

**INTERACTIVE TELE-JOURNALISM**  
**A SYSTEM FOR LOW COST, LIVE, INTERACTIVE NEWS**  
**TELEVISION PRODUCTION**

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## **Abstract**

The rise of the internet and the increasing availability of low cost means to create digital media have created an environment and an appetite in the audience for meaningful interaction with mass media. Television news is an area that holds great potential for community based programming and can be made to allow the audience a direct role in the production of such programming.

While the goals of Interactive Tele-Journalism are many, the primary focus up to this point has been to develop a working prototype of a system to support the live production of low cost, community orientated, interactive television news programs in which the audience has direct and immediate influence over the programming.

Furthermore, this project seeks to document and make available the processes and technologies developed for this system in the hopes that others who seek to further refine the concept, continue development or produce a show are able to use it as a starting point.

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Finally, I would like to thank my parents for helping me to become who I am and for their understanding and support.

## **Introduction**

This document is my final thesis paper in support of my master's studies at NYU's Interactive Telecommunications Program. Along with this paper, my thesis consists of a hardware and software prototype of the system described within. More information and current updates regarding this project can be found online at <http://www.walking-productions.com/itj/>.

This paper and associated project have arisen out of my frustration with the current state of television news and mass media in general. Journalistic and independent media activities on the internet have in comparison been making great strides to embrace the audience and welcome their participation in the making of the news. It is the purpose of this project to help bring the participatory nature of the internet to the world of television news in a manner that is accessible and open for all.

## Concept

### Overview

Interactive Tele-Journalism is a means with which to empower a community with the ability to act in aggregate as the director of a television news program. In a sense it is a merging of concepts relating to online communities, tele-presence, television news and interactive TV. It allows members of a community to push discussion and questions in what is otherwise a passive medium (television news) in a direction that interests them.

Specifically it allows individuals viewing a television program to engage in a discussion with each other and to influence elements of the news programming both individually and in aggregate. For example, a show utilizing technology from this project is able to allow the viewer of a live interview to log on to the program website and chat with other viewers as well as send comments and questions to the interviewer (tele-journalist) who may subsequently pose that question to the interviewee.

### Rationale

Although ITV (Interactive Television) has recently been making some strides in engaging TV viewers it is generally lacking in any direct real-time relationship between the programming and content of a show and the desires of the audience. Interactive Tele-Journalism is an attempt to utilize concepts and technology arising out of studies involving tele-presence to introduce a greater degree of *interactivity* in interactive television. Through the use of internet technologies and digital production tools, a greater level of audience participation may be enabled and shows produced for a lower cost than traditional live television production.

Television news programming is an area that holds great potential for direct audience participation and interaction. At most, current TV news programs will invite audience participation via telephone call-ins or email where individuals may comment on the topic or ask questions of someone being interviewed.

Internet and ITV (interactive television) technologies offer the potential to take this a step further and can allow the same levels of participation on a much larger scale than telephone call-in and email based communication can support. They can give news shows the ability to embrace the social nature of the audience and offer them the means to communicate directly with each other in response to the programming. Additionally they may allow the audience direct interaction with the coverage in many more situations such as at press conferences and during coverage of breaking news. Furthermore viewers can be given a greater level of influence over decisions relating to what events to cover, where to go and what to concentrate on; in essence become the news director.

### Goals

The long-term goals of this project are many; first is to develop and document a prototype hardware and software system by which these concepts may be demonstrated. This portion of the project is well underway and this document is a culmination of these efforts. The second major goal of this project is to utilize this system to produce a range of community orientated interactive news programming that engages the audience and compels them to interact. Finally, it is hoped that this project will have a lasting impact on the production of television news.

### Audience

The audience for this project is those who are interested in producing television news media, the audience of television news along with anyone who is interested in being informed, engaging in discussion and active with the media they are exposed to.

### Core Features and Functionality

The core features of this project are a low cost portable broadcasting system that allows for the viewing of audience feedback; in-studio software that allows various feeds to be broadcast on television with the integration of audience messages; and finally a chat like application that audience members may use to communicate with one another, the studio and the tele-journalist(s).

### Success Measures

There are many means by which to gauge the success of this project. First is the success or failure in developing the hardware and software prototype that will be used to demonstrate this concept. Second is the ability for the system to be used, enhanced and further developed for similar projects. Third and probably the most important measure by which to gauge the success of this project is the impact it makes in the realm of television news, specifically if any programs utilizing similar concepts or technology are able to be developed and they successfully engage and allow the audience the means to participate in the making of the news.

## Background and Context

### The Internet, Blogging and Social Software

There are several current trends in social and internet based technologies that point to the rising appetite for interactive media and news.

Blogs or weblogs, individual or group edited web based journals are a recent phenomena that has begun to expose the breadth of an appetite for participatory media and self-publishing. There are thousands of news related blogs where individuals are taking reporting and journalism into their own hands. They are publishing stories and commentary to the web for anyone who is interested to read. Additionally blogs have a feature that allows readers the ability to leave comments and often this leads to a dialog with other readers and the writers of the blog.

Several blog writers have begun to write about the phenomenon of blogging itself and have coined it and related phenomena Participatory Media (or Participatory Journalism when the blogs are news related). J.D. Lasica a veteran journalist and an avid blogger sums up many of these thoughts on his blog where he wrote the following in response to his own question “What makes users interact?”

*The digital age has conditioned us so that people realize we no longer have to be the passive receptacles of content force fed from big media. We have a voice and something to say, and we've begun to express that voice on weblogs, in alternative media sources, and in the channels offered by traditional media. Nearly everyone prefers a conversation to a lecture, and the Net has transformed the traditional paradigm of packaged content delivered through one-way pipes into a new arrangement that is still taking shape.*

J.D. Lasica, “How interactivity affects Journalism”, JD’s New Media Musings, 12 February 2004, [http://www.newmediamusings.com/blog/2004/02/how\\_interactivi.html](http://www.newmediamusings.com/blog/2004/02/how_interactivi.html)

Blogs have recently made dramatic impacts on contemporary culture and media throughout the world as is evidenced by their acceptance and impact in regions with large groups of people that have been underrepresented by traditional media and government. The following passage, written by one of the first individuals to create a Persian language blog does well to express the impact of blogs inside Iran and I believe that impact is equaled throughout the rest of the world.

*Weblogs are powerful bridges in a widely divided society. Bridges between immigrants and homeland inhabitants, girls and boys, parents and children, and especially between journalists and writers who were not able to publish their works freely in the politically closed atmosphere in Iran and their thirsty readers.*

Hossein Derakhshan, “How weblogs can change the way the world sees Iran”, The real Iran, 24 September 2003, <http://hoder.com/weblog/archives/008202.html>

Blogging appears to be the latest step in an overall trend of self-publishing that started sometime around the advent of the printing press. The ability to present to the world your views has always been a drive among people, especially important to those that feel

underrepresented by government and media. Today, as evidenced by the blogging phenomena, internet based technologies have greatly accelerated the growth of available means for self-publishing.

Closely related to the phenomenon of blogging is the history of social software on the internet. It is not an accident that blogs are not broadcast tools that only support one-way transmission. The conversational manner of comment posting and relationships formed between blogs are large reasons for their overall success.

Although seemingly a recent pursuit, web sites and software that embrace the social nature of the internet combined with people's desire for self-publishing have always been on the forefront. Software that enables easy means of communication between individuals and groups has been a driving force on the internet since the beginning. Early evidence of this is how successful email has been from the beginning.

*Email caught on fast after its 1971 invention. It became by far and away one of the most popular user applications on the ARPANET. In the words of one ARPANET researcher, the email service sparked by Tomlinson's first SNDMSG utility was "an instant success."*

Ian R. Hardy, "The Evolution of ARPANET email", 13 May 1996,  
<http://www.ifla.org/documents/internet/hari1.txt>

## Internet Hype, Interactive TV and Traditional Media

Throughout the phenomenal growth of the internet in the late 1990's there were many predictions of an impending convergence of the technology and devices for entertainment and communications, specifically the television and the personal computer. Accompanying these predictions were countless studies suggesting that television viewing was being replaced by internet usage or web surfing.

The entertainment industry thought that people turning to the internet instead of the television were doing so for a wider breadth of entertainment content that assumed a similar form to that of television. The internet was often thought of in terms of a television that offered an unlimited number of channels. They quickly hopped on the latest trends and began to develop web portals or gateways to various internet sites, generally those owned and operated by them. In many cases the content on these sites was a re-packaging of what was already on television or additional content that revolved around the same.

For many reasons, the predicted convergence of the personal computer and entertainment devices has not happened exactly or as quickly as predicted. Furthermore, many of the media companies were unsuccessful in their attempts to capitalize on the internet. As discussed above, the true power of the internet comes from the social and non-traditional publishing aspects and not from the consumption of re-packaged traditional media. The media and entertainment industries were blinded by the promise of broadband, unlimited channels and convergence and for the most part have missed the boat on the social aspects and power of self-publishing that continue to drive the growth of the internet.

Today, television and media companies generally utilize their websites for promotional material and to run ancillary items to shows such as episode guides and have yet to embrace the social and self-publishing nature of the internet. More often than not, the more extensive show related websites are created by fans, not the production company or television network. Fan sites, as these have been coined, often host popular features such as message boards, chat rooms, fan fiction and screen grabs from shows.

A particular example of this is the community that has grown up around Buffy The Vampire Slayer and its offshoots. While the official site for Buffy has made some attempts with the inclusion of chat and downloadable images, the real activity is on the fan-sites. A recent search turned up more the 50 sites with active message boards, many with large numbers of subscribers (in the hundreds and sometimes thousands). Many of these are in support of fan-fiction, which is fans writing side stories around the central concept of the show.

The point of all of this is that television viewers are already *not* passive viewers; they are taking the initiative to participate with or in most cases without the support of the entertainment company.

Of course some television and media companies have taken steps in the integration of interactive elements with their programming. One example of this is ABC's Enhanced TV version of Monday night football. In this case, viewers are directed to a website where a synchronized interactive trivia game can be played. It takes the form of a 'question and answer game' that involves material from the show as it is airing.

Unfortunately, as is the case with most current ITV offerings, there is no ability for audience members to communicate with each other or influence the programming in any way. In fact, a viewer of the show on television generally has no idea that anything is even occurring online along with the show.

Interactive Tele-Journalism, on the other hand, enables the audience direct influence and interaction with the programming itself. It embraces the social nature of the internet and allows viewers to engage with each-other and with those producing the show, live.

## History Portable Media Making and Internet Distribution

As important as the recent advances in internet related technology and the missteps of the television industry are to the concepts behind Interactive Tele-Journalism, is the history of independent journalism and documentary. Historically (throughout the last 30 years), video has been a tool of choice for those involved with technology, social commentary and documentary. In the late 1960's, with the introduction of a reasonably priced portable video recorder (the Porta Pak), video production was liberated from the studio and brought to the street and to the individual.

*With the first introduction of portable media technology in the late 1960s, creative and community-minded people worked alone and collectively, with a shared mission to train and equip ordinary citizens with the means of creating and distributing independent programming. Media makers explored video as an art medium and as a tool for social*

*and cultural change, producing documentaries, narratives, conceptual, and image-processed work presented on cable and television, in regional and community venues and in art contexts.*

The Experimental Television Center, "Video History Project: About the project",  
[http://www.experimentalvcenter.org/history/about\\_VHP.html](http://www.experimentalvcenter.org/history/about_VHP.html)



Sony DVK-2400/VCK-2400 (Courtesy of The Experimental Television Center:  
<http://www.experimentalvcenter.org/history/tools/ttool.php3?id=53>)

Following the rise in popularity of independent video is a continual increase in the number of venues and outlets for dissemination of the work. Throughout the 70's, 80's and early 90's these outlets were predominantly small venues, community organizations, art groups and a small amount of television (generally through PBS and public access stations).

Rapid advances in technology, in particular the move to digital video (from analog), has enabled individuals with consumer grade equipment a level of production capability and quality which is on par with professionals. This, combined with the rise in the availability and usage of the internet, in particular the ever growing popularity of broadband access, has opened a great means of disseminating video content to a broad, more distributed audience and has done great things for increasing awareness.

Perhaps the most widely publicized example of a group taking advantage of these trends is the recent "Bush in 30 Seconds" contest put on by MoveOn.org. This contest invited groups and individuals to create a commercial with their own equipment on their own time that expresses their feelings on the President. While the concept of holding a

competition for the airing of a piece of media is not unique, this particular method of submitting the pieces (through email and subsequently putting all of the accepted submissions on a website for anyone to view and vote upon) is (at least on any kind of scale).

The number of submissions they received topped 1,000 and the number of voters topped 100,000.<sup>1</sup> Ultimately the winning ad was aired on TV during the Superbowl (but not on the same channel, rather on CNN).<sup>2</sup> This along with the hundreds of other examples of video content reaching wide distribution on the internet make it clear that the combinations made possible by the internet and low-cost high quality video production equipment are powerful.

### WiFi TV and The Tele-Actor

One of the direct precursors and foundations of the concept of Interactive Tele-Journalism is WiFi TV (<http://www.open4all.org/laika/>). WiFi TV is a concept and method for shipping live video meant for live television broadcasts from non-studio based location to a distribution hub using both the wireless network and the public internet utilizing streaming media.

*The goal of the project is to establish procedure and criteria for broadcasting to the cable or satellite TV network from remote locations, using a laptop, camera and any type of available broadband Internet connection - preferably WiFi.*

*The motivation for such an exercise is the attempt to break away from classical TV production requiring hundreds of thousands of dollars in specialized infrastructure and enable immediate and on-the-fly transmission from remote locations to the TV network, ultimately leading toward creative production of programming from within a P2P network.*

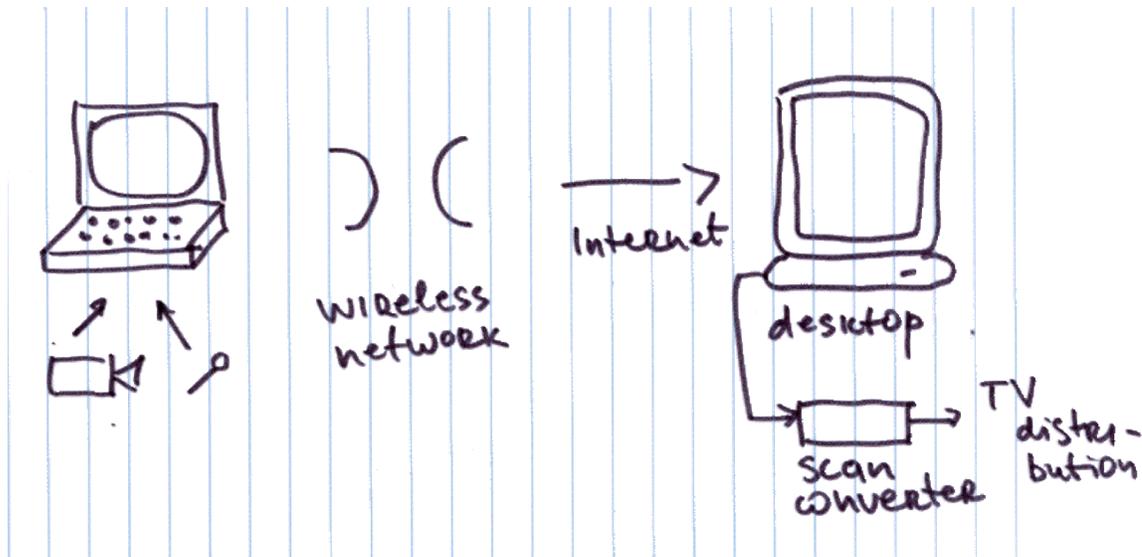
Kenyatta Cheese and Drazen Pantic, "Public WiFi Network 2 Public Cable Network", Wireless Broadcast, 2003, <http://open4all.info/laika>

Below is a quick sketch of the concept of WiFi TV taken from the website.

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<sup>1</sup> Source: MoveOn.org, <http://www.bushin30seconds.org/release-winner.html>

<sup>2</sup> Source: MoveOn.org, <http://www.moveon.org/cbs/ad/>



(Wireless Broadcast: Public WiFi Network 2 Public Cable Network, <http://open4all.info/laika>)

The natural match of WiFi TV with the Interactive Tele-Journalism concept is easy to see. WiFi TV allows for live video broadcasting from any facility that supports high-speed wireless internet access. The added bonus involved is that utilizing the internet in this manner opens up a variety of possibilities for additional direct communication between viewer and journalist, in essence providing the means for immediate influence over the programming by the audience.

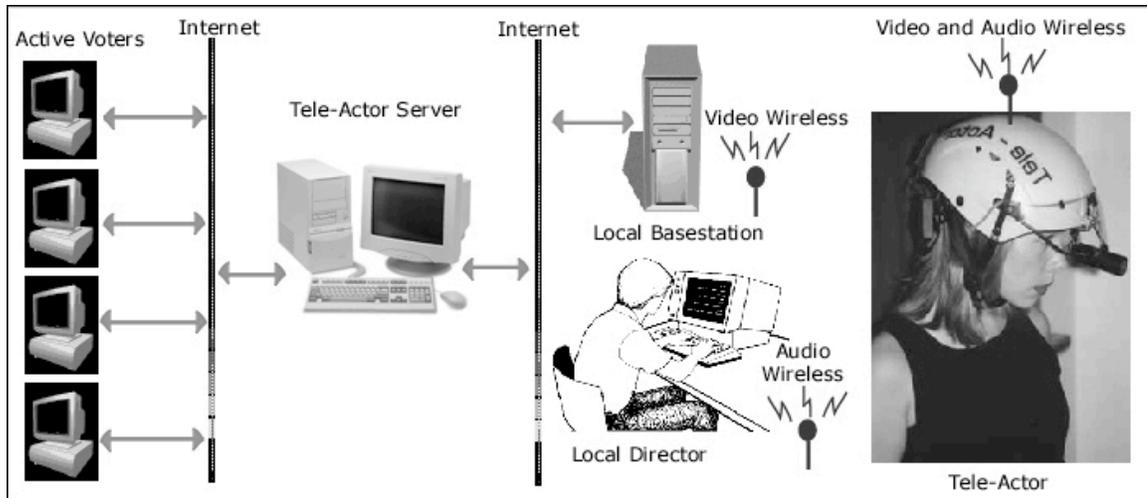
The concept of live audience feedback brings up another of the direct precursors of this project, the Berkley and MIT Tele-Actor series of projects.

The Tele-Actor group has been engaged in the study of interaction among groups of users on the internet with a human tele-actor that is acting according to the aggregate desires of the users. They describe the concept as follows.

*We propose a new framework for Internet-based telepresence, in which the participants collaboratively experience and effect events at a remote site. The system combines a remote agent (the “Tele-Actor”) with distributed audience control (the “Tele-Directors”). This framework allows the remote group of Tele-Directors not only to view but to vote on commands and thereby to participate in the Tele-Actor’s environment.*

The Tele-Actors Guild, UC Berkeley and MIT Media Laboratory, “Tele-Direction: A New Framework for Collaborative Telepresence”, <http://smg.media.mit.edu/papers/TeleDirection/Tele-presenceCHI2001.PDF>

Below is a concept diagram explaining the workings of their system.



(The Tele-Actor System Diagram, [http://teleactor.berkeley.edu/system\\_block\\_diagram.html](http://teleactor.berkeley.edu/system_block_diagram.html))

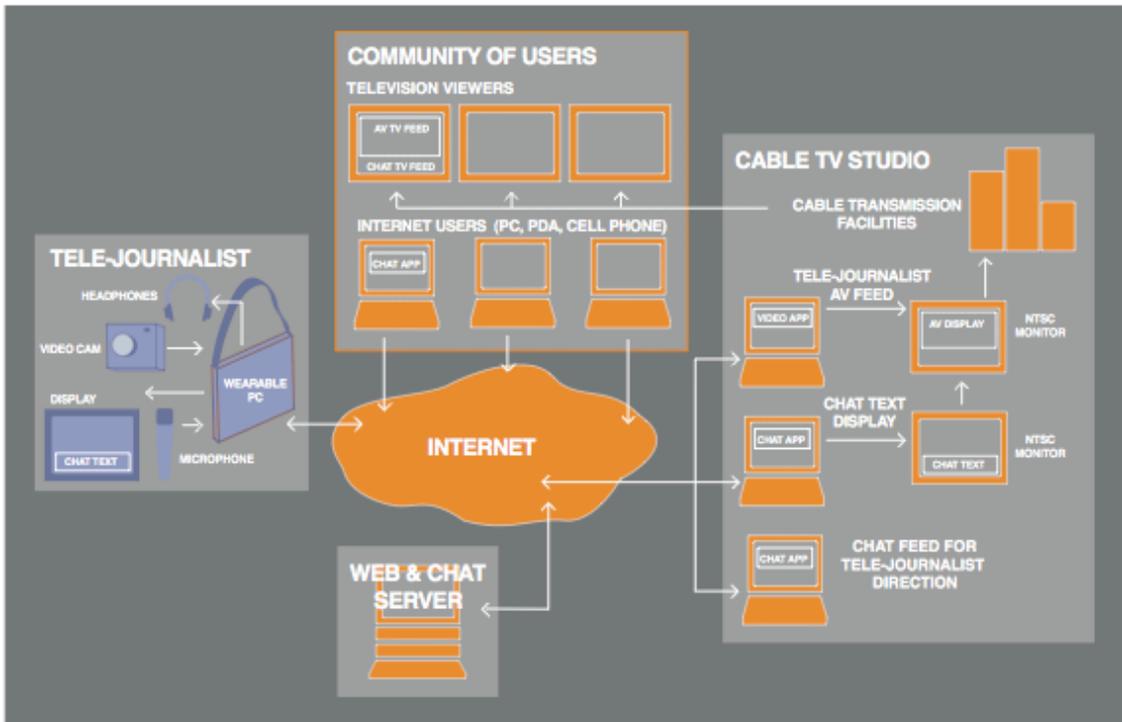
### Interactive Tele-Journalism

The social nature of the internet, the participatory power of blogs, the history of portable independent media making, low cost wireless internet based technologies for live video transmission and ideas for human to human tele-presence, Interactive Tele-Journalism takes ideas from all of these and brings them together into a cohesive platform. It embraces the social nature of the internet and doesn't use it simply as an alternative delivery platform. It takes cues from the ongoing movement of participatory media evident in the blogging world and dismisses much of the current ITV and web based trends in use by media companies. Instead, taking concepts from human to human tele-presence projects, it allows the audience a much more direct interaction with the live production of a television news show. In many ways it looks back to the roots of portable independent media making ideas, introduces methods for making low cost and accessible media and attempts to deliver the power of this medium to anyone interested.

Historically, live television, especially interactive television production has been far out of reach of individuals, small groups and independent media organizations. Along the lines of the WiFi TV project and the early history of portable media making, this project seeks to liberate the production of interactive programming by making low cost and open production tools available. Furthermore it embraces the audience by allowing an easy means for interaction that is in line with current appetites.

## Prototype Features and Functionality

The following diagram is a high-level system architecture for the project and is in support of production of a live interactive tele-journalism show. This diagram is followed by a more specific breakdown of the prototype design, features and function of each component.



### The Tele-Journalist

The box labeled tele-journalist on the left represents an individual tele-journalist who is providing the live video feed and may, through their actions, respond to audience comments, questions and desires. This individual is equipped with a single board computer, headphones, video camera, microphone, touchpad and a touch-screen display, as seen in the picture below.



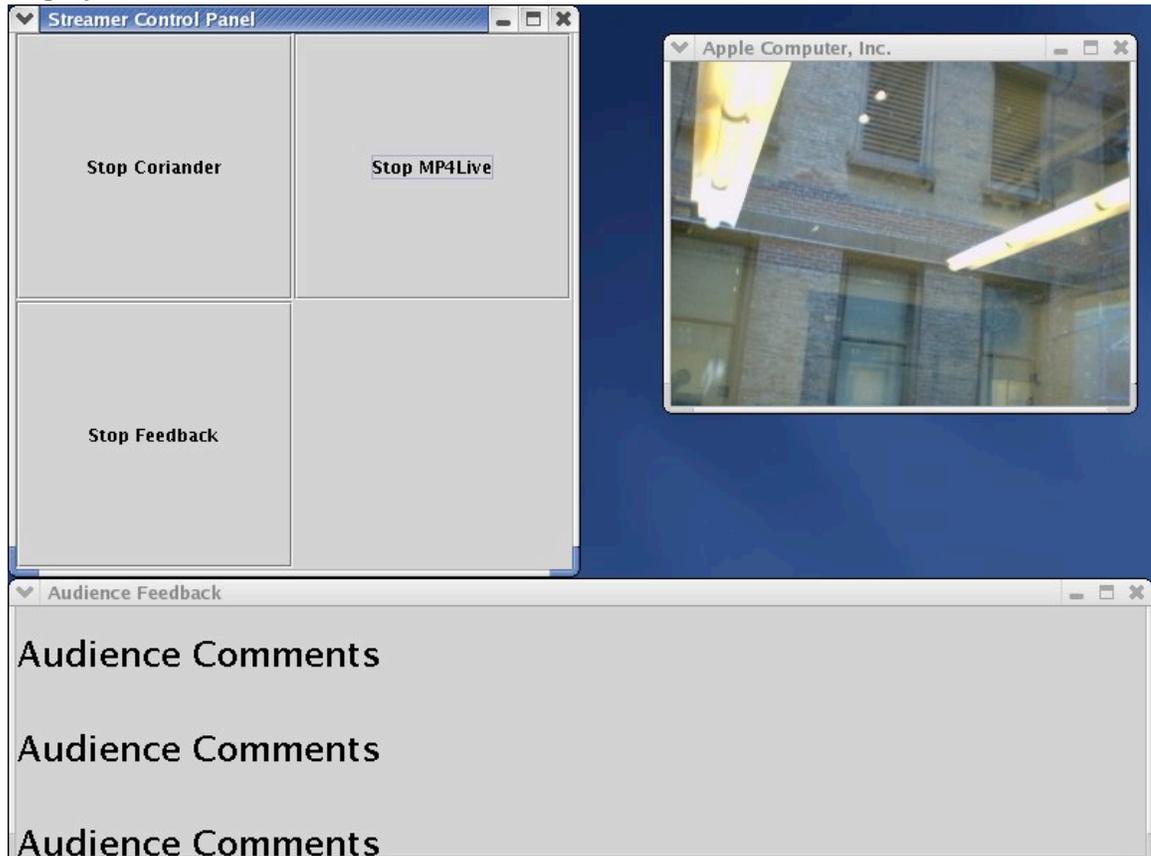
The touch-screen display, camera and a touchpad are mounted on a custom-built steady cam and table stand. The display provides the means for viewing audience feedback as well as a viewfinder for the camera and means to control the various applications necessary for instantiating the live video feed.

The steady cam setup is necessary due to the use of a low cost video camera (an Apple iSight) that doesn't provide built-in image stabilization. The means for video transmission, MPEG-4 encoding and streaming, is also sensitive to high amounts of movement so quality is very much dependent on having a stable image. The touchpad is mounted in an easy to access manner just below the display for occasions when the touch-screen built into the display does not provide enough resolution for required software interaction (such as when first turning on the computer).

This unit is connected via a series of wires to the single board computer that is carried inside a bag that the tele-journalist wears around their shoulder. This computer is powered by a camcorder battery, which also powers the touch-screen. Additionally the computer has a WiFi (wireless ethernet) card for low cost and high speed connectivity to the internet allowing for both the sending of the video stream and receiving of the audience feedback.

Finally, the tele-journalist is wearing a headphones and microphone combination that provides the audio for the video and allows him to monitor the sound quality.

The tele-journalist uses a series of open-source software running on the computer with a custom built interface for which to control the software. The interface to this software was developed specifically to allow the tele-journalist the means to control the software without the need for a keyboard and minimal use of a touchpad instead leveraging the touch-screen as much as possible. Below is a screen shot of the view from the touch-screen display.

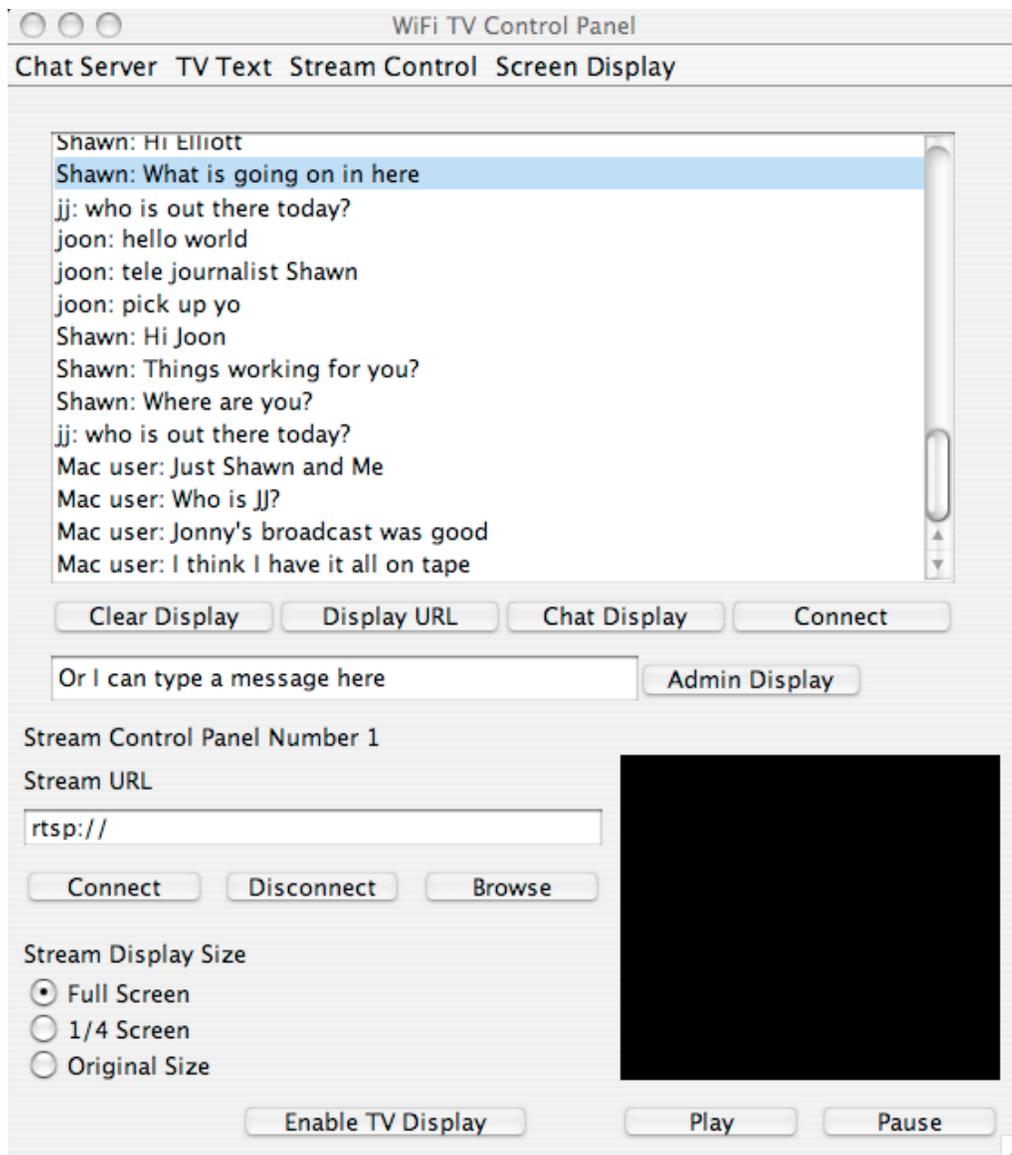


In the upper right corner of the screen there is a view of the video feed that is being transmitted to the studio. The lower portion of the screen is a scrolling display of user feedback as relayed to the tele-journalist from the studio. The top left shows the button panel interface that is used to control all of the various applications. All of these components were designed to maximize legibility and offer quick and easy control to the necessary functions of the computer while out in the field.

### The Television Studio

The studio needs the ability to acquire the audio and video feed from the tele-journalist via the internet and in-turn export it in a standard video broadcast format. Additionally it is responsible for relaying the wishes of the audience specified via the audience chat application to the tele-journalist.

A screen shot of shot of software built to support all of this is below.



This application allows for the reception and broadcasting of four tele-journalist feeds. Additionally this application allows an individual in the studio the means to monitor, display and send audience feedback messages to the tele-journalist and output these messages for display on the broadcast output.

Below is the television output of this application.



The image is the feed from the tele-journalist, the text at the bottom is where the selected audience messages or information specified by the in-studio application user appear.

### The Audience

The audience of this program may interact on various levels. The first level is simply watching the program as it is broadcast without participating in the online discussion or sending feedback to the tele-journalist. The second level involves utilizing an application available on the show's website for chatting with other viewers and offers the possibility of messages being relayed to tele-journalist and output to the television broadcast.

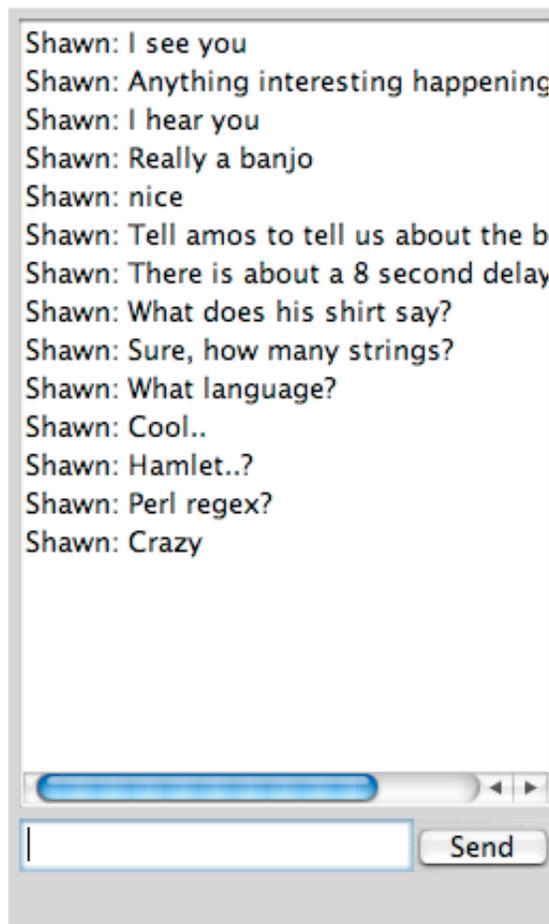
A screen grab of the prototype application enabling this audience interaction is below.



Welcome to the Interactive Tele-Journalism Chat Client.

Using this page, you can talk with others watching the show, send comments for display on TV and instructions or comments to the Tele-Journalist.

So go ahead and type away!



As can be seen this is a web based application with which the audience participants are able to monitor comments sent by other users and are able to enter into dialog with them as well as send feedback, comments and questions to the studio and tele-journalist.

## **Design Goals**

The nature of the project is well expressed through goals of its design. The Interactive Tele-Journalism prototype was designed and developed with the following goals in mind:

1. Using Open-Source Software

This system was developed to be as low cost and open as possible. The decision was made to utilize only open-source software to provide all of its capabilities. This offers the greatest chance that the project will be adopted, enhanced and ultimately utilized by independent media organizations and individuals in the future. All of the software developed for this application has been or will be open-sourced as well.

2. Using Low-Cost Hardware

Low cost hardware is imperative for the production of community based media projects. The high cost of traditional television news production is one of the primary limiting factors for the lack of experimentation and growth in alternative television productions. By utilizing low-cost hardware in the prototype of this system the door is open for on-going enhancements, redevelopment and offers the greatest possibilities for use by others.

3. Leveraging internet based technologies and infrastructures

The internet has been already been adopted by the general population. Therefore it made sense to leverage this existing use of interactive technology for the audience interaction rather than attempt to utilize the “not quite there yet” nature of specialized interactive television technologies such as set top boxes.

Due to the high-cost nature of technologies that have traditionally been used to support live television transmission, this project sought to utilize low cost and increasingly available internet based technologies and infrastructures for the transmission of video back to the studio for subsequent broadcast on television.

## **System Components and Design**

What follows are a series of statements concerning the rationale behind the choice of components as well as rationale for the design and development of the overall system.

**Wearable/portable Computer:** Via EPIA M10000

It was determined that a low cost single board computer would have the most benefits and keeping within the design goals of this project. Apple laptops were considered but

they do not offer the amount of customization and low cost that comes with utilizing a single board computer. This decision, the right one in the end, created the most difficulty in the development of this project. The single board computer is a bare-bones component requiring the addition of additional hardware for use. The research and identification of this hardware and the integration of the various components was a large part of the overall project.

Operating system and software: RedHat Linux 9

In keeping with the design goals and the reasoning for choosing a single board computer, this project has been developed on an open-source operating system called GNU/Linux. This in combination with the single board computer provides a somewhat difficult to use but provides a powerful system that is open future enhancements.

This choice had reverberations down the line in terms of software integration. All of the chosen software, from camera acquisition to encoding and networking software had to be compiled and at times required slight source code modifications. Again, having worked out all and documented these issues, a powerful open platform for future work and enhancement has been developed.

Battery: Bescor 12 volt 4.3 amp hour lead-acid

Powering a single board computer for portable use turned out to be a difficult task. The identification and utilization of an appropriate battery took quite a bit of research along with some trial and error. Ultimately a series of batteries made for portable lighting kits was identified that offered the correct amount of power at a fairly low cost.

Unfortunately there are some as yet unidentified issues with these batteries that most likely has to do with the amount of the load that is being placed on them in combination with the sensitivity of the electronic equipment they are powering. The identification of alternative batteries is an on-going effort.

Camera: Apple iSight IIDC Camera

This choice was somewhat easy since I had available to me a suitable camera that used a standards based method of transfer. Ultimately this project was developed so that other, possibly higher quality cameras be used.

Audio: Headphone and microphone combination

Although not ideal this choice offers the flexibility of a hands free microphone and headphones to monitor the audio by the Tele-journalist. Ultimately a shotgun microphone mounted along with the camera on the steady cam and table stand should be utilized for higher quality sound acquisition.

Wireless Networking: Netgear MA311 802.11b Wireless PCI card

The process of choosing this card entailed quite a bit of trial and error with faster cards that offered less than adequate Linux drivers. Ultimately this card offered a good compromise between speed and compatibility.

Computer Case: Custom built plexi-glass

Most cases specifically made for single board computers are meant of stationary use and do not lend themselves to a portable application. The decision was made early on to custom build a case out of plexi-glass since I am familiar with it and is cheap and readily available. The process of building a case with the correct form factor and requirements for heat dissipation took a couple of tries but was ultimately worthwhile. The only

drawback to using plexi-glass is that it holds static electricity and this may cause problems for the electronics mounted inside.

**Streaming and camera acquisition software: Coriander, MP4IP**

Since the choice to utilize Linux was already made, only a couple of options were available for software in support of my video streaming goals. Fortunately, a couple of open-source software projects have been developed that provide the infrastructure for capturing, encoding and streaming video over the internet. These applications although very high quality, are still in development and it took quite a bit off effort to compile and use them along with their prerequisite libraries and hardware drivers.

As with the choice to go with Linux, the choice to utilize these applications has the benefit of providing an open environment for enhancements and ever increasing quality at no cost.

**Touch-screen display: Lilliput 7" LCD monitor with touch-screen**

The choice to utilize this particular model came after doing research regarding monitors for use in cars. This particular model offered Linux support for the touch component and a high brightness for use in daylight situations. The decision to utilize a touch screen arose out of the need to give the Tele-journalist a quick and easy means to interact with the computer.

**Touchpad: Cirque Easy Cat Combo touchpad**

Although the touch-screen offered a good mode of interaction with the computer for the Tele-journalist, finer control was needed when starting up and shutting down the computer. Unfortunately, a mouse is not usable when out in the field, on the other-hand this touchpad provides fine mouse like control while being stationary and therefore useable in the field.

**Steady cam and table stand: Custom built steady cam stand made out of iron piping**

The decision to build a steady cam stand arose from the need to provide a greater deal of image stabilization than was offered by holding the camera directly. The added benefit of being able to mount the screen and touchpad directly on the stand is an integral part of the overall design, offering easy access to a view of the video coming from the camera and an upfront view of the comments and feedback from the audience. This was chosen ahead of other options including shoulder or head mounting the camera as it offers the Tele-journalist the option of looking away and pointing the camera at angles that wouldn't be possible if it were mounted on their body.

**Computer Bag: Manhattan portage**

Although in need of some modifications due to heat concerns, an appropriate bag was obtained that fit both the single board computer and the batteries. This is a shoulder strap bag that offers easy access to the computer when it is necessary. The decision to go with this over a backpack was for this reason.

**Software development: Java**

The choice to utilize the Java language in all of the software developed for this project was easy, it is cross platform, widely known and I am comfortable with it. Development of each of the custom software components has been on-going for the past year with all of the software soon to be released as open-source and available on the internet.

A detailed article concerning the development of this system, in the form of instructions for building a similar system is available in the Appendix of this document.

## Summary and Conclusions

Dan Gillmor, a journalist and blogger who is writing a book about the topic of participatory media called “Making The News” writes in the introduction of his draft:

*Tomorrow's news reporting and production will be more of a conversation, or a seminar. The lines will blur between producers and consumers, changing the role of both in ways we're only beginning to grasp now. The communication network itself will be a medium for everyone's voice, not just the few who can afford to buy multi-million-dollar printing presses, launch satellites or win the government's permission to squat on the public's airwaves.*

Dan Gillmor, “Making The News”, 2004,

<http://weblog.siliconvalley.com/column/dangillmor/archives/010092.shtml#010092>

I see Interactive Tele-Journalism as an intermediate step on the way to his theory of everyone participating in the conversation. As it is currently envisioned, it allows the public the opportunity to participate but doesn't completely blur the lines. The tele-journalist is still a reporter and a journalist but one who can respond to the desires of the audience and engage them in ways they haven't been engaged before on television.

While the goals of this project were many, the project has been primarily focused on the development of a working prototype of a system to support the live production of a show that can be used to demonstrate the concept and appetite in the audience for such a show. In this regard, the project has been successful; a working prototype has been developed and documented.

The secondary goals of the project, to demonstrate the concept, need and appetite such work is still in progress. Currently, I am pitching the idea and discussions with several individuals and groups on how they might utilize this technology and develop a show that integrates elements of the overall concept. It is my hope that such efforts will culminate in the production of a live show this summer, and will perhaps be used in coverage of events revolving around the Republican National Convention.

## Appendix A.

The following is a draft of an article that is intended to be published on the Interactive Tele-Journalism website (<http://www.walking-productions.com/itj>). It documents the steps and provides instructions for building a low cost, portable broadcasting system similar to the one I have built of the tele-journalist.

### **Building a portable, low cost, live television acquisition system for interactive TV production.**

-Shawn Van Every ([vanevery@walking-productions.com](mailto:vanevery@walking-productions.com))

The purpose of the following is two-fold; the primary reason is for the appendix of my thesis project, Interactive Tele-Journalism (more information about the project can be found at <http://www.walking-productions.com/itj>). The other reason, perhaps more important, is that I am interested in helping others to get started in the building of low cost and open sourced interactive television production tools. I feel that television needs a nudge in the right direction and that the social nature and power of the internet should be brought to it in the form of small scale community orientated interactive programming.

With that said, let's get started.

In a nutshell, you will need a cheap but powerful single board computer, some RAM, a Firewire/IEEE 1394 camera, a small touch screen monitor, a battery, a hard drive and a WiFi card. Next you will need to install Linux, add in some video capture, encoding and streaming software and your ready to go.

Almost...

Ok ok, so it isn't really that easy.

What follows is a description of the system I built along with information on how I built it and the problems I ran into along the way.

This project started about 6 months ago with the purchase of a Via EPIA M10000 motherboard. I chose the Via EPIA M10000 because several friends have had good experience with them and it seemed an especially nice single board computer with good support for Linux and great extras. It has a plethora of ports including 2 Firewire/IEEE 1394 ports, 4 USB ports, S-Video and composite video out as well as all of the standards such as VGA, parallel, serial, audio in/out/microphone, PS2, PCI and even I2C. This board is also very quiet, small (7 cm by 7 cm), low power (less than 5 amps) and sports a speedy 1 GHz x86 compatible processor. The unfortunate thing about starting with a board like this is that you have to purchase and install everything else and I mean EVERYTHING ELSE.

My next task was to pickup and install RAM. This was pretty straight-forward. The Via board takes DDR PC-2100 RAM, which is pretty easy to find and not all that expensive. I bought a 256 MB module from Crucial and snapped it into place.

Following that, I dug out a 10 GB laptop hard drive that I wasn't using anymore. Using a

laptop hard drive was necessary for this application since I needed enough space for video files and didn't want to lug around a full size hard drive and the means to power one. Some ambitious folks might want to try a Compact Flash card and IDE adapter but it could be cost prohibitive due to the amount of space required by video files. For me using a laptop hard drive was a good compromise between space, cost and power.

Unfortunately, the Via board only comes with IDE cable and pin-outs for a full size (3.5") drive so I had to purchase a 40-Pin to 44-Pin Laptop IDE cable adapter. This adapter fits in the standard IDE pins (40) on the motherboard and has a separate section that plugs into an output from the power supply and provides a 44-pin connector for a laptop drive, which includes power.

Next I needed to provide power to the board. Since this system was meant to be portable and I didn't intend to carry around an AC generator, I needed to find a means to provide power other than a standard ATX power supply. After a bit of searching around, I came upon a very nice 12 volt DC to 12 volt DC board that fit right into the power connectors available on the board. This allowed me the option of powering the board with a 12 volt battery or plugging it in, assuming I had an AC adapter that output 12 volts DC.

If there is one thing I learned and learned well, it is that this board requires more juice than can be gotten from your standard 12 volt 1.5 amp AC to DC adapter from RadioShack. For this board, assuming you will want to run it without a battery at points, you will need at least a 5 amp AC to 12 volt DC adapter. Luckily, digging through a box of unused goodies at school I was able to find a suitable adapter that came from an old flat panel display. Unfortunately along the way I learned some valuable lessons regarding polarity, fuses and the fact that ATX power supplies only work correctly with a load.

Having an AD to DC adapter was all well and good but I needed this to be portable, usable on the run, almost wearable, which means I needed battery power. During the course of my research I came across several battery types that seemed as though they would do the trick. Here is a short run-down: Motorcycle and car batteries provide plenty of power and the right voltage but are far too heavy for a portable system. Several different laptop batteries looked as though they would do the trick but would require a laptop to charge them back up, not to mention their high cost. Finally I settled on using a lead-acid battery made by Bescor that is meant to power portable lighting kits for video production. The one I choose is fairly light, low cost and provides a good amount of amp hours, unfortunately it takes an extremely long amount of time to charge (15 hours).

The need for portability raised a couple of other problems: the need for a portable display and the difficulty of using a mouse while walking around. Solutions for these issues were pretty forthcoming after finding a couple of forums that "carputer" enthusiasts frequent. There are a couple of touch-screen LCD manufacturers and dealers that supply this community. One that seemed to stand out in the forums at MP3Car.com was a series of touch-screen LCDs from a company called Lilliput. I chose to purchase a fairly bright 7 inch model that was rumored to have Linux support for its USB based touch component. Just in case, I also picked up a Cirque PS2 touch-pad to use in-place of the mouse should the touch-screen give me issues.

A couple of other purchases rounded out the shopping. I picked up a single PCI to dual PCI right angle adapter as I didn't want to have to build a case tall enough to fit my next acquisition, which was the borrowing of a friend's 802.11b WiFi card. Unfortunately, settling on this card was quite a task. My original instincts were to go with an 802.11g PCI card that sported a chip set that had Linux support. The problem was that the Linux driver turned out to be just a tad bit immature and didn't quite work as I had hoped. After struggling with this card for some time I choose to try a PCI 802.11b card but had similar driver problems. Finally, going with a tried and true card such as the Netgear 802.11b PCI card turned out to be the right choice under Linux.

Last but not least, I needed some means for sound and video input as this was meant to be a live video acquisition and streaming system. For cost reasons I choose to use an Apple iSight camera that I already owned. The iSight is a fairly standard IIDC camera, meaning that it supplies a 640x480 8 bit uncompressed video stream over IEEE 1394/Firewire. There are quite a few IIDC compatible cameras on the market with a range of quality and capabilities, visit the IEEE1394 Digital Camera List (<http://www.tele.ucl.ac.be/PEOPLE/DOUXCHAMPS/ieee1394/cameras/>) for a pretty comprehensive run-down.

For sound I picked up a cheap headphone microphone combo. I won't go into detail on this since I feel as though what I have isn't an ideal solution but it is good enough for demonstration purposes until I pickup a good microphone or two. One of the criteria that this did fill is that this setup gave me separate stereo mini plugs for the headphones and microphone which differentiates this from headset/microphone combos typically sold for phone usage. A cautionary note here: most of the headphone/microphone combos out there are sold for use with phones and these typically provide a single 2.5 mm connector which will not work with a standard stereo mini plug on a computer.

Here is a run down of the equipment purchased, how much it cost (or should cost) and in some cases where I purchased it:

- **Via EPIA M10000 Nehemiah** ([http://www.viaembedded.com/product/epia\\_m\\_spec.jsp?motherboardId=81](http://www.viaembedded.com/product/epia_m_spec.jsp?motherboardId=81)) (\$153.00 from MonarchComputer.com)
- **256MB Crucial PC-2100 DDR (266) RAM** (<http://www.crucial.com/>) (~ \$40.00 available from many online stores)
- **10 GB IBM (now made by Toshiba) 2.5 inch laptop hard drive** from an older Sony Vaio. (~\$100.00 available from many online stores)
- **iTuner 40 pin to 44 pin 2.5" IDE Hard drive cable adapter** (\$9.95 from <http://store.ituner.com/ituner/40to442laide.html>)
- **iTuner 70 Watt 12 volt DC to 12 volt DC board for EPIA-M** (\$49.95 from <http://store.ituner.com/ituner/pw70.html>)
- **AC to 5 amp 12 volt DC power adapter** (\$25.00 from <http://store.ituner.com/ituner/posoformi.html>)
- **Netgear MA311 802.11b Wireless PCI card** (\$55.99 from amazon.com)
- **Via single to dual PCI right angle riser adapter** (\$28.80 from <http://www.mini-itx.com/store/default.asp?c=8&currency=2>)
- **Cirque GPB160 Easy Cat Combo touchpad** (\$29.95 from amazon.com)

- **Lilliput 7" TFT LCD VGA monitor with USB TouchScreen** (~\$290.00 Available from many sellers on EBay)
- **Bescor 12 volt 4.3 amp hour lead-acid battery with XLR and cigarette lighter adapter and charger** (~\$79.95 from B&H <http://www.bhphotovideo.com/>)
- **Apple iSight IIDC camera** (\$145.00 from the Apple Store)
- **PS2 or USB Keyboard** (any model should do, \$0.00, everyone has one of these around, if not, garbage pick one)
- **Headphone/microphone combo with separate mini-plugs for headphones and microphone** (I don't have any suggestions as of yet but don't buy one meant for a phone as these plugs are different. ~\$20.00)
- **Shotgun microphone with mini-plug or XLR to mini-plug adapter** (Again, no suggestions as of yet)

**Total cost: ~\$1000.00 - Far less than a laptop with all of the necessary extras**

#### **Notes:**

It should be noted that many of the key and hard to find components listed above can be purchased through the iTuner Yahoo store (<http://store.ituner.com/ituner/index.html>) and Mini-ITX.com store (<http://www.mini-itx.com/store/>).

For more information on "carputers" visit the forums at MP3Car.com (<http://www.mp3car.com/>).

For more information on IIDC Cameras visit the IEEE1394 Digital Camera List (<http://www.tele.ucl.ac.be/PEOPLE/DOUXCHAMPS/ieee1394/cameras/>).

Last but not least Mini-ITX.com is a great source for more information on many things related to building small computers; they offer reviews, more articles such as this one and an online store (<http://www.mini-itx.com>).

The next step was to identify, build and install Linux along with the rest of the required software.

Since I had been a RedHat user the obvious choice for my first experiments was a standard RedHat 9 install. Unfortunately this turned out to have benefits (some precompiled drivers for the Via) but also gave me some issues (not having the latest kernel modules installed). After trying Fedora Core 1 (<http://fedora.redhat.com>), the latest Debian (<http://www.debian.org/>) and several custom kernel compiles I came up with the following instructions.

Disclaimer: these are the steps that worked for me using the hardware listed above. This is no guarantee that these steps as written will work in your particular situation, but they should be similar.

#### **Installing Linux**

Start with a stock RedHat 9 Workstation install with some minor package additions and

subtractions. You will need to make sure you have XFree86, Gnome, kernel source, development and compilation tools installed. If you have no idea what I am talking about, follow the instructions on RedHat.com (<http://www.redhat.com>) for downloading and installing or go to your local computer or book store and purchase the installation CDs with a printed manual.

Doing a couple of additional things is a good idea before we proceed to kernel compiling. One is to register with the RedHat Network via the website as this will allow you to use RedHat's up2date application for automatic installation of updates. It also helps to have wired ethernet plugged in and be using DHCP on your network so as to reduce setup pain. (Note: Since RedHat 9 has reached end of life, this might not do you much good but I could be wrong.) Also, make sure you download and install the latest up2date and up2date-gnome packages from RedHat as the ones that come with RedHat 9 do not work anymore. Next, go ahead and update most packages that need it but leave the kernel and XFree86 updates out for now. The kernel we are going to build ourselves and I have had trouble with the touch screen drivers with more recent versions of XFree86.

## **A New Kernel**

First, visit kernel.org and download the source of version 2.4.25 or the latest stable 2.4 kernel.

Next, read the instructions for compiling and installing a new kernel given in the readme file. This must be stressed, things will not work correctly if you do not follow the instructions carefully and you may need to start over if you do something wrong. Copying the i686 kernel compilation configuration file from the RedHat supplied kernel source helps with the setup of the standard modules and gives you the base capabilities of the RedHat kernel so go ahead and do that.

In the configuration step of the instructions you will need to enable a couple of additional modules. Make sure that those required for wireless ethernet, video4linux and firewire/ieee 1394 are enabled. (A more detailed list will be added soon.) Furthermore, if you are going to try out the Prism54 drivers for your 802.11g wireless card, make sure that the required firmware modules are enabled. (There may be other requirements for this module but I am not aware of them.)

Although the instructions do not specify this, running "make install" after compiling everything puts most things in the right place so go for it (you will probably have to be root at this point). To reboot the computer and use this new kernel you will have to do a couple of additional things. Assuming you are using the grub boot loader, edit /boot/grub/menu.lst and make the kernel you just compiled the default (0). Also, as root, copy the source to the /usr/src directory (cp -r linux-2.4.x to /usr/src/.) This helps with compilation of later software. Finally, fix the default symbolic links in the /usr/src directory to point to the new kernel source. Again, this helps with the compilation of later software.

Now you can go ahead and reboot the computer to make sure that everything works as it should. If it doesn't, read the instructions again, read this over again, tell me what I told

you to do that was wrong and try again. Unfortunately, it took me quite a few attempts with various Linux distributions to get this right and working correctly for me. If it works, do a backup...! I can not stress this enough, DO A BACKUP!

If this is all a bit scary or too much effort (it does take several hours and a bit of Linux know-how), I suggest stopping now and taking a look at dyne:bolic which appears to be a very nice Linux distribution on a single CD that "is shaped on the needs of media activists, artists and creatives ...". More information can be found at: dynebolic.org (<http://dynebolic.org/>). If you do this, let me know how it goes, I intend to give dyne:bolic a shot once I have a bit more time.

## **Hardware Drivers**

### **Touch-screen**

The Lilliput that I used has a touch screen that reports itself as manufactured by a company called eGalax. Fortunately, eGalax seems to be good about supplying Linux drivers and they have them available for download on their website (<http://www.egalax.com.tw/>).

To unpack the driver from eGalax, you will need to obtain and install the shareutils rpm package which is also available via the eGalax website. (`rpm -i sharutils-x.rpm`) It is possible that you already have the sharutils package installed, if this is the case you can skip this step. Next run the touchkit setup script to compile and install the driver. Make sure you run this as root (`./touchkit.setup8nm.sh`) and hope that everything goes as it should. You will need to fully restart the machine in order to tell if the drivers are working correctly. If the touch screen does not work, take a look at the source, it should have been extracted in your tmp directory, go through the script and makefiles to see if there is anything you can do about it. With a stock RedHat 9 install, this script works fine. With most other distributions I needed to edit and fiddle a bit to make it work.

### **Firewire camera and control application**

Fortunately there is a great open source application by Damien Douxchamps called Coriander that can be found here (<http://www.tele.ucl.ac.be/PEOPLE/DOUXCHAMPS/ieee1394/coriander/>) and on SourceForge (<http://sourceforge.net/projects/coriander>). Coriander is a GUI for IIDC compliant cameras (see above) which includes camera control, video display, capture and a live video4linux export module. Although there is a package available for download off of SourceForge things didn't quite work as they should have on RedHat. Getting the latest version off of the CVS (read the instructions for doing this on SourceForge) everything cleared up. I am using the pre-release of version 1.0.

Coriander has a couple of requirements; the first is the latest version of libdc1394, which contains the actual libraries for controlling the IIDC camera. You will need to get the latest version of this from the SourceForge CVS as it is closely related to the Coriander project and Coriander will probably not work with an earlier version. Next you will need to download and install the latest versions of libraw1394 and libraw1394 development packages from RedHat (running '`rpm -Fv libraw1394`' and '`rpm -Fv libraw1394-dev`'

should do the trick for installing them). Last you will need to get the vloopback driver installed. Unfortunately, this driver is pretty much unsupported and is just an add-on to the Motion project, it can be found at (<http://motion.sourceforge.net/vloopback/>). I downloaded the latest version (0.91) which unfortunately doesn't compile on RedHat. After quite a bit of searching around I came upon a patch (<http://lists.frogtown.com/pipermail/motion/attachments/20040110/9f08292d/vloopback-0.91-redhat9-kernel-2.4.20-x.obj> via <http://lists.frogtown.com/pipermail/motion/2004-January/003459.html>). Before applying the patch, I renamed it to vloopback-0.91-redhat9-kernel-2.4.20-x.diff and used diff to apply it to vloopback.c (run 'man diff' for more information). Fortunately, it compiled after doing such.

After compiling and installing all of these components you are ready to compile and install Coriander. Assuming that went alright and you now want to run it you will have to install the modules into the running kernel or Coriander will complain and refuse to run. Issuing the following commands should do the trick: 'modprobe ieee1394 raw1394 ohci1394 video1394' followed by 'insmod videodev' and 'insmod vloopback'. It is a good idea to include those commands in /etc/rc.local so that you don't need to issue them every time you restart. Assuming all of that worked you should be able to run Coriander (make sure the camera is plugged in as well).

### **Audio**

Next on our list of drivers that are necessary is the audio driver for the Via's onboard sound card. While these drivers are supposed to be enabled in the stock RedHat install, I found that they weren't and therefore this step was required. It is possible that I missed something in the RedHat install that you won't miss and they will just work. In any case, this is probably the easiest step so far, simply download the driver package from Via at (<http://www.viaarena.com/?PageID=294#md>) and follow the nice instructions on the audio section of the EPIA HOWTO for linux site ([http://www3.sympatico.ca/howlettfamily/epia/epia\\_howto/x308.html#viaaudiocombo\\_rpm\\_install](http://www3.sympatico.ca/howlettfamily/epia/epia_howto/x308.html#viaaudiocombo_rpm_install)). Incidentally the EPIA HOWTO site ([http://www3.sympatico.ca/howlettfamily/epia/epia\\_howto/](http://www3.sympatico.ca/howlettfamily/epia/epia_howto/)) is a great resource and has fantastic information on configuring and installing Linux with the appropriate optimizations for the Via boards.

### **WiFi drivers**

So having a portable system is all well and good but we need network connectivity as well. Thankfully projects such as linux-wlan project (<http://www.linux-wlan.org/>) exist and that makes our lives much easier. Unfortunately, many PCI WiFi cards are unsupported and for the time being we will just have to deal. A good run-down of cards supported by the linux-wlan project can be found at ([http://www.linux-wlan.org/docs/wlan\\_adapters.html.gz](http://www.linux-wlan.org/docs/wlan_adapters.html.gz)) but be careful, just because a card is listed doesn't mean that it is supported; only cards that list "Linux-wlan-ng" in the "Linux Support" column are supported. Also, be sure to look at the notes carefully, I purchased a D-Link DWL-520 expecting a standard Prism chipset but alas I had Rev. E which is a newer Prism3 chipset, unfortunately this did not work out very well.

If you are a brave person and want to get all of the speed you can checkout the Prism54

driver project (<http://prism54.org/>). I tried an SMC Wireless EZ Connect G PCI card (SMC2802W) but was not able to get it to work with the Prism54 drivers although it has a chipset that is supported (the support matrix on the Prism54.org site states that they have a 44% success rate with this card).

Finally, I got some brains and asked a friend who knows these things and he lent me a very nice and well supported Netgear 802.11b card (MA311). Fortunately, this card gave me very little trouble and after reading the instructions given on the Quick HOWTO: Linux Wireless Networking page (<http://www.siliconvalleyccie.com/linux-hn/wmp11-linux.htm>) I was able to use it without trouble. Unfortunately, there aren't any graphical clients that I know of that allow the easy switching of wireless networks using the linux-wlan drivers so I am stuck for now with the default settings unless I pull out the keyboard and reconfigure.

### **Video capture, encoding and streaming software**

#### **MPEG4IP**

MPEG4IP is a very nice MPEG-4 encoding and streaming package developed by a couple of people at Cisco. It was fairly painless to compile and install once I downloaded, compiled and installed its prerequisites, which are lame and faac. Lame is available from SourceForge (<http://lame.sourceforge.net/>). Faac is available from AudioCoding.com (<http://www.audiocoding.com>). Both were easy compilations and installed without a hitch with the standard './configure', 'make' and 'make install' commands (be careful and read the instructions anyway).

Now that all of the software is installed the next steps are to build a case and other means to make this a portable system.

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