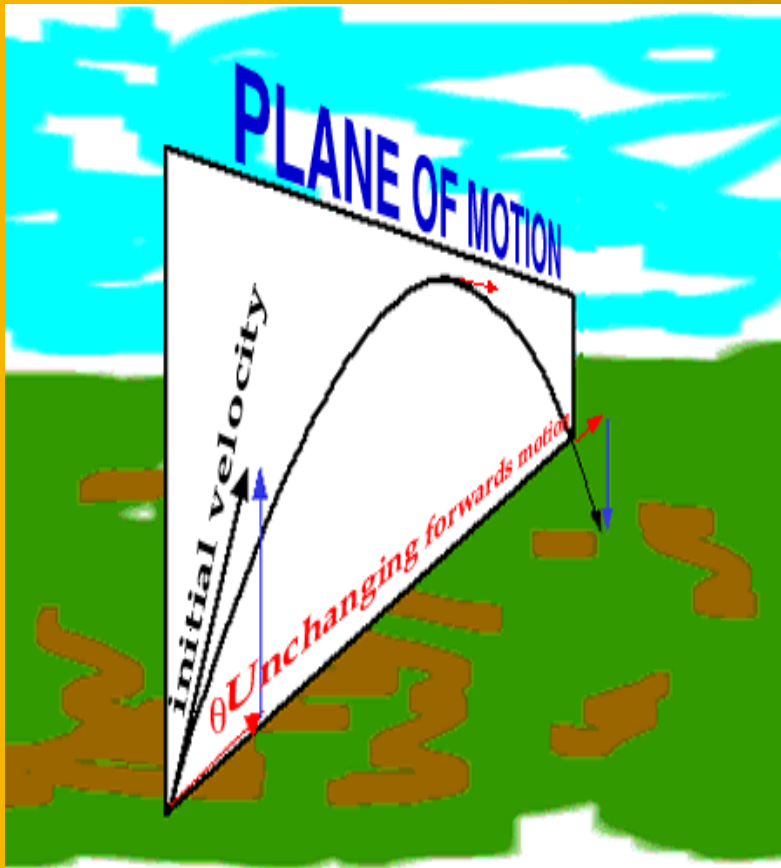# The Physics of Projectile Motion

Presentation by:
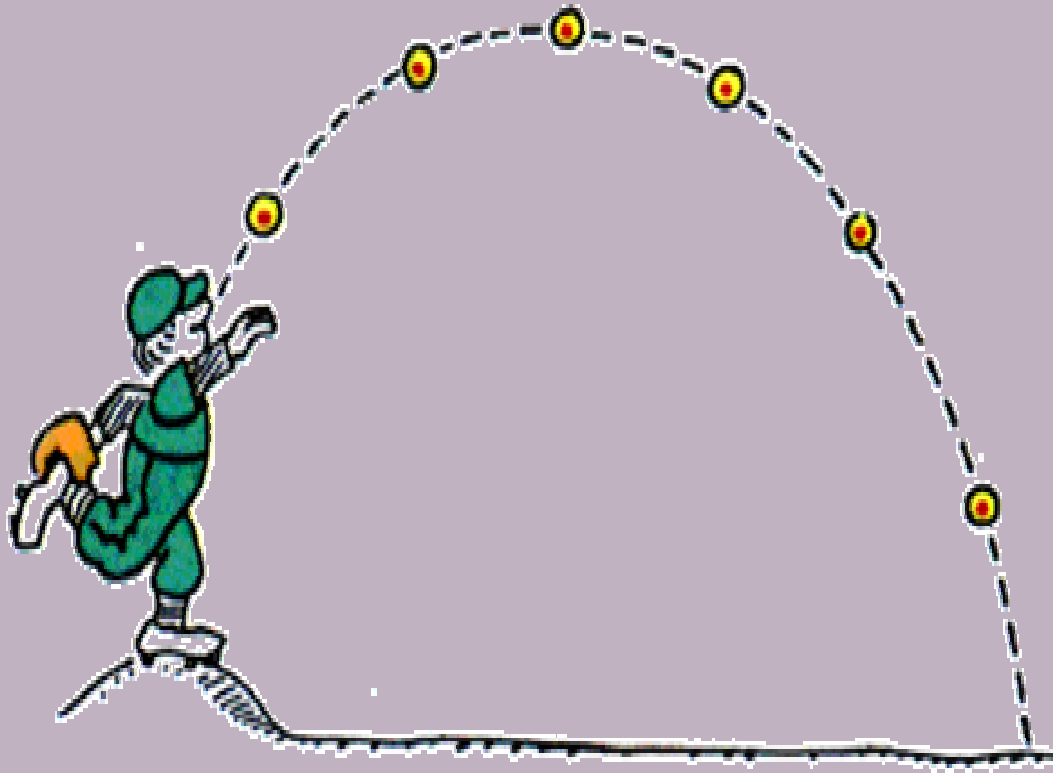
William Leacock & Marlene McGarrity

What is Projectile Motion?

- Projectile motion refers to the motion of an object projected into the air.

Projectile Motion Can Be Seen in Sports

- **A baseball or football being thrown**

- **A a soccer ball begin kicked,**

- **A skater completing jumps**

It Can Also Be Seen in:

- **Fireworks**
- **Cannons**
- **Water Fountains**

Physics Core Standards

- **Standard 1: Analysis, Inquiry & Design**

- Students use scientific inquiry and engineering design, as appropriate, to pose questions, seek answers and develop solutions.

# Physics Core Standards

- ## Standard 4: The Physical Setting

- 4.1a All energy transfers are governed by the law of conservation of energy.*

- 4.1b Energy may be converted among mechanical, electromagnetic, nuclear, and thermal forms.

- 4.1c Potential energy is the energy an object possesses by virtue of its position or condition. Types of potential energy include gravitational* and elastic*.

- 4.1d Kinetic energy* is the energy an object possesses by virtue of its motion.

- 4.1e In an ideal mechanical system, the sum of the macroscopic kinetic and potential energies (mechanical energy) is constant.*

Physics Core Standards

- ## **Standard 5: Energy and matter interact through forces that result in changes in motion.**

- **5.1e An object in free fall accelerates due to the force of gravity.* Friction and other forces cause the actual motion of a falling object to deviate from its theoretical motion.**

- *(Note: Initial velocities of objects in free fall may be in any direction.)*

- **5.1f The path of a projectile is the result of the simultaneous effect of the horizontal and vertical components of its motion; these components act independently.**

- **5.1g A projectile's time of flight is dependent upon the vertical component of its motion**

- **.**

- **5.1h The horizontal displacement of a projectile is dependent upon the horizontal component of its motion and its time of flight.**

Here is Our Demonstration

- **The cart is placed in the center of ramp platform behind the servomotor**
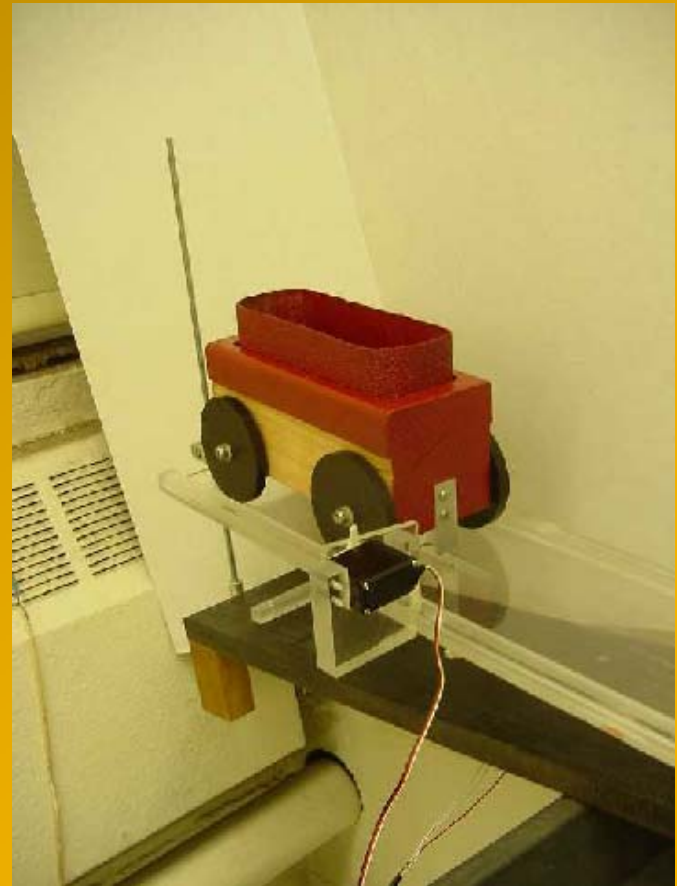
Setting Up

- **The ping pong ball is put at the launch platform and the push solenoid reset**

- **Then the demonstration is ready to begin.**

P-Basic Program

- **After P-Basic downloads the program, the sound card says "Hello" to greet the user.**

- **The servomotor resets**

- **A debug window appears and the user is asked to press the red start button on the circuit box. When the button is pressed, the user is asked to input an angle.**

The Potentiometer

- **The potentiometer is a variable resistor which sends a potential to the ADC. The ADC converts the potential to a digital signal which allows the Basic Stamp to determine the angle of the platform based upon a calculation.**
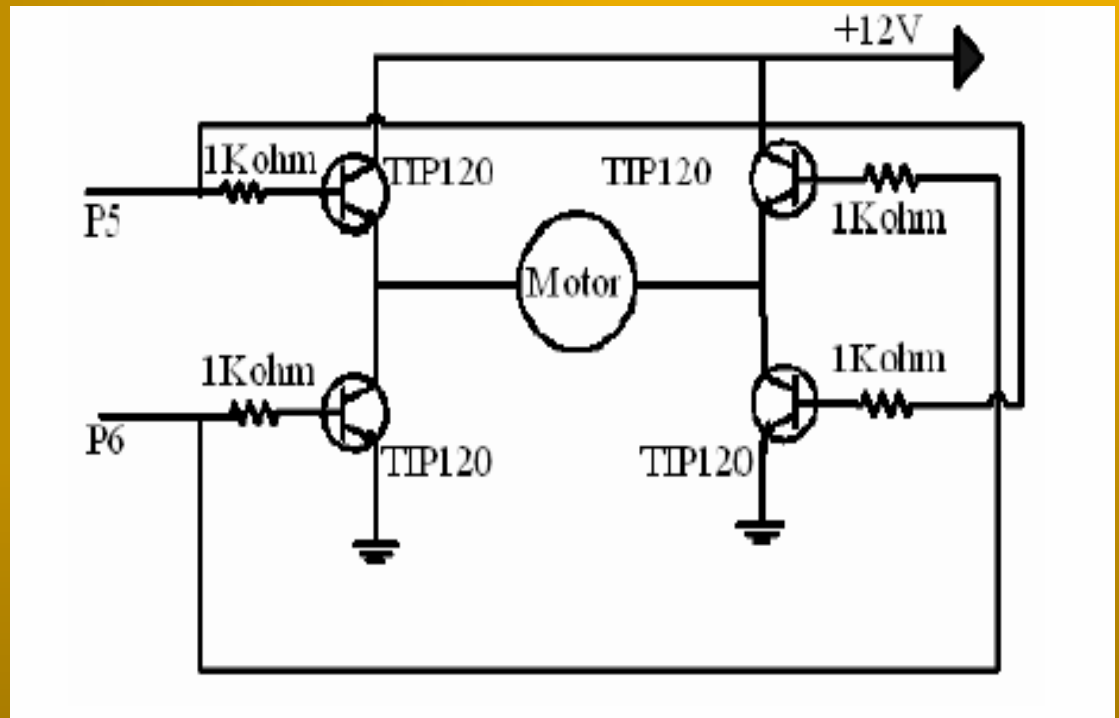
The DC Motor

After the user inputs an angle, the Basic Stamp compares the input angle to the actual angle of the platform. The dc motor begins to raise the platform.
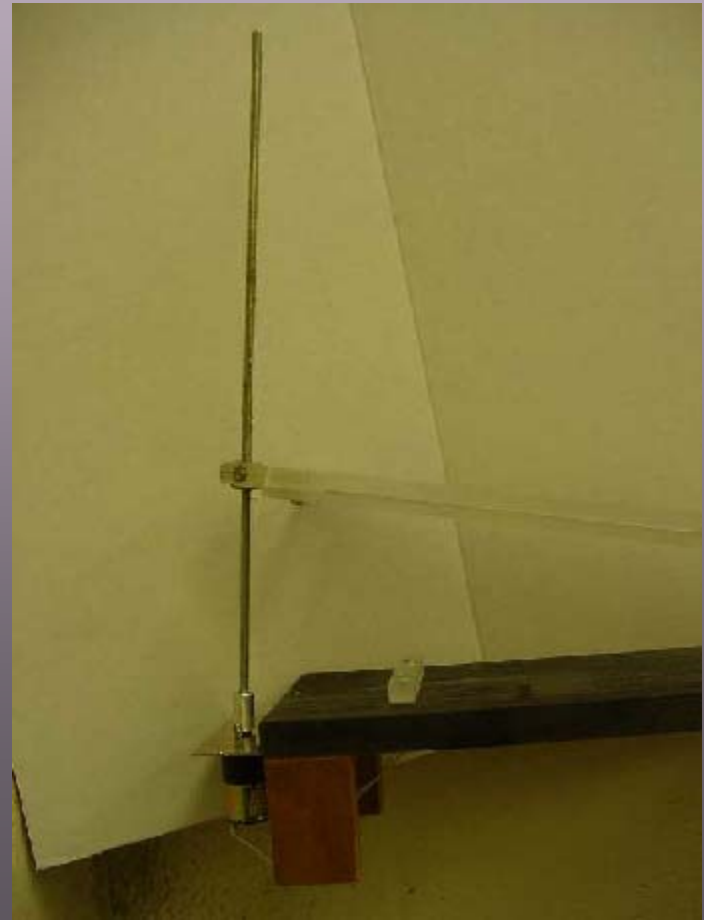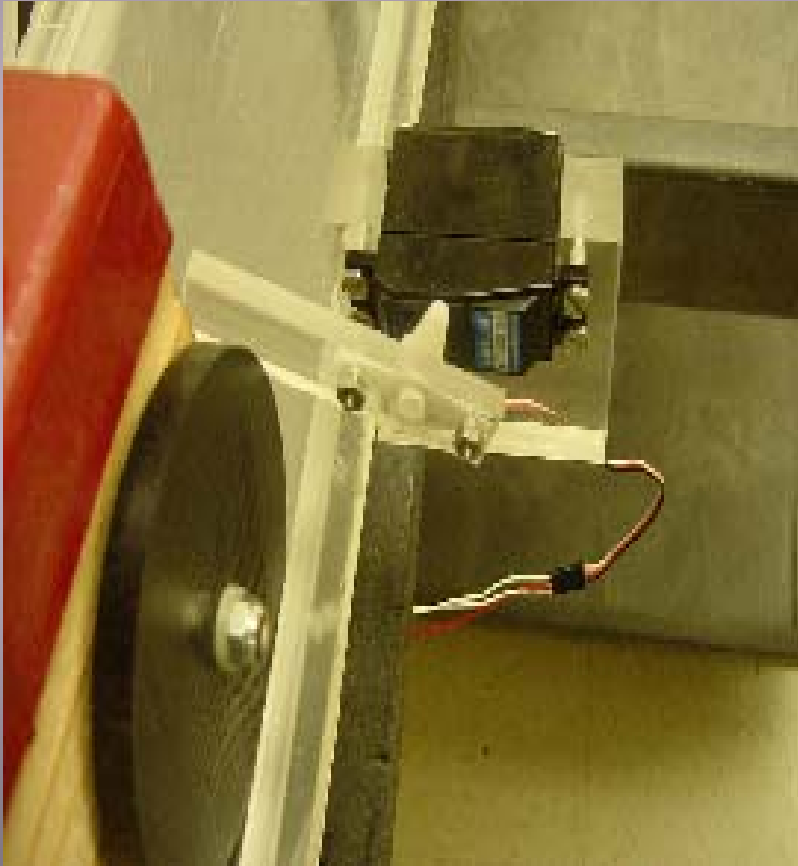
H-Bridge

The H-Bridge allows the 12Volt DC Motor to be Controlled by the Basic Stamp. In our project it provides isolation form the 5 VDC and the 12 VDC

Servomotor

- **Once the incline reaches the proper angle a signal is sent to the servomotor instructing it to rotate 90 degrees to release the cart.**

Photogates

As the cart comes down it interrupts two photogates which consists of an Infrared Emitter Diode and a Phototransistor. The the cart travels along the track and interrupts the photogates, sending a signal to the Basic Stamp.
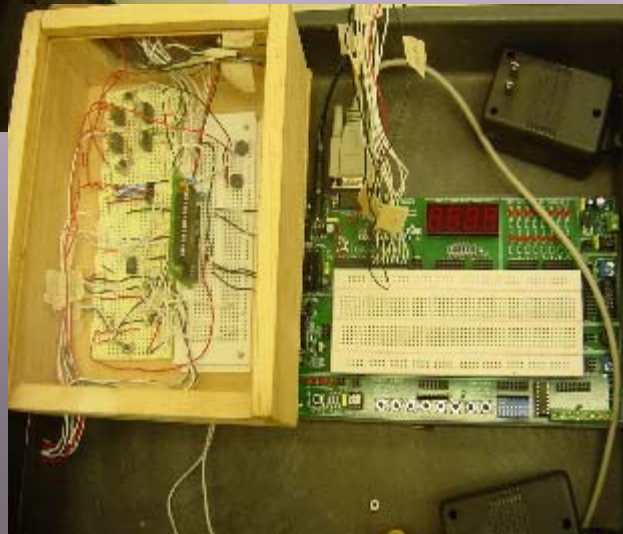
Push Solenoids

After it passes the photogates the velocity of the cart is measured. A delay time is calculated. At the proper time the push solenoid activates and launches the ping pong ball off the launch platform.

Ending

- **The ball lands safely into the cart.**
- **Then the velocity of the cart is announced from the sound card.**