DESIGN AND CONSTRUCTION OF A MICROCONTROLLER BASED VIDEO LINE SELECTOR

BY

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November, 2011

DEDICATION

I dedicate this project work to my father, Sunday Agabi and Mrs. Martha Sunday Agabi my mother.

ATTESTATION

I, Agabi Sunday Arigu, declare that this work was done by me 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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ABSTRACT

Measurements on TV signals are notoriously difficult. Even if you have an oscilloscope with a trigger button marked "TV", it is practically impossible to select a particular line from the picture signal. That problem is solved once and for all by the line selector as presented in this project.

This project presents the design and construction of a low cost Video Line Selector that can be used with all the commonly used video signal processing devices, for both private and laboratory use.

It is primarily a microcontroller-based device. This device was designed and constructed to select a composite or raw video signal from any video equipment. This was achieved by the use of an AT89C52 microcontroller, a video synchronizing separator IC (LM1881N) and a display unit using a 16 x 2 LCD. This project is meant to work on all commonly known video formats. The work was tested and proven to have met its requirement.

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CHAPTER ONE

1.0 Introduction

Measurements on TV signals are notoriously difficult. Even if you have an oscilloscope with a trigger button marked "TV", it is practically impossible to select a particular line from the picture signal. That problem is solved once and for all by the line selector as presented in this project. This is because it allows any line in the composite video signal to be selected in a simple manner.

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. For this purpose, a number of special test signals known as the Insertion Test Signals (ITSs) are included in nearly every TV broadcast, whether by satellite or terrestrial. These signals are contained in picture lines which are normally invisible to the viewer because they fall outside the viewed raster. The TV technician however, views them on an oscilloscope.

The Video Line Selector is a multifunctional device for repairing and adjusting television and other video equipments such as video recorders (VCRs).

1.1 Aim and Objectives of the Study

- The aim and objective of this project is to design and construct a low cost Video Line Selector that can be used with all the commonly used video signal processing devices for both private and laboratory.
- Identifying defects in video signals which can be cause by noise.
- To illustrate the wave form of the video signal.

1.2 Scope of the Project

The Video Line Selector was designed to process the three common video signals namely NTSC, Phase Alternating Line (PAL), and SECAM video signals.

It is made to run on a 5V D.C power supply, with a microprocessor to monitor and process the input signal that comes in via a video sync separator IC (LM 1881) and a display unit (LCD) to show the results.

1.3 Sources of Material

The materials used for this project have the internet as their primary source. Other sources include the Electrical and Computer Engineering Department lecture notes I used over the years during the course of my study.

All the components were bought from vendors in Minna and Lagos, while the casing was constructed by a carpenter.

1.4 Constraints

The major constraints experienced during the course of this project lies in the programming of the microcontroller to achieve the objectives of the project. The availability of the video sync separator IC (LM 1881) also posed a problem such that we had to order it from Lagos.

1.5 Methodology

There are numerous video line selector projects from of old. Most line selectors are made up of a sync separator and counter ICs. In this project, however, all the counter and trigger functions are processed by a microcontroller without any external counter needed, which makes the circuit a simple one.

CHAPTER TWO

2.0 Literature Review

2.1 History and Development of Video and Audio Devices

The term video commonly refers to several storage formats for moving pictures. Theses formats include Digital Versatile Disc (DVD), Quick Time, MPEG-4 etc. except in rare cases, video and audio signals are normally combined in a single sequence.

Video can be recorded and transmitted in various physical media: in magnetic tapes when recorded as PAL or NTSC electric signals by video cameras, or in MPEG-4 or DV Digital media when recorded by digital cameras.

Video quality 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. [1]

Digital video was first introduced in 1983 with the Sony D – 1 format, which recorded an uncompressed standard definition component video signal to digital form instead of the high-band analog was been common until then. Due to the expense, D – 1 was used primarily by large television networks. It was eventually be replaced by cheaper systems using compressed data, most notably Sony's Digital Betacam, which is highly used as field recording format by professional television procedures.

Consumer digital video first came in the form of Quick Time, 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 a computer readable format. While low quality at first, consumer digital video increased rapidly in quality, first with the introduction of playback standards such as MPEG-1, MPEG-2 (adopted in television transmission and DVD media), and then the introduction of the DV tape format allowing non-linear editing systems to be deployed wholly on desktop computers.[2]

In 2007, the highest resolution demonstrated for digital video generation was 33 Mega pixels (7680 x 4320) at 60 frames per second (UHDV), though this has only been demonstrated in special laboratory settings. This highest speed is attained in industrial and scientific high speed cameras that are capable of filming 1024 x 1024 video at up to one million frames per second for brief periods of recording. [3]

2.2 Video and Audio Signals

Composite video is commonly called "video signal". It is the format of an analog television (picture only) signal before it is combined with a sound signal and modulated onto an RF carrier. It is usually in a standard format such as NTSC, PAL or SECAM. 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 mono chrome picture. U and V between them carry the color information. They are first mixed with two orthogonal phases of a color carrier signal to form a signal called the chrominance. Y and UV are then put together. Since y is a base band signal and UV has been mixed with a carrier, this addition is equivalent to frequency-division multiplexing. [5]

Composite video cannot be directed to any broadcast channel simply by modulating the proper RF carrier frequency with it. Most analog home video equipments record a signal in (roughly) composite format; Laserdiscs store a true composite signal, while VHS tapes use a slightly modified composite signal. These devices then give the user the option of outputting the raw signal, or modulating it on to a VHF or UHF frequency to appear on a selected TV channel. In typical home applications, the composite video signal is typically connected using RCA jack, normally yellow (often accompanied with red and white for right and left audio channels respectively). BNC connectors and higher quality coaxial cables are often used in more professional applications. In Europe, SCART connectors are often used instead of RCA jacks – though SCART can also carry far superior RGB composite video signals (and to a lesser extent, S – Video), so where available, RGB is used instead of composite video with computers, video game consoles, and DVD players. Some devices that connect to a TV, such as videogame consoles and the ubiquitous home computers of the 1980s, naturally output a composite signal. This may often be converted to RF with an external box known as an RF modulator that generates the proper carrier. The RF modulator is preferably left outside the console so the RF doesn't interfere with the components inside the machine. VCRs and similar devices already have to deal with RF signals in their tuners, so the modulator is located inside the box. Also, most early home computers usually employed an internal RF modulator. [6]

2.3 Microcontroller

A microcontroller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/ output (I/O) peripherals. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, home appliances, power tools, warfare machines, chemical plants, toys, etc. By miniaturizing and reducing the cost compared to a design that uses a separate microprocessor, memory, and I/O devices, microcontrollers make it more economical to digitally control even more devices and processes. Mixed signal controllers are common, integrating analog components needed to control non-digital electronic systems. They generally have a low power operating capacity thereby making many of them well suited for long lasing battery applications.[7]

A microcontroller can be considered a self-contained system with a processor, memory and peripherals and can be used as an embedded system. The majority of microcontrollers in use today are embedded in other machinery, such as automobiles, telephones, security systems, and peripherals for computer systems. These are called embedded systems. While some embedded systems are very sophisticated, many have minimal requirements for memory and program length, with no operating system, and low software complexity. Typical input and output devices include switches, relays, solenoids, LEDs, small or custom LCD displays, radio frequency devices, and sensors for data such as temperature, humidity, light intensity, etc. Embedded systems usually have no keyboard, screen, disks, printers, or other recognizable I/O devices of a personal computer. [8]

2.4 Components Used

The major or active components used for the design and construction of this project are: video sync separator IC LM1881, AT89C52 microcontroller, a 16 x 2 Liquid Crystal Display (LCD), a 12V transformer, a 5V D. C power regulator, and a rectifier block.

2.4.1 Video Sync Separator IC (LM 1881)

This IC is a video sync separator which attracts timing information including composite and vertical sync, burst/ back porch timing and odd/ even field information from standard negative going sync NTSC, PAL and SECAM video signals with amplitude from 0.5V to 2.0V peak-to-peak. It is also capable of providing sync separation for non-standard, faster horizontal rate video signals. The vertical output is produced on the rising edge of the first serration in the vertical sync period. A default vertical output is produced after a time delay if the rising edge mentioned above does not occur within the externally set delay period, such as might be the case for a non-standard video signal. [9]

2.4.2 Liquid Crystal Display (LCD)

This is an electro-optical amplitude modulator realized as a thin, flat display device made up any number of color or monochrome pixels arrayed in front of a light source or reflector. It is often utilized in battery-powered electronic devices because it uses very small amount of electric power.

Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes, and two polarizing filters, the axes of transmission of which are (in most cases) perpendicular to each other. With no liquid crystal between the polarizing filters, light passing through the filters would be blocked by the second (crossed) polarizer.

The surfaces of the electrodes that are in contact with the liquid crystal material are treated so as to align the liquid crystal molecules in a particular direction. This treatment typically consists of a thin polymer layer that is unidirectional rubbed using, for example, a cloth.

The direction of the liquid crystal alignment is then defined by the direction of rubbing. Electrodes are made of transparent conductor called Indium Tin Oxide (ITO).

An LCD is normally small and low cost. It is easy to interface with a microcontroller because of an embedded controller (the black blob at the back of the board). This controller is standard across many displays, which means that many microcontrollers have libraries that make displaying messages as easy as a single line of code. [10]

2.4.3 Microcontroller (AT89C52)

The AT89C52 is a low-power, high-performance CMOS 8-bit microcontroller with 8KB of in-system programmable flash memory. The device has a high-density nonvolatile memory. It has an on-chip flash which allows the program memory to be hot or cool. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the microcontroller is made powerful to provide a highly-flexible and cost effective solution to many embedded control applications. [8]

The AT89C52 provides the following standard features: 8KB of Flash memory, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/ counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, it is designed with static logic for operation down to zero frequency.

The Idle Mode stops the CPU while allowing the RAM, timer/ counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the AM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset. [9]

It has a total of 32 pins set aside for the four ports (P0, P1, P2, and P3), where each port takes 8 pins. All the ports upon RESET are configured as input, ready to be used as input ports. When the first 0 is written to a port, it becomes an output. To configure it as an input, 1 must be sent to the port; this is done in the program.

Port 0 is an 8-bit open drain bidirectional I/O port. It is made with internal pull-ups and as such well receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.+

Port 1 is an 8-bit bidirectional I/O port with internal pull-ups. When 1s are written to Port 1 pins, they are pulled high by the internal pull-ups and can be used as inputs. P1.0 and P1.1 can be configured to be the timer/ counter 2 external count input (P1.0/ T2) and the timer/ counter 2 trigger input (P1.1 /T2 EX) respectively. Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2 is also an 8-bit bidirectional I/O port with internal pull-ups. When 1s are written to its pins, they are pulled high by the internal pull-ups and can be used as inputs. The port emits the high-order address byte during fetches from external program memory and during accesses to external data memory that uses 16-bit addresses. In this application, the port uses strong internal pull-ups when emitting 1s. During accesses to external data memory that uses 8-bit addresses, Port 2 emits the contents of the P2 Special Function Register (SFR). It also receives the high-order address bits and some control signals during Flash programming and verification.

Port 3 is an 8-bit bidirectional I/O port with internal pull-ups. When 1s are written to its pins, they are pulled up high by the internal pull-ups and can be used as inputs. It also receives some control signals for Flash programming and verification.

- **RST PIN**

RESET pin is an input and is active high (normally low). Upon applying a high pulse to this pin, the microcontroller will reset and terminate all activities. This is often referred to as a power-on reset activating.

- **ALE/ PROG**

Address Latch Enable (ALE) is an output pulse for latching the low byte of the addresses to exter memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation, ALE is emitted at a constant rate of 1/6 the oscillator frequency and may be used for external timing or clocking purpose. If desired, ALE operation can be disabled and the disable will have no effect it the microcontroller is in external execution mode.

- **PSEN**

Program Store Enable (PSEN) is used to read the external program memory. When the AT89C52 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

- **EA/ VPP (External Access Enable)**

External Access (EA) must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. EA is strapped to Vcc for internal program executions.

- **XTAL (1 AND 2)**

XTAL1 is input to the inverting oscillator amplifier as well as to the internal clock operating circuit, while, XTAL2 serves as the output from the inverting oscillator amplifier.

2.4.3.1 MEMORY ORGANISATION

- **Program Memory**

If the EA pin is connected to GND, all program fetches are directed to external memory while its connection to Vcc makes program fetches directed to the internal memory.

- **Watchdog Timer (WDT): (One-time Enabled with Reset-out)**

The WDT is intended as a recovery method in situations where the CPU may be subjected to software upsets. The WDT consists of a 13-bit counter and the Watchdog Timer Reset (WDTRST) SFR. The WDT is defaulted to disable from exiting reset. When the WDT is enabled, it will increment every machine cycle while the oscillator is running. Its timeout period is dependent on the external clock frequency. There is no way to disable the WDT except through reset (either hardware reset ir WDT overflow reset).
In Power-down mode the oscillator stops, which means that the WDT also stops.

- **Oscillator Characteristics**

XTAL1 and XTAL2 are the input and output respectively, of an inverting amplifier that can be configured for use as an on-chip oscillator. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, EXTAL2 is left unconnected while XTAL1 is driven. There are no requirements on the duty cycle of the external clock signal, but minimum and maximum voltage high and low time specification must be observed.

- **Idle Mode**

In idle mode, the CPU puts itself to sleep while all the on-chip peripherals remain active. The mode is invoked by software. The content of the on-chip RAM and all Special Function Registers (SFR) remain unchanged during this mode. The idle mode is terminated by any enabled interrupt or by a hardware reset. However, when idle mode is terminated by hardware reset, the device normally resumes program execution from where it left off, up to two machine cycles before the internal reset algorithm takes control.

- **Power-Down Mode**

In this mode, the oscillator is stopped, and the instruction that invokes Power-down is the last instruction executed. The on-chip RAM and Special Functions Registers retain their values until the Power-down mode is terminated. Exit from Power-down mode can be initiated either by a hardware reset or by an enabled external interrupt. Reset redefines the SFRs but does not change the on-chip RAM. The reset should not be activated before Vcc is restored to its normal operating level and must be held active long enough to allow the oscillator to restart and stabilize.

2.5 Previous Works

As earlier stated, there are numerous video line selector projects from of old. This work is a modification of an existing one.

In the previous model, the device was designed and constructed with the trigger and counter functions processed externally by the counter IC (74HCT221) while the microcontroller used was a two-port PIC16C54. These two ICs are not commonly found and moreover, the PIC16C54 microcontroller has less features and does not give room to expansion on it.

In modification, an AT89C52 microcontroller was used. This is most commonly found in the stores and is a four-port IC which allows for expansion and as well has a larger memory capacity. With this modification, all the counter and trigger functions are processed by the AT89C52 microcontroller without any external counter needed, which makes the circuit a simple one and with less components.

CHAPTER THREE

3.0 Design and Implementation

3.1 Breadboarding

The required components were first tested and assembled on a breadboard in order to test for functionality of the entire circuit. This however, was carried out according to the different modules before being interfaced together.

After certifying the circuit on the breadboard, the same setup was then transferred to the veroboard and soldered.

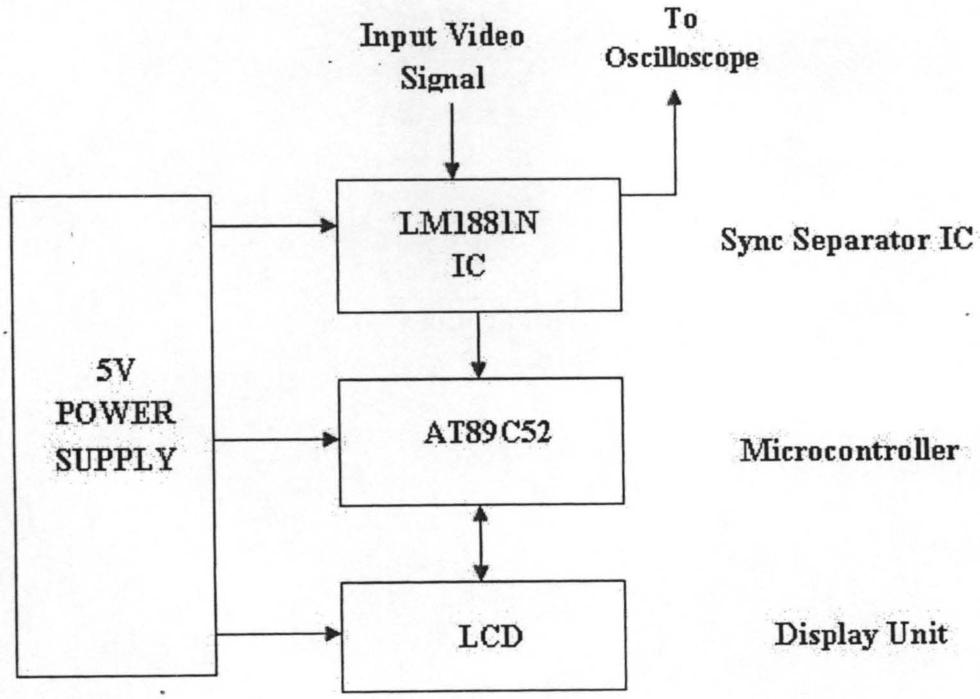

Figure 3.1: Block diagram of the Video Line Selector

3.2.0 Modular Design

The circuit is made up of two modules, namely: the synchronization separator and the processor (interfaced to LCD display, which acts a general control) modules. The steps to designing the circuit were done according the different modules that make up the complete circuit, as shown below.

3.2.1 Synchronization Separator Module

This comprises majorly of the LM1881N Integrated Circuit (IC) and two sockets K1 and K2. They were connected as shown below.

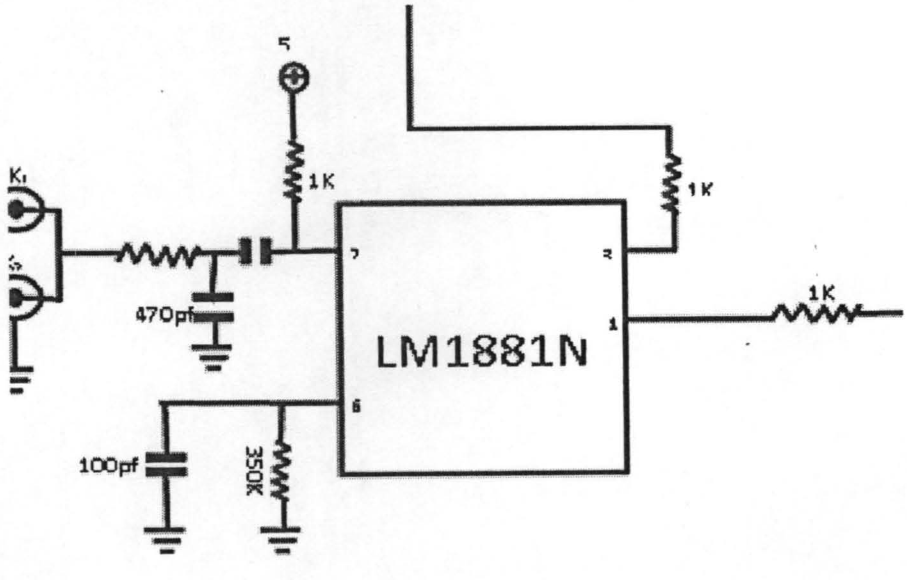

Figure 3.2: The circuit diagram of the Synchronization Separator Module

A 5V power supply (Vcc) is fed into the LM1881 IC via the CVBS (pin 2) with a limiting resistor (R1). The input video signal applied at the socket K1 passes through an RC filter, which comprises of R17 and C2. This filter removes the ambient noise contained in the incoming composite video signal.

3.2.2 Microcontroller and Display Module

The microcontroller and the LCD display interface are shown below in figure 3.3. Connected to the crystal oscillator are two capacitors which are normally of the value 30pF ± 10. In the case of ceramic capacitors, it is of the value 40pF ± 10. The crystal oscillator has the machine cycle of 11. 0592 MHz, while the one connected to the controller is 12 MHz. The machine cycle is therefore given as:

$\frac{11.0592}{12} = 912.6$ KHz .... Equation 3.1

Clock Cycle = $\frac{912.6}{32} = 28.8$ KHz .... Equation 3.2

Where: 32 is a constant, since the microcontroller operates at a clock frequency as low as 32 KHz.

The LCD on the other hand, displays the output parameters. The 10K variable resistor is used to vary the contrast of the LCD. The RS (pin 4) is used to send a reset instruction to the microcontroller, the E (pin 6) is an Enable, used by the LCD to latch information presented to its data bus, while W/R (pin 5) is used by the microcontroller to read from or write to the LCD. An 8-bit data line also exists (pins 7 – 14) to send information or instruction codes to the LCD and to read the content of the LCD's internal register.

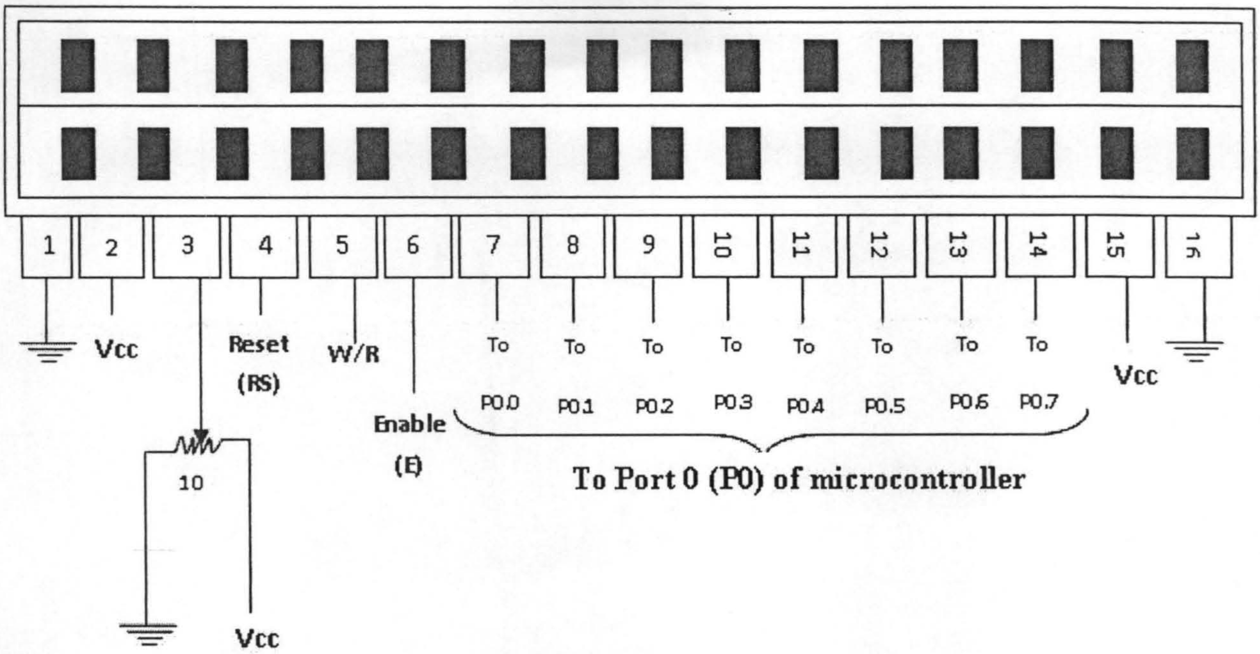

Figure 3.3: LCD pin configuration with microcontroller interface indications

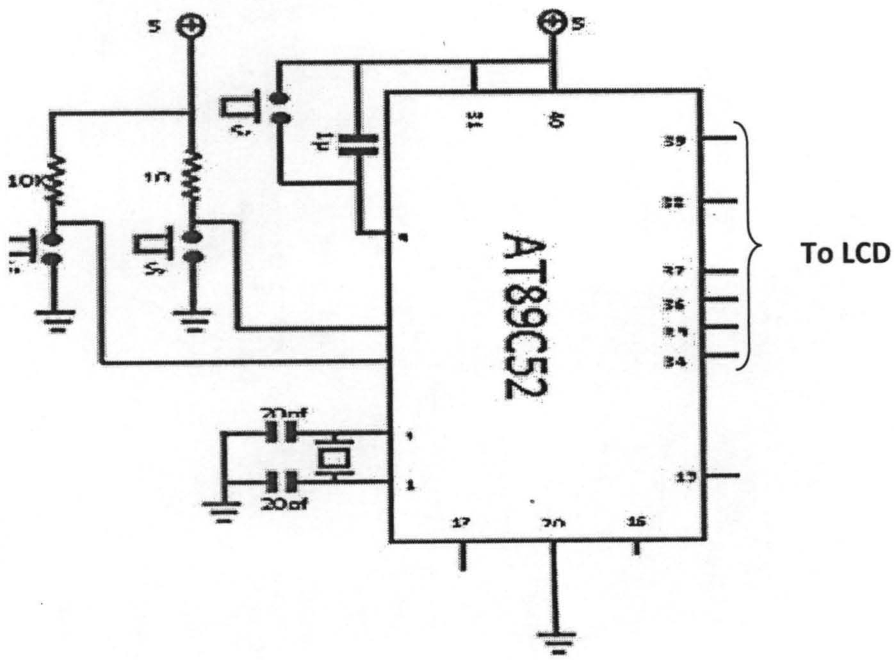

Figure 3.4: basic microcontroller pin configuration with interface indications

3.3 Programming

The program was written in C language. This is a high level language in programming used to write codes or programs that instruct hardware to function in the manner in which the programmer so desires. Each microcontroller has a set of instructions which is called "instruction set"; this is what is used in programming the IC. However, in C language, instructions sets are not used instead, a compiler is used to convert the written codes into hexadecimal file, which is the language understood by a hardware. A device called a burner is then used to load the written software onto the microcontroller.

When the device is switched on, the LCD display is initialized and is made set to perform further functions.

3.4 Power Supply

A regulated 5V DC supply was needed to operate the system. This was realized by using a 12V step-down transformer wired to a full-wave bridge rectifier. The connection was done as shown below:

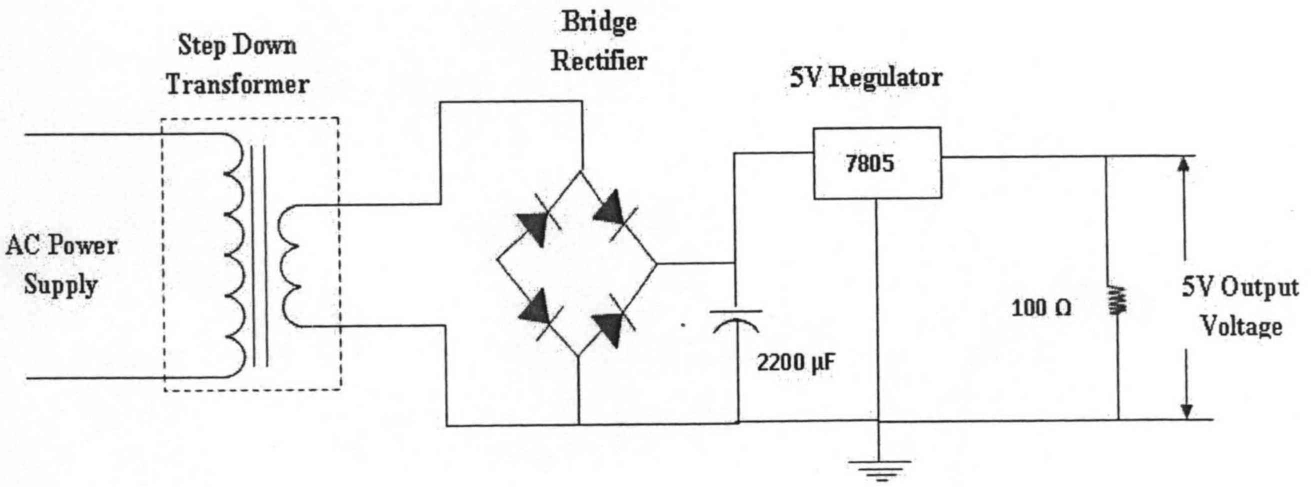

Figure 3.5: Power Supply Unit

The 12V rms ac voltage was connected to a pulsating dc voltage of amplitude:

Vpeak = [(Vrms√2) – 1.4]

Where:

Vrms = seconadary AC Voltage.

√2 = rms – to – peak scaling factor.

1.4 = 2 – diode forward voltage drop

Using the system variables:

Vpeak = 12√2 – 1.4 = 15.571V ≈ 16V

This value of voltage was smoothened by a capacitance evaluated from Q = CT = IT

Where:

C = value of smoothening capacitance

V = maximum value of AC

I = maximum load current

T = ½ (full wave bridge rectifier)

F = IT/ V = I $(\frac{1}{2}$ F)/ V

For the 7805 regulator, the minimum input voltage needed to maintain regulation is 7V. therefore a 2V peak-to-peak AC ripple voltage was fixed.

The maximum system current drain was normally taken as 150mA.

Calculating for C:

C = 0.15 x 1 / (2 x 50) / 2

$= 0.00152/2$

$= 0.000075F$

$= 750\ \mu F$

3.5 The Operation principle of the System

After the device is switched on, the device initializes itself ready to take in the required put composite video signal (CVBS) which is fed to the circuit through the socket K1. To keep the loop-through connection to the oscilloscope as simple as possible, the CVBS signal re-appears on the socket K2. A simple RC filter (R17 and C2) removes the spurious pulses and other noise from the video signal. The filtered signal reaches the CVBS input of C1 on LM1881, via the coupling capacitor C3. The sync separator Integrated Circuit (LM1881) then unravels the composite video signal which is outputted in four forms namely:

1. The composite synchronization signal
2. The vertical synchronization pulses
3. A color burst marker, and
4. An odd/ even field marker

These signals provide all the information necessary to determine the timing of a composite video signal. The TV line monitor only uses the composite and vertical synchronization signals. The position of the color burst is of no consequence to the circuit.

As mentioned earlier, the processor is used for all computing and control functions in the circuit. These functions are:

a. Driving the display in multiplexed mode
b. Scanning the press-keys for activity

c. Counting the picture lines, and

d. Enabling the trigger pulse.

This output is then fed into the microcontroller (AT89C52) for further processing, after which the output is displayed on the LCD.

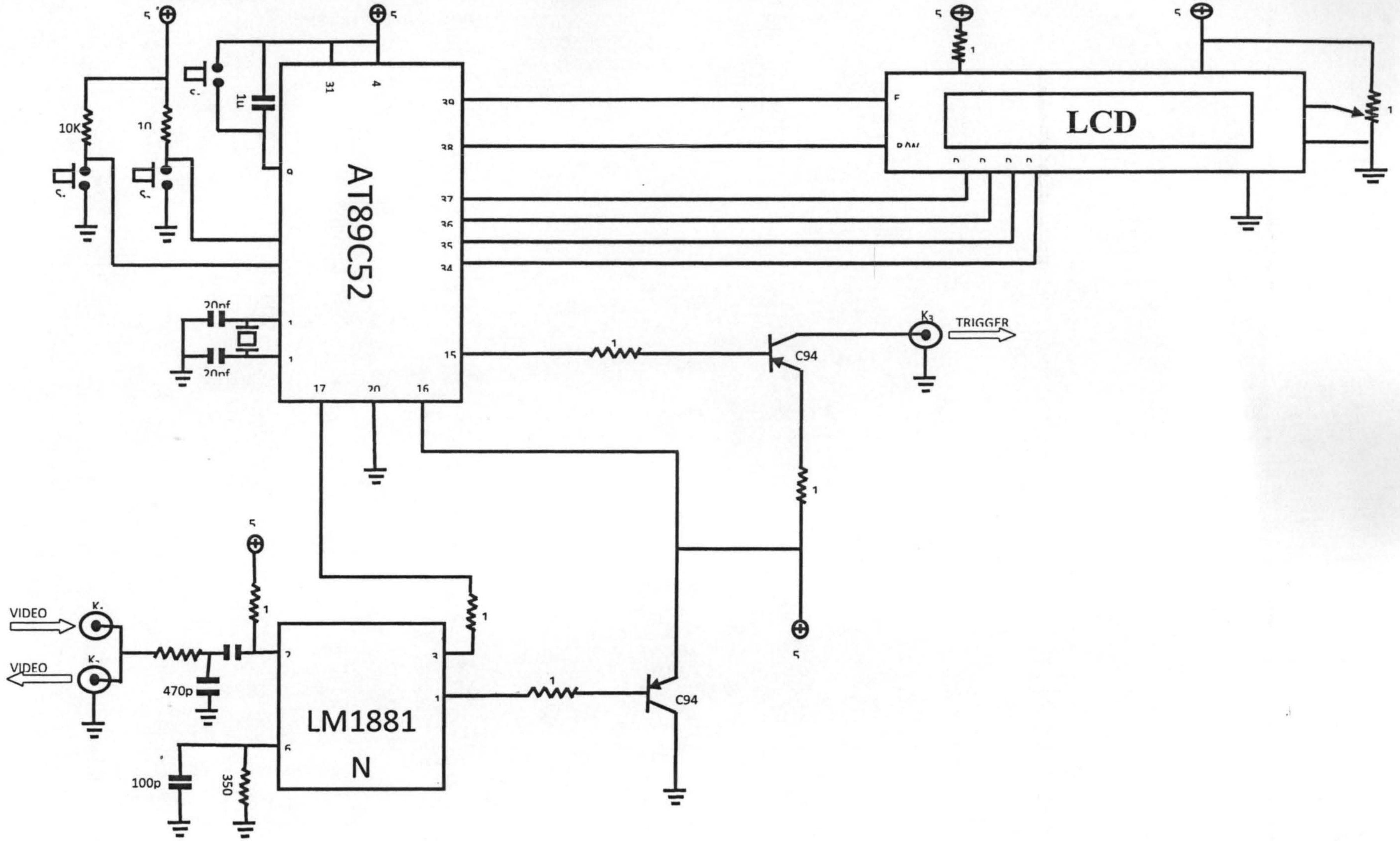

Figure 3.6: the complete circuit diagram of the Video Line Selector

CHAPTER FOUR

4.0 Test and Results

The device was constructed and tested with the following observations and analysis recorded.

4.1 Software

Foreground task processes only user interface. Counting incoming syncs and trigger control are processed by interrupt driven background tasks. AVR has very high performance; it will be able to be implemented some additional functions. Any customized trigger mode or superimposing line marker will be easy to implement with modifying the firmware or expanding some external components.

4.2 Setting up the Device

- Connect the device to the mains.
- Connect a composite video signal (PAL standard) to socket K1.
- Connect the input of the oscilloscope to socket K2.
- Connect the external trigger input of the oscilloscope to socket K3.
- Select external triggering on the oscilloscope, and set for a sensitivity of 0.5V per division, DC coupled.
- Switch on the device and wait for initializing message on the LCD.

4.3 Test Results

The device was set up as indicated above.

The content of the line was visible on the oscilloscope screen. Depending on the time-base setting, successive lines also appeared on the screen. When an unsuitable video signal was applied to the circuit, the LCD display went on and off describing a circle. But when the correct signal was applied, however, and the circuit was fully functional, and a line number was randomly selected by quickly by processing the "+" and "-" keys and watching the LCD display.

The TV line selector is controlled by the two press keys UP and Down ("+" and "-" respectively). The picture line number selected in this appeared on the LCD display. Any time a key is pressed, the line number is increased (+) or decreased (-) by one. And when the press-key is kept pressed, the line went step up or down automatically at a rate of two per second. When it was kept longer than 4 seconds, the auto-step speed went up 25 lines per second.

The other field was selected by pressing both keys at the same time. With a suitable video signal not present at the input, the circuit showed a moving bar on the LCD display.

Finally, the device is capable of recognizing both fields in a picture only if the input signal meets the PAL standard as regards interlacing.

Testing the device with an oscilloscope connected gave the wave form shown below:

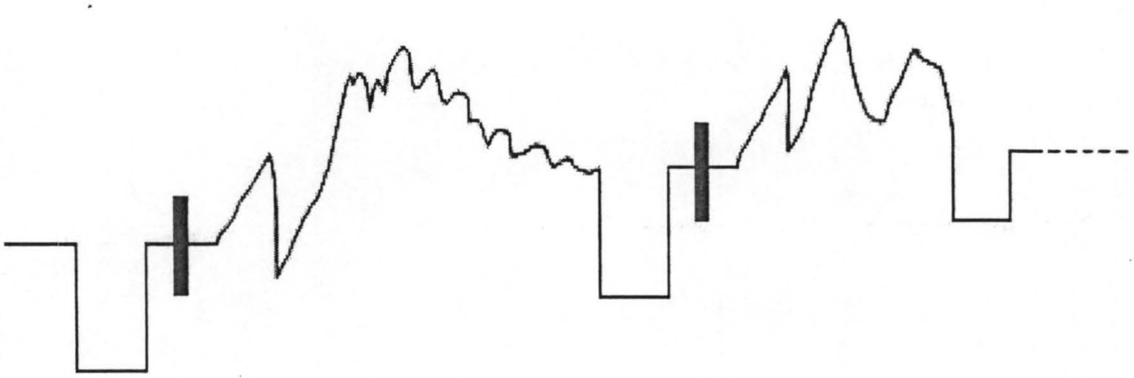

Figure 4.1 Output Video Si signal on LCD with video line connected

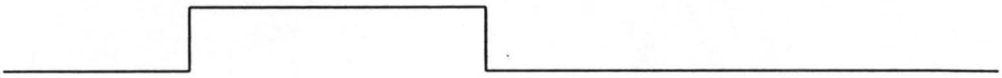

Figure 4.2 Trigger signal on LCD

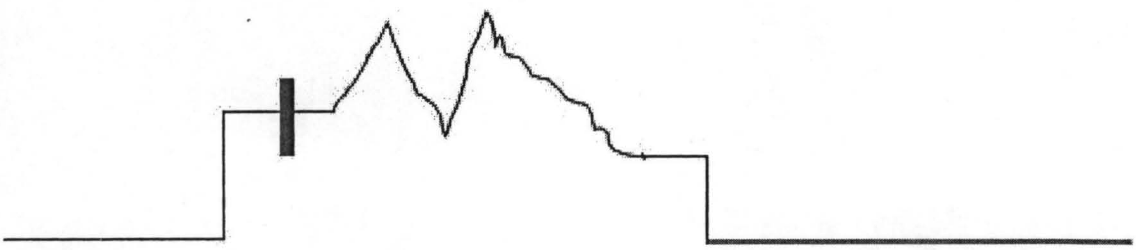

Figure 4.3 Output wave form on oscilloscope with input video signal applied

CHAPTER FIVE

5.0 Conclusion and Recommendations

5.1 Conclusion

Based on the results obtained, it can be concluded that the video line selector actually senses, reads and selects an incoming video signal that is applied at the input. This implies that the aims and objectives of the project. And since it was tested with a DVD machine and the required result was obtained, this means that the device is actually useful for personal, laboratory and industrial use. Furthermore, it is inexpensive since the components are inexpensive, not many (only three major components), and readily available stores within the country.

5.2 Recommendations

In order to make improvement on this project or device, the following are recommended:

1. This device only takes one connected device at a time; for further development therefore, it should be made to take more than one video signal device at the same time.
2. The video line selector could be made to work as a wireless device, i.e. it should not require any physical interface between the device and the equipment transmitting the video signal
3. The Electrical and Electronics Engineering Department of this great institution should make hardware programming courses taught to students during the early stage of their study and should be continuous so that the stress we went through to achieve a workable code for the project will not be experienced by any other person.

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APPENDIX

```
#include<reg51.h>

#include<stdio.h>

#include<intrins.h>

#define lcd_port P0

#define size 8

#define scale 12.333333

//******************

sbit inc=P2^0;

sbit dec=P2^1;

sbit enq=P2^2;

sbit rs=P2^6;

sbit out =P3^7;

sbit en= P2^5;

sbit triger=P1^1;

sbit signal=P3^2;

sbit reset=P1^2;
```

```
//sbit inter=P3^0;

//unsigned int count=0;

unsigned int preset=0;

unsigned int max=626;

unsigned int min=0;

unsigned int defalt=0;

//****************

void delay(unsigned int k)

{

unsigned int x,y;

for(x=0;x<k;x++){

for(y=0;y<1000;y++);

                    }

}


void write(unsigned char c,unsigned char reg_select)

{
```

```
en=0;

//rw=0;

rs=reg_select;

lcd_port=c;

en=1;

en=0;

}

void lcd_data(unsigned char c)

{

        write(c,1);

        delay(1);

}

//****************

//****************

void lcd_cmd(unsigned char c)

{

        write(c,0);
```

```
        delay(1);
}
//***************
void clear_lcd(void)
{
        lcd_cmd(0x01);
}
//****************
void lcd_pos(unsigned char row, unsigned char pos)
{
        if(row==1)lcd_cmd(0x80+pos);
        if(row==2)lcd_cmd(0xc0+pos);
}
//*****************
void lcd_string(unsigned char code *p
){
        while(*p)lcd_data(*p++);
```

```
}

//*****************

void lcd(unsigned char data *ptr)

{

        while(*ptr)lcd_data(*ptr++);

}

//*****************

void init_lcd(void)

{

        lcd_cmd(0x38);

        delay(1);

        lcd_cmd(0x38);

        delay(1);

        lcd_cmd(0x38);

        delay(1);

        lcd_cmd(0x0c);

        delay(1);
```

```
        lcd_cmd(0x01);

        delay(1);

        lcd_cmd(0x06);

        delay(1);

}

//*****************

void interup()

{

 IT0=1;

 EX0=1;

 EA=1;

 //if(!inter

}

void es0_isr(void)interrupt 0

{

        if(!triger){TR0=1;}

}
```

```
unsigned int update_count(void)

{

static   unsigned int count=0;

//unsigned int value;



if(!inc)

{

  if(count<626)count++;}

{

 if(!dec)

{

   if(count>1)count--;}

}

return (count);}



//******************
```

```
void show_count(void)

{

        unsigned char data lcd_buffer[10];

   unsigned int value;

        unsigned int preset;

        static unsigned int last_count=0xffff;



        value=update_count();

        if((!signal)&&(preset<value)){preset=min++;last_count=0xffff;}

        if((!signal)&&(preset==value)){last_count=0;triger=0;out=1;delay(400);triger=1;out=0;}

        if(last_count!=value)

        {

                clear_lcd();

                lcd_pos(1,0);

                lcd_string("SIGNAL=:");

                sprintf(lcd_buffer,"%u",preset);

                lcd(lcd_buffer);
```

```
            lcd_pos(2,0);

            lcd_string("PRESET =:");

            sprintf(lcd_buffer,"%u",value);

            lcd(lcd_buffer);

            delay(100);

            last_count=value;

        }

}

void triga(void)

{

unsigned int value;

 if(preset>=value)

 {

 triger=1;

 delay(500);

 triger=!triger;

 }
```

```
}

//***************

void show_logo(void)

{

        clear_lcd();

        lcd_pos(1,0);

        lcd_string("MICROCONTROLLER");

        lcd_pos(2,0);

        lcd_string("    BASED     ");

        delay(600);

        clear_lcd();

        lcd_pos(1,0);

        lcd_string(" VIDEO  LINE  ");

        lcd_pos(2,0);

        lcd_string("  SELECTOR BY ");

        delay(600);

        clear_lcd();
```

```
lcd_pos(1,0);

lcd_string(" ABUBAKAR YAHAYA");

lcd_pos(2,0);

lcd_string("  2006/24434EE");

delay(600);

clear_lcd();

lcd_pos(1,0);

lcd_string("YUSUF ISYAKU ");

lcd_pos(2,0);

lcd_string("2006/24435EE");

delay(600);              clear_lcd();

lcd_pos(1,0);

lcd_string(" SUNDAY AGABI ");

lcd_pos(2,0);

lcd_string("2006/24438EE");

delay(600);

clear_lcd();
```

```
        lcd_pos(1,0);

        lcd_string("  SYSTEM READY ");

        lcd_pos(2,0);

        lcd_string("***NO SIGNAL***");

        delay(600);

}

//*****************

void sys_init(void)

{

        interup();

        init_lcd();

        //show_logo();

}

//***************

void show_ready(void)

{
```

```
lcd_pos(1,0);

lcd_string(" MAX COUNT=626");

delay(300);

}

//****************

void main(void)

{

        sys_init();

                show_ready();

        while(1)

        {

                show_count();

                triga();

                //      es0_isr();

        }

}
```