Computerize your car

By Lionel Felix
(December 7, 2005)
Estimated time required:
2 days
Estimated cost: $1,300 to $2,600

Step 1:
Getting started

No longer the domain of technology early-adopter illuminati, the car computer has matured to a point where the weekend PC warrior can get one up and going before the Monday morning commute.

There are many different motivations for installing a computer in your vehicle. Jobs that require a significant amount of driving are made more efficient with GPS as well as live traffic reports and e-mail access. The family hauler can get premium entertainment with DVD movies, a TV tuner, and Internet access so that little Brittany and Cole can IM with their peeps across town. The daily carpool commuter can entertain coworkers with some in-flight entertainment as well as giving them access to work e-mail even before they're at work.

Every in-car computer install will have unique challenges and logistical problems to solve. Vehicles with no trunk, such as SUVs, minivans, and hatchbacks, offer limited space to house the CPU. Some cars have no unused dashboard real estate, making it difficult to place a monitor. Leased vehicles present the challenge of keeping the car unmodified so as not to break the contract.

Temperature variations, vibration, moisture, dust, and radio interference are commonplace in any motor vehicle, but resistance to those factors has been engineered into their design. Computers, on the other hand, want to be coddled, lovingly kept in a cool dry place. It's important to consider that computers, even those made for vehicles, still need to be protected from the elements.

The basic installation steps include making determinations regarding your desired features, checking out the different places around your car where components would go, shopping for parts, and putting it all together.

Step 2: What you'll need

The center stack of this car has been modified for a flush-mount LCD.

The Ampie PC is made specifically for cars.

The standard boilerplate in-car computer consists of a monitor, a CPU, input devices, peripherals, and cabling. Every install will be somewhat unique depending on what features you want. Desired features and project cost are directly related. Some nice-to-haves can be put off for a while to keep the initial cost down.

Monitors

Two manufacturers currently dominate the small touch-screen market. Xenarc and Lilliput make the majority of screens for this application. Both manufacturers build quality screens with different sizes and form factors. What it boils down to is the look and size that suit your needs.

Monitors come in four general variations: flush mount, external mount, and retractable. Flush-mount and external-mount devices are very similar and can often be interchanged. Flush-mount monitors are set into the dash or center console and require some kind of modification for the area where they will be mounted. Flush mounts make the best fixed, professional-looking installations.

External-mount monitors have a universal mounting bracket that allows for installation nearly anywhere the mounting base can be secured. This style of monitor is useful where fabrication would be too expensive or too destructive to the interior. Motorized and manually retractable monitors, housed in a single DIN case, can save precious space in the dash as well as offering the person installing it a standard size to work with. (Single DIN is a standard size for aftermarket and some OEM stereos.) If you have an unused single DIN-size opening or don't mind replacing your car stereo, it is a very good but somewhat more expensive option.

CPU

The heart and soul of the install, the PC, will most likely end up hidden deep inside your car. Function, heat dissipation, and mounting ease are important considerations when picking a PC. Cars get subjected to temperature extremes that computer components were not designed for. Although your local PC shop may have some tiny systems that look right, mobile-computer makers offer finned, heat-dissipating cases designed to withstand high temperatures. Standard plastic CPU cases may not offer the rigidity or temperature protection offered by car-specific case designs.

Most systems will come with the standard palette of VGA, keyboard/mouse, audio output, 10/100 Ethernet, USB 2.0, and microphone connectors. PCMCIA/CompactFlash slots give you the option of using 802.11g Wi-Fi cards or GPRS/EDGE access cards from your wireless phone provider. If you intend to get a wireless broadband card from your mobile telco, this is a must-have slot.

Many peripherals such as external DVD drives, TV tuners, GPS antennas, Bluetooth dongles, and Wi-Fi adapters are USB based. Peripherals can very quickly outnumber your available ports. In addition, many of the USB-connected devices have power requirements that, when connected to a standard USB hub, will demand more than the single source port can give. Your local big-box electronics store may not have the solution on its shelf, but IndustrialComponent.com came up with a combo pack that has everything you'll need to get four powered USB ports out of one.

When it comes to powering the CPU, we are once again faced with the reality of living in a 110V AC world, or at least a 110V AC country. Although motherboards and internal components of a computer run off DC, the power supplies do not. A DC-to-DC power supply lets you connect the computer's power terminal to the vehicle 12V supply without having to deal with AC power supplies. For a roll-your-own system, Opus Solutions provides DC-to-DC converters, or you may want to keep things simple by purchasing a system that comes with the DC-to-DC converter preinstalled. The advantage to having a DC-DC power supply is that the computer can sense the 12V switched power coming on and off and can handle its own bootup and

shutdown.

Car-specific computers

Xenarc offers a number of form factors to choose from, depending on your needs. Most systems come with FireWire, an integrated DVD player, PCMCIA slots, and lots of USB.

The **CarBot PC** includes a solid CNC lathe-cut aluminum case, a mounting base, and an integrated DC-to-DC power supply. The PCMCIA and CompactFlash slots let you plug in your favorite GPRS or EDGE network card for always-on broadband Internet.

MP3 Car sells about six different mobile computers, including the Ampie, which not only has a funny name but also looks pretty cool.

CarCPU sells complete packages that include everything from the GPS antenna to the wireless keyboard.

Apple made a huge splash in the mobile-computing scene with its nearly single-DIN, slot-loading **Mac Mini**.

Our friends on the other side of the pond are just as enthusiastic about their mobile-computing projects. **CarTFT** has complete mobile-computing packages for those with pounds sterling burning holes in their pockets.

Step 3:
Assess your car

Many cars and trucks conceal empty space behind body panels.

A car computer can be bolted into a variety of places.

SUVs, minivans, and hatchbacks were built to make the most use of the interior space. The challenge is finding an unaccounted-for cavity to mount the CPU. The first place to check is behind the interior body panel by the rear wheel wells. Larger SUVs will often put big interior panels over those spaces to create a space for electronics, a jack, and other roadside repair tools. Other possible mounting locations may be found under seats, inside the dash, or inside the center console.

Sedans, coupes, and convertibles that include a trunk offer good mounting options all over the cargo area. Hanging the unit upside down under the rear deck allows you to keep all of the cargo space while making the unit accessible. Make use of false panels if you cannot find space. A false panel can be simply constructed of particleboard and matching carpet. It is important to keep the CPU clear of speakers. Magnets used in car speakers can adversely affect your computer components.

After you find a good mounting point, consider the path for your wiring. There are few direct routes, so most wires will have to be run under carpet, through body panels, and under seating. Although all wires are subject to radio interference from the alternator and various vehicle electronics, the video and audio leads are most susceptible. Shielded video cable may be more expensive but will be less likely to suffer from picture-distorting interference. The same rule applies to your run of audio cable from the rear of the car to the amp or head unit. Shielded audio cable prevents engine whine from coming through the speakers.

The last part of the assessment is finding power. The ground connection is the simplest to find; it's best achieved through securing a self-tapping screw directly into the vehicle's interior sheet metal. Make sure you know what's on the other side! Continuous 12V power can come directly from the battery or an always-on connection in the car. Some cars' cigarette lighters are always on; some are not. Use a voltmeter to see if the power is switched off after the key is out. That leads us to the last part: 12V switched. Somewhere in your vehicle's wiring harness and fuse panel is a circuit of 12V power that is live only when the car is on. If your test shows that the lighters are live only after key-on, you've found a good source for 12V switched power. Wiring diagrams are available through off-the-shelf manuals such as Chiltons, which can be had at your local bookstore or auto parts shop. Poking around the wiring harness with a voltmeter is a risky option for vehicles with sensitive onboard electronics. Placing the meter on a data wire may short out a very expensive onboard safety or fuel management system. Once you find your power sources, run the wiring through the vehicle. Make sure the wiring gauge is appropriate for the power needed by the components. Basic car computer applications will rarely need anything thicker than 12 gauge.

Toolbox

Having the right tools will be a big time-saver. If you'll be removing body panels, get a panel tool, which runs about $10 at auto parts stores. A good wire stripper/cutter and crimper can make your install go very quickly, with quality results. Invest in a Klein or similar electrician-grade pair of crimpers and stripper/cutters. Fish tape lets you route wires through things you never thought possible, and zip ties make everything neat. Foam-backed double-sided tape is good for permanently securing USB hubs and small devices. Self-tapping sheet-metal screws save you from drilling pilot holes. Black and red 12- to 16-gauge wire will handle your CPU's power requirements, and an in-line fuse kit protects all your expensive electrical components.

Step 4: Anchor the PC

At this point, the CPU is just about ready to be mounted. Be sure to allow ample clearance for any connections on the unit. USB connections, the power button, and any slot will need to be accessible. If the unit has an internal DVD drive, the CPU needs to be positioned so that the drive is in the standard flat position. Although most drives can work sideways, the optical head won't have the same shock-absorbing ability in that orientation.

If the CPU has its own mounting bracket, secure the empty bracket first to make sure everything is square and fits properly and the car's panels fit back in place. This is where self-tapping sheet-metal screws come in handy. Since you already ran the ground and power connections, this is a good time to terminate the wires with crimped-on connectors. Go through a dry run by connecting and plugging in all of the peripherals to make sure there is enough clearance for everything.

Getting audio from your computer to the car's sound system can be an entire project in itself. If your stereo head unit has an auxiliary input, it's easy to connect the audio output on the computer to the input of the stereo. If you need to add an auxiliary input to your stereo, take a look at Pacific Accessory or Precision Interface Electronics, which both specialize in auxiliary adapters for stock stereos.

If you're going to use a GPS antenna (and why wouldn't you?), check that it can be mounted with direct overhead sky access while still having enough cable to reach the CPU. A USB extension cable may be required if the cord is not long enough. A good trick to hide a GPS antenna is to find sheer speaker fabric in the same color as the vehicle interior. Wrap the antenna in the fabric and secure the antenna to the rear deck with Velcro, double-sided tape, or a simple mounting base.

Access to the Internet while on the road dramatically increases the functionality of an in-car computer. The cheapest way to go is an 802.11 Wi-Fi card, but Wi-Fi connections are short range and don't travel well. Until a technology such as WiMax covers cities with a blanket of continuous Internet coverage, Wi-Fi will remain useful only at hot spots or unsecured access points.

Wireless providers offer another solution through GPRS/EDGE networks, which give you cell phone range. With a data-enabled phone, you can connect through Bluetooth or data cable and see transfer speeds from 56Kbps up to 2Mbps, depending on the offering and technology. Or you can opt for the PCMCIA card version that lives in your PC. Each service provider has its own cost structure, and not knowing your plan details can lead to catastrophic data usage bills

Step 5: Install the display and input

Dashboards offer multiple places to bolt a mounting bracket.

This center-mounted LCD is easy to see from the driver's seat.

Complexity of installation depends heavily on your choice of monitor. For a weekend project, an external base-mounted system should be used. If you want to flush-mount it later on, pulling out the base mount is simple and leaves no traces. External monitors can generally work as a base- or flush-mount, making them a decent investment if you plan on setting it in your dashboard at a later date.

The external-mount monitor can be installed in less than an hour, but does not provide the clean look of a flush-mount or retractable model. Retractable monitors are more expensive but offer relatively simple installation with their single-DIN form factor. And it looks cool when the screen comes out of the dash.

Every external monitor is going to have its own style of mounting base. Often it will work with your dash, but sometimes it may need to be modified. Fortunately for those of us without a sheet-metal press in our garage, the good people at Panavise offer various vehicle-specific mounting brackets. These mounts generally involve taking off a part of the dash or center stack and bolting the mount in place. The Panavise site lets you choose a mount by car make and offers instructions on how to put it in place.

After the mount is secured, carefully put the dash or center stack back together. Most properly constructed mounts should fit your vehicle without any further modification. If modification is needed, you can make a decision to modify your dash parts to make it fit, modify the mount, or find another mounting bracket.

Once the monitor is mounted, make sure all of the cables are routed nicely through whichever path you chose--no tight bends, never over a seat rail, and steer clear of hot or moving parts. Tap into the 12V switched circuit you located earlier, and use that for the monitor's primary power. Avoid using direct battery power to supply current, or you may find your car with a dead battery.

Although the touch screen should cover most input needs, a keyboard and mouse may be necessary for typing in locations and URLs. Gyration makes a durable and compact wireless keyboard and mouse suite with good range and resistance to RF interference. The mouse not only works without wires, it has no need for a flat surface. For the budget minded, a small-footprint keyboard can be had for about $25. These smaller integrated keyboards can live in the seat-back pocket and don't cost a lot to replace if lost.

Step 6: Boot it up

The Roadrunner UI makes common car applications accessible.

Windows XP looks great on a 17-inch monitor but can give you a case of the squints on a 7-inch screen. Add in some road vibration, and the icons can start to blend together. Quite a few other people noticed that same thing when putting computers in their cars and made their own touch-screen interfaces that install over Windows. Nearly 100 of these user interfaces (UIs) are floating around. Some are very straightforward and have set features, while others allow for plug-ins. As is the case with computer software, you are not required to pick one and stick to it. If you don't like your UI, install another, rinse, repeat.

Centrafuse, by Flux Media, covers most of the bases, with integrated GPS, DVD, FM, DivX, traffic, and Web right in the interface.

The RoadRunner UI goes the open-source route and has a strong following. It provides hooks into many peripherals, but with an open-source product, you're left to FAQs and message boards for support.

CNS Maestro's slick interface is worth looking into. You can change its skins to customize the look and feel.

Getting your software loaded, drivers installed, and operating system patched can be done through a direct-wired Ethernet connection snaked out from your router to the garage or through a wireless card. Systems without any kind of removable media or immediate network access can use a USB memory stick to shuttle device drivers around until networking is up and fully functional.

Tip: Before turning that ignition key, make sure you have a quick way to disconnect power in the event of a short. You don't want to destroy your new computer just after spending a weekend installing it. If the CPU power supply is properly connected to ground, 12V constant, and 12V switched, the computer should boot up when you turn the ignition key. If the system does not start its boot process, check the fuses, the continuity of connections to power sources and then, of course, the power button. It's often the simple thing that isn't working

Step 7: System suggestions

Mild:

CPU: Xenarc MP-SC8, $900

Specs:

Windows XP Home
Internal CD-RW / DVD
2GHz Celeron
256MB of RAM
40GB laptop hard drive
Built-in audio and video
10/100BaseT Ethernet, 3 USB 2.0, 1 FireWire, mic-in, line-out, 2 PS2, 1 serial
DC power input

Monitor: Lilliput 7-inch touch-screen VGA, $280

GPS: Microsoft Streets & Trips 2005 with GPS, $100

Input: Fentek mini keyboard with touch pad, $55

Wireless: Netgear WG111 USB Adapter, $40

Total: $1,375

Wild:

CPU: CappuccinoPC SlimPRO SP615 Fanless, $1,350

Specs:
Windows XP Pro
Internal CD-RW/DVD
2GHz Celeron
512MB of RAM
80GB laptop hard drive
Composite video out
Onboard VGA video
Mic-in, Line-out, 2 PS2, 1 serial
10/100BaseT Ethernet, 3 USB 2.0, 1 FireWire

Monitor: Xenarc 700TSV 7-inch touch screen, $395

GPS: CoPilot 8 navigation software with Bluetooth GPS antenna, $300

Input: Gyration Ultra Cordless Optical Suite, $110

Wireless: Proxim Orinoco 11a/b/g ComboCard Gold, $45

Accessories:
Linksys USB Bluetooth Adapter, $50 Hauppauge USB 2.0 TV Tuner, $100 Sierra Wireless AirCard 710, $60 External magnetic mount 5dbi Wi-Fi antenna, $75

Total: $2,485

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