

ZOOM ZOOM



Exploring the relationships of distance, rate, and time.

A project in mechatronics built by Chanel Tillman and Bronwyn Ryan
Bryant High School and The Center School

Goal

Our goal was to successfully re-configure a slot car track to have cars travel at one of four different constant speeds and to be “sensed” so that we could calculate the time it took a car to travel the length of the track and use results to work with our students on a variety concepts.

Materials Used

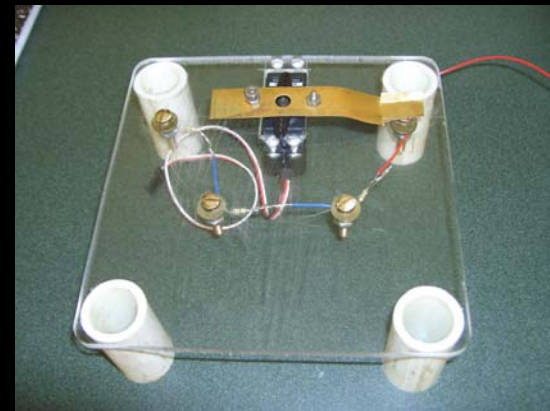
- 1/32 Carrera Car Set (cars and straight track only)
- 2 servo motors
- 2 "pseudo" potentiometers
- 6 infrared sensors
- BS2
- Breadboard
- Copious amounts of wires
- Re-rigged connector cable
- 2 20 - 25 Ohms Resistors
- 6 220 Ohms Resistors
- 6 1000 Ohms Resistors
- 4 15 Ohms Resistors
- An absurd amount of patience



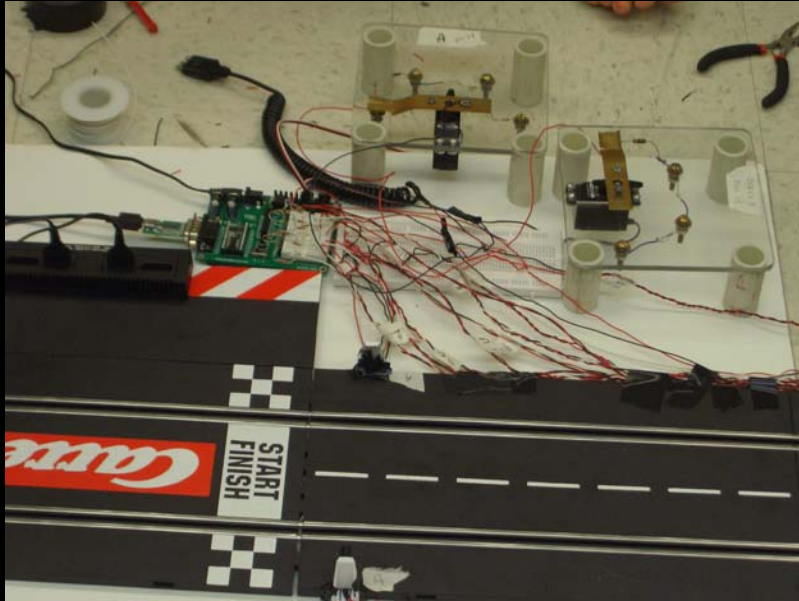
The first leg of the journey was to look into the electronic details of our new Carrera car set and figure out how we could get the cars to maintain a constant speed. We had to do quite a bit of re-wiring, but as you can see we made the most of it.



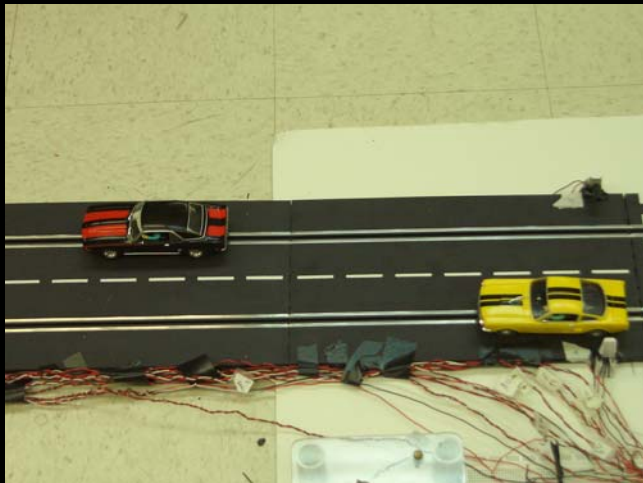
This is the controller that came with the car set. It is essentially a "push-button" mechanism that slides along a path of different resistances which control the car speed.



This is what we designed to do the job. Each of the screw heads represents a specific speed. The servo motor will rotate to one of the four speeds when prompted by the computer.

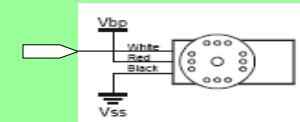
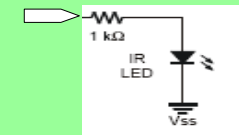
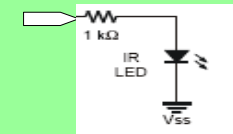
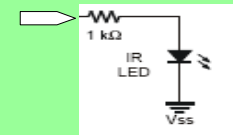
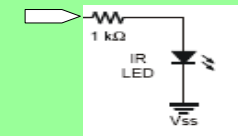
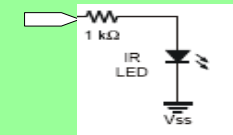
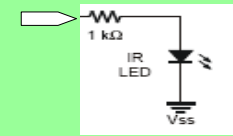
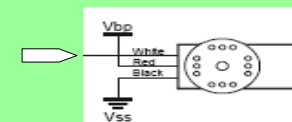
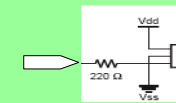
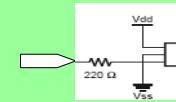
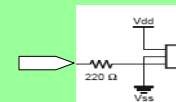
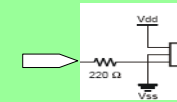
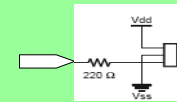
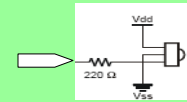


The finished product is by no means pretty, However the wire configuration to the left works to both power the cars and to operate the infrared sensors which measure the objects distance/time by detecting the emitted infrared from the cars as they near the sensors.



These are the cars just zooming down their track, you can see the first set of sensors just at the tail end of the yellow car. The project works well but has some limitations.

This is the schematic for the project. Pins 0,2,4,6,9, and 11 are used for the infrared receivers and pins 1,3,5,7,10, and 12 are used for the transmitters. pins 14 and 15 are connected to the servo motors.



Time Trials...

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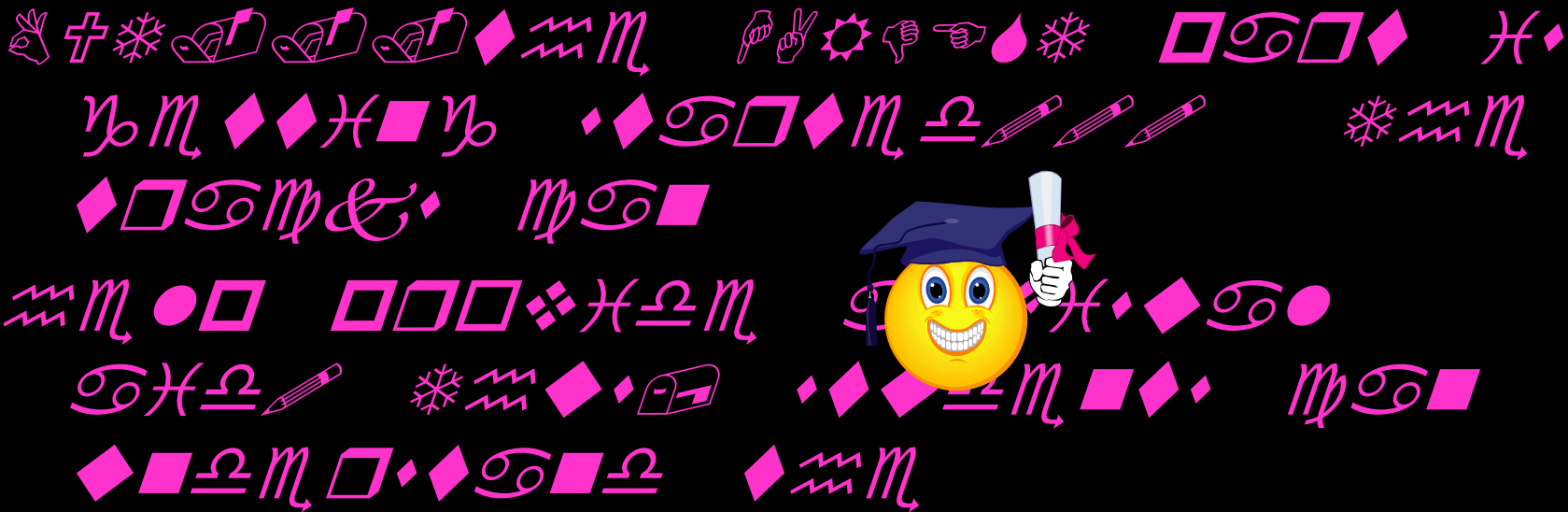
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➤ Two trains start at the same time from the same station and traveled in opposite directions. One traveled at the rate of 50 mph and the other traveled at the rate of 60 mph. In how many hours were they 660 miles apart?



➤ Mack left home by car, driving on a certain road at 30 mph. Two hours later, his brother started after him on the same road, driving 45 mph. How long did it take Mack's brother to catch up to him?



Limitations of the Project

Throughout the duration of this project, we learned a vast amount about circuits, connecting cumbersome wiring configurations, and computer programming.

Upon the conclusion of our project we have found that although the project functions, it has a few limitations:

- As the program runs the car may be so fast that the program has not had an opportunity to begin pulsing out to the first infrared transmitter.
- The second mishap could be that the car passes through the first infrared sensor while it is pulsing out to other infrared sensors, thus rendering the entire counter within the programming useless.
- It may be interesting to devise a system that detects the distance, rather than time. Distance would be more desirable since intuitively; one would expect time to be the independent variable and distance to be the dependent variable.

Standards Met

Mathematics

Students use ideas of uncertainty to illustrate that mathematics involves more than exactness when dealing with everyday situations.

Students use measurement in both metric and English measure to provide a major link between the abstractions of mathematics and the real world in order to describe and compare objects and data

Students use patterns and functions to develop mathematical power, appreciate the true beauty of mathematics, and construct generalizations that describe patterns simply and efficiently.

Students use mathematical reasoning to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.

Students use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.

Students use mathematical modeling/multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships.

Technology

Technological tools, materials, and other resources should be selected on the basis of safety, cost, availability, appropriateness, and environmental impact; technological processes change energy, information, and material resources into more useful forms.

Engineering design is an iterative process involving *modeling* and *optimization* used to develop technological solutions to problems within given constraints.

Technological systems are designed to achieve specific results and produce outputs, such as products, structures, services, energy, or other systems.

Computers, as tools for design, modeling, information processing, communication, and system control, have greatly increased human productivity and knowledge.

Without your help
we would be stranded
on a
dirt road
instead of racing down our fancy car
track...

- ✓ Padmini Vijayrakumar
- ✓ Anshuman Panda
- ✓ Sang Hoon-Lee aka Nathan
- ✓ Keith Ching
- ✓ Jared Frank
- ✓ Billy Mark
- ✓ Shin Lik Wong
- ✓ Dr. Vikram Kapila
- ✓ Professor Noel N. Kriftcher