Cye is a breakthrough, personal robot with a versatility, performance and price as astonishing as its Y2K design. Because Cye is controlled through a simple graphic user interface on any PC, it's accessible to a whole range of users: People who enjoy the fun offered by remote controlled devices. The technologically curious with very basic point and click PC skills. People searching for inexpensive, cyberage solutions to tasks at home or in the office. Hobbyists or serious developers who can create their own Cye software or hardware accessories.

Cye is a fun remote control device

Take Cye out of the box, plug it's home base into your PC com port and 110 volt outlet, load the "Map and Zap" software into your PC and click open the Mapping window. The image on your screen will show what the robot and the space around it would look like if viewed from above. The robot icon appears surrounded by an indistinct grayish background-as though Cye were in a dense fog. Click the robot icon and drag it around the screen using your mouse or joystick. As you do this, the real Cye will move on the floor, mirroring the movement and direction of the robot icon on the screen.

Playing with Cye in this way is similar to playing with any remote control car, boat, or plane. But unlike conventional devices, Cye is not just moving around space. It is actually exploring and learning its environment. Wherever it moves, Cye reports back to the PC where it is finding obstacles, and where it is finding free space. Gradually, patches of fog on the screen clear up. The places where Cye finds obstacles are marked as black areas. The places where Cye finds free space become clear, white areas on the screen

Cye is a mapping tool

The ability to record what it encounters in this way makes possible a second level of usage mapping entire environments in precise detail. To do this, you are not confined to the dragging the robot icon across the screen. You can also use the point-and-click mapping tools on the menu bar. By using the pencil and the eraser tools, you can mark areas on the screen map as "clear"or "filled." This saves time and effort, since you don't have to drag the robot icon around the screen to establish these things.

Once the basic map is completed, you can use the point-and-click labeling tools on the menu bar to mark different places Cye needs to be aware of. You can use the "Danger" tool to rope off areas on the screen map - such as stairways - that you don't want Cye to enter. You can use the "Hot Point" tool to mark and type in the name of destinations - like the dining area or the kitchen - that you may want the robot to go to later. You can use the "Check Point" tool to show Cye where there are straight sections of wall it can use to update its position. You can use the "Vacuum Patch" tool to designate rectangular areas you may want the robot to vacuum. If you double click on a vacuum patch, you can specify which corner the robot should enter and whether the zig zag

pattern Cye follows should be horizontal or vertical. This enables you to create a path that won't cause the vacuum to run over it's cord. At any time, you can click in this patch and the robot will execute it, cruising through it's zig zag pattern. If you have attached any upright vacuum to Cye using the vacuum attachment, Cye will pull the appliance through this pattern and vacuum your floor. You can set up a series of these patches using the "FlowZap" tool (see below) and get Cye to vacuum your entire house.

Cye is a programmable robot

You can save the map of Cye's world and use it to guide Cye around obstacles, race around the room, or drive a ball into any goal or target area you establish. But you can also use it enable the third and what is probably the most exciting level of usage: making Cye perform a whole range of tasks any time you specify.

To do this requires no more than basic point-and-click, drag- and-drop, type-a-word-or-a-number-in-an-open-window computer routines. You simply open the Flow-Zap window and, in a few seconds you can set up a job for Cye to carry out. For example, to get it to wake you up, you can create a simple, four-step do-list that says: "Wait till 6:30 AM." "Go to my bedroom " "Sing National Anthem " "Go to home base." You drag-and-drop the basic routines from a menu bar. Since you created the map with the "hot points" on it, the names of the destinations are available for selecting on pull down menus, as are all other major options. The only elements you must type in yourself are the specific times you want events to take place.

Just as simply and quickly, you can command Cye to execute a great variety of tasks in your home and business. You can make a do-list that instructs Cye to execute the path of one of the vacuum patches you have mapped at 5:00, then check in at a check point you have create to eliminate any positioning error that may have accumulated, then move on to the next patch, check in again, and so on until you have vacuumed your entire house. Of course you will have to lay out these patches carefully to avoid getting your vacuum cleaner's cord tangled up in your furniture, but that is up to you.

You can create a do-list that runs Cye and its wagon into the dining area at 7:00PM; waits to be nudged before carrying dirty dishes into the kitchen; returns to the dining area when nudged to continue clearing; goes back-and-forth as many times as you instruct; and then returns to its home base.

In a business environment, by using the same simple point and click, and drag-and-drop commands, you can create a do-list that enables Cye to collect and distribute up to 10 lbs. of mail, supplies, or other material to any number of people or locations you specify.

You can instruct Cye to carry out amusing and entertaining tasks and routines. You can even create a do-list that will get a soccer ball into a net, no matter where you place the ball at the start.

Cye is a Hobbyist's and a Developer's dream

Cye comes with an RJ 45 connector accessible just in front of Cye's LED. This 8 pin connector has a relay driving output, a 5 volt input, and a 12 volt and 5 volt power supply. With these signals, hobbyists can manipulate muscle wires, read sensor inputs, turn on lights or sirens, or whatever else they might imagine. The input can be read and the state of the output set right from the Flow Zap window as part of the users program. So Cye could easily be programmed to do such things as go to the family room, rotate 45 degrees, and fire a nerf gun rigged with muscle wires. The wagon has a convenient holder for mounting popular 2"x4" hobby boxes.

For developers, the Cye hardware and software is completely open facilitating development of both new software applications for manipulating the robot and for creating hardware that attaches to it. Communication from the user's PC to Cye is handled through an OCX server which can be accessed from any Visual Basic or C programming environment on the user's PC. Using the OCX, developers can create their own application for Cye because the entire Cye hardware command set is exposed. This includes everything from "go to Cartesian X, Y" to "set PWM duty cycle on wheel A to value X", to "what is your battery level now?" Altogether, there are 35 commands to the robot and 20 messages from the robot that are included in this protocol.

In addition, the radio receive and transmit signals are exposed on the RJ connector. Probotics Inc. will provide the C code for the communications protocol for anyone wishing to communicate to their own remote microprocessor board through Cye's radio link. Cye has a unique address and only responds to messages sent to this address. Additional hardware mounted to Cye and connected through the RJ45 connector can have another address and share the radio link with the robot.

Breakthrough technologies

The technologies behind Cye's versatility, performance and ease of use are as innovative as its striking, distinctive design.

The threshold issue that mobile robots have to wrestle with is finding a way to keep track of precisely where they are in their environment.

Probotics founder and chief guru, Henry Thorne, solved this challenge in a remarkably simple manner: he developed a group of 5 patented technologies that make the age-old navigation system known as "ded-reckoning" accurate in dealing with the distortions and errors created by slippage and other problems of traction produced by the robot as it travels. In fact, Thorne's technology is more accurate and ten times less expensive than GPS, the leading currently available positioning technology.

Not surprisingly, he calls his technology FunDR-functional ded-reckoning. Following the standard ded-reckoning Formula, 500 times per second, Cye calculates its location based on its previous position, its current speed, and the direction it is traveling.

The accuracy and reliability of the calculations is the result of design, construction and software innovations. Cye's entire carriage is suspended on two wheels with projecting

tips, 1/16 of an inch wide. This keeps Cye's points of contact with the floor as well as the external forces on the robot to a minimum. The wheels themselves are made of stiff plastic in a bicycle sprocket configuration, with a layer of very sticky urethane on the tips for good gripping. With this design, the amount of slip on any surface is minimized, while the pivot point - crucial in monitoring Cye's location - is perfectly defined.

Every 10th of an inch, Cye calculates the extent of any wheel slippage that may be taking place, and immediately compensates for it by slightly over-rotating the appropriate wheel. To eliminate any error that may accumulate in Cye's calculations, Cye goes to the checkpoints established by the user when creating the map of Cye's environment. At these checkpoints, Cye verifies its position and updates it if necessary.

Price

Not the least remarkable feature of Cye is its price. At $629, it offers some features only available for hundreds of dollars more, and unique capabilities unavailable until now at any price. Primarily, cost has been removed by utilizing the processing power of the user's existing PC to reduce the hardware requirements in the robot.

Additionally, numerous innovations in the mechanical and electrical design made this low-cost, high-quality product possible. Instead of expensive shaft encoders, the gear motor cooling fans double as encoders by running them through low-cost slotted optics. There are no wiring harnesses because everything - including the motors, battery, radio and antenna - is mounted directly to the central circuit board. The home base contacts double as the circuit board mounting bolts. Instead of expensive NI-CAD batteries, sealed lead acid batteries are used because the extra weight helps make the ded-reckoning calculations more accurate. A single dual H bridge driver chip drives both motors. Low cost high speed CMOS circuitry is used throughout. A single 16-bit micro-controller serves as the brains of the robot while also capturing analog inputs such as motor current and battery level and performing all timing functions. There are no moving parts other than the wheel on one end of the motor and the cooling fan on the other.

Extensive support available

At every level of usage, using Cye is highly intuitive and a joy to work and play with. For all but the fourth level of usage, the only computer skills the user has to have are basic select-and drag, point-an-click, drag-and-drop, and typing routines familiar to even the greenest PC novice.

Nonetheless, Cye comes with extensive support. In addition to a manual and help-file, users can consult a Probotics web site where they will find the general techniques for mapping and other operations presented using a unique LAYGo (Learn as you go) format that anticipates and presents relevant information as the user requires it. The site

also includes an FAQ and a direct E-mail feature that can be used to forward any questions directly to Probotics technical support.

Specs
Cye is 16" X 10" X 5" and weighs 6 lbs. It operates from any PC with a Pentium 133 MHz chip or higher. Cye communicates to and from the PC 10 times per second via an FCC approved 900 MHz radio link. Its 2.9 amp hour rechargeable batteries will power Cye for 20 hours when idle, 4 hours when driving around on light carpet, 30 minutes when pulling the vacuum on light carpet; and 20 minutes when pulling a heavy vacuum through medium carpet with a half-inch sponge pad underneath.

Accessories
You can buy a wagon accessory, a vacuum attachment accessory, and a switched-outlet accessory. The wagon lets you carry goods around your home or business.

The vacuum accessory allows you to snap any upright vacuum cleaner onto Cye. Cye can pull around any upright vacuum on any carpets up to medium-thickness.

The switched-outlet accessory lets you pull an extension cord around and turn on or turn off an outlet powered by the extension cord.

Radio and Television Interference Statement

The equipment described in this manual generates and uses radio frequency energy. If it is not installed and used properly, that is in strict accordance with the manufacturer's instruction, it may cause interference to radio and television reception.

This equipment has been tested and complies with the limits for a Class B Digital Device in accordance with the specifications in Part 15 of the FCC Rules. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or TV reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

* Reorient the receiving antenna.
* Relocate the computer with respect to the receiver.
* Move the computer away from the receiver.
* Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/TV technician for additional suggestions. The user may find the following booklet, prepared by the Federal Communications Commissions, helpful: *How to Identify and Resolve Radio and TV Interference Problems*. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402.

WARNING

This equipment has been certified to comply with the limits for a Class B Digital Device under Part 15 of the FCC Rules. Only peripherals (modems, printers, etc.) certified to comply with the Class B limits may be attached to this computer. Operation with non-certified peripherals is likely to result in interference to radio and TV reception. Any changes or modifications to this equipment not expressly approved by the manufacturer could void the user's authority to operate this equipment.

REMARKS

To meet FCC requirements, shielded interface cables and power cords are required to connect the device to a personal computer, peripheral, or other Class B Certified device.