Television System

Team Members:
Jun Wei Guo
Shou Hang Shi
Raul Gomez
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Introduction of the television set:

Television, or TV, is one the best sources for news, entertainment, and communications. People with a television set can sit in their house and watch the President make a speech or visit a foreign country. In addition, TV provides great entertainment programs that include, action-packed dramas, comedies, soap operas, sporting events, cartoon, and movies. Television brings pictures and sounds from around the world into millions of homes. People can see and learn about each other’s cultures, places, and things in distant lands. About 98 percent of the households in the United States have televisions. On the average, a television set is in use in each home for about 7 hours each day.

History of TV:

The principles of television are technologically sophisticated. There is no one person can be called the inventor of television. Many scientists contributed to the development of television. Light had to be converted into electricity in order to convert visual images into electrical signals. The transmission and reception of still or moving images are by means of electrical signals. This concept led Joseph May from Ireland to discover the properties of the element selenium in 1872. The resistance of selenium would change if it were exposed to light. The photoconductive properties of the element selenium were discovered: that is, its electrical conduction varied with the amount of illumination. This discovery seems to help Paul Nipkow in Germany to receive a patent in 1884 for inventing a scanning disk with concentric holes for scanning the image and then reproducing it. However, his system worked mechanically, rather than
electronically as television does. In 1906, Max Dieckmann, another German, invented the first electronic display, the cold cathode ray tube (CRT). A year later, Boris Rosing, Russian, applied for a patent on an early television system that used a mechanical scanner and a cold CRT for display. In 1920, as a 14-year old high school student, Philo T. Farnsworth described the electron-scanning process and by 1927 invented an electronic television image dissector (camera) tube and successfully transmitted a series of images far superior to current mechanical television systems. Vladimir Zworykin, Boris Rosing’s student, invented the iconoscope and the kinescope in 1923. The iconoscope was the first television camera tube suitable for broadcasting. The kinescope is the picture tube used in TV receivers. Zworykin patented a television system employing electronic scanning in 1928. Zworykin demonstrated the first completely electronic, practical television system in 1929. In 1954, when there were 26 million households with black & white television sets, RCA introduced the first consumer color sets, using a new tri-color picture tube. Most of the American households today have a color set.

Transmitting and Receiving TV Signals

The basic procedures for creating television video and audio signals involve with the use of a television camera. A TV signal begins when light from the scene being televised enters a television camera. TV signals are created by light and sound waves from the scene. While the camera changes the light into electronic signals (video signals), its microphone also changes the sound waves into electronic signals (audio signals). The most common video signal broadcast by television stations is called composite color video signal. This signal produces a color picture when received on a
Color television produces full-color pictures using the three primary colors, which are red, blue, and green. Different combinations of these colors can produce any color of light.

A television camera first captures the image of a scene through its lens. The lens collects the light from the scene to form an image that has all the colors of the scene. Next, the camera’s two dichroic mirrors separate the colorful image into three images with each representing one of the three primary colors. The V-shaped figure in the mirror system on the diagram is the two dichroic mirrors (See Figure 1). The two dichroic mirrors act like filters. One of them lets red and green light to pass through it by reflecting the blue image. When the green and red images reach the other dichroic mirror, the red image will get reflected. The remaining green image is allowed to pass through it. Other mirrors that are next to the dichroic mirrors will reflect each of the three images into a separate image sensor.

The process of creating video signals begins after the image is captured. The three image sensors will change the light images into electronic signals. The sensors create a separate video signal for each of the three primary colors. These image sensors may be a kind of improved vacuum tube called vidicon tubes or electronic sensing mechanisms called charge-coupled devices (CCD’s).

The camera tube shown in Figure 1 is a vidicon tube. Vidicon tubes produce more accurate colors and sharper pictures than CCD’s. A vidicon tube has a glass faceplate in the front end with a signal plate and another plate, target, right behind it. There is an electron gun all the way in the rear of the tube. Light from the image will pass the faceplate, the signal plate, and the target. The layer of photoconductive material
on the target will conduct electric current when there is light. Because of the light, electrons or negatively charged particles will move to the signal plate from the photoconductive material. This leaves a positive electric charge at the back of the target. If the brightness of the light on a specific area on the target increases, its positive charge strength on that area also increases. The light image had transformed into an electric image of positive charges on the back of the target. Next, the electron gun emits a beam of electrons that moves across or scans the back of the target. As the beam scans across the target, areas on the target that has the strongest positive charge will attract the most electrons from the beam. This is so because positive charges attract with negative charges (electrons).

The electron beam scans every other line on the target. After the beam scans the top line, it quickly goes back to the left and scans the third, fifth, seventh line and so on. When it reaches the bottom of the target, it goes back and scans the second, fourth, sixth and so on. This is called interlaced scanning that most television systems use. The scanning pattern of TV cameras in the U.S. and several other countries like, Japan and Taiwan, use the NTSC (National Television System Committee) system. It is made up of 525 lines (262.5 odd-numbered and 262.5 even-numbered lines). The beam completes the scanning of one field each time it scans 262.5 lines. Two fields make up a complete television picture called a frame. The electron beam moves with a very fast speed that scans a line in 1/15750 of a second and produces 30 complete frames in a second. This speed is so fast because it has to prevent television picture flickers and shows moving objects smoothly. Some countries like, Germany and China, use PAL (phase alternating lines), France and former Soviet Union, use SECAM (sequence electronique couleur avec
Both systems display 625 lines per frame at 25 frames per second. As the electrons move through the target, an electric current is created and flows in the signal plate. This current has a voltage that changes depending on the brightness of the area where the beam is striking on the image. This changing voltage is called the video signal.

After the three image sensors converted the three primary colors to electronic signals by a scanning process, the three electronic signals will be carried to the electronic circuits in the camera by wires. These signals will be strengthened there. After that, they arrive in the encoder, where they are combined with other signals to produce a composite color video signal. A circuit in the encoder, called the matrix, combines the three electronic signals into two color-coded signals and a black and white signal. The two color-coded signals are called chrominance signals, and the black and white signal is called a luminance signal. Another circuit in the encoder, the adder, combines the chrominance and luminance signals and, adds a color burst and a synchronization signal. The color burst allows a color TV to separate the color information in the chrominance signals. The synchronization signal sets the TV into the same scanning pattern as that used by the camera.

The composite video signal produced by the encoder is important because it produces a color picture when received on a color set, and a black and white picture on a black and white TV set. All three analog TV systems (NTSC, PAL, SECAM) use this composite video format. A modulation called quadrature amplitude modulation (QAM) is used to combine the two chrominance vector components, I-signal and Q-signal, into a single chrominance signal C, varying in both amplitude and phase. The amplitude of the chrominance signal represents the saturation of the color, and the phase of the
The chrominance signal represents the hue. The I-signal contains information about colors ranging from orange to cyan, and the Q-signal from magenta to yellow-green. Since the human eye is more sensitive in terms of spatial resolution to the colors represented by the I-signal, the I-signal is band limited to 1.5 MHz. The human eye is less sensitive to the Q-signal, which is band limited to 0.5 MHz. The chrominance signal is used to amplitude modulate a high-frequency sine-wave carrier at approximately 3.6 MHz, with the carrier suppressed if there is no signal, which is called suppressed-carrier amplitude modulation. The chrominance is called a subcarrier.

The luminance signal and the chrominance signal must share the same spectrum space. In order to do that, the spectrum of the luminance signal is shifted by one-half of the horizontal scanning frequency so that its harmonics fall exactly between the harmonics of the luminance signal. This is like aligning the teeth of two combs so that the teeth of one fall between the teeth of the other. This is called frequency interleaving. That is one of the criteria that the color subcarrier frequency must meet. Another criteria is that there must be no interference with the audio carrier at 4.5 MHz. The last one is that the color subcarrier frequency must be high enough where the luminance component has very low energy. The chrominance subcarrier is added to the luminance signal, and this combined signal then modulates the radio-frequency (RF) carrier. The combined signal is called the composite video signal. In short, the construction of a composite signal relies on the property that the chrominance signals have a significantly smaller bandwidth than the luminance component. By modulating each chrominance component to a frequency that is at the high end of the luminance component, and adding the
resulting modulated chrominance signals to the original luminance signal, one creates a composite signal that contains both luminance and chrominance information.

Most TV signals are broadcast through the air. A transmitter in the TV station is used to produce a TV signal from separate video and audio signals. A typical TV signal requires 4 MHz of bandwidth. When sound is added, a TV signal requires a total of 6 MHz of bandwidth. Bandwidth is the width of frequencies or rate of vibration, required to carry a channel. The transmitter increases the frequency, of audio and video signals by a process called modulation. TV signal needs a high frequency to carry information through the air. The signal, called electromagnetic wave, is carried by wire to an antenna and for broadcasting. Electromagnetic waves travel at the speed of light at about 186,282 miles per second. However, this signal can be received up to a distance about 150 miles only. First, the transmitter generates high-frequency electromagnetic waves called carrier waves. The video part of the TV signal is produced by the variations of the amplitude or strength of the carrier waves using the video signal by the transmitter. The audio part of the TV signal is produced a modulation of another carrier wave using the audio signals by the transmitter. This frequency modulation process (FM) shifts the frequency of this carrier wave slightly. Finally, the transmitter combines the modulated video and audio carrier waves to form the television signal. The TV signal is then amplified to a power of 1,000 to 10,000 watts.

This signal is carried to the transmitting antenna by a wire called transmission line. The transmitting antenna releases the signal into the air for broadcasting. These antennas are often placed on high skyscrapers so that the TV signals can reach as far as possible. The maximum range of most TV signals is from 75 to 150 miles, depending on
the antenna design and transmitting power. TV stations in the same area must transmit on different frequencies so that their signals won’t interfere with each other. The Federal Communications Commission (FCC) makes maintaining order in the airwaves possible.

FCC regulates television and radio broadcasting in the U.S. FCC is an agency of the federal government that assigns frequencies to stations that can broadcast on. It has the power to give or take away station-broadcasting licenses. FCC requires stations to provide public services and programs designed to meet the needs of their local communities. It also requires stations to avoid offensive and pornography in their programs. The antenna, a cable, or a satellite dish receives the television signals from the transmitter. The type of antenna needed depends on the distance between it and the transmitting antenna. Cable television can bring network and local programs to places that either cannot receive TV signals through the air, or can receive them only with much interference. Such places include mountain valleys, isolated communities, and areas with tall buildings. Cable services also provide many channels that show movies, news, sports, music, and other entertainment content. Satellite television offers even more channels than cable television. Households in different countries can receive signals from direct-broadcast satellites (DBS). For example, a satellite in Europe can broadcast programs to viewers in France, Germany, and many other countries. Dish shaped antennas are used to receive DBS signals. A simple dipole or rabbit ear antenna collects enough signals within a few miles or kilometers of the transmitter. The television receiver uses the signals to make copies of the pictures and sounds from the televised scene by decoding the signals and changes them back into copies of light and sound waves (See Figure 2). Then, the television set sends one tiny part of the picture, followed
by another tiny part, until it has sent the complete picture on the screen. This scanning process happens so fast that viewers are able to see a recreated complete picture on the screen.

The group of frequencies over which one station broadcasts is called a channel. The TV tuner receives signals from the antenna and selects the signal from the station that the viewers desire to receive. The other signals from other stations are all blocked. There are about 82 channels available for television broadcasting in North America. Channels numbered 2 through 13 are called very high frequency (VHF) channels. VHF refers to signals with a frequency between 30 megahertz (million vibrations per second) and 300 megahertz. Channels numbered 14 through 83 are called ultra high frequency (UHF) channels. UHF signals have a frequency between 300 and 3000 megahertz, which are less likely to be influenced by electromagnetic interference than VHF broadcasts.

From the tuner of the TV, the signals are transferred to a group of complicated electronic circuits to get amplified and separated into audio and video portions. The speaker changes audio signals into sound waves. The picture tube or kinescope accepts the video signals to recreate the picture. Similar to the TV camera, the TV set has circuits that use color burst to separate the video signal into the two chrominance signals and the luminance signal. Next, the matrix or decoder transforms these signals into red, blue, and green signals that duplicate the signals from the three vidicon camera tubes. These signals will travel to the picture tube, which transforms the video signals into patterns of light that duplicate the scene in front of the camera.
The decoder transforms the composite video signal into red, blue, and green signals by a process of demodulation of the luminance and chrominance. After that, the audio and three components of the video signals must be demultiplexed. To separate the video and audio signals, a low-pass filter can be used. This method causes some of one signal to corrupt the other. The best separation of the two signals requires the use of filters that have frequency characteristics that look like the teeth of a comb, called comb filters. Comb filters electronically separates the chrominance and luminance signals to reproduce sharper detail from higher resolution video sources.

The most common way to split the composite video into and chrominance and luminance signals is by simple analog filters. Filtering out the color information from composite video with a low pass filter derives the luminance signal. This works since the color information is in a frequency band centered at about 3.58 MHz and extends down to about 2.1-2.3 MHz. The low pass filter was set to reject frequencies above about 2.5 MHz. Although this effectively filters most of the chrominance signal out of the luminance signal, it also removes the higher frequency luminance signal components. This loss of bandwidth reduces the horizontal resolution of the luminance signal, and fine details in the picture are also lost. If the chrominance information is not completely filtered out of the luminance signal, it creates interference in the luminance signal. In general, the failure to filter the entire color signal out of the luminance signal is called cross-luminance, and creates artifacts and crawling dot patterns. Dot patterns along the edges of objects or boundaries are called 'dot crawl' or 'hanging dots'.

A color (chrominance) signal is separated from the composite video by using a bandpass filter centered at 3.58 MHz to obtain only the frequencies between about 3.0
MHz and 4.2 MHz. Unfortunately, this doesn't remove the luminance signal that overlaps the chrominance signal in this same frequency range. The high frequency luminance signals pollute the chrominance signal and generate unwanted color patterns, or rainbows, in picture areas with fine details. This unwanted color interference is called cross-color. If the lower frequencies had not been filtered out, then cross-color effects would occur everywhere in the picture, not just in areas where fine detail is present. The bandpass technique also reduces the available bandwidth of the chrominance signal, which extends as low as about 2.1 MHz. This reduces the already marginal color resolution in the NTSC system.

There are three electron guns in the picture tube, one for each primary color. The electron guns are located in the narrow neck of the picture tube. Each electron gun shoots a separate beam of electrons at the screen. Each beam scans the screen just as the beam in each vidicon tube scanned its target. The synchronization signal, which is part of the video signal, sets the TV into the same scanning pattern as that used by the camera. This is important since the beam must be in step with each other in order to produce a steady picture. If the scanning process was done with 525 lines (NTSC) in the TV camera, then the scanning process in the TV set must also be completed with 525 lines and not 625 lines (PAL or SECAM). If not, the picture on the TV screen will get distorted. The other end of the picture tube forms the screen of the TV set. It is nearly flat and rectangular shaped. The screen of most color tubes is coated with more than 300,000 tiny phosphor dots, or red, green, and blue chemicals. These phosphor dots are grouped in triangular arrangements of three dots each, one red, one blue, and one green. When struck by the beam, the colored dots glow and form the color picture. A metal
plate behind the screen called shadow mask has holes that keep each electron beam in line with its own color dots and away from dots of other colors. The video signal from the camera controls the strength of the beam; the dots are bright where the scene is bright and dark where it is dark. The three primary colors can produce all the colors of the original scene when the three colored dots are mixed in different ways. (See Figure 2).

TV viewers see an entire picture all at once on the screen. However, television cannot send a picture of an entire scene all at once. It has to send only one tiny part of the picture, followed by another tiny part, until it has sent the complete picture. A television camera divides a picture into several hundred thousand tiny parts through scanning. As the camera scans the picture, it creates electronic signals from each part of the picture. Then, a television set uses these signals to create the image again on its screen. Another scanning process will take place to put the picture back together again piece by piece. The scanning process is so fast that the viewers will not even notice, they only see a complete picture on the TV screen.

Types of Color Television:

TVs come in a wide variety of shapes and sizes and vary greatly in their design and technological advances. The most common and least expensive type is conventional curved screen TV called direct-view TV (See figure 3a). Since they use a glass screen and a cathode ray tube, they are often less than 40 inches (measured diagonally across the screen). They are built around a single large CRT or picture tube, a specialized vacuum tube in which images are created when an electron beam scans back and forth across the backside of a phosphor-coated screen. Another downside of this type is that the curved
screen tends to reflect glare at all angles. Therefore, the picture is not as clear as a flat screen television, which is another type of direct-view TV. Another advantage of flat screen over curved screen is that the flat screen surface reflects glare in only one direction, which allows viewers to watch at multiple angles. In addition, these come in many different sizes and have a crisp and detailed image.

Another type of TV is called projection TV (See Figure 3b). A rear projection television reflects light off a projection display panel and then projects it onto the screen. It produces clear, sharp pictures that look best when viewed straight on, from a seated position. The picture looks dimmer when viewing from the side, or standing up. The projection cathode ray tubes, or CRTs, are found within the set and behind a plastic projection screen. The light from the CRTs strikes a mirror and is reflected onto the rear of the screen, where it forms an image to allow viewers to see on the other side. Rear projection TVs use 3 CRTs, a series of focusing lenses, a mirror, and a display screen. Each tube provides one of the 3 primary colors of television, red, green, or blue, and their signals are reflected off a mirror and onto the back of a complex screen. Front projection screen televisions use a separate projector that is set-up across the room to project the image onto a screen. Front projection screen sizes are almost unlimited, but viewing is best in a dark room since they produce a lower light output. Rear-projection screens can reach up to about 65 inches and can be watched in a variety of lighting conditions.

Flat-panel TVs create bright, crisp images without using traditional CRT picture tubes. The screen is completely flat (See Figure 3c). The space-saving flat design can provide a variety of placement options. The best thing about these flat-panel TVs is that they provide an extremely clear picture, while taking up a minimal amount of space.
These super-slim, wall-mountable TVs use either plasma or LCD (Liquid Crystal Display) panels. Neither LCD nor plasma TVs require the scanning electron gun found in conventional CRT tube-type TVs. Flat-panel TVs won’t be distorted from a nearby magnet, like an unshielded speaker, because it has no picture tube. When unshielded speakers getting too close to conventional TVs, there is a high risk of damaging the picture tube inside.

An LCD TV is sometimes called a "transmissive" display. There is a light bulb behind the panel that shines light through the display. The display consists of two polarizing transparent panels and a liquid crystal solution in between. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. Each crystal acts like a shutter, either allowing light to pass through or blocking the light. The pattern of transparent and dark crystals forms the image.

A plasma TV is sometimes called an "emissive" display. The panel is self-lighting. Plasma TVs use an array of cells, known as pixels, which are composed of three sub-pixels or gas filled cells, corresponding to the colors red, green and blue. The display consists of two transparent glass panels with a thin layer of pixels in between. Gas in a plasma state is used to react with phosphors in each sub-pixel to produce colored light (red, green or blue). Each sub-pixel is individually controlled by advanced electronics to produce over 16 million different colors to display viewable images on the display.
The Future of Television:

Digital television has become the hottest discussion topic in the television industry. Digital television is a system of transmitting and receiving television signals in digital codes or binary digits, and displaying those signals on a digital TV set. It offers image and sound quality comparable to a movie theater. Digital systems allows TV signals to carry more information by using data compression techniques. Data compression makes it possible to remove unnecessary information form the signal. It reduces the number of bits that need to be transmitted each second.

A standard for data compression of the audio and video portions of digital video signals is the MPEG-2 compression. The increased picture detail and high quality surround sound is squeezed into the same 6 MHz bandwidth used by analog television. The MPEG-2 software records just enough of the picture without making it look like something is missing. Only changes to the image are recorded. The rest of the image that is the same as the previous frame is not recorded. The resulting image quality is much better than traditional analog TV. In addition, HDTV sets include built-in Dolby Digital decoding and a digital output. By making a single-cable digital connection to a A/V receiver, the crystal-clear Dolby Digital sound that is standard on HDTV broadcasts can be enjoyed.

DTV consists of two subgroups: HDTV (High-Definition TV) and SDTV (Standard-Definition TV). Usually, a HDTV or a SDTV is used to receive digital TV signals. HDTV is a type of digital television that offers a greater number of scanning lines (from 720 to more than 1000), and therefore a clearer picture, than the 525 or 625 lines of analog television systems. HDTV is generally considered to be 1,080-line
interlaced (1080i) or 720-line progressive (720p). Since the tuner in a HDTV can receive both digital and analog signals, a total of 1080 scanning lines will be processed in two sequences (interlaced) for analog signals, and 720 scanning lines will be processed all at once (progressive) for digital signals. The picture produced by HDTV is about four times sharper than a picture produced by a standard TV. HDTV’s progressive scanning produces much clearer and smoother picture than interlaced scanning because it scans all the lines at one time in every frame (See Figure 4a and 4b). The analog NTSC system uses only 525 scanning lines to create a picture or frame. The frame is made up of two fields: The first field has 262.5 odd lines and the second field has 262.5 even lines. The odd lines are scanned in 1/60th of a second, and the even lines follow in the next 1/60th of a second. This presents an entire picture of 525 lines in 1/30th of a second. Progressive scanning shows the whole frame every sixtieth of a second. In other words, NTSC video displays 30 frames per second while progressive scan displays 60 full frames per second. As a result, progressive-scan picture quality is more film like, with more fine detail and fewer flickers.

Most of the analog direct-view and rear-projection TVs have 4:3 screens. All HDTVs have a wider 16:9 screen. This is called the aspect ratio or width to height ratio of TV. The 16:9 format is closer to the ratios used in theatrical movies. Currently broadcasters must both pan and scan the image (shrink the full picture of the film down to 4:3, eliminating part of every scene in the process) or letterbox it (present the full picture only on the middle part of the screen, with black bars above and below it). With a 16:9 screen, panning and scanning a theatrical movie doesn't remove so much from the original picture and letterboxing doesn't block out so much of the TV screen (See Fig. C).
Since most of the movies recorded in DVDs and HDTV broadcasts are in wide screen format, HDTV displays them using the entire screen (without black bars above and below it as they are in a 4:3 TV).

There is currently HDTV stimulated programs on every night of the week on CBS, Fox, NBC, ABC, and PBS. HDTV signals can also be received from digital satellite TV providers and Cable. The tuner in a HDTV is able to accept those digital signals and transformed them into vivid and lifelike images on the screen. With a HDTV-ready TV or HDTV monitor, a separate digital tuner must be used in order to receive digital broadcasts. Standard Definition TV (SDTV) offers lower resolution (480p or 480i) but still looks cleaner than analog broadcasts.

This new digital broadcast TV standard will soon completely replace the 60-year-old analog NTSC system. Many TV manufacturers think that no consumers are willing to buy HDTVs since there are not enough digitally transmitted programs. On the other hand, networks think that there are too few people have digital receivers to accept the digital signals. Therefore, the FCC had voted to require that all new TV sets sold in the U.S. to include digital receivers by July 31, 2007. Also, all sets with screens larger than 35 inches must have them by mid-2005. The smaller sets must have them between 2005 and 2007. All the TV stations must turn off their analog signal and begin digital broadcasting by December 2006.
Additional TV Features:

Televisions come with a variety of exciting features. Most of the television sets produce today comes with remote controls. Some of those TV remote controls not only control the TV, it can also operate on VCRs, DVD players, A/V receivers, and more. This type of remote control is called the universal remote control. A Universal remote control may be programmed with codes for use with different devices of different brands. Usually, the default setting of the universal control is set to the codes of the devices that are produced by the same brand of the television. For example, a Sony TV’s universal remote control can be used to operate on a Sony VCR without programming any codes into the remote. However, the Sony remote must be programmed with a code to operate on a Panasonic VCR by inputting the code into the remote. Closed captioning is another good feature to have in a TV, especially for the hearing impaired. Viewers can have a choice of displaying subtitles on the bottom of the TV screen. Another feature that a TV might have is the sleep timer function. The sleep timer can be set to turn off a TV automatically after a desired length of time. Sometimes, a viewer might fall asleep while watching a TV show at night. Therefore, the TV goes on until the viewer is awake in the morning to turn it off. With the sleep timer function enabled, the TV will turned off automatically while the viewer is sleeping. This is a good way to conserve electricity. If a television set has V-chip control, that means that users can block out the video and audio of a channel based on its rating. That way, adults can prevent minors from viewing mature contents on TV. If a TV has PIP, that means that it has the ability to show two channel images at once with a smaller image displayed within the larger one. If a TV has a built-in comb filter, it will show better-detailed and sharp images. A comb filter
improves the picture quality of broadcast signal sources and signals of any video source components connected to the TV's composite video inputs.

**A/V Inputs/Outputs Jacks:**

TV has a variety of different types of inputs for connecting with other electronic systems such as VCR's, DVD's and video game consoles. The most common connectors found on most A/V components are the RCA jacks. RCA jacks are commonly found on receivers, CD players, turntables, MiniDisc recorders, cassette decks, VCRs, DVD players, and more. RCA video and audio cables usually comes with three colored connectors (See Figure 5b). One of them is for composite video input or output. A composite video input or output uses a single standard RCA jack to pass video signals. This type of connection combines chrominance and luminance information, sending it along a single cable. The composite video jack is usually yellow, used to connect two video sources together, such as a TV and a VCR. The other two connectors are often colored with red and white, for passing audio signals between the left and right channels of two components.

RCA audio cables come only with the red and white colored audio connectors. The composite video jack could be replaced with a separate S-Video cable or a component video cable. Although composite video is able to deliver a high quality picture, it is not as accurate as either S-video or component video, both of which provide separate paths for chrominance and luminance. S-Video jacks could be found on most DVD players, DBS receivers, camcorders, Super VHS VCRs, TVs, and other kinds of A/V components. S-video inputs and outputs use a round, 4-pin jack to pass video signals (See 4c). The "S" in S-video stands for "separate": S-video connections transmit
the chrominance (color) and luminance (brightness) portions of a video signal along different paths, allowing them to be processed separately.

Even though S-video provides a sharper picture than composite video. However, component video connections perform even better than S-video by further dividing the chrominance portion of the video signal. This 3-cable connection allows the chrominance (color) and luminance (brightness) portions of a video signal to be processed separately (See Figure 5d). S-video works similarly, but component video improves color accuracy further by splitting the chrominance signal into two portions. Component video connections are found on most DVD players and HDTV tuners, and on a growing number of TVs and A/V receivers. Component video inputs provide the highest quality video. It improves color, resolution and picture detail.

Another type of connector is the 75-ohm coaxial jack or an "RF input," this kind of jack is commonly used for hooking up antennas, cable boxes, VCRs, and TVs. A 75-ohm coaxial cable can carry video and stereo audio information simultaneously (See Figure 5a). RF cable connectors (often called "F-type" connectors) either screw onto the 75-ohm jack, or just push on to connect. Standard coaxial cable is the "RG-59", "RG-6" cable has a higher quality and better shielding, and it allows less high-frequency loss over longer runs. For connecting DBS satellite systems, it is necessary to use RG-6 cable to correctly pass the entirety of the digital signal.

There are many types of electronic systems that work with TV. One of the most common ones is the videocassette recorder (VCR). There are many types of VCRs, such as, standard VHS VCR, HI-FI VCR, and S-VHS VCR. A VCR can record and play back video images and audio sound on television sets. The video and audio was stored on a
magnetic tape or videotape. A VCR with hi-fi capability means that it can produce hi-fidelity or stereo sound from most of the videos you buy or rent. Surround sound information is carried on hi-fi movie soundtracks. Hi-fi VCRs can also record TV programs for surround sound playback, provided the program was broadcast with surround sound. Standard VHS VCR has a resolution of 240 lines while S-VHS or super VHS VCR has a higher resolution up to 400 lines. The number of lines of resolution defines picture clarity. The higher the resolution, the sharper the picture will get. Most of the VCRs are connected to the TV using RCA cables or 75-ohm coaxial or RF cable. Most of the S-VHS VCRs have the S-Video and component jack that allows it to be connected to the TV using S-Video cable or component cable.

Another common component that often pairs with TV is the DVD or digital videodisc player. DVD can produce somewhere around 500 lines of resolution, which is a step up from videotapes. There are two types of DVD players, interlaced-scan or progressive-scan. Picture quality is much better and more film like if a progressive DVD player is connected to a HDTV through the component video jack. Most of the DVD players include three types of video jacks: composite, S-video, and component. In order to enjoy the beautiful progressive-scan picture, the progressive DVD player must be connected to a HDTV and using the component video cable.

**Impact of Television on Society:**

**Social:** Television has a major impact on people’s lives. TV affects the way people spend their time and the way they learn. On certain TV programs, teachers instruct viewers in such things as foreign languages, literatures, mathematics, and science.
Television takes viewers to faraway lands around the globe to see how other people live and look. Television brings laughter to people by showing them comedies. On the other hand, TV shows its viewers what real-life tragedy is like, as when it covers the victims of war, natural disasters, and poverty.

Not all of television’s effects on learning are good. Many television programs include strong violence and sexual content, which is not suitable for youngsters. These scenes may cause viewers, especially children, to have abnormal behavior. TV violence might influence children who have violent tendencies to act violently. It also may promote viewers an impression that they are living in an evil world. In addition, TV programs and commercials often show people with more material possessions than most viewers. These programs and commercials often raise viewers’ material expectations. These expectations can cause people to become so dissatisfied with their lives that unhappiness results. Raised material expectations can be really harmful when people continually see on television how much better off other people are in comparison to them. This may stir up anger in the viewers, and may result in violent behavior.

Political: Many political candidates use television in their campaigns to win supporters. They buy commercial time to convince voters to support them. They also appear on interviews to answer questions about their views. Television has led to a unique kind of political campaigning called the spot announcement. Spot announcements are political messages that last from 10 to 90 seconds. These short messages are a common form of political advertising on television.
Some people criticize political advertising on TV. Critics say spot announcements are too short to allow candidates to explain clearly about issues. Since television time is so expensive, it is not fair for the candidates with the less money who cannot afford to buy commercial time for their campaigns. Another complaint about television campaigning is that it leads to the selling of candidates through advertising methods similar to those used to sell products.

**Economic:** Today, there are more than 1500 TV stations in the United States. These stations have contributed an impact on the American economy. In addition, manufacture and sales of television sets and broadcasting equipment became big business because of the rise of television. The sales of television have improved the business of many retail stores, including radio, department stores, and appliance stores. Television Broadcasting requires much expensive equipment, including cameras, control boards, and transmitters. The manufacture of such equipment has become a multimillion-dollar industry. In addition, the huge demand for television commercials has created a boom in the advertising industry. The television industry has created thousands of job opportunities in many career fields. The industry needs writers, producers, directors, camera operators, engineers, electronics technicians, stagehands, lighting specialists, graphic artists, and set designers to help produce TV shows. Actors and actresses are needed to appear in them. TV news departments provide jobs for journalists, broadcasters, and news reporters. TV broadcasting also creates many jobs for specialists in management, market research, and advertising. The television industry also employs workers in technical fields outside of
broadcasting. Scientists and engineers are needed to design television equipment. Factory workers manufacture television sets and other TV equipment.

**Summary:**

Television sets have become the most common electronic systems in people’s homes. It is a great source for news, entertainment, education, and communications. In producing a composite video signal, the TV camera must capture image of the scene being telecast, create video signals from the image, and encode the color signals for transmission. The TV camera mainly uses a lens, mirrors, image sensors, and an encoder to perform the above procedures. The basic components of TV include a tuner, picture tube, and a phosphor coated screen. They are used together to complete the process of displaying the captured images on the TV screen. New technology has replaced the traditional CRT tube TVs with flat plasma and LCD TVs. These kinds of TV produce better picture quality and used up less space.

Digital television will bring the TV industry to a higher level in the future. This format is getting more popular as HDTV and SDTV become cheaper and cheaper. A few years ago, the average price for a 42-inch HDTV or SDTV was more than $10,000. Now, the average price has dropped to around $6,000. When all television sets include digital tuners by July 31, 2007 in the U.S., digital television would take over the TV and broadcasting industry.
**Figures**

Figure 1. Transmission of TV signals

[Diagram of TV signal transmission]

**Color Television Transmission** begins with a television camera, above left. A mirror system breaks light from a scene into the three primary colors of light—red, blue, and green. At the same time, a microphone changes sounds into audio signals. Camera tubes then convert the color light images into electronic video signals. These signals go to the encoder, above center, which produces a compatible color signal for transmission. The transmitter, above right, combines the audio and video signals for broadcast from the antenna.

A camera tube, left, produces a video signal for one of the primary colors. Light striking the tube covers a pattern of electric charges to form an image. As an electron beam scans (moves across) the target, electrons flow from the target and become one of the primary color signals.

Figure 2. Reception of TV signals

[Diagram of TV signal reception]

**How Color Television is Received**

A color television receiver, diagrammed above, picks up television signals with its receiving antenna. The signals travel to the tuner, which selects the desired station. Electronic circuits within the TV set separate the television signal into audio and video signals. The set amplifies the audio signal and changes it into sound. A decoder changes the video signals into primary color signals. Three electron guns in the picture tube—one for each primary color—scan the screen. The screen is covered with tiny phosphor dots of red, blue, and green. When struck by a beam, the colored dots glow and form the color picture.

The Picture Tube Screen, a part of which is shown at right, has more than 300,000 colored phosphor dots arranged in groups of three on its surface. A metal shadow mask behind the screen has holes that keep each electron beam in line with its own color dot and away from dots of other colors.
Figure 3a. Direct-View TVs

Conventional Curved Screen TV

Flat Screen TV

Figure 3b. Projection TVs

Front Projection TV

Rear Projection TV

Figure 3c. Flat-Panel TVs

Plasma TV

LCD TV
Figure 4a. Interlace Scanning

Figure 4b. Progressive Scanning

Figure 5. Back View of TV

Figure 5a. 75 Ohm Coaxial Cable

Figure 5b. Composite (RCA) A/V Cables

Figure 5c. S-Video Cable

Figure 5d. Component Video Cable
References:

Noll, Principles of Modern Communications Technology, Chapters, 9, 11, 12, 13

“How Television Works”
http://entertainment.howstuffworks.com/tv.htm

“How Choosing a TV for Today ... and Tomorrow”
http://www.crutchfield.com/infocenter/S-mHIDHmcvS91/home/tv.html

Project Plan

The topic for this project is on the development of the television system. First, the history of T.V. will be discussed. How it was built, how it works, including the descriptions of some basic components used in the invention. Then the transmission and reception of TV signals will be discussed. The television signals from a transmitter are fed into a home TV set through a receiving antenna, a cable, or a satellite dish. The way in which the television signals get transmitted to the television receiver will be explored. Cable and satellite technology and other receiving equipments will also be discussed. Then, different television standards (SECAM, PAL, NTSC) will be compared.

As television sets become common in most people’s homes, many improvements had been made in the T.V. industry. There are many types of color televisions, conventional/curved screen (4:3), flat screen, LCD/Plasma (16:9), projection, and HD T.V. Each of those types will be described in detail, including comparisons in quality, picture technology. Next, television sets have many types of inputs for connecting with other electronic systems such as VCRs and DVD players. The types of inputs used can make a difference in picture and sound quality. Some input/output cables include, Coaxial cable, RCA cables, S-video cable, and video component input. After that, other electronic systems that often pair with T.V., such as, VCR and DVD player will be discussed. These systems had a major impact on the T.V. industry. Finally, the impact of television on society, including political and economic issues (both positive and negative effects), will be discussed.
## Timeline

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Team Members</th>
<th>Due Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction and History of TV</td>
<td>Raul Gomez</td>
<td>3/10/2003</td>
</tr>
<tr>
<td>Transmission of TV signals, basic components of TV camera, TV standards</td>
<td>Shou Hang Shi</td>
<td>4/1/2003</td>
</tr>
<tr>
<td>Reception of TV signals, basic components of TV,</td>
<td>Jun Wei Guo</td>
<td>4/6/2003</td>
</tr>
<tr>
<td>Types of Color TV</td>
<td>Shou Hang Shi</td>
<td>4/12/2003</td>
</tr>
<tr>
<td>TV Features</td>
<td>Jun Wei Guo</td>
<td>4/20/2003</td>
</tr>
<tr>
<td>Digital TV, interlaced and progressive scan</td>
<td>Raul Gomez</td>
<td>4/25/2003</td>
</tr>
<tr>
<td>Descriptions of Video components</td>
<td>Shou Hang Shi</td>
<td>4/30/2003</td>
</tr>
<tr>
<td>A/V Inputs/Outputs Jacks:</td>
<td>Jun Wei Guo</td>
<td>5/2/2003</td>
</tr>
<tr>
<td>Summary</td>
<td>Jun Wei Guo</td>
<td>5/5/2003</td>
</tr>
</tbody>
</table>