Introduction

As mentioned in previous documents, a "Digital Picture Box" is being designed that acts essentially as a buffer between a personal computer storing digital photographs and a VGA compatible display. This system permits individuals to convert old VGA compatible devices (CRT, LCD monitors, etc) into "Digital Picture Frames." The system also has other practical uses…for instance, displaying images (perhaps of lecture slides for a class) on a VGA-compatible projector.

The system works basically as follows: JPEG images are decoded and then transferred to a Rabbit 3000 Core Module's RJ-45 port. Once received, the Rabbit interfaces with an Epson graphics controller which is responsible for generating the appropriate VGA signals. The Epson also interfaces with a 256K x 16 EDO DRAM memory chip that is used as a "framebuffer" to store a particular image. The system operates using a standard unregulated 9 VDC wall wart, which is respectively converted to +5V and +3.3V via low-dropout regulators. The digital picture box also has a built-in IR receiver/decoder which permits the use of an IR remote control, allowing one to place the VGA device and picture box in a relatively inaccessible location. Finally, there are also status LED's along with pushbuttons to control the system directly from the box.

As with any engineering project, there are numerous ethical and environmental concerns that should be addressed. In particular, since this project utilizes solder and a printed circuit board, there are almost certainly some environmental concerns. Those aside, it's imperative to provide the end-user with a product that is safe, usable, and reliable. All of these have ethical implications that lie beneath them.

Ethical Impact Analysis

There are numerous ethical issues related to this particular project if it were to actually go into a manufacturing stage. The first, and most important, is user safety. Since the device would ultimately be enclosed in a "box" of some sort, permitting the user only to press buttons and utilize the IR remote, many of these issues resolve themselves. However, there are still a few basic issues that should be addressed. Care should be taken to organize the components in such a manner as to minimize the risk of a short or some other failure related to the box being moved or shaken (during an accidental fall, for instance). That aside, care should also be taken to ensure that the box is grounded (if it or portions of it are made of metal) and that it isn't possible for the user to come into contact with any circuitry while pushing the buttons on the device. The device is not designed to have a normal user service its internal parts. As such a warning label should be clearly placed somewhere indicating that there are no user-serviceable parts inside and that the user risks electrocution by opening the box. Once that is accomplished, there should be no ethical liability (or legal liability, for that matter) with regards to a user attempting to service components internal to the device. Finally, as a form of extra precaution, it would probably be desirable to build some type of current monitoring device into the system to detect any shorts (if, for instance, the device has some type of liquid spilled on it) and immediately terminate power.

Next up is reliability, something that can easily destroy a product's value if it doesn't exist. The device should be thoroughly tested in various operating conditions before being placed into production. These conditions, of course, should reflect the intended environment…namely indoors. Tests should include, but are not limited to, reliability (how long individual components last), durability (how does the product deal with every-day "abuse"), and finally safety (what happens if the device is repeatedly dropped, submerged in water, etc). Consideration must also be made for the remote control and 9V wall wart. If appropriate target results aren't met, it would be prudent to select more reliable parts at that point or perhaps establish and notify the user of the device's life expectancy. As briefly touched upon at the beginning of this paragraph, potential fallout from having an unreliable product includes numerous things. The device would quickly gain a poor reputation; unforeseen problems could hypothetically result in some sort of harm to the user (a seizure from a certain screen refresh frequency, for instance); and of course product sales would decrease significantly.

Finally in terms of ethics (and a quality product, for that matter) comes usability. This particular device is fairly intuitive, although consideration should be given to the onscreen menu system to ensure that it is easy to understand and efficient. Another issue which may not be readily apparent is the fact that this is a networked device. In other words, network security should also be ensured. Some type of authentication clearly needs to be added to ensure that only proper users can obtain and manipulate control of the device. In terms of actual data security, since it is assumed that the images will be displayed in a somewhat public setting anyway, data security (ie, encryption) is most likely unnecessary. Without these additional insurances, the same problems mentioned above could again be encountered; namely, the device gaining a poor reputation and the ultimate drop in sales revenue.

Ultimately ethics play a large roll in the revision process before this product goes into actual production. It is clear that the existing prototype is unfit for public use, and to ensure a quality product, capable of turning a profit, numerous additional features should be built-in.

Environmental Impact Analysis

Ethical considerations aside, there are also environmental implications related to this device. At first thought this may not be obvious, since many people consider digital systems to be incredibly clean and efficient devices, at least with respect to "traditional" pollution. However, this particular device has an environmental impact through all stages of its life; from manufacture, to normal usage, and ultimately disposal/recycling.

The manufacturing process realistically has the most potential to be environmentally damaging. Traditional PCB fabrication processes tend (at least until recently) to use lead-based solder which besides the obvious fact that it contains lead, also tends to release toxic fumes when heated. With respect to this precautions need to be taken to properly contain and vent the fumes as well as control the amount of lead released into the environment. This can be easily resolved by using solder that isn't lead based, but in some cases this can be more expensive. Printed circuit boards contain amounts of lead as well and at this point there a real cost-effective method around this fact is lacking. However, the manufacturing processes are mature enough that the environmental impact is minimal. However, as we will see shortly, it does present some concerns during device disposal. In addition to these potential environmental hazards, one also has to consider the manufacturing process behind each IC used as well as other components. Each has an associated environmental "cost."

In terms of normal usage, the only notable environmental impact would be with respect to the energy band (ie, radio waves, IR waves, etc) and energy usage. The device does utilize IR signals and has potential to interfere with similar devices. Moreover, since this is a digital device with switching logic it has the ability to generate its own electromagnetic field which could easily interfere with other nearby devices. Overcoming this can be done through sane design layouts as well as constructing the external casing of a material that would assist in reducing EMF output. It is important to note that realistically only the former is a viable solution, as the FCC generally frowns on reducing EMF just by throwing the device into a Faraday's Cage. Finally, something that is often overlooked is the device's power consumption. Despite what many believe, electricity is not in infinite supply. Moreover, many of the techniques used in electricity generation are still taxing on the environment. As such, careful consideration should be given to selecting low power devices and minimizing any potential extraneous energy usage. These aside, the device is fairly benevolent during its operational life, at least with respect to the environment.

Of course, the end of a products life cycle can have almost as much of an impact on the environment as its start. As mentioned earlier, PCB's contain lead, which by itself essentially mandates that instructions be included on proper disposal of the device. It should not simply be thrown into the garbage. The best course of action would be to take the device to some type of recycling plant equipped to handle PCB's and related circuitry. Here parts may potentially be recycled and it can be ensured that the lead containing materials are handled properly.

As one can see, device design and manufacture is composed of more than simple "engineering" concerns. There are numerous ethical and environmental issues that are at the heart of a product's design as well.

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5V

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IR

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