An Investigation into the Use of Control Technology in the Car Industry

The Mustang's body area encompasses 355,000 square feet. It also utilizes 145 robots to perform welding for structural integrity, material handling for assembly, and sealer application for water leak prevention.
Six major assembly/welding lines, along with three subassembly and buildup areas, are required to complete a Mustang body. There are three subassembly buildup areas: front structure framing and respot where a front end is created, rear pan assembly and respot, and the bodyside subassembly. The six major assembly/welding lines are:
1) The press line which joins the rear pan, center pan and front end to create an underbody.
2) The underbody respot and clamp line which joins the bodysides to the underbody.
3) The welding bucks which provide dimensional and weld integrity.
4) The roof line
5) The IBM respot line
6) And the closure line which assembles the doors, hood and rear deck lid to the vehicle.
A perception vision system is also used to verify dimensional quality.
The last process before a unit leaves the body area is metal finishing, where metal surface imperfections are removed before delivering a body to paint.

PAINT SHOP:

The paint department provides four functions to the finished product. The four functions are: the application of the phosphate/e-coat coatings, body sealer, primer coating, and color coatings. The following is a brief description of each of these functions:

Phosphate/E-Coating

The phosphate coating is the primary safeguard against rust. In addition, the phosphate coating provides an excellent surface that paint will adhere to. The application process causes nonferrous crystals to grow directly onto the metal. Because the phosphate is crystalline, the finished product is rough when viewed under a microscope.
The next process is an application of a water based primer using electricity to cause the primer to migrate to any uncoated metal surface of the unit. This process requires the unit to be dipped into a tank holding 90,000 gallons of the electro-coat primer; an electric current is applied to the paint and the unit is connected to the opposite electrical polarity. This creates an attraction which causes the paint to flow deep into all the joints and interior surfaces of the unit.

Sealer Application

Sealers are applied to all the welded seams on the unit to eliminate the possibility of water leaking into the unit from the exterior. Robots apply sealer to the interior floor pan, the fire wall, the left and right wheel house, and the back panel of the unit. This equals approximately 70% of the sealer that is applied in the paint shop. There are minimal sealer operations before and after the robots, to reach areas of the unit that the robots can't reach. In addition, hot metal patches are applied to certain areas of the unit to provide sound deadening, and wide noise reduction.

Primer Coating

This is a workable layer of paint that is smoothed and dressed so that the color coats can be applied over a perfect base. Mustang primer is color compatible; that means that a chip to the color coat will be less noticeable because the color underneath is close to the same color as the exterior of the car. Most of the prime coat is applied with robots called "Bells", which use the principles of electrical attraction to apply the paint. A bell doesn't spray paint using pressurized air, rather the bells spin at very high speed which atomizes the paint into very small particles. The side to side motion of the bell ensures that an even coating of paint is applied.

Color Coat

The first step is applying a perfect color coat is to prepare a perfect surface to apply the color coat onto. Thus, the first operations in the enamel area are: sanding operations that remove surface imperfections and smooth the previously applied primer, then the unit is wiped and blown clean. Next, the color coats are applied using robot bells and a type of robot called a reciprocator. A reciprocator used air to supply the final metallic color coats. The reciprocator doesn't influence the orientation of the metallic particles within the layer of paint.
After color coating, the unit is coated with a clearcoat paint which provides shine. Red units are coated with a tinted clearcoat. In this case, the clearcoat paint is tinted with a red tint, which makes the shine appear a mile deep.
At the present time the Mustang plant uses six different primers, five exterior primers, ten exterior color coats, and two clearcoats, tinted and clear.

Quality

The attention to quality within the paint shop has resulted in reduction in customer concerns of 32% based on the average number of customer concerns reported by NVQ for the 1994 model compared to the first quarter NVQ for the 1997 model.

Future Quality Actions

Dearborn Assembly Plant has just been authorized to construct a new paint facility to be located on the east side of the plant. This shop will be a separated, stand alone facility utilizing the latest technology to produce the best painted surface on the market. The new paint shop will be constructed employing clean room principles, those operations that create dirt will be on the first floor of the new building, while the clean activities will be on the second floor. Access to the second floor will be limited to individuals passing through clean rooms and dressed in approved garments. The paint will be water based in contrast to the current solvent based paint. The water based paint is environmentally safer. This facility will be launched with the 2000 model year Mustang.

FINAL ASSEMBLY

Due to the unframed door glass system on the Mustang, unique door glass setting fixtures have been installed to fit and adjust the door glass. the installation of convertible tops is integrated within the production system, instead of being installed off line in a subassembly area. Four synchronous carriers (also known as people movers) have been installed within the trim department that allow the operators and their work station to move with each unit, eliminating unnecessary walk time. Various overhead conveyor systems are used to transport components such as instrument panels, door panels, "A" and "C" appliqués from subassembly and select areas to on line operations. An automated windshield and backlite decking robot system has also been incorporated within the trim department.

The chassis department also has several overhead conveyor systems that are used to transport components such as: front and rear bumpers, taillights, rocker panels and engines from subassembly and select areas to on line operations. Automatic crossmember and front engine mount secure facilities are also installed within the chassis department. Semiautomatic engine decking, front spring press and rear axle decking sleds are incorporated within the chassis department. Within the area known as the loop, an overhead power and free clam shell conveyor system is used for installation of underbody suspension components. Two overhead synchronous carriers are also installed for the front gear box and detent secure process. State of the art brake fill and hydroboost/brake stroke equipment, with panel view trouble shooting screens, are installed. Semi automated gas fill system and unique FORI and ANZEN toe in facilities that use laser technology are also installed within the chassis department.

The final area has installed over 48 unique articulating arms. All these facilities within the final assembly area have been installed in our continuing our efforts to improve quality, ergonomics, safety and productivity.

PRE DELIVERY

Vehicles entering pre delivery are subjected to a variety of inspection, test, surveillance and audit functions in line with the plants quality operating system (QOS). Every vehicle must pass exterior, interior, underbody, electrical function, water test, road test and underhood examination prior to being released to transportation. Audits are taken on released vehicles to verify the effectiveness of the QOS. Representing the "voice of the customer", Pre delivery continues to review and analyze customer data to improve the QOS, inspection methodology and the quality of released vehicles.

PLANT ENGINEERING

Plant engineering operations consists of three departments: Maintenance, Plant Services, and Plant Engineering. These departments work closely together in maintaining and improving Dearborn Assembly's appearance and overall performance.

Maintenance and plant services perform non production activities which consist of skilled trades who maintain the facilities required for the assembly process. Their responsibilities vary from daily clean up operations to the maintenance of miles of conveyors which exist in Dearborn Assembly.

Plant Engineering is a non production department consisting of engineers who assist Dearborn Assembly in solving their electrical, mechanical and environmental problems. Their work involves new project implementation, equipment design improvements and constant compliance with local, state, and federal regulations.

MATERIAL PLANNING AND LOGISTICS

Dearborn Assembly Plant, Material Organization coordinates the receival dispersal and inventory of approximately 3,000 parts required to build the current Mustang.

Rail receivals are limited to body metal from Ford stamping plants, gas tanks from Dearborn Engine, and exhaust systems from Missouri.

Dearborn Assembly unloads an average of 10 hi-cube rail cars per day

Dearborn Assembly unloads an average of 150 trucks per day

ASSEMBLY AND SHIPMENT

Number of Mustangs produced between May 1964 to 1997: 7,212,143

Other locations that built Mustangs: Metuchen, New Jersey and San Jose, California. Some test vehicles were also assembled at Edsel Ford Pilot Plant in Allen Park, Michigan.
Current Mustang line speed: 37 JPH
Daily production of Mustang: 592 units
Total time for product through plant: 32 hours
Finished Mustangs are shipped at a rate of 600 per day; approximately 360 via rail and 240 by truck.
Dearborn Assembly Plant - far southeastern corner. On a late Sunday afternoon, these Mustangs await ship via rail (far right corner).

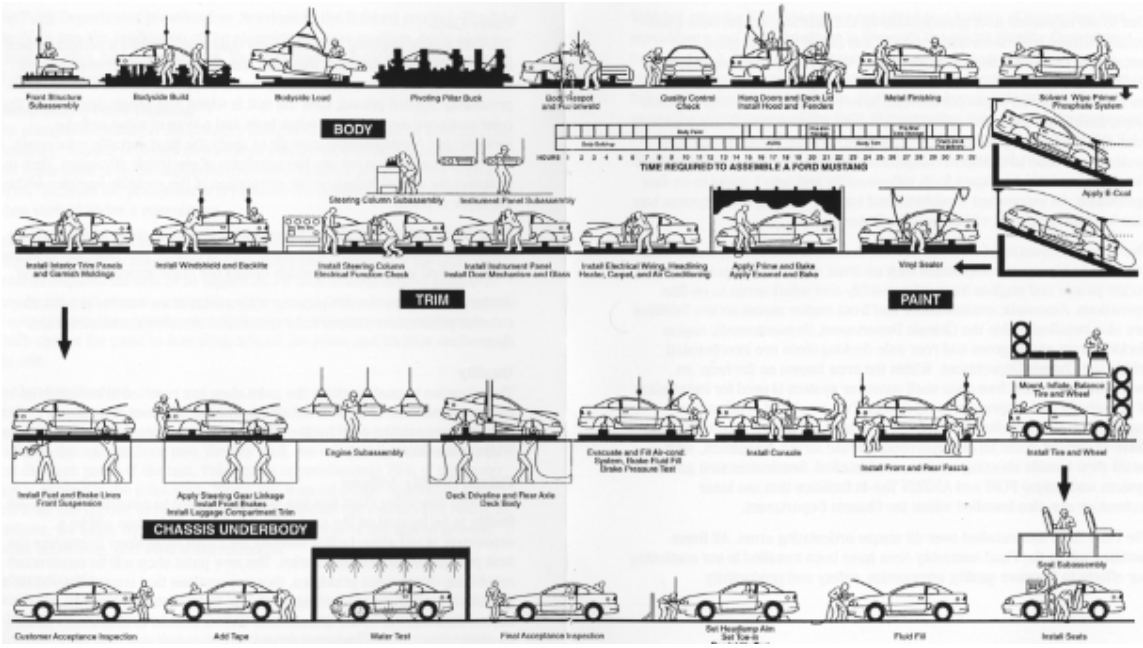
At one time the Dearborn Assembly Plant could:

Supply electric power to all the homes in Boston, Mass.
Used as much water as Detroit, Washington and Cincinnati combined.
Required 7,000 mop heads a month to keep it clean.
Had 110 miles of railroad tracks with 22 diesel locomotives
81 miles of conveyors.
4 bus lines.
Handled 7,500,000 phone call per year.
Had a hospital staff of 171, including 12 doctors and 30 nurses.
Encompassed over 1,212 acres.
And could harbor at least 4 - 612' boats, from the Ford Navy.

The Rouge Complex is still formidable today and consists of :

- **Dearborn Assembly Plant**
- **Year opened/ 1918**
- **Products/ Ford Mustang only**
- **Plant size/ 2,570,834 square feet**
- **1996 production in units/ 135,620**
- **Dearborn Engine & Fuel Tank Plant**
- **Year opened/ 1941**
- **Products/ 2.0 engines and fuel tanks**
- **Plant size/ 2,200,000**
- **1996 production of engines/ 310,000**
- **1996 production of fuel tanks/ 2,530,000**
- **Engine assembly line length/ 2,850 feet**
- **Engine conveyor length/ 7 Miles**
- **Dearborn Frame Plant**
- **Year opened/ 1946**
- **Products/ Frames, Subframes, Hinges and Crossmembers**
- **Plant size/ 816,200**
- **1996 production in units/ 1,488,899**
- **Dearborn Glass Plant**
- **Year opened/ 1923**
- **Products/ Laminated windshields and float glass**
- **Plant size/ 1,000,000**
- **1996 production/ 157,000,000 square feet of float glass and over**
- **2,570,000 windshields**
- **Dearborn Stamping Plant**
- **Year opened/ 1936**

- **Products/ Body panels, sheetmetal**
- **1996 production/ 117,103 tons of steel**
- **Dearborn Tool and Die Plant**
- **Year opened/ 1939**
- **Products/ Stamping dies**



The Mustang made it's debut on April 14, 1964 at the World's fair in Chicago. The car was available with a wide range of options in coupe and convertible, and was advertised for $2,368. Reaction to the Mustang's arrival was tremendous and dealers could not get enough. April 17,1964 saw 22,000 cars sold at or above retail price. Ford had originally projected first year sales of the Mustang to be around 100,000, they later bumped this figure up to 240,000. It took only four months to reach the 100,000 mark and by the end of 1965 production total was actually 680,992, an all time record for the first year sales of a production car in America. By March 1966 the Mustang had reached the 1,000,000 mark. This sales record is more impressive considering that until September 1964, there were only two body styles, the coupe and the convertible. The fastback was then added to the mix. In April 1965 the GT options made it's debut. This package included fog lights, special GT badging, dual exhaust, and other features. The engine also had option these included the 289 4V A-code of K-code (Hi-Po) V8. In 1966 there were little changes made to the overall Mustang design. The car continued to sell well. Most of the changes for 1966 were in the form of cosmetic refinements. A new grille which featured chrome edging, horizontal inserts replaced the honeycomb grille of 1965. The chrome bars that extended horizontally and vertically from the running horse were deleted on the 1966 grille. The lower rocker panel molding became standard equipment, so did the backup lights and a chrome hood lip molding. The rear quarter panel sported a new three fingered ornament. As for the petrol filler cap it no longer included the plastic insert found on the earlier models. The Mustang interior was updated to a standard five gauge instrumentation panel and woven vinyl seat inserts, with choice of styles and colours for the mustang being over thirty varieties. This gave the customer even more ways to personalize their "Stang". 1967 saw the first major body change to the Mustang. With competitors Chrysler and GM widening the car bodies to accommodate the new 390 big-block powerplants, Mustang made changes to the rear taillight panel and side body flair's, but engine changes were not made. However the following year (1968), the 289 small block was dropped from the Mustang line up for the lager 302, this became standard with the Mustangs from then on. In April of 1968, Ford introduced the 428 engine and the GT model was chosen as the platform for the new engine. Traction was given more consideration with wider rims and tyres being fitted to the new Mustangs. Other changes made to the car was the deletion of the F-O-R-D letters from the front of the hood, deletion of the Horizontal grille bars and changes to the rear quarter panel. Due to government regulations being

tightened safety features were also made, the Mustang now included front and rear side marker lights, flush mounted interior door pulls and an energy absorbing steering coloumn. In 1969 with the introduction of the Mach1, the Boss 302 and the semi-hemispherical headed Boss 429 the GT option would be gone from the mustang range for some years. Some of the new features in 1969 was the introduction of quad headlights, front parking lights put in, rear quater panel ornaments were added, side scoops and integral rear spoiler on the Sportsroof models, front and back seat locks, and for the first time the VIN number was fitted to the car. 19790 would see a new grille design for the Mustang. The headlights became dual units instead of the quad units, the rear quater panel scoops were deleted and rear taillights were now recessed into the body housing. The inside saw new high back seats and new oval steering wheel (which was to ease the entry and exit into corners), and the ignition switch was moved to the steering coloumn so that the steering would lock when the ignition was off. For 1970 the 390 engine was dropped from the lineup. 1971saw the Mustang recieve an entirely new design. The body was beefed up to accomidate the new 429 Cobra Jet engine. A new wide chrome strip was placed on the edge of the front fenders and the hood was used from the 1969 Shelby's. The long hood now turned up at the windshield to cover the hidden wipers. Large, rectangle shaped triple lens tail lights appeared or the rear of the new "Stangs". The surface mounted door handles were gone, in thier place were flush mounted door handles that were snug in line with the body. The interior saw major change as well with new high-back bucket seats, a mini console, and all new instrumentation panel. With the added option of power windows. The basic design of the car was kept for the following year. But big block power was out, which left the 351-4V as the biggest powerhouse in the Ford stable. Due to increasing government fuel economy regulations, all the Boss cars were dropped from the 1972 lineup. The Boss 351 and both versions of the 429 were dropped. During the early part of 1972, a special 351HO model was offered, which featured a low compresion Boss 351. The engine was equipped with a special high lift cam, mechanical lifters, a special 4-barrel manifold and forged aliminium pistons. The Mach1 was the only performance model that remained that year. 1973 was to see the begining of the end of this musclecar breed. The convertible was gone as well as the end of the first generation Mustangs. They were to be replaced by a lighter, smaller model. Most of the changes were cosmetic with large square headlamps surrounded by chrome, along with chrome trim around the tail lights. The Musclecar era had gone and with it some of the best mustangs ever built, but these days Mustangs are starting to impress me more and more.

ICT Case Study Year 10

Computer Study

Introduction

Computers are now used to control the operation of many machines and everyday objects. The instructions contained in the computer program send signals out of the computer to devices like switches and motors which make the machine operate in the correct way.

You can use computer control in the following applications:

- Washing machines
- Microwaves
- Watches
- Cameras
- Robotic arm

These are all embedded applications, you cannot always see the computer circuit board as it is install inside the machine. The input sensors and output

control devices are then connected to these circuits. This is an embedded computer. The input/output devices that we are most familiar with - the keyboard, mouse, monitor – are not required. The computer control program is written using ‘’normal’ computer and ‘downloaded’ into the embedded computer. The software program is stored in a ROM (read only memory) chip and activates when the machine is switched on. It is nessecary to input data from both the machines and the surrounding environment.

There are many benefits for using computers for control here are some:

- Although the cost of computerised machines in factories is high, the operating costs are low in comparison to wages for people doing the job as the manual system.
- Computers work without the need for breaks and sleep, unlike manual workers.
- The quality of output from the machine is consistent whereas manual workers can work well one day and bad the next.
- Machines can handle very heavy work or very precise tasks, whereas only very skilled manual labourers can achieve this.
- Machines can work in places which are comfortable or hostile for people.
- Computers process data very quickly and so the machines can operate faster than manual labourers.
- Computers can operate the machines with data from a range of sources.

Computer control can be used in many different areas including motor industry, distribution warehouse, theatre companies and the fire services. In the motor industry computer control can be used in

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ICT GCSE Case study:

- This should take between 5 and 10 hours in duration
- This is aimed at you developing your understanding of control systems
- This will be assessed as part of your final grade for the course

The task:

The case study should explore a control system and should focus upon either the manufacturing, production, or service industries.

The case study should compare a manual system used in manufacturing, production or the service industries with a computerised control system that would perform the same function.
You should explore the security of data necessary to support the control system.
The work should demonstrate your understanding that all systems be they mechanical, electronic or process based have three parts: input, process and output.

The assessment criteria:

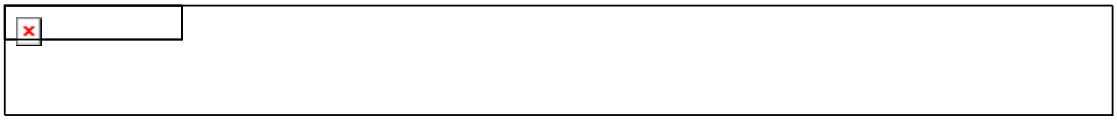
You must demonstrate that you can:
1. Apply your knowledge and understanding of measurement and control to different contexts.
2. Identify and describe stages and components of systems for applying computerised measurement and control technology within a specified context.
3. Describe where IT is used to simulate dangerous situations or costly investigations.
4. Identify and describe the use of security procedures to prevent unauthorised use of data when working with a system, giving reasons why they are necessary for the system.

Resources:

Robots in Industry discussion of control issues
http://www.kranendonk.nl/ website for a robotics manufacturer
How A Ford Mustang is Made an explanation of how this is assembled
A Guide to Fords Assembly Plants
http://www.hfmgv.org/histories/fmc/fmc.chrono.html Chronology of the Ford Motor company
http://www.fordheritage.com/100yearsofford/1900fs.html From 1900-2000
Automotive Industries- Yesterday's Manufacturing Marvels Parallel.s between old and new methods of manufacturing cars
Manufacturing Plant modern hand built cars
Any relevant search engine eg (www.yahoo.com)
Try looking up the following terms:
assembly line,

Report structure:

Title: An Investigation into the Use of Control Technology in the Car Industry
Introduction
Theory of Control Technology (149-161, GCSE Information Technology)
Relevant hyperlink: Robots in Industry
An explanation of Manually Controlled Production Lines (Using human labour, include a flowchart)
Relevant hyperlink: Manufacturing Plant
An explanation of Computer Controlled Production Lines (Using robots/automation, include a flowchart)
Relevant hyperlink: How A Ford Mustang is Made
Comparison of the Input, Process and Output methods between the two systems
Relevant hyperlink: Automotive Industries- Yesterday's Manufacturing Marvels
Security of Data (why it is important that this is safe, what problems can occur?)
The Impact of Computer Control on the Car Industry (conclusions)



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Automotive Industries- Yesterday's Manufacturing Marvels Parallel.s between old and new methods of manufacturing cars
Manufacturing Plant modern hand built cars
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Try looking up the following terms:
assembly line,

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Security of Data (why it is important that this is safe, what problems can occur?)
The Impact of Computer Control on the Car Industry (conclusions)

Technology should aim to make the learning process as interactive as possible. Hence, we have produced *Classrooms* for schools who realize the advantage of computer labs as a powerful medium for teaching and not simply another room in which to teach.
When teaching lessons within a computer lab, an instructor has two options. Either the teacher's computer screen can be projected for student viewing using the appropriate hardware. This can be very expensive. Or the teacher can visit each student individually providing instruction on each workstation. This can be very time consuming. *Classrooms* is a software solution to address both these problems.
The crux of the program has to do with the transmitting of images from one computer to another. If a teacher wants to show a class how to use a piece of software or where to find information on a web site, the teacher can simply conduct the lesson on his/her workstation. Simultaneously, the students are able to watch the actions taking place on the teacher's computer screen in a window appearing on their own workstations. Furthermore, the technology is used in reverse to allow the teacher to view the screens of

any computers on the network without the knowledge of the students and to lock a student workstation (disable functionality) as desired. In addition, remote control and Internet monitoring capability are included as well as a package of tools for sending messages and files across the network and for having classroom discussions. Also, there is a wizard for building computer based exams to be administered and corrected over the network.
Classrooms is the future of interactive teaching. Please read on to learn more about each of the tools within the Classrooms suite and how learning environments can use the program in a very practical way.

Features

What can Classrooms do for you?
Classrooms is a software solution to transform computer based teaching sessions into interactive learning experiences.

- Show Teacher's Screen to Students
- View Student Screens (Uses Viewer*)
- Remotely Control Student Computers (Uses Remote Control*)
- Broadcast a Particular Student's Screen to other Students
- Internet Monitoring
- Lock Student Workstations
- Discussion Forums
- Develop & Administer Online Exams
- Messaging and File Transferring Tools
- Virtual Chalkboard
- Remotely Edit Student Control Panel Settings
- Remotely Shutdown, Log-Off or Reboot any Student Computer
- Remotely Launch a Program
- Collaborative Paint Program
- Force Students to Log-In

Applications

Classrooms is for learning environments that seek to use network computing as a medium for teaching.

Computer software training

- Use *Classrooms* to conduct computer software lessons over the network.
- Students follow along interactively using their own computers.
- No need for students to huddle around the teacher's computer screen to view a lesson.
- Expensive projection equipment no longer required.
- Reduce the need to visit each workstation individually to provide instructions.
- Avoid using overheads or the chalkboard to teach complex lesson plans.

General lesson teaching

- Teachers can conduct routine lessons, using all of *Classrooms*' tools, over the network.
- Decrease the need for making print-outs.

Student monitoring

- Watch and monitor the computer screens of students from the teacher's computer.
- Interrupt the actions of a student by freezing the computer.

Remote Control

- A teacher can take control of any student computer on the network.
- Teach a student how to perform tasks by controlling the student's computer from the teacher workstation.
- The student can watch on his/her computer screen while the teacher remotely controls applications on the student's computer.
- The teacher can remotely launch a program on any student's computer.
- The teacher can remotely shutdown, logoff, reboot or power off a student computer.
- The control panel settings of any student can be remotely altered by the teacher.

World Wide Web monitoring

- Use keyword searches of site addresses and titles to monitor the Internet sites being visited by students.
- Visit the sites themselves through the computer's default browser.
- Block access to selected sites.

Internal communication

- Send messages and files from the teacher to students and vice versa.
- Messages can be sent between students at the discretion of the teacher.

Building Exams & Worksheets

- Use a built-in wizard to develop worksheets or multiple choice exams.
- Administer the exams over the network.
- Use the *Viewer* tool to monitor a student's progress during the exercise.
- Automatically correct exams over the network.
- Strictly enforce time limits.
- Compile individual and class exam statistics.

Focusing student attention

- Focus the attention of students during a screen transmission by drawing freehand on the Windows interface.

Description

Transmitter

- Have students view the teacher's screen in a window appearing on their own computer.
- Set the level of control given to each student:
- Full Control: The student is allowed to minimize the window.
- No Control: The student cannot do anything except watch the window.
- Determine the size and location of the transmission window.
- Broadcast a particular student's screen to other students.

Screen shot of the options in the Transmitter Panel

Viewer

- View student screens on the teacher's computer without the knowledge of the students.
- Set Viewer to rotate automatically or manually between chosen students on the network.

Screen shot of the options in the Viewer Panel

Lock Workstation

- Lock a student workstation.
- Disable the student's ability to perform any actions.
- Block access to the keyboard and the mouse.
- Blank a student's screen.

Internet Monitoring

- Set keyword searches of all the sites being visited by all the students on the network.
- Block access to particular web sites.
- Keep a log of all the sites visited by a particular student during a class period.
- Go to a site a student has visited by automatically launching the default browser.

Screen shot of the Internet Activity Log

Remote Access

- Take control of a student's computer from the teacher's workstation.
- The student can watch on his/her computer screen while the teacher remotely controls the mouse and keyboard on the student's computer.
- The teacher can remotely launch a program on any student's computer.
- The teacher can remotely shutdown, logoff, reboot or power off a student computer.

- The Control Panel settings (Remote Registry) of any student can be remotely altered by the teacher.

The Remote Access Panel

Screen Shot of the Remote Registry Panel

Exam/Worksheet Builder

- Use a wizard to build true/false, multiple choice or short answer exams.
- Disseminate the exam over the network with the option of strictly enforcing time restrictions.
- Compile student and class statistics.
- View a student's progress while the exam is being written.

Screen shot of the Exam / Worksheet Builder window

Chalkboard

- Use drawing tools and a palette of colors to draw shapes or freehand on the Windows interface.
- Images can be shown to students over the network using a virtual chalkboard.
- Launch a collaborative paint program for selected students to use as a group.

Screen shot of the options in Chalkboard

Screen Shot of Shared Paint Program

Messenger

- Send messages from the teacher to students and vice versa.
- Send messages between students if the student has been given the ability to do so.

Screen shot of the options in Messenger Panel

An example of the message that appears on the Student workstation

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Discussions

- Set-up discussion groups within the network.
- Mute or remove a student from a discussion group with the click of a button.
- Set-up a discussion forum with an attached virtual chalkboard and send images to student screens.

Screen shot of the options in the Discussions panel

Screen shot of a Discussion Forum

Screen shot of the Virtual Chalkboard in a Discussion Forum

Handouts/HandIns

- Send files to a student's computer. Allow the student to send files to the teacher.
- Have the file automatically launch the appropriate program in which to be viewed.

Screen shot of the options in the Handouts Panel

Classroom Organization

- Organize students in groups.
- Assign aliases to student login names or numbers.
- Force students to log-in.

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http://www.ddes.com/classrooms/description.html

Competitive Advantages

Unlike similar network communication solutions, *Classrooms* has been specifically built for learning environments. We have not simply taken a corporate solution and introduced it to the education market. Hence, *Classrooms* fully realizes the unique needs and concerns of educators.

Classrooms is a software solution.

- No need to buy new hardware or re-wire your network.
- Simply install the program onto your system, and run it from your desktop.

Classrooms works to accommodate to your learning environment.

- No need to reconfigure your system.
- The program runs as a transparent solution on-top of your network platform.
- The tools are easy to understand and to use.
- Classrooms works like any other Windows application.

Classrooms empowers teachers with the control they require.

- The teacher is able to specify the degree of control over each student.
- The level of interactivity that is essential is not sacrificed for control.

Classrooms is an affordable option.

- The solution costs less than competing software and hardware options.
- To purchase each of the tools within the *Classrooms* suite would cost far more.

Classrooms only gets better as your technology improves.

- The program will not go obsolete as your hardware is updated.
- The faster your technology becomes, the more effectively the software works.

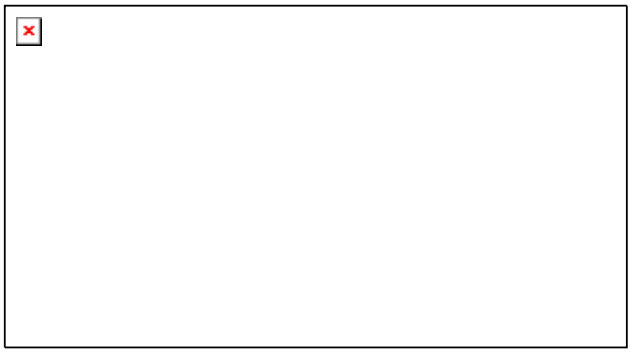
With the *Classrooms* suite of tools your learning environment will be equipped with the technology to create the ideal virtual classroom. No networking solution on the market provides such a comprehensive set of tools for teaching within a computer lab.

OptiMark Technologies uses *Classrooms* to train brokerage houses throughout the world on how to use their software.

The diagram shows the OptiMark™ Institute network. The Server Machine runs the *Classrooms* teacher software. The Client Machines each run the *Classrooms* student software. During exercises, the server machine shows the progress of the exercise on the projector and can easily switch the display among the student machines to illustrate various concepts as issues arise.

Users of OptiMark's solutions are trained more effectively, and the experience is more rewarding.

"The OptiMark Institute reaches 2000 students each year with our mobile training networks. Classrooms has been easy to install and requires almost no training for new instructors. The best part of using Classrooms is the excellent service that we have received from DDES."



Bill Smith - Manager of Research and Development

OptiMark Technologies

What if you could trade without disclosing your identity or your strategy? What if you could bring your entire order to the market without worrying about market impact? What if you could discover price at all sizes? The OptiMark™ Trading System makes all of this possible AND lowers your cost of trading.

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the.community uses *Classrooms* to teach senior citizens how to use computers.

Classrooms is used to replace a projection device, hence reducing eye strain and improving the learning experience. The element of interactivity achieved through group chatting, file transferring and the instructor's ability to remotely control a student's computer has resulted in increased client satisfaction. For the administrator, the power to

standardize registry settings improves the efficiency of network maintenance and saves time.

the.community
the.community is a New York based company with a nationally expanding chain of computer training centers catering towards senior citizens. The centers are located in retirement community complexes.

United Kingdom - Prices In Pounds

Classrooms - Network Teaching Tools

One Lab = £995.00

Classrooms Light - (Features: Transmitter, Viewer, Handouts, HandIns, Discussions, Messenger)
One Lab = £495.00

Lab = Single teacher (server) program. An unlimited number of student (client) programs can be installed with each server program purchased.
Note: Please contact your reseller for site license and multiple copy discount options. All prices are subject to local taxation if applicable.

Where to Buy:
Counterpoint MTC
England, Scotland, Wales, Northern Ireland & Erie
+44 (0) 1903 538844; andy@counterpoint-mtc.co.uk; http://www.counterpoint-mtc.co.uk/
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Minimum hardware specifications
- Pentium 166 PC.
- 32 MB RAM on student computers; 64 MB RAM on teacher computer.
- TCP/IP compatible network.
- 10baseT network or Novell.
- Super VGA graphics card.

Minimum software specifications
- Windows 95, 98, NT 4.0.
- In labs with more than 14 computers, Windows NT Workstation ***may*** be required on the teacher's computer.

Note:

1. The Teacher Workstation must have a static IP address, whereas, the Student Workstations can have dynamic IP addresses. Upon request, Classrooms can be configured to allow for dynamic IP addresses for both the Student Workstations and the Teacher Workstation.
2. The Teacher Workstation does not require any special hardware or software server products (i.e. the Teacher Workstation does not have to be a WindowsNT Server).