DESIGN AND CONSTRUCTION OF A VIDEO LINE SELECTOR.

BY

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2006/24434EE

A Thesis submitted to the Department of Electrical and Computer Engineering, Federal University of Technology Minna, Niger State.

NOVEMBER 2011.

DEDICATION

This project is dedicated to Almighty Allah (S.W.T.) who spared my life and gave me the understanding through my programme of study.

To my dad late mallam Yahaya Shuaibu

To my untiring mum Hajiya Hamdalat Yahaya who never gives up on me for all her motherly advice and financial support.

To my Elder brother Mr. Aminu Mustapha who has always being there for me.

To my Uncle Alhaji Sani Abdulrazak for his fatherly advice and supports.

Thank you all and God bless.

DECLARATION

I Yahaya Abubakar, declare that this work was done by me under the supervision of Mr. P.O Abraham Attah, and has never been presented elsewhere for the award of a degree. I also hereby relinquish the copyright to the federal University of Technology, Minna.

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....

(Signature and Date)

CERTIFICATION

This is to certify that this project work titled DESIGN AND CONSTRUCTION OF A VIDEO LINE SELECTOR was carried out by Yahaya Abubakar (2006/24434EE) for the award of bachelor of engineering (B.Eng) degree in Electrical and Computer engineering. Federal University of Technology, Minna.

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ACKNOWLEDGEMENTS

I thank Almighty Allah for sparing my life to see the completion of my course of study in the university.

I would like to acknowledge the love and support I have received from my parents Late Malla Yahaya Shuaibu and Hajia Hamdalat Yahaya.

To Dr. (Engr.) A.G RAji the H.O.D of electrical and computer engineering for the fatherly support. And most especially to my supervisor Mr. P.O. Abraham Attah and Mallam Yahaya Ibrahim, for their unflinching support, and under whose understanding advice I was able to accomplish the enormous challenge posed by this research/work. I am also grateful to the entire lecturers and staff of the department, thank you all.

Unquantifiable thanks to my brother Mr. Aminu Mustapha for all his financial and fatherly advice, Mr. Mohammed Raji, Haj. Ramatu Yahaya, Mallama Sadiyatu Abdulrazak, Mujidat Yahaya, Kafayat Abdulrahman.

I am also deeply grateful to Alh. Bala Ciroma and Haj. Fatima Bala for your concern and support.

To my friend Mr. Sarafadeen Akinmoyero for your concern, support and guidance.

To Miss Mufidah Rabiu for your love, care and support throughout my stay in school.

To all my course mates for their togetherness throughout our stay in the university.

ABSTRACT

This project presents the design and construction of a video line selector. The line selector allows any line in the composite video signal to be selected for analysis. The line selector is a multifunctional tool for repairing and adjusting TV sets and other video equipment, such as video recorders (VCRs). This design is based on type AT89C52 microcontroller. When measuring video signal with oscilloscope, video line selector is very useful in finding a scan line. The line selector generates trigger pulse at the selected line while an ordinary oscilloscope displays only selected line. The line selector also enables an oscilloscope to be triggered at the start of the TV line selected by the user. The TV line to be viewed on the oscilloscope is selected with two press keys and it is indicated on an LCD display.

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CHAPTER ONE

1.0 Introduction

Measurements on TV signals are extremely difficult. Even with an oscilloscope with a trigger button marked "TV" it is practically impossible to select a particular line from the picture signal. This problem is solved by a line selector because it allows any line in the composite video signal to be selected in a simple manner [1].

Video is the technology of electronically capturing, recording, processing, transmitting and reconstructing a sequence of still images representing scenes in motion. Video technology was first developed for television systems, but has been further developed into many formats to allow for other applications [2]. For a well founded verdict on the operation of a TV set, it is often required to perform measurements on individual lines in the video signal as processed by the set. The selector is based on a type AT89C52 microcontroller.

1.1 Statement of the Problem

When working with video signals, it is particularly difficult to measure or analyze such signals due to noise; these electronic noise are present to some extent in all video signals. These noise are overcome generally by special test instruments/equipments to enable analysis and measurement. That problem is solved by the line selector described.

1.2 Aims and Objectives:

The aims and objectives of this project work are as follows:

- To design and construct a video line selector that solves the problem of selecting a particular line from picture signals.
- To allow any line in the composite video signal to be selected in a simple manner.
- To provide a test instrument that enables an oscilloscope to be triggered at the start of the TV line selected by the user.
- To provide a tool for repairing and adjusting TV sets and other video equipment, such as video recorders (VCRs).
- To provide a tool that can also act/serve the purpose of a remote controller of a TV set.

1.3 Methodology

This project work began with an in-depth literature review of the subject matter. PROTEUS electronic design software was used for the design phase of the work; the circuits were simulated using PROTEUS before physical assembling was carried out. Soldering of the various components was done on the Vero-board and care was taken to avoid damage to the components. The selector was finally assembled after the soldering operation. Tests and experiments were performed to ensure workability.

1.4 The Scope of the Project

This project centered on the design and construction of a handy instrument, which can be used to measure and analyze video signals in electronic workshop and test centre. The line selector requires a video input and a trigger output to the oscilloscope. The video line to be viewed on the oscilloscope is selected with two press-keys, and indicated on a read out consisting of an LCD display.

1.5 Merit and Limitation

The line selector serves as a handy and multifunctional tool for repairing and adjusting additional video equipments, such as video recorders (VCRs).

A possible limitation is that the selector is only useful in laboratory, instrument test centre or electronic workshops. Because it's often required to perform measurements on individual lines in the video signals, and special test signals (insertion test signals ITS's) are included. These signals (ITS's) are contained in picture line which are normally invisible to the viewer and as such can only be viewed on an oscilloscope [1], so this limits the line selector to test centre's and electronic workshops.

1.6 Project Outline

This section presents an orderly account of the thesis. It consists of five chapters:

Chapter One presents a general introduction, statement of the problem, the aims and objectives of the project were highlighted, methodology, scope of the project, merits and limitations of the project were highlighted. Chapter Two deals with the literature review, historical and theoretical background, previous work of others in this area of study and difficulties that limit performance. Chapter Three covers the system design and analysis, construction of system, circuit diagrams, selection of components used and implementation. Chapter Four contains the report, steps taken in construction, test and measurement methods, results obtained and general discussion. Chapter Five comprises conclusions, summary of the work, summary of result obtained, problems encountered and recommendation.

CHAPTER TWO

2.0 Literature Review

2.1 Composite Video Signals

A composite video signal is a signal in which all the components required to generate a video signal are embedded in a single signal. The three main components of a composite signal are [3]:

- The luma signal (or luminance) — contains the intensity (brightness or darkness) information of the video image
- The chroma signal — contains the color information of the video image
- The synchronization signal — controls the scanning of the signal on a display such as the TV screen.

It is a composite of three source signals called Y, U and V (together referred to as YUV) with sync pulses [4]. Y represents the brightness or luminance of the picture and includes synchronizing pulses, so that by itself it could be displayed as a monochrome picture. U and V represent hue and saturation or chrominance; between them they carry the color information. They are first modulated on two orthogonal phases of a color carrier signal to form a signal called the chrominance. Y and UV are then combined. Since Y is a baseband signal and UV has been mixed with a carrier, this addition is equivalent to frequency-division multiplexing [4].

Composite video can be described as an analog television (picture only) signal modulated onto an RF carrier without combining with a sound signal. In contrast to component video (YPbPr) it contains all required video information, including colors in a single line-level signal. Like component video, composite-video cables do not carry audio and are often paired with audio cables such as an RCA connector [4].

2.2 Video Signal Standards

The visual resolution of a video signal or display is the amount of detail that can be seen. This is different from the resolution format of a signal or display. There are many different kinds of video signals, which can be divided into either television or Computer types [6]. The format of signals varies from country to country. In the United States and Japan, the NTSC format is used. HDTV/SDTV refers to High Definition TV and Standard Definition TV. VGA and XGA are PC video resolutions. In Europe, the PAL format is commonly employed. PAL stands for Phase Alternating Line. PAL is an improvement on NTSC format. SECAM is used in France and stands for sequential coleur avec memoire (with memory) [6].

Although all the above standards use the same basic scanning system and represent colors with a type of phase modulation, they differ in several ways, including specific scanning Frequencies, number of scan lines, and color modulation techniques [6].

Table 2.1 shows the comparisons between the various video signals including how they vary with frequencies.

Video format	NTSC	PAL	HDTV/SDTV	VGA	XGA
Description	Television format for North America and Japan	Television format for most of Europe and South America	High definition TV /standard definition TV	PC video resolutions	PC video resolutions
Vertical resolution format (visible lines/frame)	Approx 480 (525 total lines)	Approx 575 (625 total lines)	1080 or 720 or 480; 18 different formats	480	768
Horizontal resolution format (visible pixels/line)	Determined by bandwidth, ranges from 320 to 650	Determined by bandwidth, ranges from 320 to 720	1920 or 704 or 640; 18 different formats	640	1024
Horizontal rate (KHz)	15.734	15.625	33.75-45	31.5	60
Vertical frame rate(Hz)	29.97	25	30-60	60-80	60-80
Highest frequency (MHz)	4.2	5.5	25	15.3	40.7

Table 2.2: Video Signal Comparison

2.3 Basic Video Formats

The three basic video signal formats in order of decreasing quality are [5]:

- Composite or CVBS Interface (Color, Video, Blanking, and Synchronization/also called Composite Video Baseband Signal), which uses one wire pair.

- Y/C or S-video Interface, which uses two wire pairs.
- Component Interface, which uses three wire pairs. In order of increasing quality, the composite (or CVBS) which uses one wire pair.

In order of increasing quality, the composite (or CVBS) uses one wire pair; Y/C (or S-video) uses 2 wire pairs; and component, which uses 3 wire pairs are the 3 basic video signal formats. Each wire pair consists of a signal and ground. The three Interfaces differ in the level of information they can combine (encode). More encoding typically degrades the quality but allows the signal to be carried on fewer wires. Component has the least amount of encoding, whilst composite has the most [6].

2.3.1 Composite/CVBS Interface:

Composite video signals, which are also referred to as CVBS, are the most commonly used analog video Interface. They combine brightness information (luma), color information (chroma) and synchronizing signals in one cable . The connector is typically an RCA jack. Brightness information in the signal is the instantaneous amplitude at any point in time [6]. The amplitude of the modulation is proportional to the amount of color.

2.3.2 Y/C Interface:

Y/C signals, which are often referred to as 'S-video' signals are less encoded than those of Composite signals. The Y signal represents brightness and the C signal represents color. They are both carried over 2 separate wire pairs.

2.3.3 Component Interface:

The component signal Interface is the best performer as it contains the least encoding. The signals exist in a nearly native format. They use three pairs of wires that typically include a luma (Y) and two color-difference format signals on an RGB format signal. Color-difference formats are normally used in TV applications, whereas an RGB format is almost always used in computer applications. In addition to the brightness, the Y signal also contains synchronizing information [5].

2.4 Structure of a video signal

The basic structure of a video signal with its various components is as shown below:

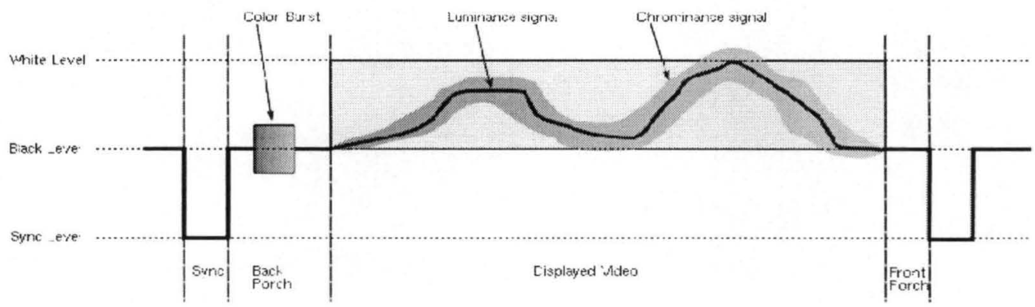

fig. 2.4 structure of a video signal

2.5 Development of Video Devices

Video technology was first developed for cathode ray tube television systems, but several new technologies for video display devices have since been invented [2]. Standards for television sets and computer monitors have tended to evolve independently, but advances in computer performance, digital television broadcasting and recording are resulting in a convergence of standards and use of content [2]. Computers can now display television and film-style video clips and streaming media, encouraged by increased processor speed, storage capacity, and broadband access to the Internet. General purpose computing hardware can now be used to capture, store, edit, and transmit television and movie content, as opposed to older dedicated analog technologies.

In [2] the term video (meaning "I see", from the Latin verb "videre") commonly refers to several storage formats for moving pictures: digital video formats, including digital versatile disc (DVD), Blue-ray Disc, QuickTime, MPEG-4 and analog videotapes, including VHS and Betamax. Video can be recorded and transmitted in various physical media: in magnetic tape when recorded as PAL or NTSC electric signals by video cameras, or in MPEG-4 or DV digital media when recorded by digital cameras [5]. In the UK, Australia, The Netherlands and New Zealand, the term video is often used informally to refer to both video recorders and video cassettes; the meaning is normally clear from the context [2].

Quality of video essentially depends on the capturing method and storage used. Digital television (DTV) is a relatively recent format with higher quality than earlier television formats and has become a standard for television video [2]. 3D-video; digital video in three dimensions, premiered at the end of 20th century. Six or eight cameras with real-time depth measurement are typically used to capture 3D-video streams. The format of 3D-video is fixed in MPEG-4 Part 16 Animation Framework Extension (AFX) [5].

Digital video (the latest video technology) was first introduced in 1983 with the Sony D-1 format, which recorded an uncompressed standard definition component video signal in digital form, instead of the high-band analog forms that had been commonplace until then [2]. Due to expense, Sony D-1 was used primarily by large television networks. It would eventually be replaced by cheaper systems using compressed data, most notably Sony's digital Betacam, still heavily used as a field recording format by professional television producers. Consumer digital video first appeared in the form of QuickTime, apple computer's architecture for time-based and streaming data formats, which appeared in crude form in 1990. Initial consumer-level content creation tools were crude requiring an analog video source to be digitized to computer readable formats [7]. While low quality at first, consumer digital video increased rapidly in quality, first with the introduction of play back standards such as MPEG-1 and MPEG-2 (adopted for use in television transmission and DVD media), and then the introduction of the DV tape format allowing recording direct to digital data and simplifying the editing process, allowing non-linear editing systems to be deployed wholly on desktop computers [5].

The size of a video image is measured in pixels for digital video, or horizontal scan lines and vertical lines of resolution for analog video. In the digital domain (e.g. DVD) standard-definition television (SDTV) is specified as 720/704/640×480i60 for NTSC and 768/720×576i50 for PAL or SECAM resolution. However in the analog domain, the number of visible scanlines remains constant (486 NTSC/576 PAL) while the horizontal measurement varies with the quality of the signal [5].

Video resolution for 3D-video is measured in voxels (volume picture element, representing a value in three dimensional space). For example 512×512×512 voxels resolution, now used for simple 3D-video, can be displayed even on some PDAs [6].

2.6 Developments in line Selector

2.6.1 Video Selector

The invention by Ellner, Henrik (Stockholm, SE) in 06/25/2008 provides a method for selecting input video signals in a video conference for transmission. The method bases its selection decision on the momentary voice activity of the participants, but does so while observing constraints aimed at [10]:

- improving stability of the image seen by each participant;
- decreasing flickering of the image;

- choosing comfortable and helpful swapping times between different image configurations; and
- reflecting the importance which is attributed to persons having a higher past average activity in a natural conference.

Most line selectors are composed with a sync-separator and some counter ICs. In this project, all of counter/trigger function are processed by a microcontroller without external counter. Therefore, the circuit diagram could be very simple and it has many functions.

In 2008 Bamidele Olanire of Federal University of Technology Minna, Nigeria designed a Digital 3-channel audio/video selector as a project work. The Audio/Video selector is used to select a particular AV signal from three available signals for video studios, close-circuit television (CCTV) and other home-use applications [8].

2.6.2 Video Waveform Generator

A primary function of the Video Waveform Generator is its wide frequency range, and ability to reset itself via its synchronization input at video clock speeds, such as Field rate and Line rate in order to produce a stable, jitter-free pattern [9]. Frequency ranges 3 & 4 are optimized for Field rate clock usage, and frequency ranges 5 & 6 are optimized for Line rate usage. When locked to Field clock, the oscillator will produce stable horizontal bars. When locked to Line rate, the oscillator will produce stable vertical bars. Changing the frequency of a video-synchronized oscillator will change the number of bars which are displayed. By modulating a Line synchronized oscillator with a Field-synchronized oscillator, the creation of zig-zag and curved patterns can be achieved [9].

CHAPTER THREE

3.0 Design and Implementation

This chapter presents a detailed outline of the designed modules and criteria for component selection. The block diagram of the line selector is shown below:

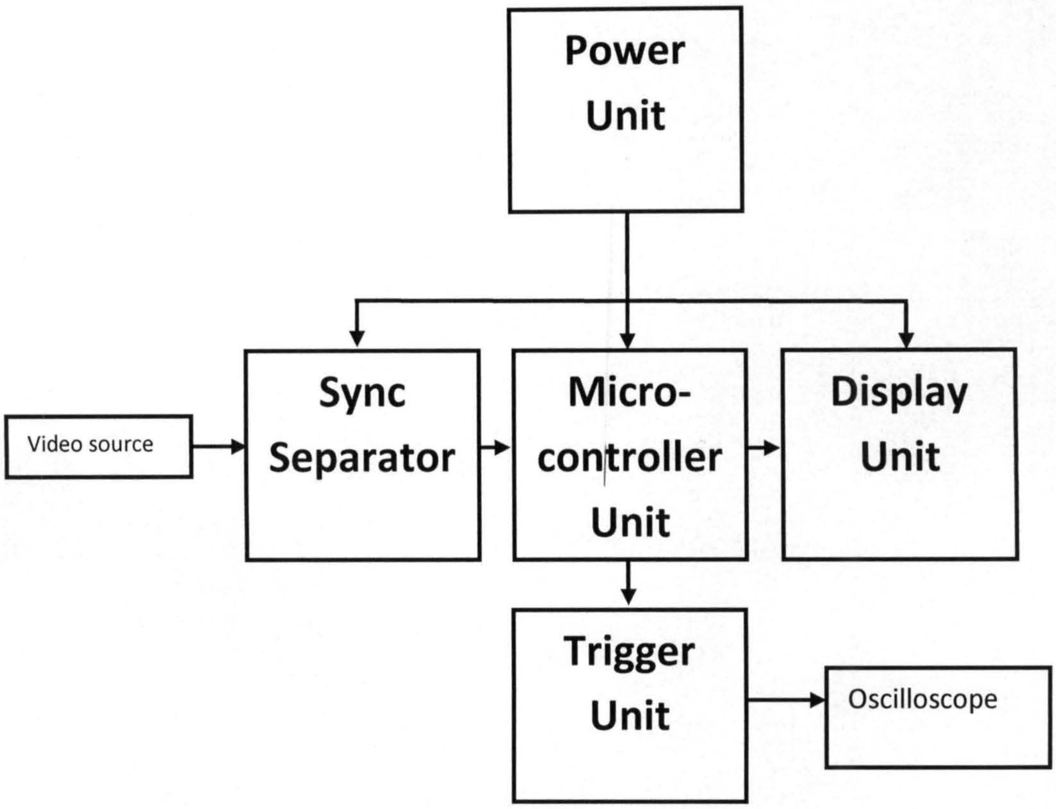

Figure 3.0 Video Line Selector Block Diagram

3.1 Design of Power-Supply Unit

Most electronic equipments and circuits require DC voltages for its operation [12]. The available 230V AC, 50Hz is converted to DC through a rectifying circuit. The DC voltage produced by power supply is used to power all types of electronic circuits, such as television receivers, amplifier circuits, computers and laboratory equipments. A DC source can also be obtained from electrolytic cells. A typical DC power supply consists of five phases as shown below in fig. 3.1. Transformer and rectifying unit forms the power supply unit in this project. IC's and other components run on a power supply of 5V and 12V DC, hence the supply is regulated to prevent fluctuation in voltage level.

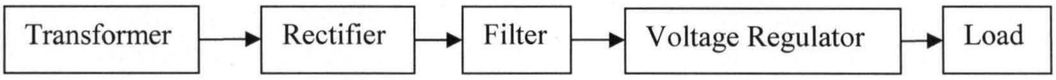

Fig. 3.1 A typical dc power supply block diagram [12, 13]

The block diagram of the power supply unit used is shown below.

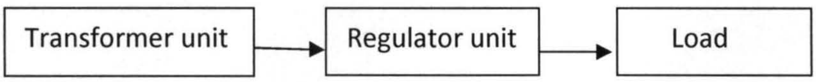

Fig 3.2 dc power supply unit

These blocks are briefly explained as follows:

I. **Transformer :** This is simply a device used for transferring electrical energy from a PRIMARY to a SECONDARY WINDING with a change in voltage, current, phase or impedance. It steps up or steps down the input voltage to a level suitable for the operation of the equipment. A secondary function of the transformer is to provide electrical ground insulation of the device to reduce potential shock hazards [12].

II. **Voltage Regulator**: Its main function is to keep the terminal voltage of the DC supply constant even when the supply voltage or the load varies. Fluctuations and ripples superimposed on the rectified DC voltage can be filtered out by a capacitor. More precise control over voltage levels and ripples can be achieved by the voltage regulator, which also makes the internal voltages independent of fluctuations from an AC outlet [12].

III. **Load:** The load forms a continuous conducting path between the terminals of the current source. The load includes all the components in the circuit, connecting wires and other devices [12].

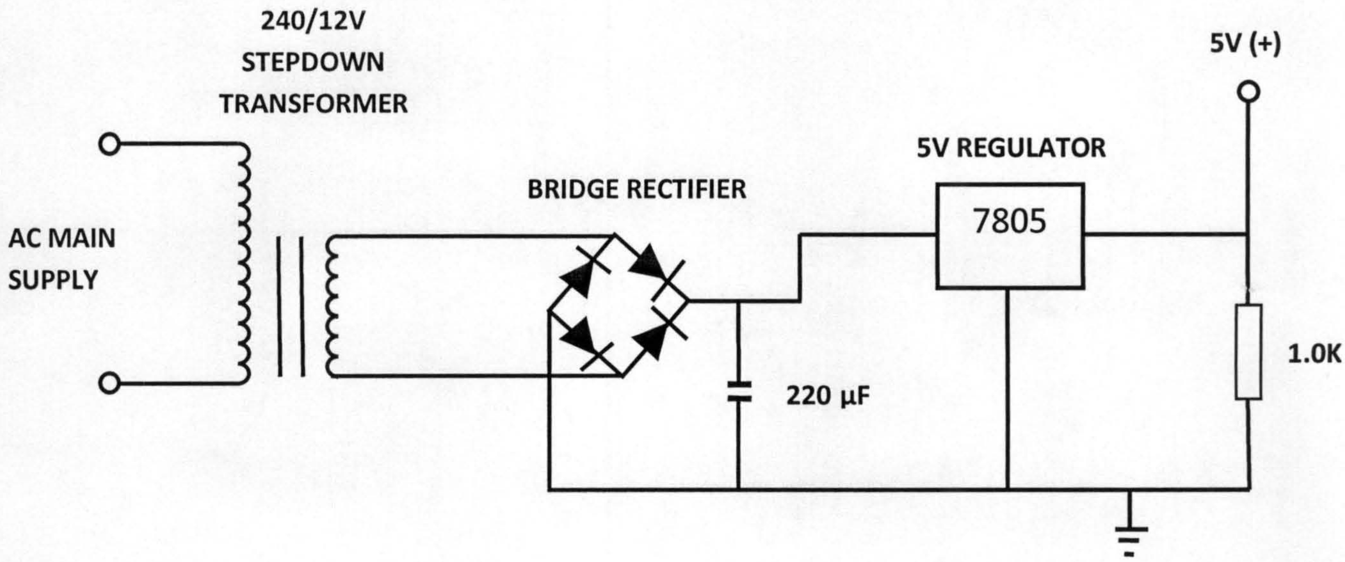

FIG. 3.3 circuit diagram of power-supply unit.

3.1.1 BRIDGE RECTIFIER:

The diode bridge rectifier is an electronic circuit having four arms that each contains a rectifier, used for rectifying both the positive and negative parts of an alternating current. Usually a capacitor is added to the rectifier to eliminate the AC ripples present in the DC [13].

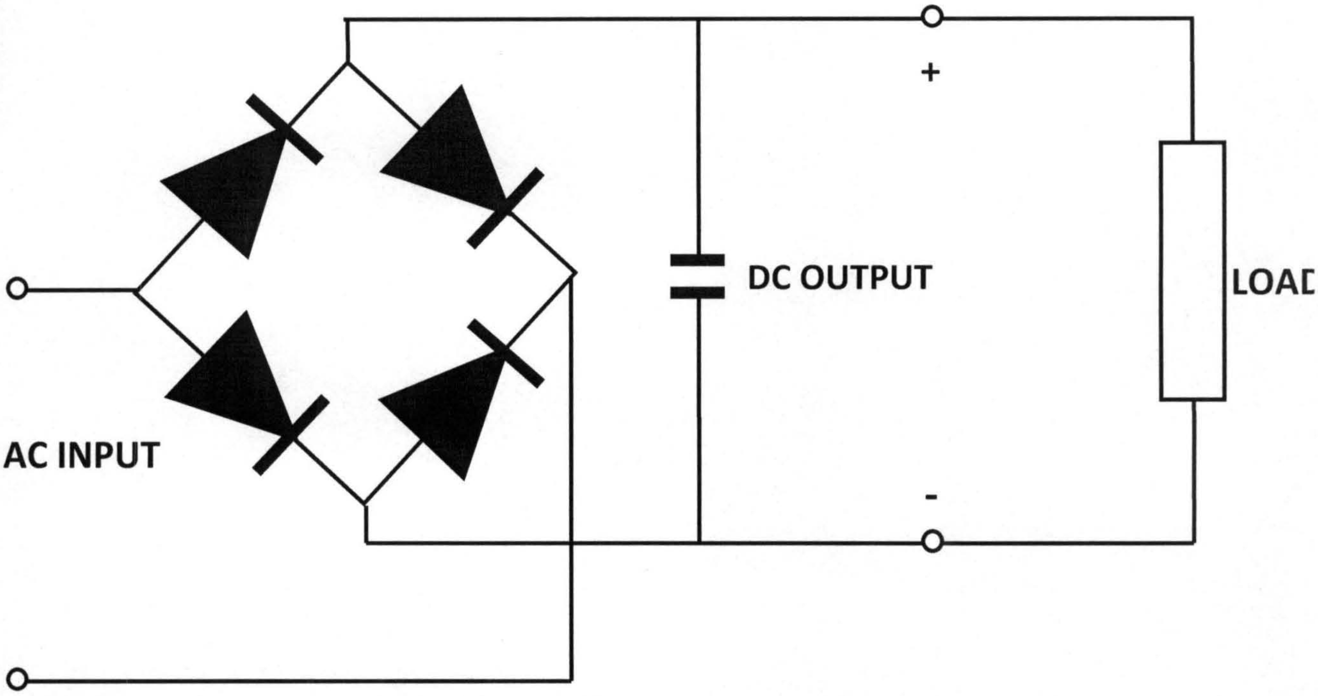

Figure 3.4 Bridge Rectifier

3.1.2 THE REGULATOR

A voltage regulator, which also makes the internal voltages independent of fluctuations that, may be encountered at an outlet. The regulator is shown below:

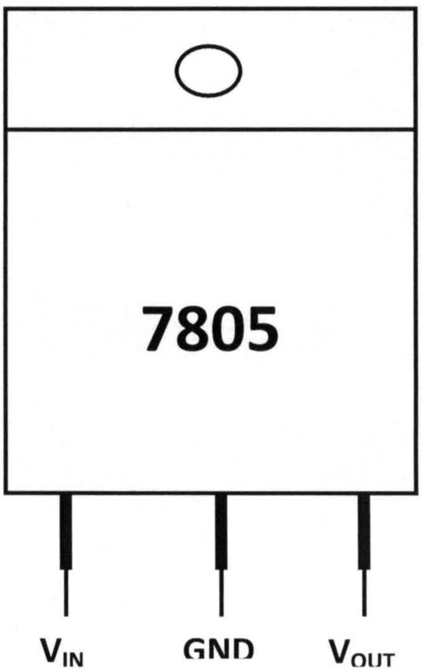

Figure 3.5 Pin configuration of a 7805 Regulator

3.2 Video socket:

The video socket is also referred to as the video jack. The video jack takes the form of a hole or recess specially shaped to receive the video signal from the source e.g. DVD.

3.3 Design of LM1881 Video Sync Separator

The LM1881 Video sync separator is designed specially to unravel composite video signals from composite video sources that are in, or similar to, the N.T.S.C. format. Input signals with positive polarity video from 0.5V (p-p) to 2V (p-p) can be accommodated [1]. The LM1881 operates from a single supply voltage between 5V DC and 12V DC. The integrated circuit is also capable of providing sync separation for non-standard and faster horizontal rate video signals. The LM1881 has the following basic features [14];

- AC coupled composite input signal
- >10 kΩ input resistance
- <10 mA power supply drain current
- Composite sync and vertical outputs
- Odd/even field output
- Burst gate/back porch output
- Horizontal scan rates to 150 kHz
- Edge triggered vertical output

3.3.1 The LM1881 Connection Diagram

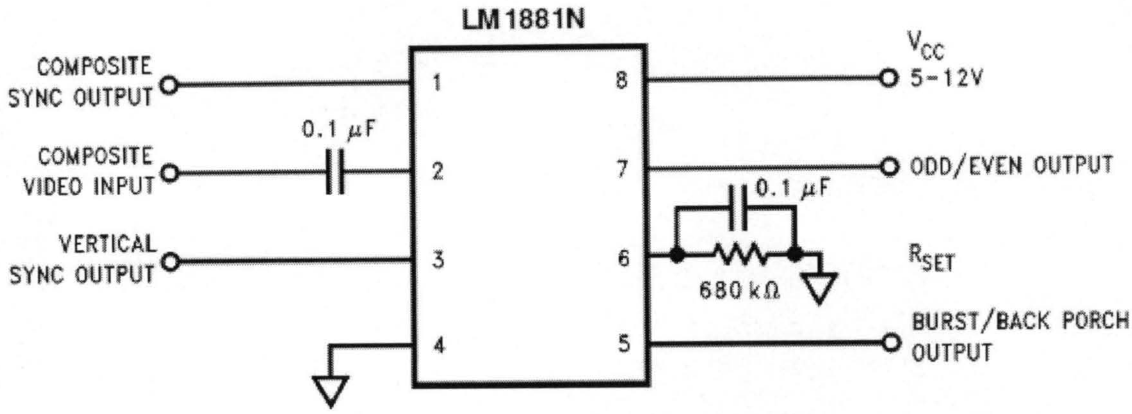

FIG. 3.6 LM 1881 CONNECTION DIAGRAM [14]

As shown above, the LM1881 has four major sync output signals:

- Composite sync: it's simply a reproduction of the signal waveform including both horizontal and vertical scan timing information[14]
- Vertical sync pulse: the vertical sync output is derived by internally integrating the composite sync waveform[14]
- A burst gate or back porch clamp pulse and
- An odd/even output. The odd/even output level identifies which video field of an interlaced video source is present at the input [14].

These signals provide all the information necessary to determine the timing of a composite video signals. The line selector only uses the composite and vertical synchronization signals because the position of the color burst is of no consequence to the circuit. The odd/even field signal is less suitable for use here, mainly because it tends to be erratic if the video signal contains noise [1]. Normally the signal source for the LM1881 is assumed to be clean and relatively noise-free.

3.4 The AT89C52 Microcontroller unit

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 and 80C52 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a Conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications [15].

3.4.1 FEATURES OF THE AT89C52

- Compatible with MCS-51™ Products
- 8K Bytes of In-System Reprogrammable Flash Memory
- Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Programmable Serial Channel
- Low-power Idle and Power-down Modes [15].

The following basic criteria were considered in selecting the AT89C52 microcontroller:

- Ability to handle the task at hand efficiently and cost effective.
- The maximum operating speed the microcontroller can support.
- Power consumption of the microcontroller.
- The timer on the chip and the number of I/O pins.

The AT89C52 processor is used for all computing and control functions in the circuit. These functions are [1]:

- Driving the display in multiplex mode;
- Scanning the press-keys for activity;
- Counting the picture lines;
- Enabling the trigger pulse.

The pin configuration diagram of the AT89C52 microcontroller is shown below:

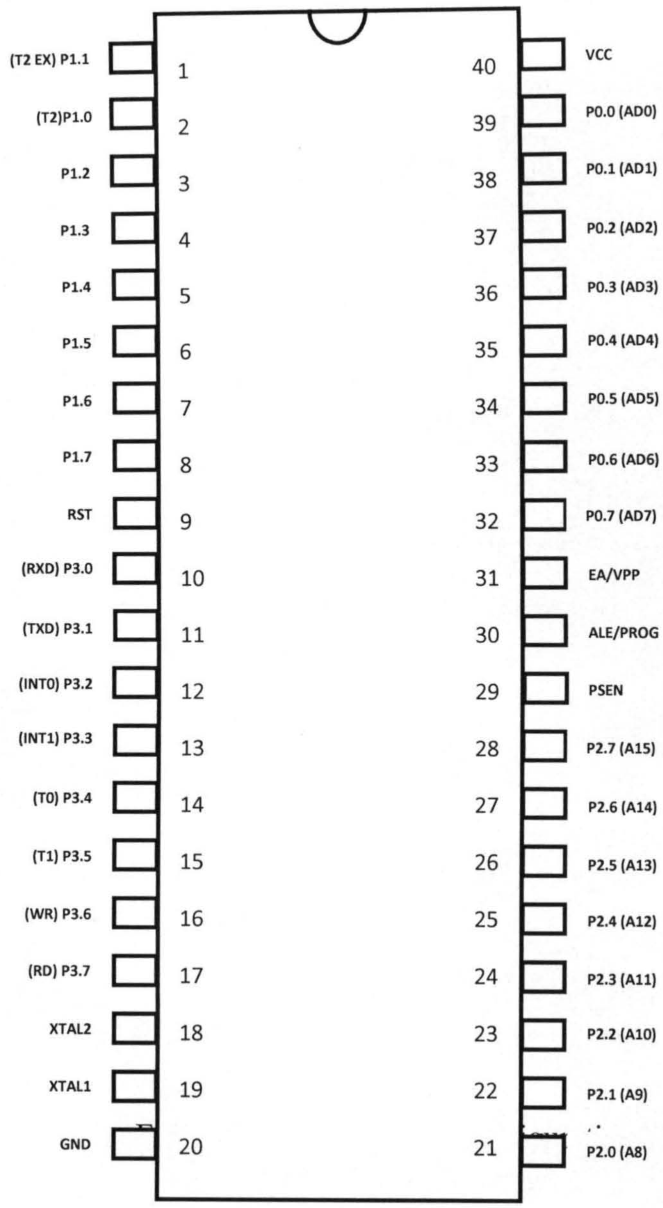

Figure 3.7 AT89C52 pin configuration [15]

3.5 The Trigger Unit

The trigger unit was realized with the use of C945 NPN transistor. The trigger to the oscilloscope is a high. The C945 acts as switch that sends a +5V to the collector pin when it has 0V as its base pin voltage. The pin diagram of the C945 NPN transistor is shown below:

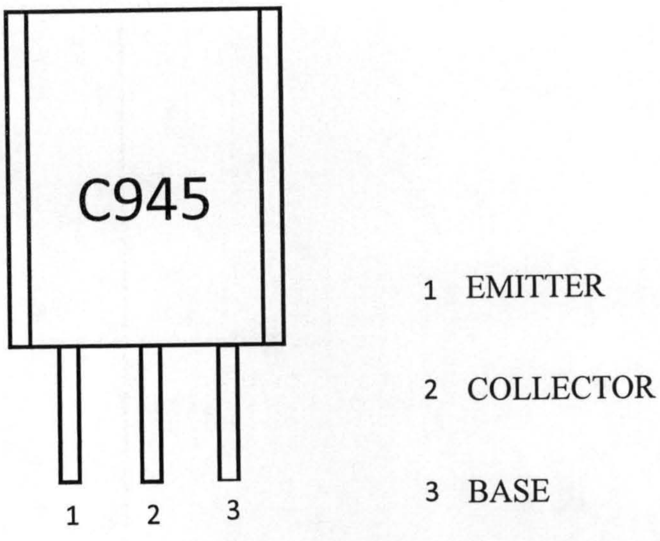

Figure 3.8 C945 (NPN) transistors

3.6 Design of Display Unit

The display unit consists of a 16 character by 1 line LCD display. A 1602B LCD is used. It has maximum character length of 16. This is displayed on one line with an operating voltage of 5V. LCD displays designed around Hitachi's LCD HD44780 module are inexpensive, easy to use, and produce readouts using the 8x80 pixels of the display. They have a standard ASCII set of characters and mathematical symbols [16]. For an 8-bit data bus, the display requires a +5V supply plus 11 input/output lines. For a 4-bit data bus it only requires the supply lines plus seven extra lines. In this project, the 8-bit data bus was used. When the LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller.

3.6.1 Signals to LCD

The LCD requires 3 control lines from the microcontroller, this control lines are listed below:

I. Enable:

This line allows access to the display through R/W and RS lines. When this line is low, the LCD is disabled and ignores signals from R/W and RS. When (E) line is high, the LCD checks the state of the two control lines and responds accordingly [16].

II. Read/Write:

This line determines the direction of data between the LCD and microcontroller. When it is low, data is written to the LCD. When it is high, data is read from the LCD [16].

III. Register select

With the help of this line, the LCD interprets the type of data on data lines. When it is low, an instruction is being written to the LCD. When it is high, a character is being written to the LCD [16].

3.6.2 Writing and Reading Data from the LCD

Writing data to the LCD is achieved by the following procedures:

- Set R/W bit to low
- Set RS bit to logic 0 or 1 (instruction or character)
- Set data to data lines (if it is writing)
- Set E line to high
- Set E line to low

Read data from data lines (if it is reading):

- Set R/W bit to high
- Set RS bit to logic 0 or 1 (instruction or character)
- Set data to data lines (if it is writing)
- Set E line to high

- Set E line to low [16]

LCD's with one controller has 14 Pins and those with 2 controller has 16 Pins (Two pins are added in both cases for back-light LED connections). The LCD display is shown in the diagram below:

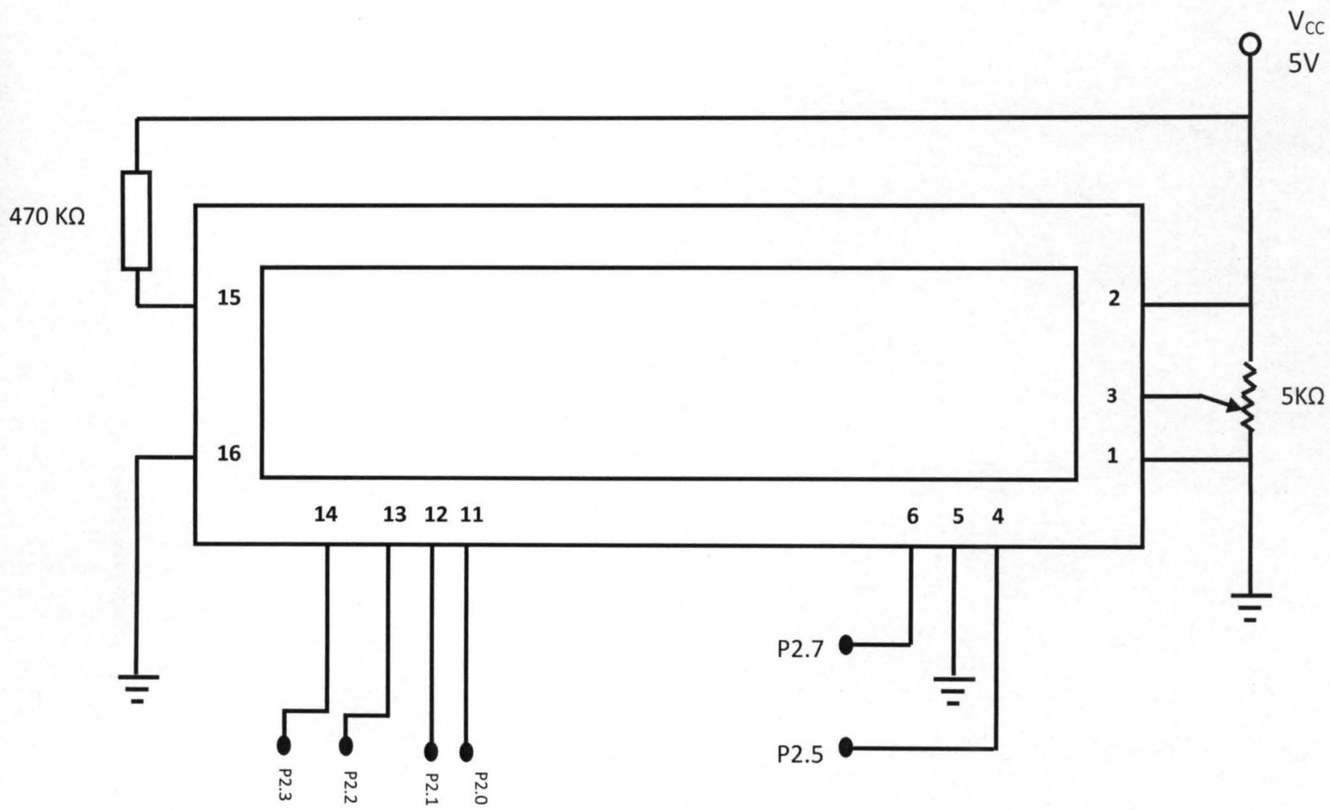

Figure 3.8 Schematic of the 1602B LCD

3.9

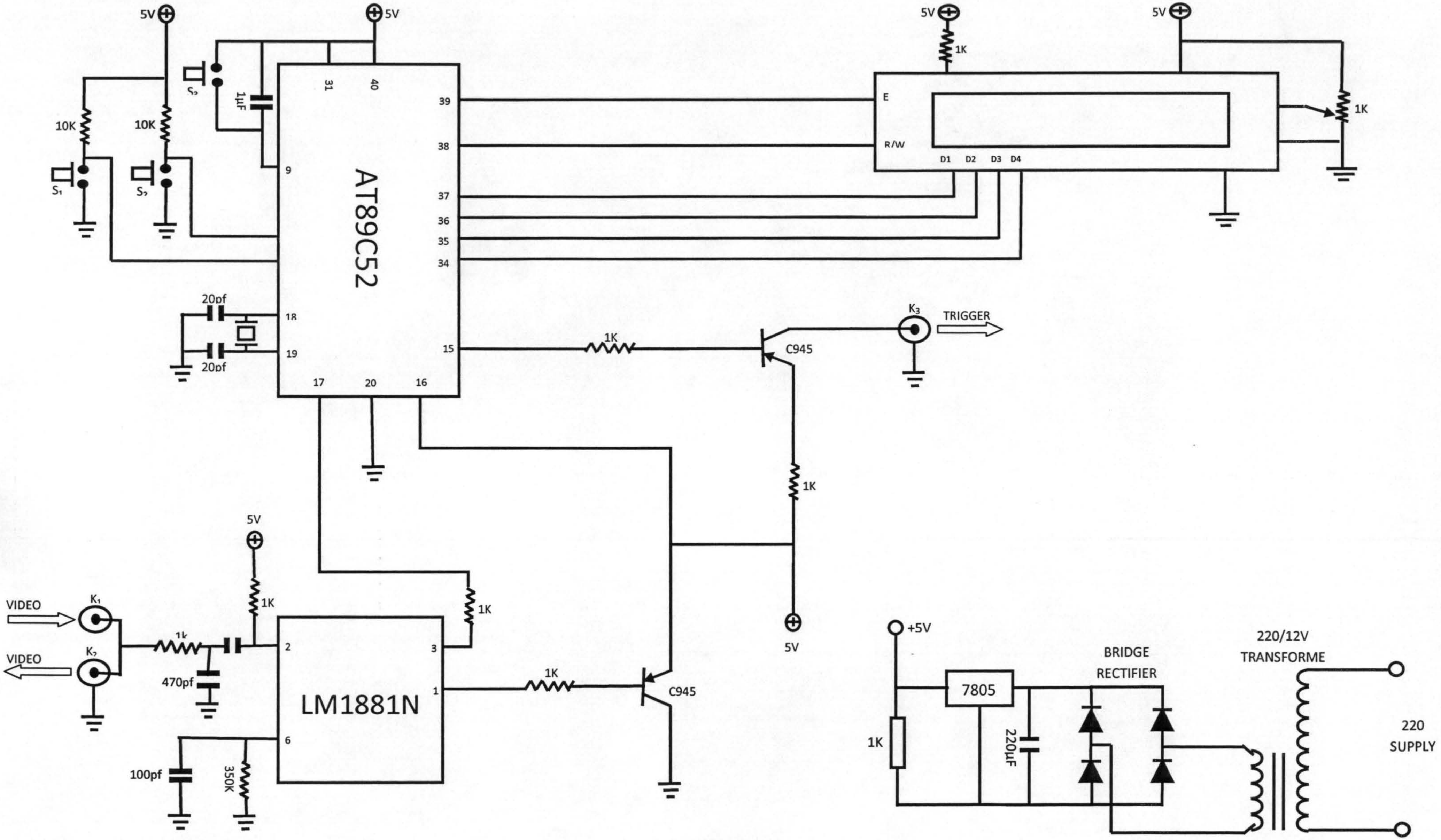

Fig. 4.0 Complete Circuit Diagram

3.8 Construction

The complete circuit was constructed on a 15 by 10cm Vero board. All components, including the LCD display and the two press keys, are accommodated on the board. The flow of the logic signal was noted and the different sections were laid out accordingly. All passive components were fitted at appropriate locations and all active parts, sockets, and the vero-board terminal block were mounted in their proper positions.

The power is supplied to the main board by 7805 voltage regulator which feeds the driving circuit. IC sockets were used for the various IC's to avoid damage due to excessive heat. Also, the Vero board was checked carefully for continuity and any solder bridging.

3.9 Principle of Operation

The composite video signal (CVBS) is applied to the selector via socket K_1. To keep the loop- through connection to the oscilloscope as simple as possible, the CVBS signal re-appears on K_2. The oscilloscope is operated in the trigger mode, so it doesn't display wave form until it is triggered. A simple RC filter removes the spurious pulses and other noise from the video signal. The 'clean' signal reaches the CVBS input of IC_1 an LM1881.

Based on the selected line, the selector will send only trigger signal at the start of that particular line selected. On receipt of the trigger, the oscilloscope displays the wave form of the video for a time period of 64µs (length of one line).

The microcontroller is programmed in such a way to count the number of horizontal and vertical synch pulses such that the trigger is sent only when the line count equals the preset value set by the user.

CHAPTER FOUR

4.0 TESTS, RESULTS AND DISCUSSION

4.1 Testing

AT89C52 microcontroller is a programmable IC, which needs to be pre- programmed to suit the design. The source code was written in C- language and compiled using the Keil µVision4 Simulator. Proper concentration was given to the code during compilation in order to avoid any logic errors. The hex file was then generated and transferred to the chip with the aid of a universal programmer (TOP2005+).

All the ICs were tested separately on a bread board to make sure they work properly. The whole circuit was also tested on the bread board to make sure that the design was correct. During construction, each section was tested to make sure the connections were done correctly before going onto the next section. This was done by applying the correct logic signals to the ICs and observing the output

Testing of the project work was done in two stages;

- Hardware and
- Software testing

4.1.1 The hardware testing:

This test is performed on all the components of the circuit to ensure that the circuit is fully functional. Some of the tests carried out include:

- Continuity Test: This is checking of the electric circuit to see if current flows (that it is in fact a complete circuit). This is the testing of all physical connections or paths and polarity linking the different circuit components used. This was done to ensure that the circuit was realized as it is in the diagram.
- Short Circuit Test: The polarity of supply was tested all across the circuit before power on to avoid damage to the circuit due to short circuit current.
- Partial Contact Test: This was done to ensure that all components were firmly placed on board, so that errors that may arise due to partial contact were avoided.

All components including Resistors, Oscillator, IC's, push buttons, ground, LCD and microcontroller linked with power supply were all working correctly when tested and the circuit is well powered.

All grounds are also connected to the source and all gave sound when tested.

4.1.2 Software Testing

To avoid malfunction of the circuit due to software errors, the software was also tested. The test carried out on software was basically running the software on the microcontroller after each segment is written. Errors detected were immediately corrected and the process repeated until software development was completed.

4.2 Circuit Testing

On completion of circuit arrangement, a video source was fed to the circuit and the input to the synchronization separator was tested. The output, the vertical and horizontal synchronization outputs were tested. Finally, the trigger output was tested. After all tests results were completed, the circuit was placed in a case for protection.

4.3 Results

When the video signal was fed to the circuit and a particular video line was selected, the oscilloscope only displayed an output at that particular line. The observed waveforms are shown below:

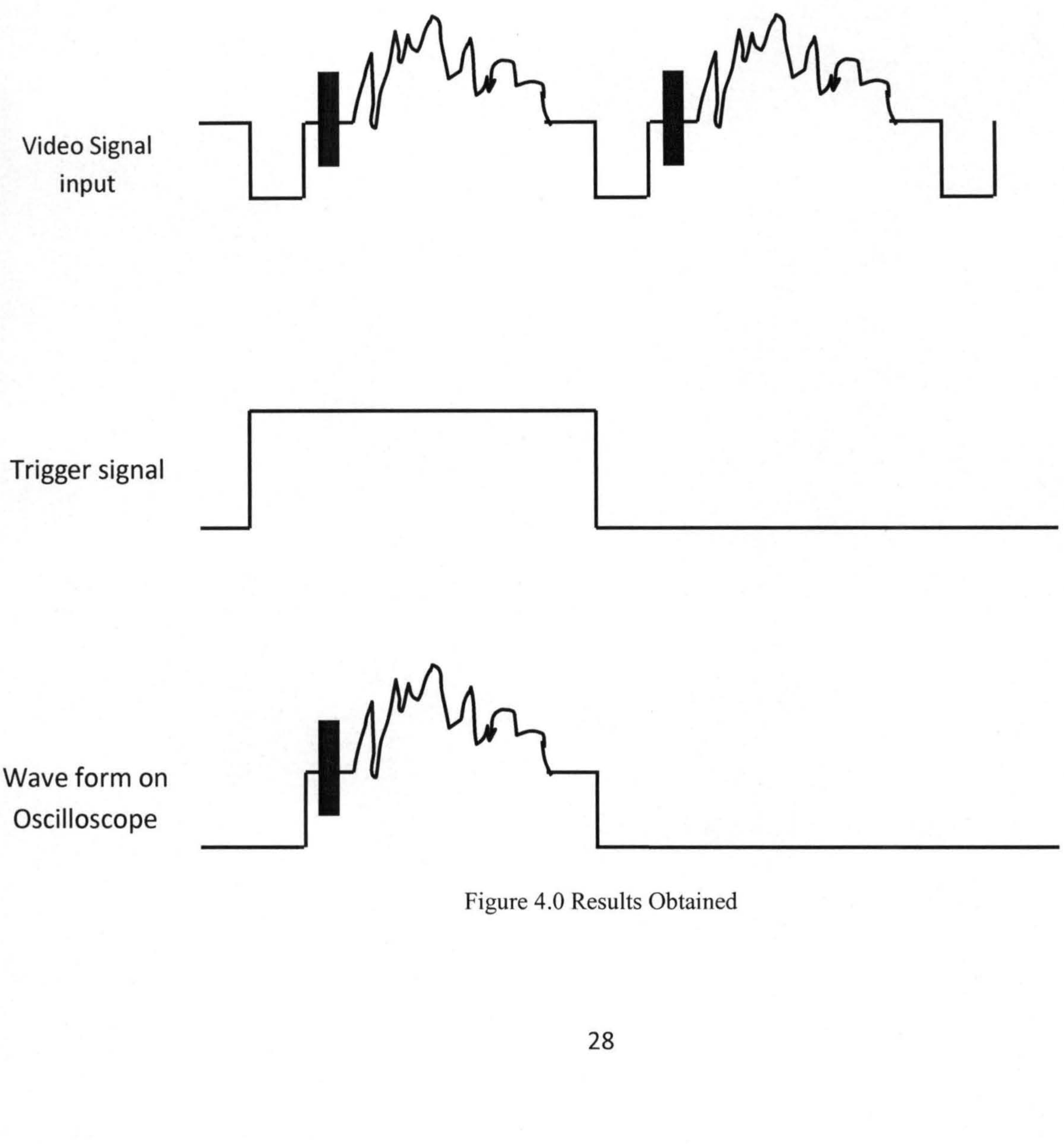

Figure 4.0 Results Obtained

4.4 DISCUSSION OF RESULTS

VIDEO LEVELS

The video levels define the levels and ranges for the different parts of the video signal. The unit used to define video levels is the IRE (Institute of Radio Engineers). The blanking level refers to 0 IRE and the white level refers to +100 IRE. The blanking level, which is the reference level for the video signal (usually 0 V), is different from the black level if a setup is applied to the signal as shown in

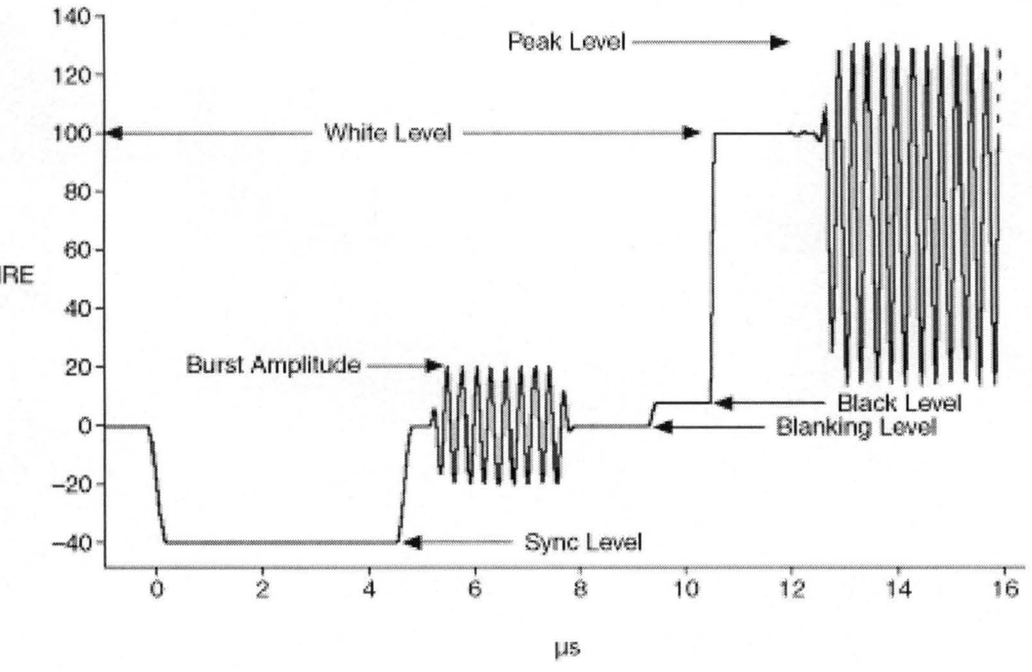

Fig. 4.1 video signal levels

For NTSC, a setup of 7.5 IRE is usually applied, moving the black level to +7.5 IRE. For PAL and SECAM, the black level is aligned with the blanking level at 0 IRE.

CHAPTER FIVE

CONCLUSION

5.1 Conclusion

The video line selector was designed and constructed. The following specific aims of the project were achieved:

- Selecting a particular video line for analysis
- Composite video signal line is selected in a simple manner
- Triggering of the oscilloscope at the start of the video line selected by the user.
- Adjusting TV sets and other video equipments (ITS)
- The selected TV line is indicated on a read out LCD display.

5.2 Problem Encountered

Some of the challenges faced in the design and construction of this instrument were associated with the circuit design and component selection. The search for the needed information was also challenging.

5.3 Recommendation

Based on the functions performed by this instrument, it is recommended for use in the following places:

- Science Laboratories
- Instrument Test Centre
- Quality control unit/centre's of TV manufacturing companies.
- Signals units of military and paramilitary base.

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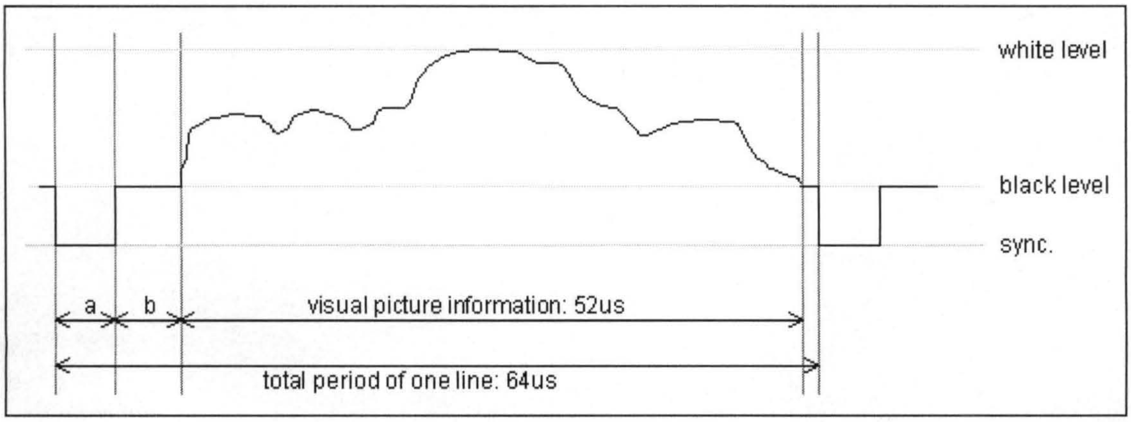
APPENDIX A

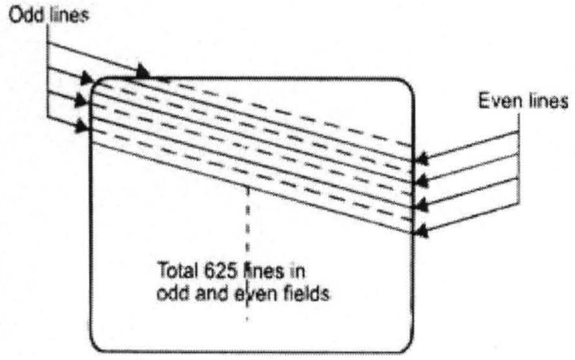
PAL VIDEO TIMING SPECIFICATION

General timing

- Line period 64 us (Micro-seconds)
- Line blanking 12.05 +- 0.25 us
- Line sync 4.7 +- 0.1 us
- Front porch: 1.65 +- 0.1 us
- Burst start 5.6 +- 0.1 us after sync start.
- Burst 10 +- 1 cycles



Interlacing: The lines of odd-even field lie alternately . This method of scanning is called interlacing. This interlaced scanning is used to reduce flicker while displaying the image on a monitor.



APPENDIX B

SOURCE CODE

```
#include <reg52.h>

#define lcd_port P2

#define LCD_en  0x80

#define LCD_rs  0x20

unsigned int x ,y;

sbit incr    = P1^0;

sbit decr    = P1^1;

sbit trig_osc = P1^2;

//void get_countFromtmr0(unsigned int);

unsigned char *val[] = {"0","1","2","3","4","5","6","7","8","9"};


void delay_50ms() //Configuring 16 bit built in timmer.

  {

  TMOD = 0x10;                          //Timer1 @ mode1.

            TL1 =  0x50;

            TH1 =  0x4C;

            TR1 =  1;

            while(TF1==0);

            TR1 = 0;

            TF1 = 0;

  }

void LCD_busy() //Monitoring busy flag of the LCD.

  {

                                        unsigned char i,j;

     for(i=0;i<50;i++)        //A simple for loop for delay

       for(j=0;j<255;j++);

}

void delay(unsigned int n)              //Making Timing variable.
```

```
{
        for(x=0;x<n;x++)
        { delay_50ms();
                        }
        }
void send_data(unsigned char info)
  {
        lcd_port = (((info >> 4)&0x0F)|LCD_en|LCD_rs);
    lcd_port = (((info >> 4)&0x0F)|LCD_rs);


    lcd_port = ((info&0x0F)|LCD_en|LCD_rs);
    lcd_port = ((info&0x0F)|LCD_rs);


    LCD_busy();



        }
void send_cmd(unsigned char ch)
  {
        lcd_port = ((ch >> 4)&0x0F)|LCD_en;
    lcd_port = ((ch >> 4)&0x0F);


    lcd_port = (ch &0x0F)|LCD_en;
    lcd_port = (ch &0x0F);
                        LCD_busy();
                        LCD_busy();


        }
void send_string(unsigned char *x)
  {
        while(*x)
```

APPENDIX C

A list of all the components used is given below:

i. power supply unit

   a) transformer
   b) one 7805 regulator
   c) four 0.1µf capacitors

ii. integrated circuits

   a) LM 1881 (National semiconductor)
   b) AT89C52 (Microcontroller)

iii. Display unit

   a) One LCD display

iv. Components

- Resistor
- Capacitors
- BC547B semiconductor

v. Miscellaneous

   - S_1, S_2 : digitast presskey
   - K_1, k_2, K_3 : line sockets.