1-4-2006

Medieval Conquest

Aaron Harrington
The College at Brockport

“Medieval Conquest”

Teacher: Aaron Harrington
Participating Students: Jonathan Babb and Nathan Fries
Newark Central School Physics Department

Abstract:

The goal of our project was to create a model that demonstrated the concepts of two-dimensional projectile motion. We decided early on that the model would be most effective if we could create an interactive “video game” that required the user to apply the laws of physics in order to complete the challenge. Our team created an interactive model, set in medieval times, with a scenario of the user defending his/her castle from an approaching army. The physics user must apply his/her knowledge of projectile motion in order to defend his/her castle against the approaching army. The model was designed so that many aspects of the model can be easily controlled.

Modeling Software Selection:

For the creation of this interactive model, our team selected the Interactive Physics modeling software. The Interactive Physics software is ideal for demonstrating kinematical models physics. The software is so “user-friendly” that my students were able to begin creating the model after only ten minutes of formal software instruction.

Project Log:

October 12, 2005 at 2:30

- Initial project introduction
- Topic brainstorm session
- Possible ideas: Newton’s Laws, projectile motion, video game type interactive

October 19, 2005 at 2:30

- Introduction of Interactive Physics software
- Students experimented with possibilities/limitations of software and project ideas

October 26, 2005 at 2:30

- Topic decision: Projectile motion in two-dimensions
- Blueprinting ideas for interactive, decision was to go with a medieval times setting and conquest of a defended castle

November 3, 2005 at 11:30

- Building of model, outside wall and projectile created
- “Constraint instability” issues encountered not resolved

November 4, 2005 at 11:30

- Building of model, castle added and approaching army (currently a block) created
- Constraint instability will be an issue only on the first run of the model after adjustment

November 9, 2005 at 2:30

- Building of model, Text box with constants and initial x velocity of project control added

November 15, 2005 at 11:30

- Model completed, and ran successfully (except constraint issues)

December 8, 2005 at 2:30

- Final touches to model finished and ready for competition

Project Overview:

The goal of our project was to create a model that demonstrated the concepts of two-dimensional projectile motion. We decided early on that the model would be most effective if we could create an interactive "video game" that required the physics user to apply the laws of physics in order to complete the challenge. Our team created an interactive model, set in medieval times, with a scenario of the user defending his/her castle from an approaching army. The physics user must apply their knowledge of projectile motion in order to defend his/her castle against the approaching army.

The model was designed so that many aspects of the model can be easily controlled. Slide bars were added to allow the user to control the initial velocity of the projectile, the initial velocity of the approaching army, and the initial velocity of the battering ram. Air resistance can be added in order to make the model more closely depict a real world setting.

So that the problem solution did not become too complicated our team decided to place the projectile launcher on an elevated platform with a the launch angle of zero degrees, completely horizontal. This creates a scenario where the vertical component of the projectile's velocity is only a function of time and acceleration due to gravity (g). In order to successfully "conquer" the model the physics user must have a working knowledge of two-dimensional projectile motion (see NYS Physics Standards below).

One of the main problems that we encountered on the creation of our model (and a problem that I have encountered previously) is what appears to be a computer software "glitch." At high velocities, projectiles will pass directly through a stationary object, when it should be bouncing off of the object. To avoid this "glitch" we created projectiles with velocities that stayed below the upper limit allowed by the "glitch."

Our team was very enthusiastic about the completed model. We selected several physics students to give our model a test run. After a brief tutoring session on the workings of the program, the students were allowed to experiment with the interactive model. The most eye opening comment by one of my

students, after seeing the velocity vectors applied to the projectile was, “Oh my gosh, it now makes sense.” The interactive model took the abstract concept of vectors, applied it to a concrete scenario, and it suddenly made sense.

This project was extremely rewarding for the students that were able to participate. It allowed them to take their knowledge of physics and apply it in a setting that they truly enjoyed. As our student’s lives become increasingly computer oriented, we need to find ways to tap into this interest and knowledge. Interactive Physics models, such as “Medieval Conquest,” are exactly on target!

Content Standards:

NYS Physical Setting/Physics Core Curriculum

Key Idea 5:

Energy and matter interact through forces that result in changes in motion.

Major Understanding:

5.1c The resultant of two or more vectors, acting at any angle, is determined by vector addition.

5.1d An object in linear motion may travel with a constant velocity or with acceleration.

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.

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.