

Computers in Process Control: The Rube Goldberg Chase

Team Project 8

Advisor: Mr. Manny Bhuta

Teaching Assistant: Justin Hotchkiss

Who We Are !

■ Mr. Manny Bhuta



■ Paul Kolb



■ Justin Hotchkiss



■ Andrew Lee

■ Lee-Shing Chang



■ Rajani Sharma



■ Dave Templeton

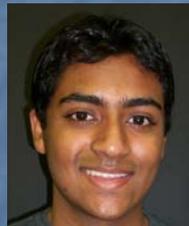


■ Mike Costa



■ Tina Wong

■ Eash Cumarasamy



■ Pat Ho



Rube Goldberg Device

- Rube Goldberg Device
 - An overly complex device that performs a *ridiculously* simple task
 - Created by Rube Goldberg to display the ingenuity and inefficiency of mankind
- Process Control
 - Use of computers to control the actions performed in the machine
 - Responds to variable conditions

The Task

- Our task is to raise a target bearing the suspect's face and then shoot a ping pong ball at it with a pressurized gun



What We Used

- Programming and Software
- Motors
- Nichrome Wires
- Thermistors
- Power Supplies
- Infrared Emitters/Sensors
- Relays

Programming and Software

■ Basic Functions

- Provides checkpoints throughout the process
- Starts and stops certain processes
- Two main functions:
 - Measures resistance change
 - Supplies power

■ DAQ

- Data Acquisition Unit
- Intermediate device between computer and relays
- Contains two multiplexers with ten relays each

■ Computer Program

- Written in High-Tech Basic (HTBASIC)
- Computer commands:
 - OUTPUT *@io-path; "command"*
 - cls<x>
 - opn<x>
 - two<x>
 - TIMEDATE
 - REM *text*
 - statement !text*
 - REPEAT
 - program statements*
 - UNTIL *condition*

The process
Many hours
as possible



complicated.
s complex

And it's all

Remote Control MINI Cooper

- The remote control is hard-wired to the computer control which signals the MINI Cooper to go forward and left, allowing it to travel a circular path.



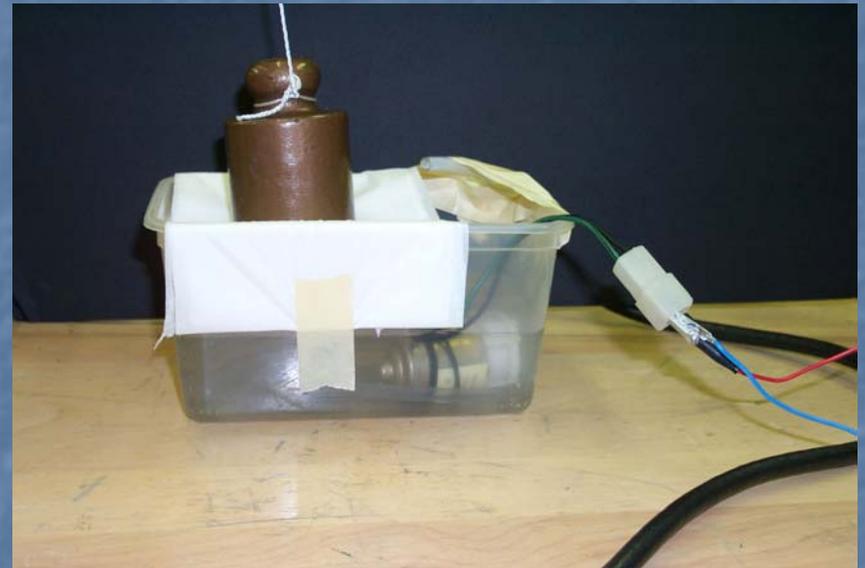
Jack-in-the-Box



- This starting module is manually cranked until the box opens.
- The lid holds a circuit closed, but when open, it breaks the circuit and stops the current.

Water Pump

- Car windshield cleaner fluid pump
- Submerged in a tub filled with water
- Computer signals the pump to start following the jack-in-the-box
- Pumps water from the tub onto toilet paper
- Toilet paper weakens, and a weight falls into the tub



Ramp and Block



- When the weight falls, it pulls a string which raises the ramp
- When the ramp is raised, a roll of duct tape careens down
- At the bottom of the ramp, it knocks over a block, pulling a string downwards

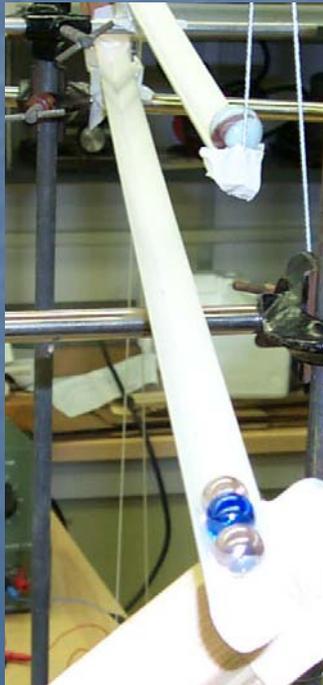
Marble Ramp

- String attached from block to ramp
- When the block falls, string pulled and ramp lifted
- Gravity causes the large marble to roll down incline
- The large marble drops from first ramp to second ramp



Pachinko Machine

- The large marble traveling on a ramp hits three small marbles, and all four go onto the pachinko board
- At the end of the pachinko board, the marbles fall into a funnel and start down another ramp

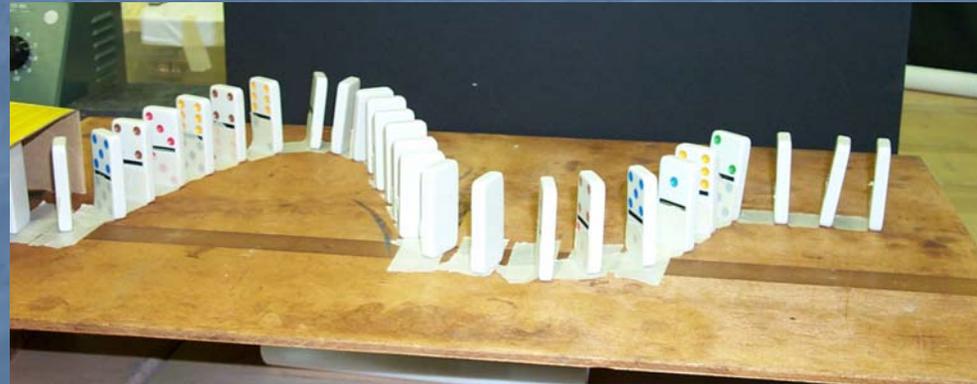


- The three small marbles fall through a hole on the ramp, which activate the catapult. The larger marble goes on to topple the dominos.



Dominoes and Infrared Sensor

- The large marble from the chute hits the first domino, causing the dominoes to fall in succession
- The last domino falls down and blocks an infrared sensor, sending a signal to the computer

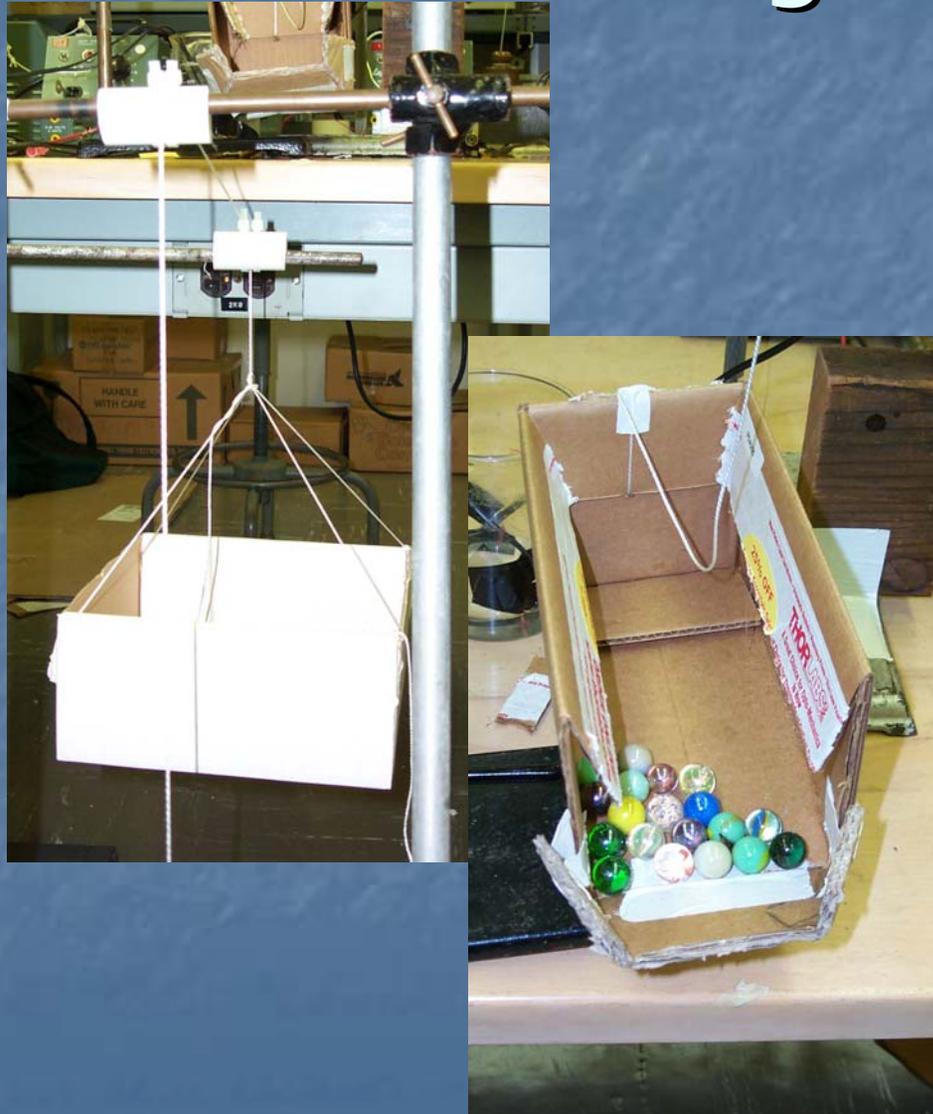


Baking Soda/Vinegar Reaction

- The computer responds to the IR sensor by activating a motor
- The motor lifts one end of a PVC tube filled with sodium bicarbonate
- The NaHCO_3 is dumped into a beaker with vinegar, causing a reaction to take place
- The reaction causes a change in resistance in the beaker, and the computer control senses this change and starts the next module



Raising the Target



- The computer activates another motor which winds up a string that raises one end of a container holding marbles
- These marbles fall into a pan which is attached to a pulley system above, raising a target on the other end of the string
- The raised target hits a switch that connects a circuit

Zip Line, Pail, and Salt Water Circuit

- The catapult tugs a string which causes the pail to descend the wire
- The pail knocks over a graduated cylinder containing salt water into a beaker
- The salt water completes a circuit



Blow-up Car and Flames

- The motor is rewired so that when the circuit is complete, power from battery drives the motor forward
- The car is set to “crash” into next step
- The center of the cardboard is depressed when the car crashes into the box
- Two flaps, each hinged on edge of the platform, spring up in response to pressure from the box



Pyrotechnics



- Denatured Alcohol fumes inside
- Nichrome wire is applied 12VDC and heats up
- Alcohol ignites and a thermistor senses the increased temperature

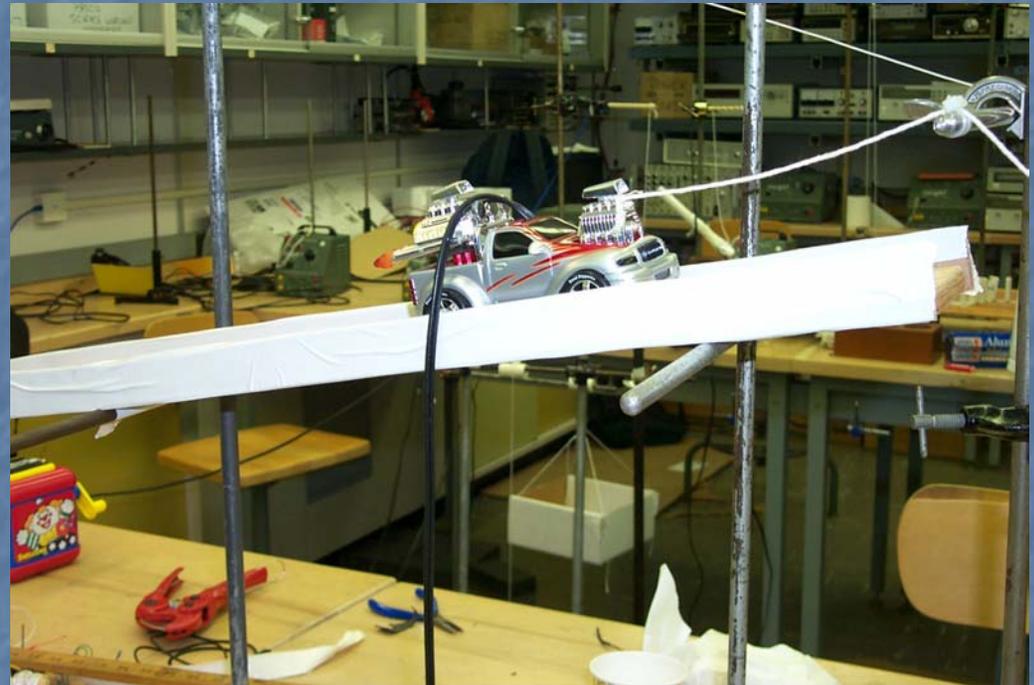
The Marble Chute

- A nichrome wire heats up when current is applied, burning through a string
- A small mass pulls the string down, releasing the marbles
- The marbles roll down the four tracks, finally landing in a tub



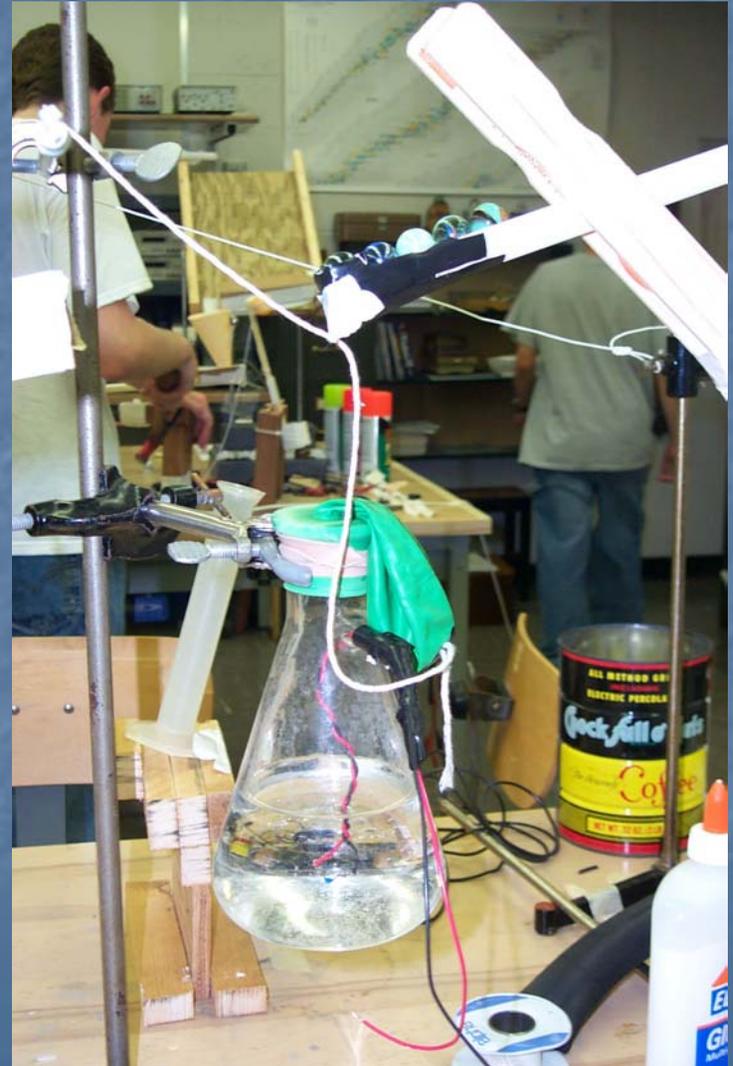
Towing Car

- The electric motor is rewired so that when the circuit is complete, a battery powers the motor to run backwards
- A decline ramp makes up for motor's insufficient power by adding gravitational force



Balloon/Flask Reaction

- The towing car tugs a string so that a baking soda-filled balloon is pulled upright
- The baking soda falls into a flask that contains vinegar, initiating a reaction
- CO_2 inflates the balloon



Marble Seesaw



- The balloon lifts one end of seesaw so that marbles at one end roll toward the other end
- A scale is set so when all the marbles drop into a plastic container, a weight sensor is activated

The Pressure Gun

- The computer triggers a compressor to pressurize the “tank” at 30 psi
- The dowel is manually pushed in, releasing a rubber seal
- Air rushes to the top pipe and ejects the ping pong ball
- The target is hit



Conclusion

- The target is hit and the perpetrator is apprehended. How do you like them apples, Surace?

