# *CAREER EPISODE 2 – DIGITAL TELEVISION*

***SUBMITTED TO:***
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'All statements of fact in this report are true and correct and I have made claims of acquired competencies in good faith.

The report is all my own work and is a true representation of my personal competence in written English. I confirm that I understand that members of the engineering team in Australia are required to display a commitment to exercising professional and ethical responsibility in all aspects of their work.

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# CAREER EPISODE 2

# DIGITAL TELEVISION

## CE 2. 1 INTRODUCTION

This episode has been prepared specially for submission to Engineers Australia for CDR assessment. This narrative is being submitted for Stage 1 Competency demonstration for Professional Engineer. Details herewith declared have been extracted from the report submitted and is in no way a full reproduction of all the details of the project. Please use care and caution before trying to make use of this paper for other purposes other than CDR assessment. More details of the same can be obtained on request. Following sections will provide the necessary extracts.

### CE 2.1.1 PROJECT DURATION

The project started in June 1994 and was completed by July 1994. This was part of my seminar workshop that is a pre requisite for completing my Degree.

### CE 2.1.2 PROJECT LOCATION

The project was carried out in College campus. The campus is located in Aiwan-E Shahi area, Gulbarga, Karnataka state, India.

### CE 2.1.3 NAME OF ORGANISATION

I was an Engineering student at Poojya Dodappa Appa (P.D.A) college of Engineering, which is an autonomous college, funded by Central Government. It is located in Gulbarga city, Karnataka state, India

### CE 2.1.4 MY ROLE

I played the role of organizer, preparation and delivery of the workshop for a class of about 80 members. I reported to Head of Department, who was also our guide for this workshop.

## CE 2.2 BACKGROUND

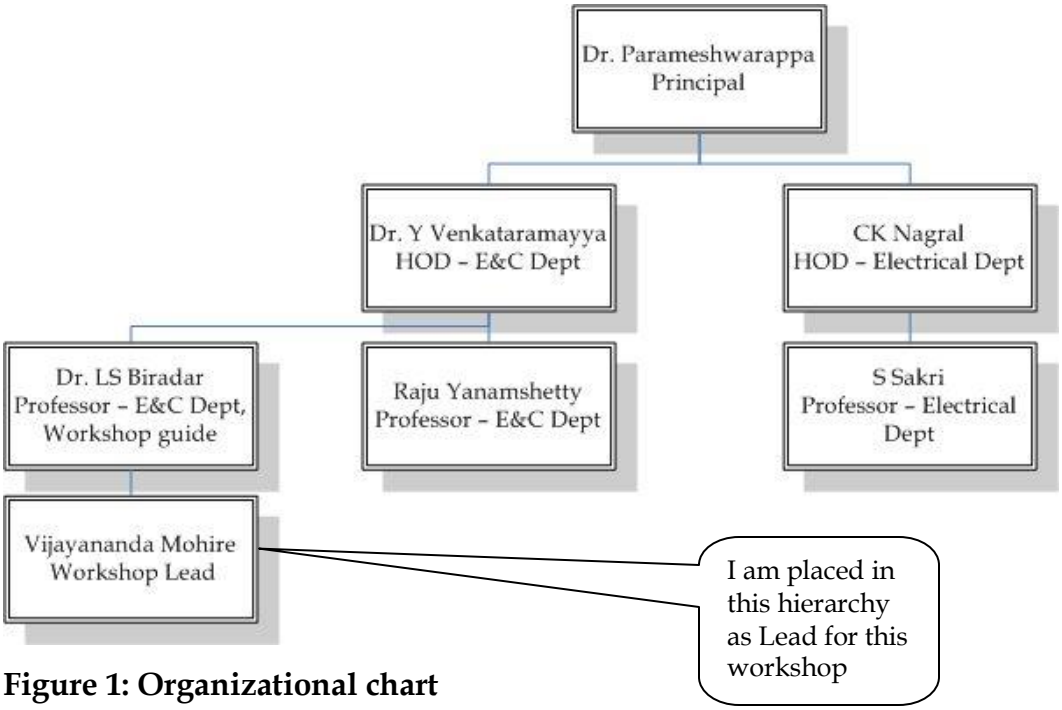


**Figure 1: Organizational chart**

### CE 2.2.1 AIMS & OBJECTIVES OF THE PROJECT

- To demonstrate the shortfalls of conventional Analog Television (TV)
- To provide an introduction to Digital TV
- Technologies used in Digital TV
- Feature analysis and their benefits
- Demonstrate working samples
- Digital TV and Satellite communication

### CE 2.2.2 METHODOLOGY

- Analysis of the Analog TV and identify the limitations
- Study references documents, IEEE transactions, library books related to Digital TV
- Define the approach to demonstrate the features of Digital TV based on Hardware and Software used.
- Develop the content for presentation – here it includes Digital filter algorithms, digital memory to store frames, digital filtering , optimization techniques and many more features
- Demonstrate the features and benefits to guide and external reviewer
- Conduct workshop with sample outputs from Digital TV

- ❖ Obtain the necessary credentials for successful completion of the workshop
- ❖ Handover the workshop documentation and workshop assets to department

## CE 2.3 PERSONAL ENGINEERING ACTIVITIES

### CE 2.3.1 ANALYSIS OF ANALOG TV

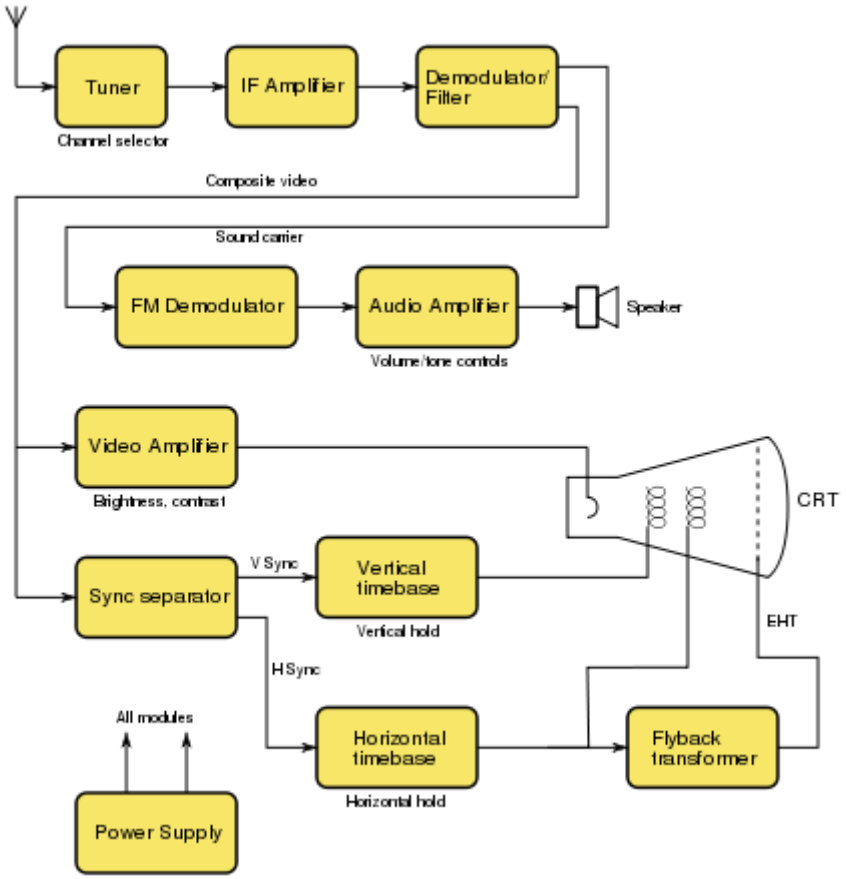


**Figure 2: Analog TV**

The existing analog TV based on NTSC/PAL standards is a sophisticated system and uses complex processing and high voltages to transmit mono chorme and color signals without making use of wide bandwidth.
However it has few inbuilt limitations as below:

Limitations I was able to demonstrate in an Analog TV:

1. Cross Luminance and Cross-color interferences (Y/C signal): These are caused due to non accurate isolation of luminance and chrominance. This results in cross- talk or overlap of signal dots.

2. Line flickering and coarse scanning lines: These are caused due to interlace scanning. Line flickering is most prominent at the edges where the image changes its brightness in the vertical direction. Coarse scanning is due to reduced scanning rate and is more prominent in motion pictures where scanning rate is low of the order of 262.5 lines a field

These issues are addressed in the Digital TV using below features:

| Digital TV feature | Improvements |
|---|---|
| Motion adaptive Y/C separation | Eliminates Cross luminance and cross color interferences |
| High S/N ratio | Improves signal strength |
| Motion adaptive scanning line interpolation | Eliminates line flicker and coarse scanning |
| Two color contour compensation | Enhancement of picture |

**Table 1: Digital TV features**

Apart from the above Digital TV has made advances like replacing the materials, Carbon (potentiometers, resistors), Copper (Wires, Delay lines), Glass (condensers), Ceramic (Condenser) by Silicon.

## CE 2.3.2 ANALYSE BUIDLING BLOCKS OF DIGITAL TV

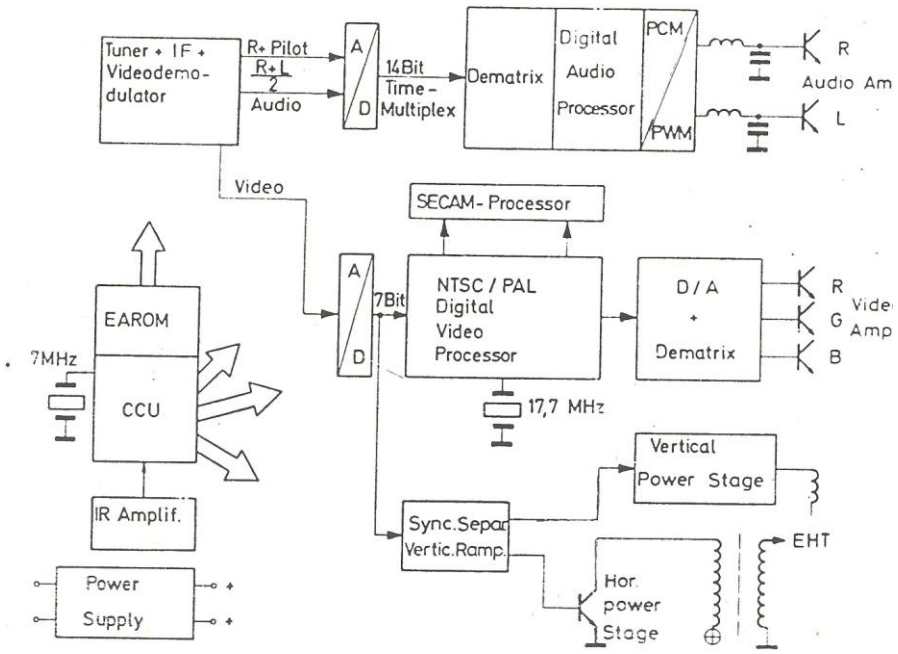


**Figure 3: Block diagram – Digital TV**

#### CE 2.3.2.1 ANALYSE AUDIO PROCESSING MODULE

With reference to Figure 2, Center piece is the Digital Audio processor unit (APU) is a fast 16*8 multiplier uses single clock for all signals and uses a variety of filters whose coefficients can be changed to get best results. The APU receives input signals from Audio Codec Unit (ACU - Dematrix) which is an Analog to Digital Converter (A/D) of flash type.

#### CE 2.3.2.2 ANALYSE VIDEO PROCESSING MODULE

At the core of video processing is the Digital Image processor (DIP). This uses 1H, 2H, 3H or 264H NTSC Comb filter which separates Y/C signals in a better way.

Interlace scanning is replaced by Progressive scanning based on a Sampling criteria.

#### CE 2.3.2.3 ANALYSE CENTRAL MICROCONTROLLER MODULE

This coordinates all the activities of the above mentioned processors and called as Central Micro Control unit (CCU). It also controls the tuning stage and also remote control basic commands.

#### CE 2.3.2.4 ANALYSE SYNCH AND DEFLECTION MODULE

This uses a count down algorithms for generating horizontal and vertical frequencies. It obtains a lock on the received signals and makes it immune to excessive noise and flutter.

Combined by a chain of delay gates and comparators digital control over this is possible.

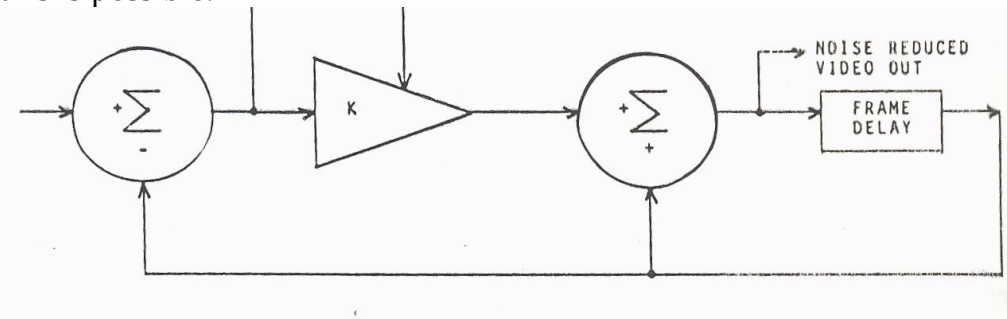


**Figure 4: Block diagram – Noise reduction using filters**

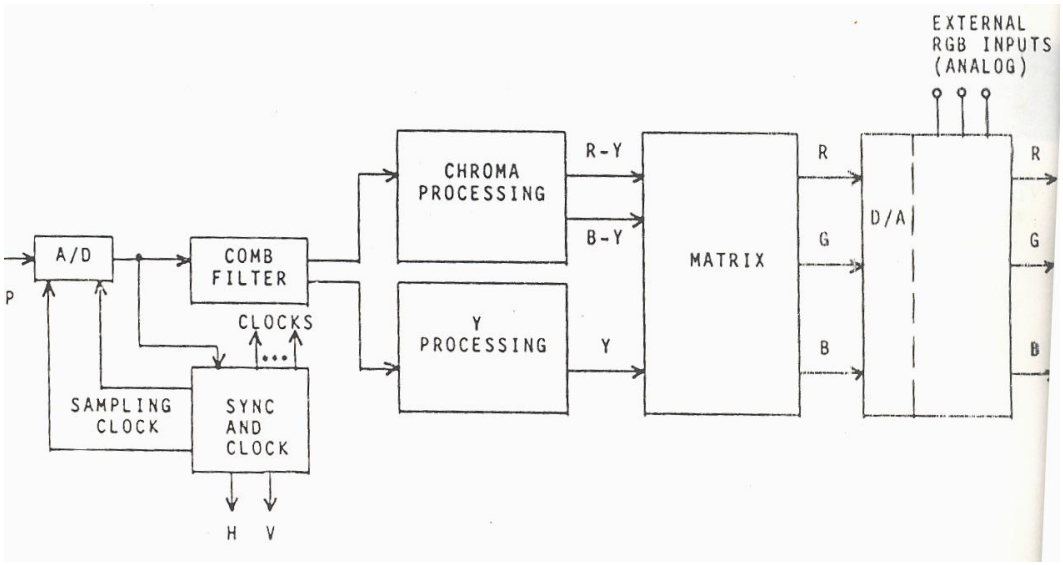


**Figure 5: Digital video processing**

**CE 2.3.2.5 IDENTIFY KEY BENEFIT OF DIGITAL TV**

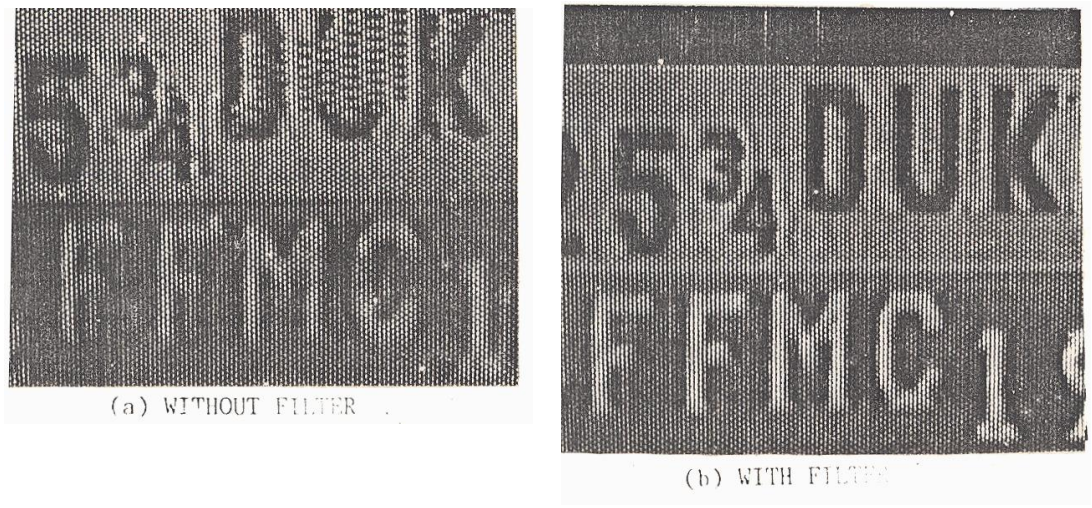


**Figure 6: Comparison of Output from Analog and Digital TV**

As shown above the key benefit is reduced interferences and noise**.** Left side figure shows without Digital filter and right side is with Digital filter.

**CE 2.3.4 MY TECHNIQUES AND STRATEGIES**

1. Technical contribution: I had to study IEEE guides, analyze the current trends in differences and limitations in analog TV and Digital versions. I had to go through a dozen books from library

and get the technical details of the high level modules used in the Digital TV. We had studied Analog TV components during our final year of the course.

2. Group involvement: Being responsible for overall success of the project as I was the only person preparing the workshop I had to interact with senior members and faculties who had specialization in this area and get the guidance and confirming the correctness of the data I had presented in the report.

3. Challenges faced: I had limited time and since I had to prepare for attending my final year exams it was very much distracting. However I put in extra efforts and treated this as another subject so I could make progress. Also understanding new Digital techniques and Digital signal processing capabilities and applying these to what I studied like Fourier transforms (FFT), Signal processing in terms of electromagnetic theory and complex modulation/demodulation techniques (Phase modulation), Adaptive filters etc. was challenging.

4. Reporting to Guide: I did get expert guidance from our college staff especially the lab staff that helped me identify the physical components of the Analog and Digital TV so that I could explain the same in the workshop.

5. Presentation in report format: I had to personally bring up the text, and images. I had to use Word processors and Engineering drawing materials to come up with good images

6. Conducting the Workshop: I had to practice internally. I had to learn ways of presentation in limited time period. I learnt the way to reduce complexity and explain the details in a simple and clear format.

## CE 2.4 SUMMARY

My responsibility of design and conducting workshop on the Digital TV was completed successfully. This provided me the confidence to face the real world and provide suitable design and solution to real world problems using Electronics**.**