Standard 5—Technology

Elementary

Technology

Context

This is 5th grade work where the students in teams, were asked to design a model of a multi-functional freestanding playground structure for kindergarten children to use.

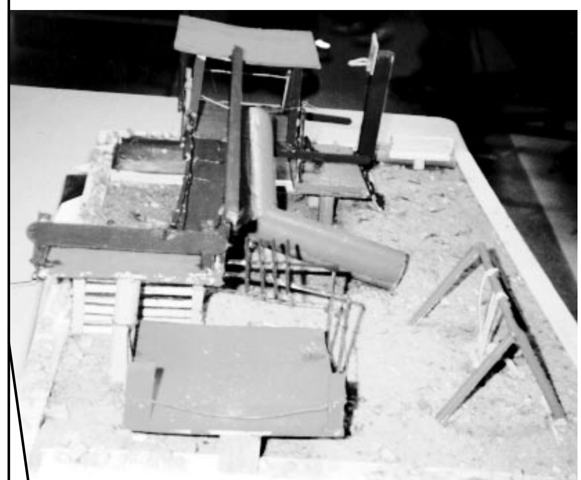
Student Work Sample

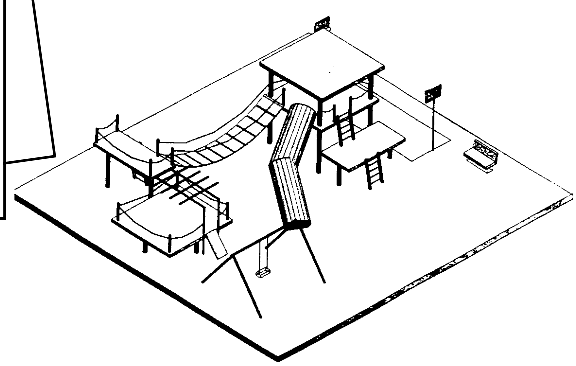
Today we are starting a mini-project, on technology. Technology means an advancement in scientific creation. Just as a guess, the club, might be one of the first advancements in technology. The wheel was also, perhaps. So technology is really something to make things easier in everyones lives. It takes something like a stick, and turns it into a thicker thing like a club. "Necessity is the mother of inventions". The idea is when you have a need, people will start inventing. Such as the telephone. Usually people think about inventing something after a problem has happened.

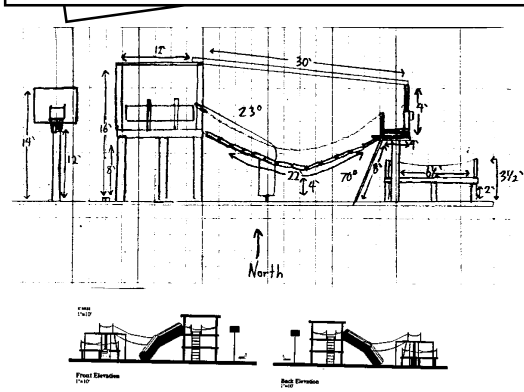
Today we made our zipline. This by far was the hardest thing so far. First we couldn't cut the wire. But our teacher cut it off. Second of all the poles were cut unevenly. Then the wood was splintery and we had no sandpaper. But the wire was the hardest. Since the wire is so thin it was hard to glue it down on the pole. With the glue gun. Since the glue gun's glue is hot you couldn't press the wire down because your finger is wider than the wire. Than finally after we got the wires finally on I realized that I forgot to put the paper clip on. Because of this I had to repeat the whole method over again. This was HARD!

Our construction period was long and tough. We had a serious problem with supplies. But we got just enough to build our design. Most of the wood we worked with was from scraps of other cut wood. I thought the first part of building was the funnest, because the second part was extremely hard cause of the monkey bars.

Then probably the hardest one of them all, the blueprints. They had to be drawings in exact scale. It was torture to measure almost every possible thing to measure on our playground, but I had to do it, and I did. Plus, since my dad's an architect, I had the perfect program to do it with. So I also drew it in 3-D. In an isometric view. And I'm proud of what I did. And I'm glad it's over with because it was such a hard task to complete. In my final presentation, I had two elevations, a plan view, and two isometric views. The program I did it in was called MiniCad. CAD stands for computer assisted design. It's a program for architects. But I used it for my needs.

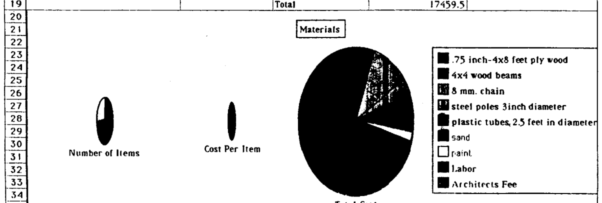






Lets start with the Bill of Materials. It was sort of like a bill. You had to determine what certain parts of your project would be, like if you had a long pole, you might make that out of 2x4s, and we have this catalog from Pergament that would tell you how much 2x4s cost. You also had to pay for labor. If you were going to do it on the computer, you would use a spreadsheet. Our Bill of Materials also included some graph information for some extra good grades.

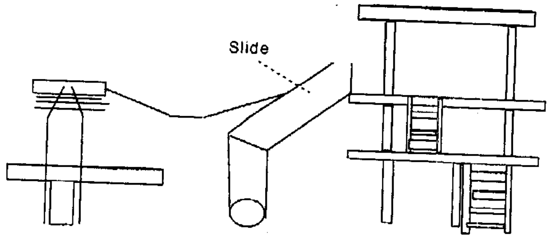
	A	B	C	D	E
1	Architects: Bobby Choi/Ian Lotto	Project Manager: Kyle Diamond, Jon Fajardo		10/19/95	
3		Bill Of Materials			
6	Arts + Entertainment				
9	Materials	Number of Items	Cost Per Item	Total Cost	
10	.75 inch--4x8 feet ply wood	65	24	1560 dollars	
11	4x4 wood beams	55	6.99	384.45	
12	8 mm. chain	200 feet	4.06/foot	812	
13	steel poles 3inch diameter	45	6.29/foot	283.05	
14	plastic tubes 2.5 feet in diameter)	- -		500 dollars	
15	sand	26 yards	25 dollars/yard	650	
16	paint	10 gallons	16 dollars/gallon	160	
17	Labor	5 men /3 days	30/hour	3450	
18	Architects Fee	2 men / 2 days	60/hour	1920	
19			Total	17459.5	

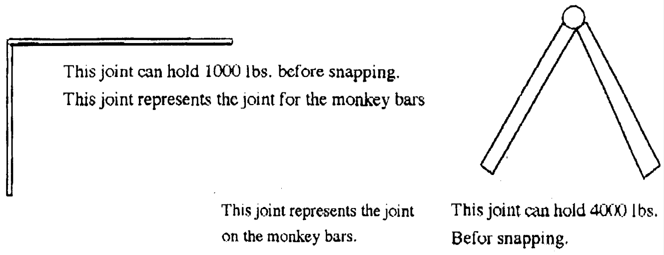


Performance Indicators and Commentary

Students explore, use, and process a variety of materials and energy sources to design and construct things.

- The playground model is well constructed and colorfully painted. Common materials (cardboard, wire, balsa wood, plywood, sand, and paint) were used. Students tested joint strength, however, erroneously reported breaking point in pounds, rather than grams.





Students develop basic skill in the use of hand tools.

- Hand tools such as glue guns and paint brushes were used, however, there is no evidence students used a range of tools in this endeavor. One is led to believe materials were precut for them. Availability of additional hand tools might have enabled students to be more creative and adept in construction.

Students use simple manufacturing processes (e.g., assembly, multiple stages of production, quality control, etc.) to produce a product.

- Students primarily used gluing techniques to assemble the model. References were made (in the bill) to materials beyond those used, but no indication was given as to how students would have assembled the real playground equipment which included 3” diameter steel poles, and 2.5’ diameter plastic tubes.

The final piece had four platforms, two high ones, and two low ones. They were all made of plywood except for the lowest one on the left, which was made from balsa wood. The slide was made from cardboard. Each platform could hold around 6000 lbs. The slide could hold 2000 lbs. And the bridge that was also made from balsa could hold 1000 lbs. per block. The playground met the safety code and building code perfectly. And so far I have noticed it is the only one that fits the safety code. There are some other playgrounds that would kill a child a day.

Students use the computer as a tool for generating and drawing ideas.

- A CAD program was used to draw orthographic and isometric views of the playground. Drawings were well done and clearly descriptive of the various types of equipment, but would have been enhanced by dimensions, particularly in the orthorgaphic drawing. This omission was recognized by a team member in the final evaluation.

Students identify technological developments that have significantly accelerated human progress.

- A discussion of technological invention evidenced a basic understanding of the impact of technology on human capability; a stronger response would have recognized that early technology occurred long before science and was more than “an advancement in scientific creation.”

Students participate in small group projects and in structured group tasks requiring planning, financing, production, quality control, and follow up.

- The students worked in a group and delegated certain tasks (e.g., drawing, financing, testing of joints) to subgroups, or individuals.

Looking back on our project, we think that it's o-kay. It is not perfect since it's somewhat off scale and the paint job was bad. It is still sturdy and strong, has saftey in its design and Ian has made a great 3-D blue-print from his computer. Many people think that ours is one of the best but I personally think its a little above satisfactory.

The first thing I saw that was bad was the scale of the project. Some of the columns were too big and the wood had little drops of paint on it from people who tried to play with our project. That forced us to paint the project. Another big problem which I pointed out in an earlier entry, was our indecisiveness. We could never decide what on where we should put something.

I think that our team deserves a 3 on our sketches because we did all the angles, demensions and veiws possible but our sketches did not resemble the final product. [NAME] was not in our group then but he made the final real sketches which turned out great except there were no demensions.

I think that we got a 4 on our blueprints because Mr. [NAME] said so and because we had every dimension and view needed. [NAME] really overdid it because he did a 3-D computer blueprint on a Mini Cad program on his computer.

I think our model construction is a 3 because the paint job is horrible although it is very strong. Everything is level and O-kay. Nothing is absurdly crooked or anything. Our slide is 23° and every platform is neat. I think that we rushed a little with the painting because we missed a few spots. I think we made up for it when we made our blueprints and bill of materials.

If I could make the project over, I'd make it more simple and neat. I would not paint it and I would listen to my groups opinion more.

Standard 5—Technology

Intermediate

Technology

Student Work Sample

Context

This is an example of work from middle school technology students who decided to produce an item for sale to classmates as a class project. The chosen product was a clock with a quartz movement which was mass produced in the technology lab.

Performance Indicators and Commentary

Students choose and use resources for a particular purpose based upon an analysis and understanding of their properties, costs, availability, and environmental impact.

- Students chose a variety of woods, assessed their costs, and determined which combinations of wood would be best liked. No evidence was provided that students considered other materials, nor was there any explanation as to why the particular wood types were chosen.

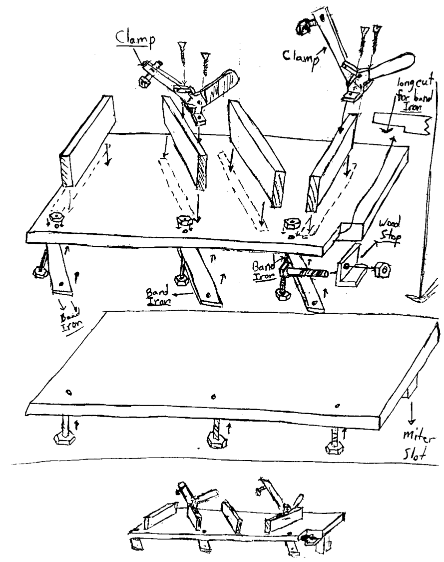


Figure 4: Sketches of Sanding Jig.

Figure 1: Finished Clocks.

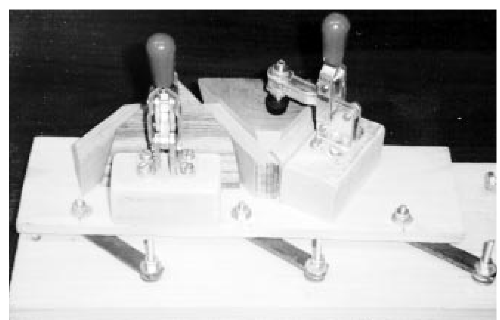


Figure 5: Finished Sanding Jig With Clock Pieces Clamped in Place.

Students use a variety of hand tools and machines to change materials into new forms through forming, separating, and combining processes, and processes which cause internal change to occur.

- A layout of the technology lab illustrates the wide range of tools and machines used. These include drawing tools, sawing and drilling machines, soldering tools, shaping tools, and sanders. A high level of mechanical knowledge was evidenced in construction of the clamping device and other sub-assemblies of the sanding jig.

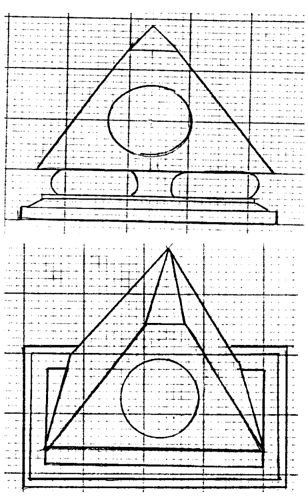


Figure 2: Orthographic and 3-Dimensional Drawings of Clock.

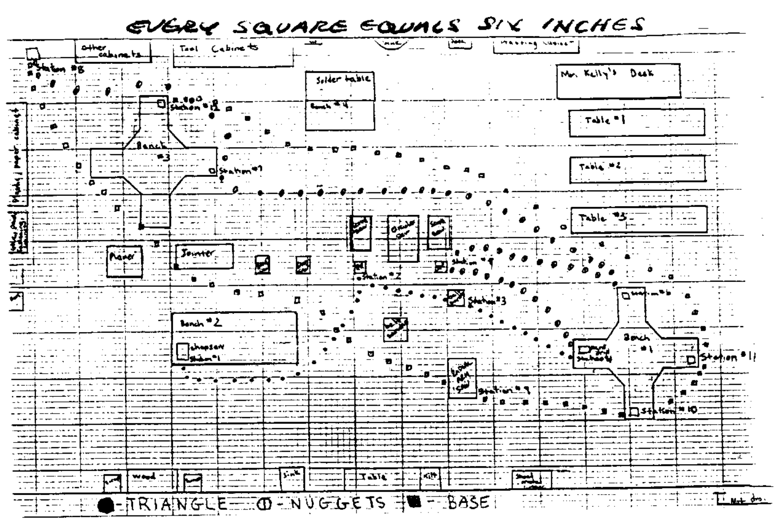


Figure 3: Layout of Technology Laboratory Depicting Production Flow.

FINANCE DEPARTMENT

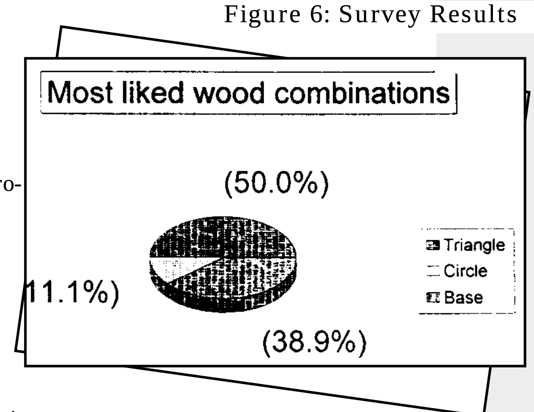
Cost of Materials ($3.18 per clock)

			BOARDFEET / COST PER BF
Black Cherry	Base	25	3.71
Black Walnut	Base	25	4.13
Red Oak	Base	25	3.09
Hard "Rock" Maple	Base	25	3.28
Butternut	Base	25	3.99
Black Cherry	Triangle	25	9.17
Black Walnut	Triangle	25	10.22
Red Oak	Triangle	25	7.64
Hard "Rock" Maple	Triangle	25	8.11
Butternut	Triangle	25	9.87
Black Cherry	Triangle	25	1.56
Black Walnut	Donuts	50	1.74
Red Oak	Donuts	50	1.3
Hard "Rock" Maple	Donuts	50	1.38
Butternut	Donuts	50	1.68
	clocks	25	$40.00
Sandpaper(belt)		1	7.95
Sandpaper(palm)		10	
Stain(Danish Oil)		1 qt. clear	5.89
Stain(Danish Oil)		1qt. black	5.89
fasteners		50	$1.35
adhesive disk		1	$5.20

Student Survey Questions

1. Do you think people of your age would buy this clock?
2. When would be a good time to sell these clocks?
3. What colors do you like these clocks in?
4. How much should they be sold for?
5. Would you like to see digital faces or the kind with hands?
6. Would you buy this clock for yourself or for someone else? Who?

Figure 6: Survey Results



Performance Indicators and Commentary

Students combine manufacturing processes with other technological processes to produce, market and distribute a product.

- The laboratory diagram shows how students determined the sequence of operations and plotted the production flow for each component of the clock. Drawing, computer-based information processing, and graphic design processes were integrated into this project.

Students process energy into other forms and information into more meaningful information.

- Information processing is evident in computer-generated charts and tables, technical drawings, and the advertisements.

Students manage time and financial resources in a technological project.

- Students developed a price list for materials, and kept a daily log of accomplishments.

Students assume leadership responsibilities within a structured group activity.

- Students organized into project work teams (marketing, production, administration, and finance). They kept track of each others progress and provided critical feedback.

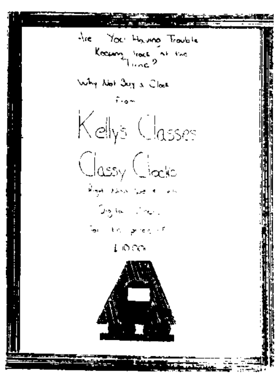
Students identify needs and opportunities for technical solutions from an investigation of situations of general or social interest.(From Standard One)

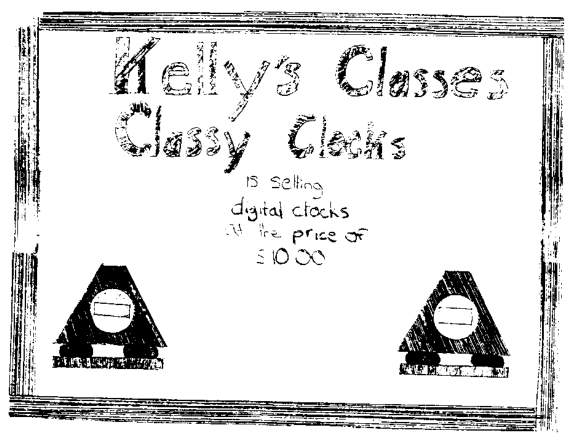
- Students determined, through a marketing survey, that a clock would sell well to classmates, and that both a digital face, and one with hands would be saleable.

Students develop plans, including drawings with measurements and details of construction, and accurately construct a model of the solution, exhibiting a degree of craftsmanship. (From Standard One)

- Drawings were developed, but did not include construction details or dimensions. Finished products were functional, attractive, and of commercial quality. A jig was designed and built to hold the housing for the clock face while it was being sanded. This triangular part with beveled edges required complex conceptualization and superior drawing and construction skills to implement.

Figure 7: Advertising Ideas





Marketing Dept.—

Your group has a problem with cooperation, I believe. If I'm wrong, let me know. I need to know everything that is going on in your group. Your log was fine, but I need to have it handed in with the paper in the folder. I need your leader, Nora, to come & talk to me about your group. Thank you.

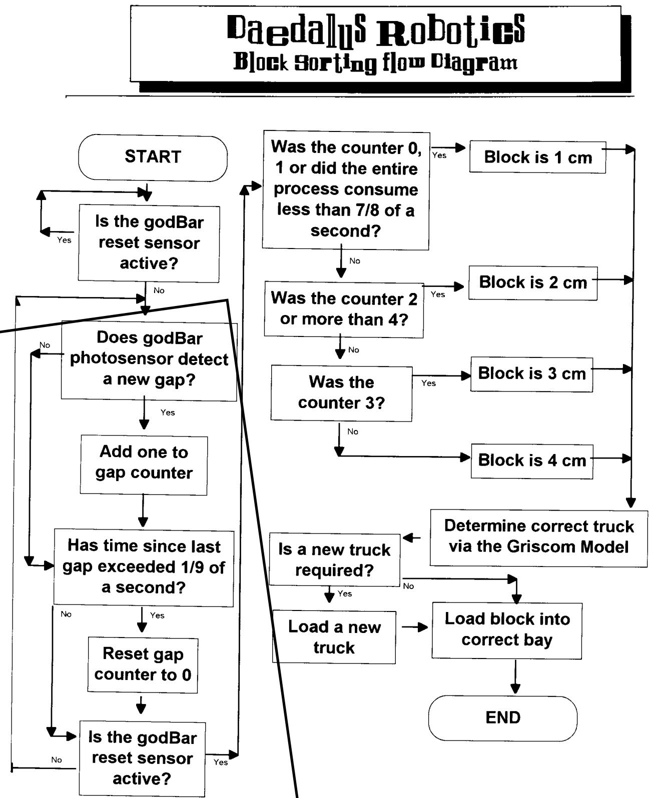
Commencement

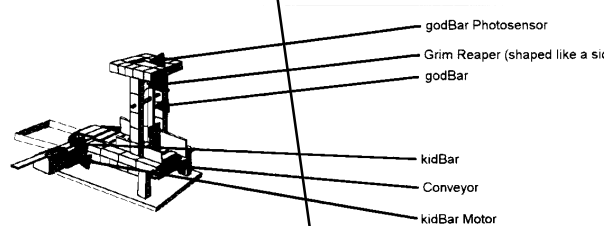
Technology

Student Work Sample

Context

This is an example of work from students in a 12th grade Principles of Engineering class who were challenged to design and model a system to evaluate the size of packages, and load two trucks so that optimal use is made of truck space.





This has surely been fun. I never had so much work in my life. Coming into this project, I thought it would be breeze; just a regular walk in the park for a great tried-and-true programmer such as myself. Well, guess what-I didn't realize that I'd have to contend with inferior and convoluted mechanical designs such as the sorry one my team put out. The sensor didn't work half the time, the kidBar would stop the 4 cm block half the time, and no one knows how the reset sensor didn't work at all until I spent about 1 1/2 hours fixing it!

After hooking the project up to my computer and discovering in a rather painful way that the project did not run under OS/2, I spent the next hour trying to get DOS to run BC++ without crashing. Kudos to DOS. Now do you know why I switched to OS/2 in the first place?

Anyway, I then worked in a rather sparse text mode interface to get the project to detect the block correctly. After building four different grim reapers following my readjusting the conveyor slightly, I finally got the project to detect the 3 and 4 cm blocks with 100% accuracy. The 2 cm blocks work correctly about 80% of the time, and the 1 cm blocks...well, let's just say they work when the wolf bays at the moon.

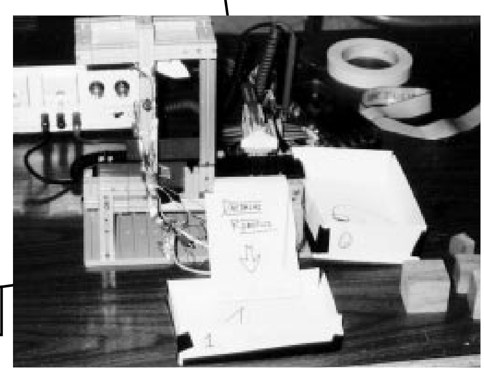
The first problem was a tendency for the 1 cm block impulse on the godBar to cause it to bypass the 1 cm photo sensor gap completely, registering the block as 2 cm. Well, to repair this problem, I simple added a timing element tot he program, making ti so that a block that ran through the godBar in a short enough interval, would always be registered as a 1 cm block.

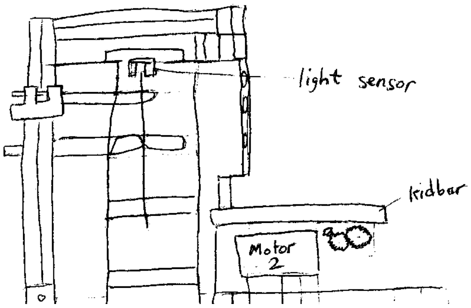
The second problem was that the 2 cm blocks kept being registered as 3 cm or more, since the 2 cm photo sensor gap on the godBar would sometimes be positioned right at the spot where the 2 cm block would advance the godBar to. Thus, the photo sensor would register 3, 4, 7, 18, however many light level changes there were, and thus make the block 18 cm3. Try fitting that in one of our trucks. I repaired this problem by moving the 2 cm gap back slightly. This increased the accuracy of the system tenfold.

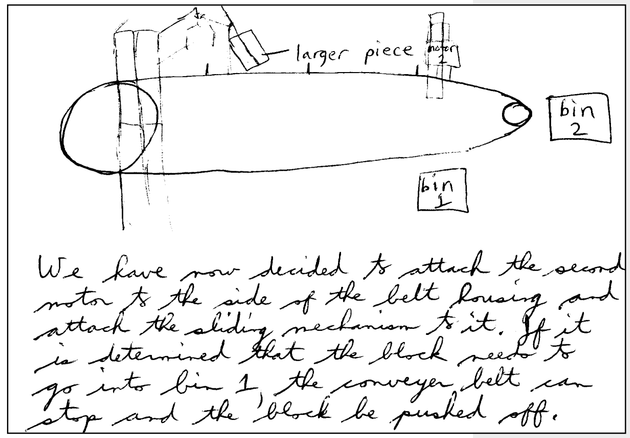
I will attempt to describe the benefits and failures of our mechanical design:. We could also have used more sensors; specifically, ones to determine how far to retract the kidBar, so it would be retracted to the same point after every use. As it is, the kidBar may retract slightly less or slightly farther every time; far is good, but not enough makes the 4 cm blocks run into it and jam the machine. And that gets messy. ("Sir, our radar's been JAMMED!")

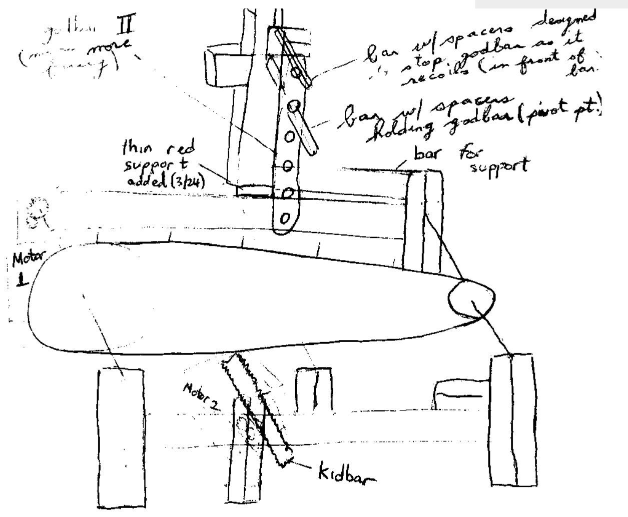
Our mechanical design was also far too fragile to make it useful in large-scale production. Every time you set up the project, you'd have to fiddle with the superstructure to get the conveyor to the correct height. Bad Boy's design, while similar in the way it detected the blocks was also significantly more well built. Their robot is prettier and more reliable. Their programming could be better, but the mechanics were nearly flawless.

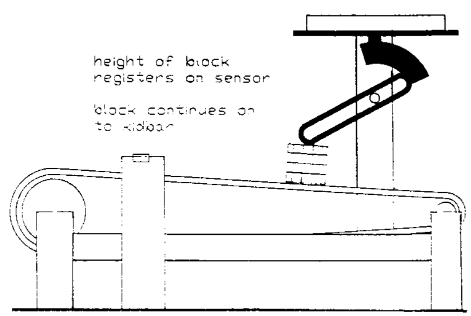
Our project in spite of all its flaws and all my insults, was actually a great success. If I consider how well our project works compared to some of the other teams, I am happy that ours works as well as it does. Thus, I can justify the grades that we are giving our team members. Our detection method, while perhaps not as reliable as it could have been, did actually detect the blocks correctly about 97% of the time. And the mechanics, while not the prettiest, did get the blocks where they were going. And the programming, well...how can you improve on omnipotence? Thanks to XXX for getting the mechanics done, to XXX for doing the wiring and finally getting the reset sensor to work nominally, and to XXX for setting up the project every day. We are a good team.











Performance Indicators and Commentary

Students describe and model methods (including computer-based methods) to control system processes and monitor system outputs.

- The model was computer controlled, using an interface with 10 inputs and 5 outputs. Operation of the photo sensor was clearly understood as a feedback control mechanism, and was used to monitor the size of the passing blocks.

Students develop and use computer-based scheduling and project tracking tools, such as flow charts and graphs.

- A flow chart was designed and used as a management tool to monitor system performance.

Students develop work schedules and working plans which include optimal use and cost of materials, processes, time, and expertise; accurately construct a model of the solution, incorporating developmental _modifications while working to a high degree of quality (craftsmanship).(From Standard One, Engineering Design)

- Critical analysis has been made of each design; individual improvements were suggested, tried, revised, and tested. The solution evolved through many developmental modifications. The working model was well built and the students demonstrated great tenacity while working on this complicated multi-faceted problem.

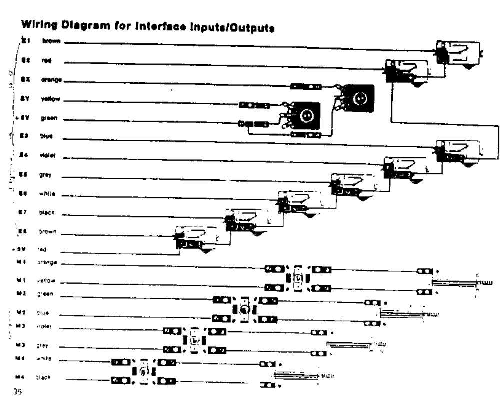
Students understand basic computer architecture and describe the function of computer subsystems and peripheral devices.

- References to various operating systems, wiring the interface, and the connection to the computer and to sensors and mechanical devices makes clear that students have developed a high level of computer system expertise.

Students develop an understanding of computer programming and attain some facility in writing computer programs.

- Programming was extensive. Students wrote pages of code to control and monitor the system's operation.

:hat will fit in the truck



Programming Code

```
int project1::mcl()
/* Main Control Loop
   Actually determines the block size and controls to which bin the b
   oes; keeps track of which trucks have which blocks and which truc
    n each bay */
{
   /* Stack variables */
   int    done = 0,                    // Main control loop done (quit pro
          blockplaced,                 // Block was placed already?
          setcount0,                   // Set open counter to 0?
          blockdone,                   // Determines whether block is done
          count,                       // Number of opens in sensor
          tsum,                        // Temporary sum
          smallestavail;               // Smallest available space
   long   lasttimer,                   // Saved timer information
          startblocktimer;             // Block start timer information
   unsigned char  tctr,                // Truck counter
                  bayctr,              // Bay counter
                  inbay,               // Block eventually placed in bay ?
                  *capline,            // Truck capacity line
                  blockctr;            // Block size counter
   unsigned capacitytruck[4];          // Capacity of a particular truck
   char tempstr[50];                   // Temporary string

   /* A modification was added here which would spawn to TRUCKING.EXI
      neglected to bring the latest copy of the source code home to p
```