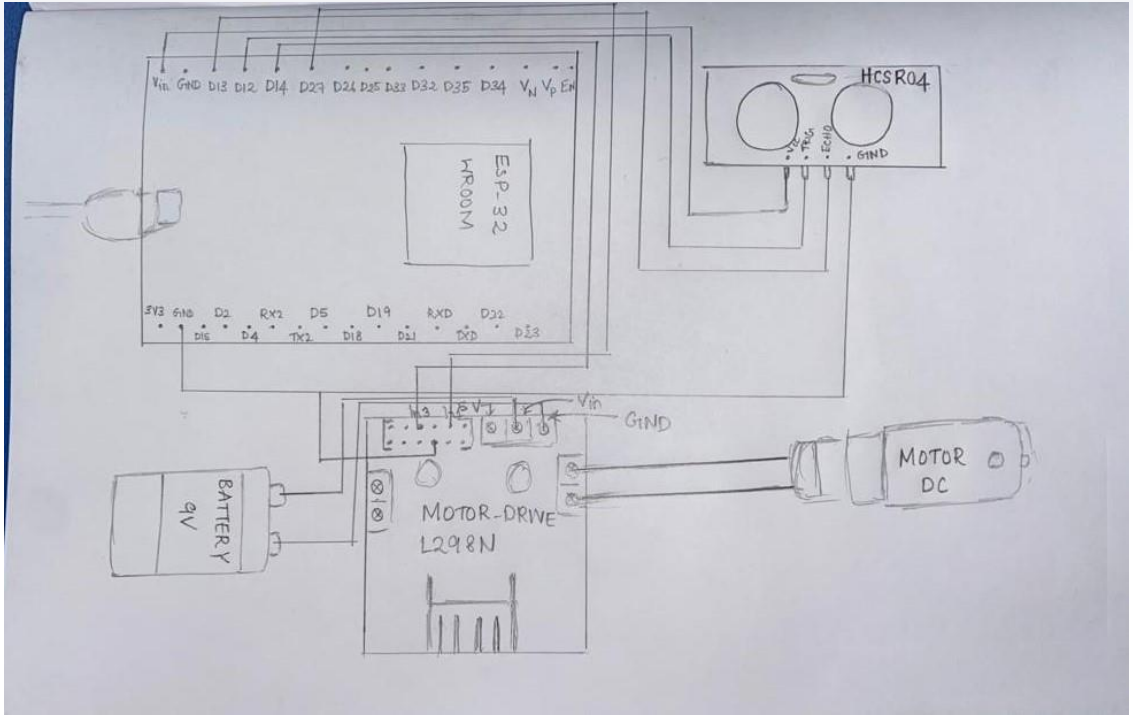
Setup Diagram



Block Diagram Of IOT Based Setup



Circuit Diagram



TimeLine

1st Idea

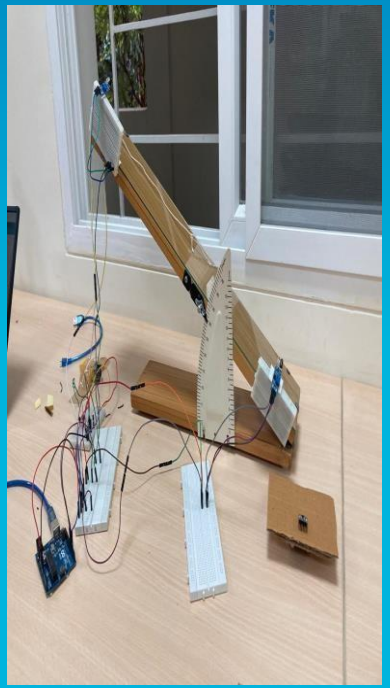
2nd Idea

Final Idea

Our First Idea:

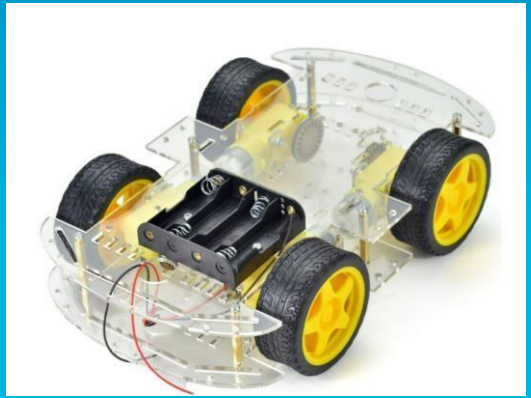
Our idea was to connect a small car to a motor using a thread on an inclined plane. We mounted the motor on the top of the inclined plane and connected the car to it using athread.
When the car is at the bottom of the inclined plane the motor starts to pull the car, as the car reaches the top of the inclined plane an IR sensor at the top goes HIGH and the motor stops pulling the car, the accelerometer was used to give the values of acceleration; using which, the values of velocity and distance covered had been computed.

But our assumption failed while working on this idea. As the car reached the top of the inclined plane it didn't fall freely. It started to move down the inclined plane only when the motor started to rotate in anti-clockwise direction, in this case there was no free fall of the car. To show that the mechanical energy is conserved the object must fallfreely.



Our Second Idea:

As our earlier idea didn't work, we came up with a new idea. This idea was to make a car using two motors and make a hill-type track. When the user starts the experiment, the motors start working and the car starts climbing the track, as it reaches the top of the track, an IR sensor at the top goes HIGH, and motors stop, we thought that the car would fall freely.



But our assumption that the car falls freely failed in this case also and there were few disadvantages in this idea:

- Should supply sufficient power to motors such that the car can reach the top of the track.
- Wheels of the car could only rotate when motors are on, otherwise they won't rotate freely as they are tightly attached to the motors.

Final Idea

Finally, our idea was to take a small car and connect it to one end of a pulley using a thread and another end of the pulley to a motor. When the car is at the bottom, the motor starts pulling the car up the inclined plane, as the car reaches the top of the inclined plane the motor stops, and we will be giving a small jerk to the car such that it starts to fall freely (similar to our first idea).

We worked upon this idea, and it worked out successfully. An Ultrasonic sensor has been used to measure the height and velocity of the car to calculate the Kinetic and potential energies.

Potential Energy = mgh = (mass of moving body) * (g) * (distance * sin(30))
Where, 30 degrees is the angle of inclination.

Flow Chart of the Code

Motor starts pulling the car,when the distance measured by ultrasonic sensor at the bottom is less than 5cm.

```
distance=sendSensor();
 if (distance<=5)
 {a=1;
digitalWrite(motorPin, HIGH);}
```

Motor stops when the distance by Ultrasonic sensor is greater than 45cm.

```
else if (distance>45)
 {a=0;
  digitalWrite(motorPin, LOW);}
```

Car starts falling freely, Ultrasonic sensor displays the values of velocity and height of the car on blynk dashboard.

```
distance= sendSensor();
 ds =distance - distance_now;
 distance_now =distance;
 float v =float(ds/dt);
 //Serial.print("Velocity");
 //Serial.println( v)

 duration =pulseIn(echo, HIGH);
//Read echo pin, time in
microseconds
 distance =duration *0.034 /2;
//Calculating actual/real distance

 Serial.print("Distance =");
//Output distance on arduino serial
monitor
 Serial.println(distance);
 Blynk.virtualWrite(V0, distance);
```

Dashboard

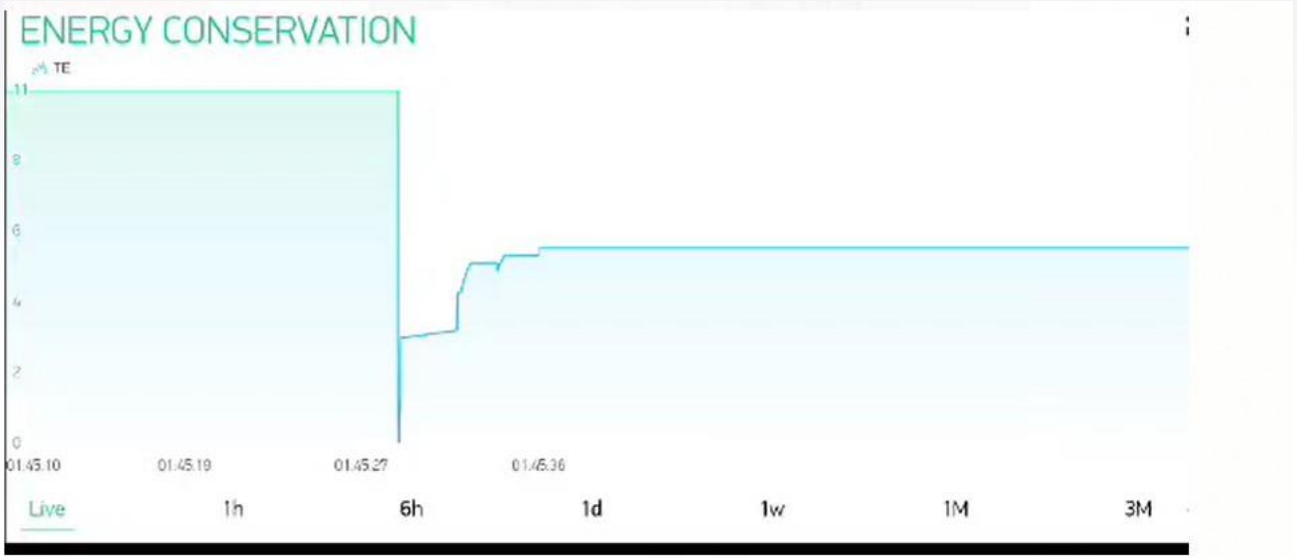
For our project we are using blynk software dashboard.

Here user will have the option to start the experiment. When the user starts the experiment they can observe the graphs of kinetic energy, potential energy and mechanical energy.

By observing the graph of mechanical energy user can observe that mechanical energy is being conserved, there will be very small energy loss due to frictional force of the inclined plane and other resistive forces.

Here the user can also see the live streaming of the experiment.

Dashboard Preview



THANK YOU

Video link:

https://www.youtube.com/watch?v=UPzxpm1VQMc

Team Name: Connective

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