影像處理系統之硬體與軟體

壹、硬體組成概述

貳、軟體概述

參、影像處理在農業上之應用

VFG Frame Grabber基本架構

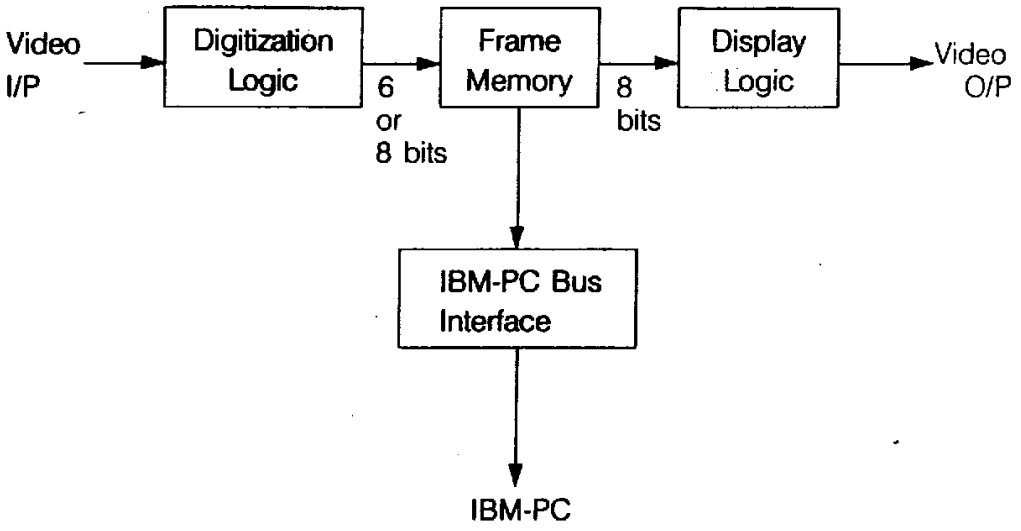


Fig. 2.1 VFG Frame Grabber Block Diagram

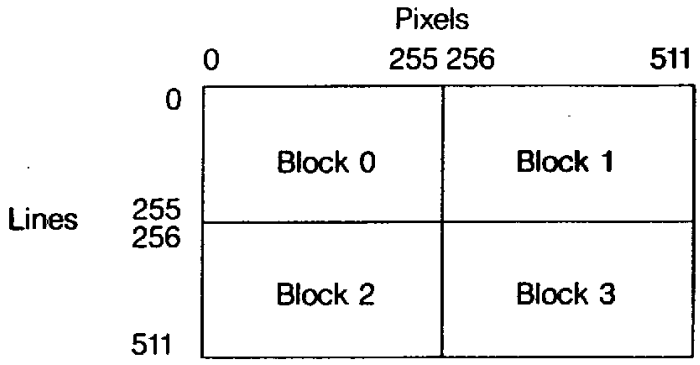


Fig. 2.2 VFG-512 Memory Block Partition

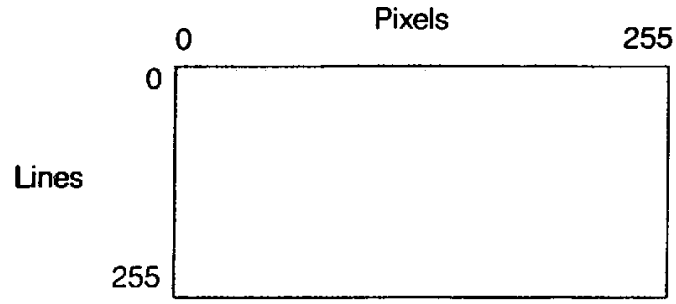


Fig. 2.3 VFG-256 Memory Block Partition

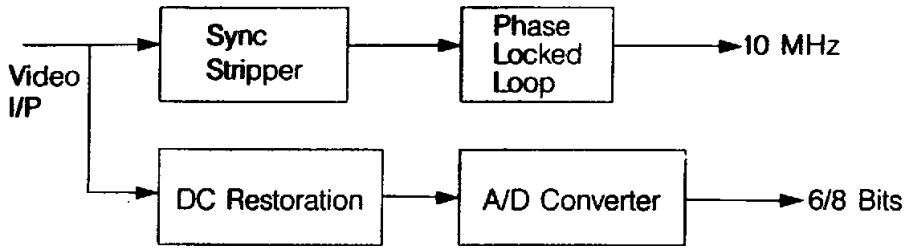


Fig. 2.4 Digitization Logic Block Diagram

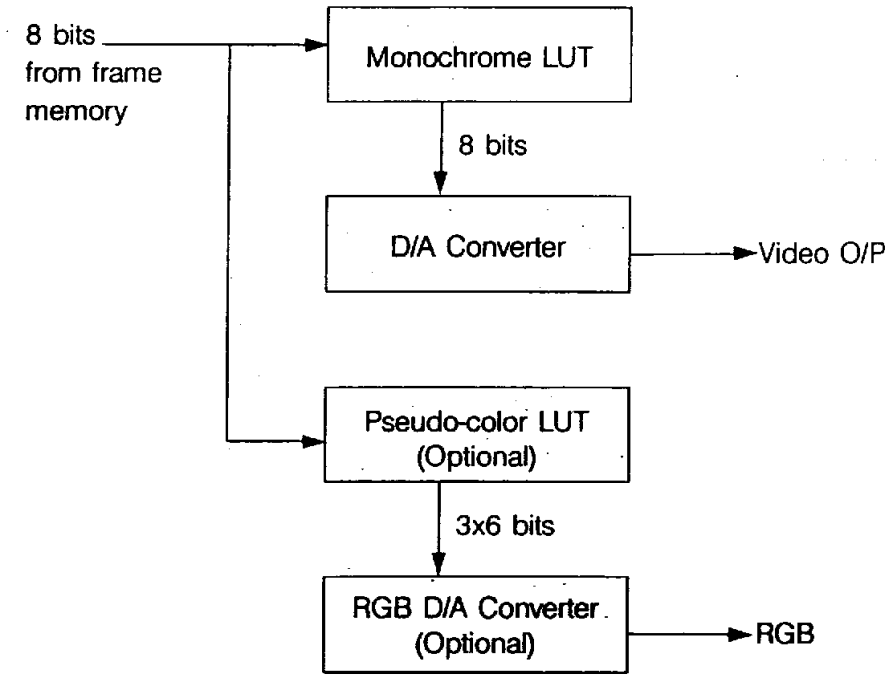
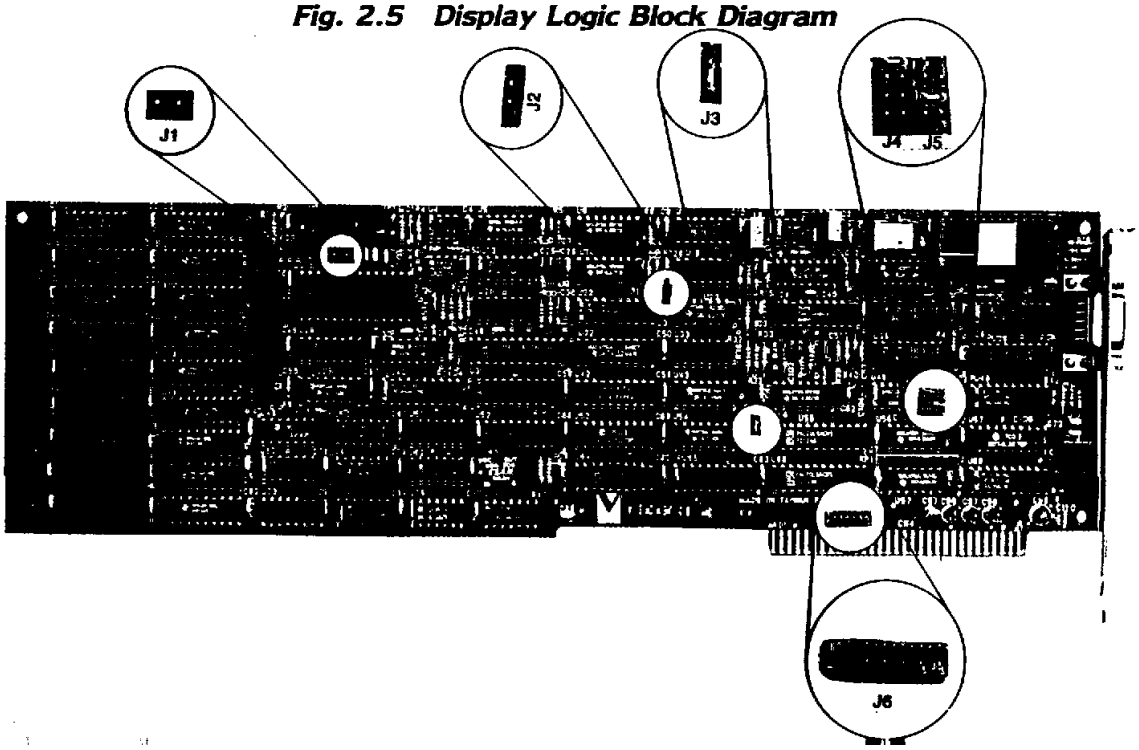
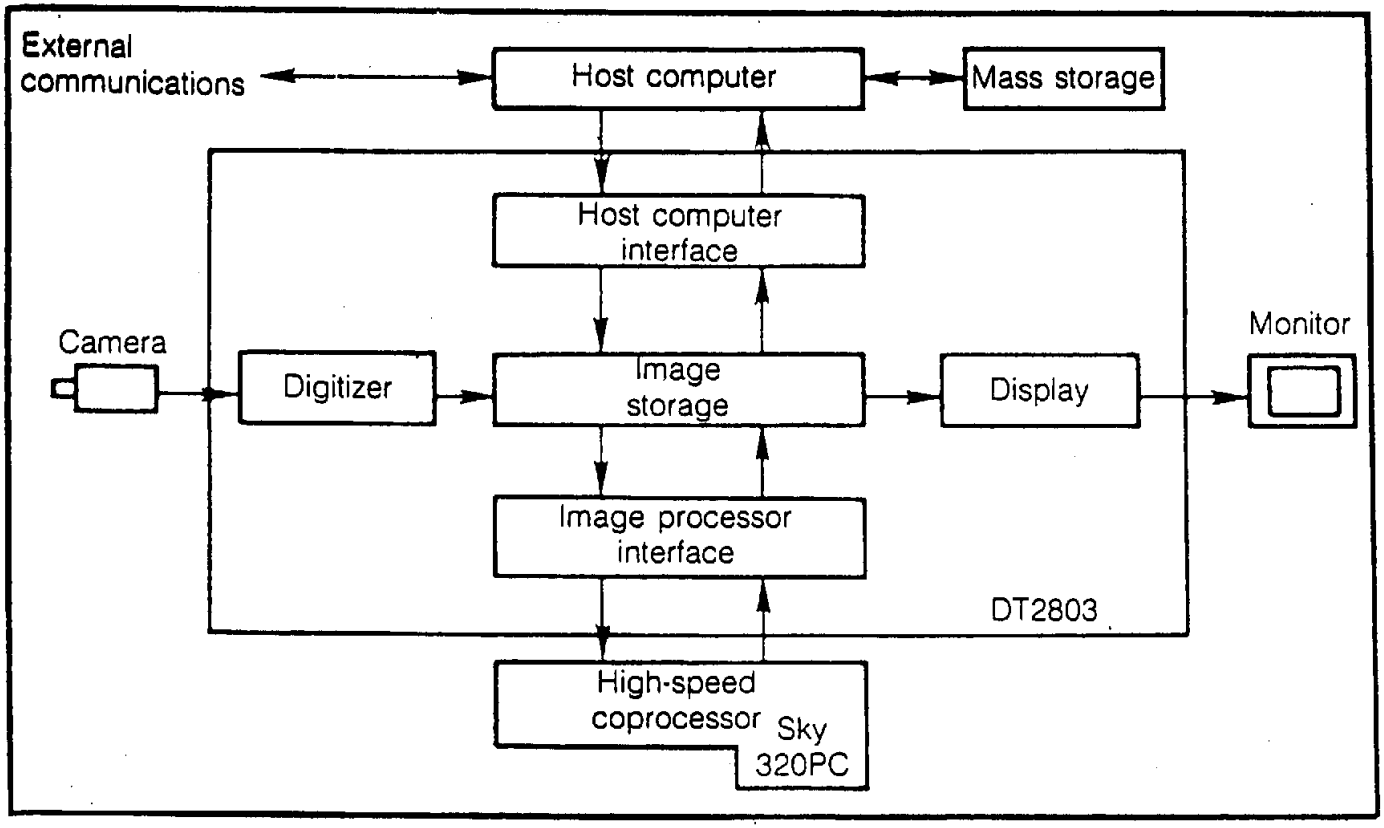
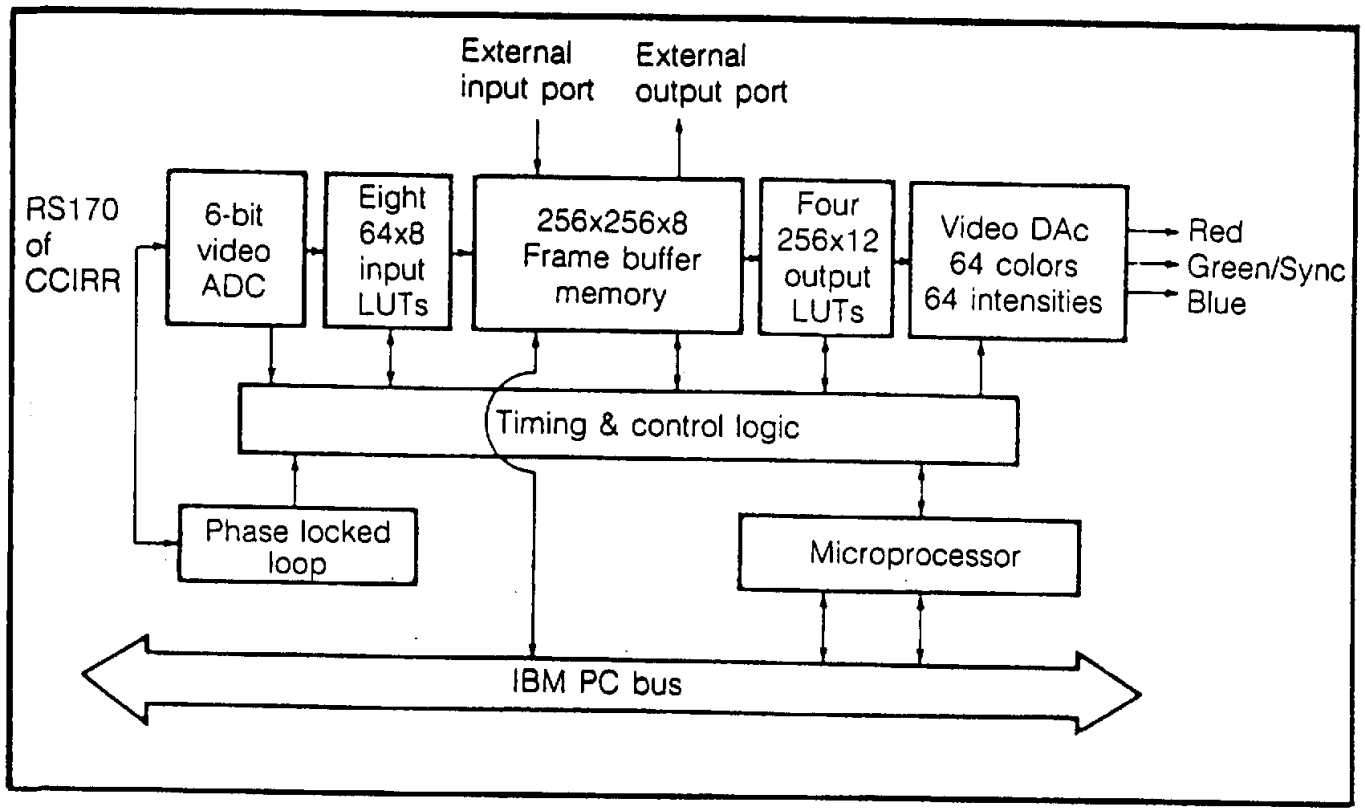


Fig. 2.5 Display Logic Block Diagram

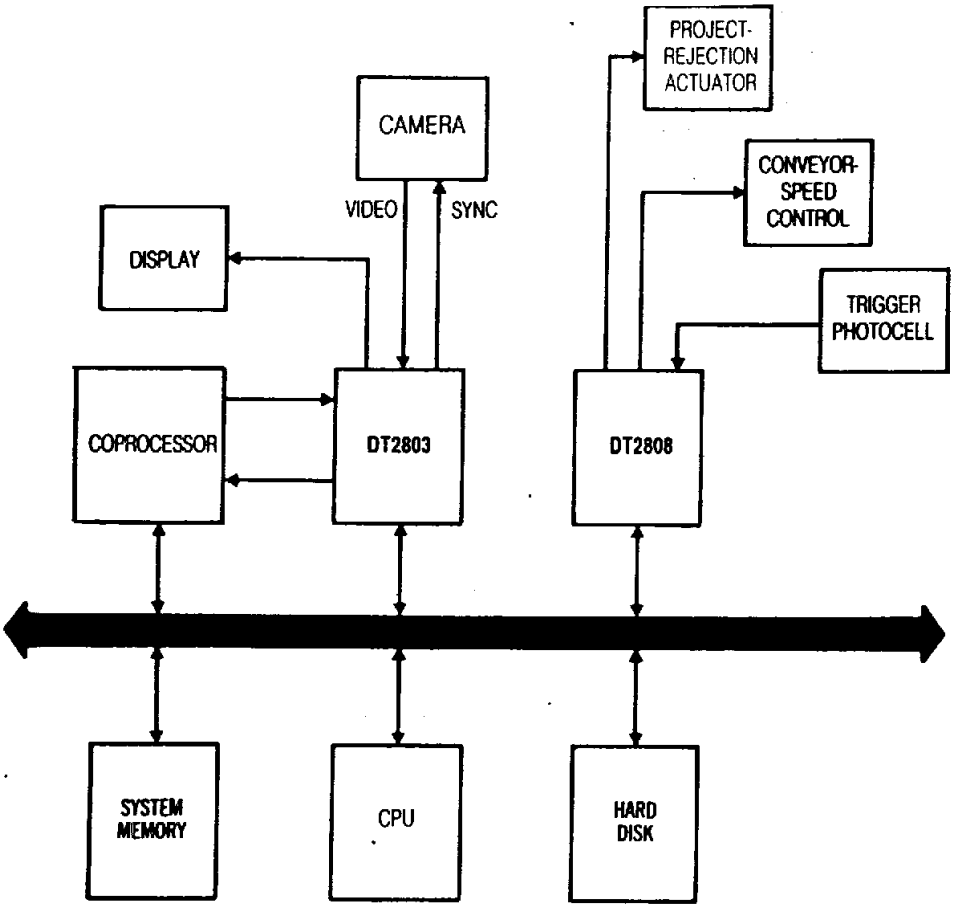




Basic image processing system with a host computer, video I/O board and high-speed coprocessor.



Schematic diagram of the DT2803.


PROJECT-
REJECTION
ACTUATOR
CAMERA
CONVEYOR-
SPEED
CONTROL
VIDEO
SYNC
DISPLAY
TRIGGER
PHOTOCELL
COPROCESSOR
DT2803
DT2808
SYSTEM
MEMORY
CPU
HARD
DISK

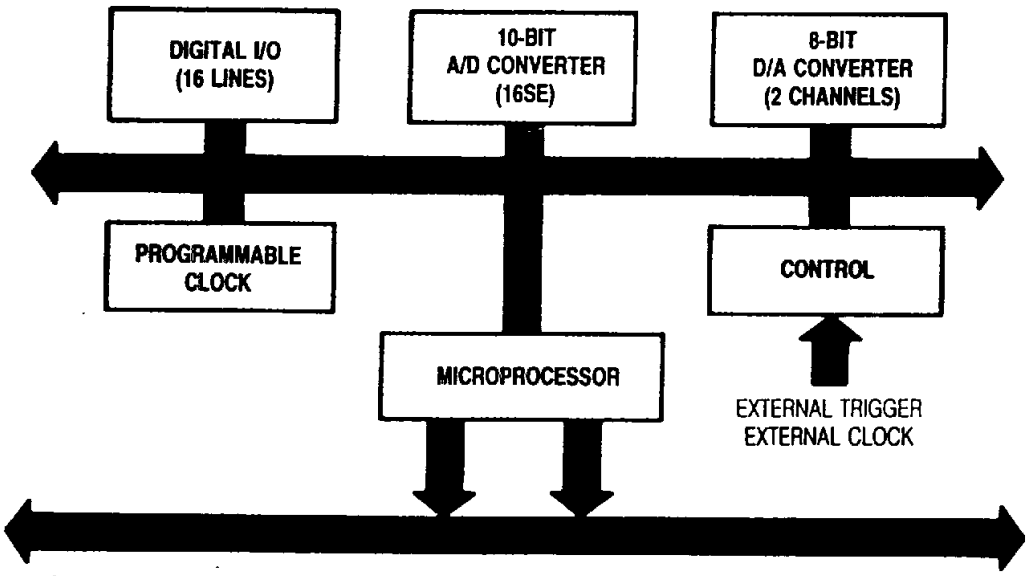


Fig. 2. Analog and digital I/O boards like the DT2808 from Data Translation let personal-computer-based inspection systems monitor and control the processing and testing procedure.

MVP-AT SPECIFICATIONS

MVP-AT PROCESSING SPEEDS	
Feature	*Speed*
Statistical Analysis	3.5 frame times
Frame Averaging	Real-time + 1 frame time
Inter-Image Ops	1 frame time
Convolutions	
3 x 3	10 frame times
5 x 5	26 frame times
7 x 7	50 frame times
Erosion/Dilation	10 frame times
Connectivity Analysis & Line Thinning	10 frame times
Graphics Operations	
Character Draw	2500/sec (8 x 8 cell)
Vector Draw	20,000/sec (1cm)
Raster Copy	1.25 million bytes/sec

VIDEO STANDARDS SUPPORTED

Input RS-170 RS-330 CCIR NTSC RGB

DISPLAY INTERFACE

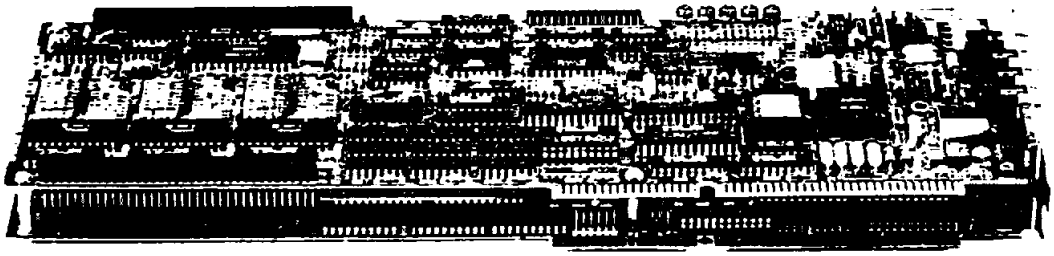
Resolution	512 x 512 or 640 x 480
Lookup Tables	12-bits in/8-bits out, RGB
Zoom	1X, 2X, 4X, 8X (output only)
Refresh Rate	50/60Hz interlaced or non-interlaced

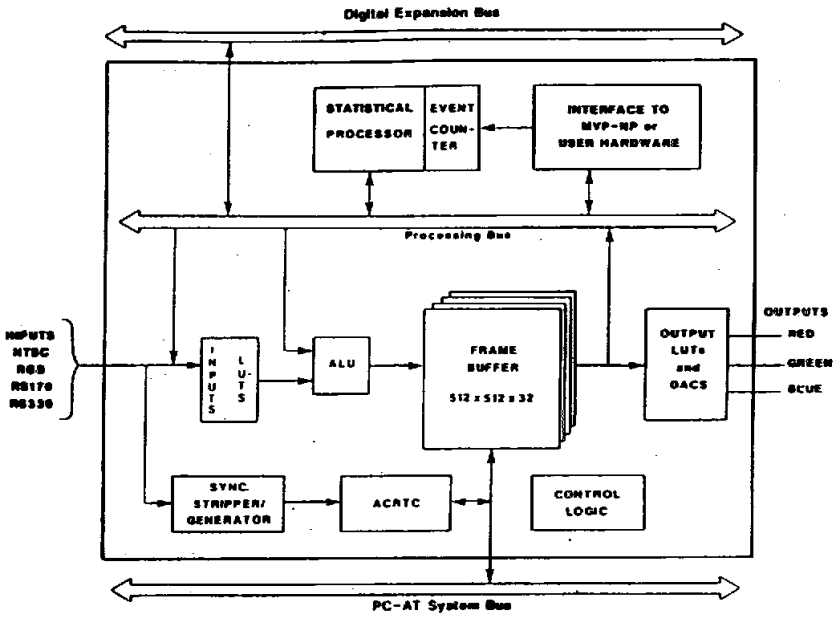
FRAME BUFFER

Resolution	4 x 512 x 512 x 8 or 2 x 512 x 512 x 16 or 1 x 512 x 512 x 32 or 2 x 1024 x 512 x 8 or 1 x 1024 x 512 x 16 1 x 1024 x 1024 x 8
Masks	Read and Write Plane Masks
Access	Memory-mapped 64K window

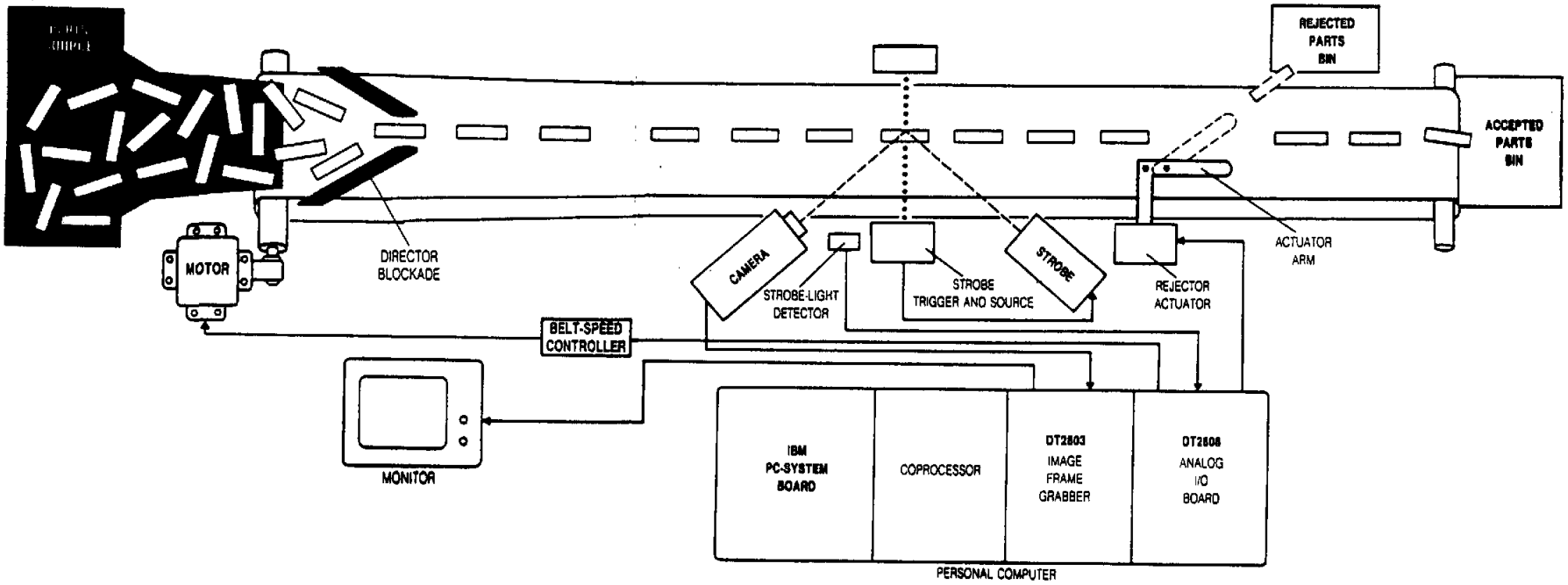
ORDERING INFORMATION

MVP-AT	Two-board imaging set (American
IMAGER-AT	Software Support Package for MVP-AT





MVP-AT BLOCK DIAGRAM



Special video add-on hardware teams with the personal computer to make feasible low-cost automatic inspection systems for simple tasks such as checking pen-barrel quality. The system enables a frame grabber to acquire the pen-barrel image and application software to perform either a high-speed acceptance test or a slower quality-control test.

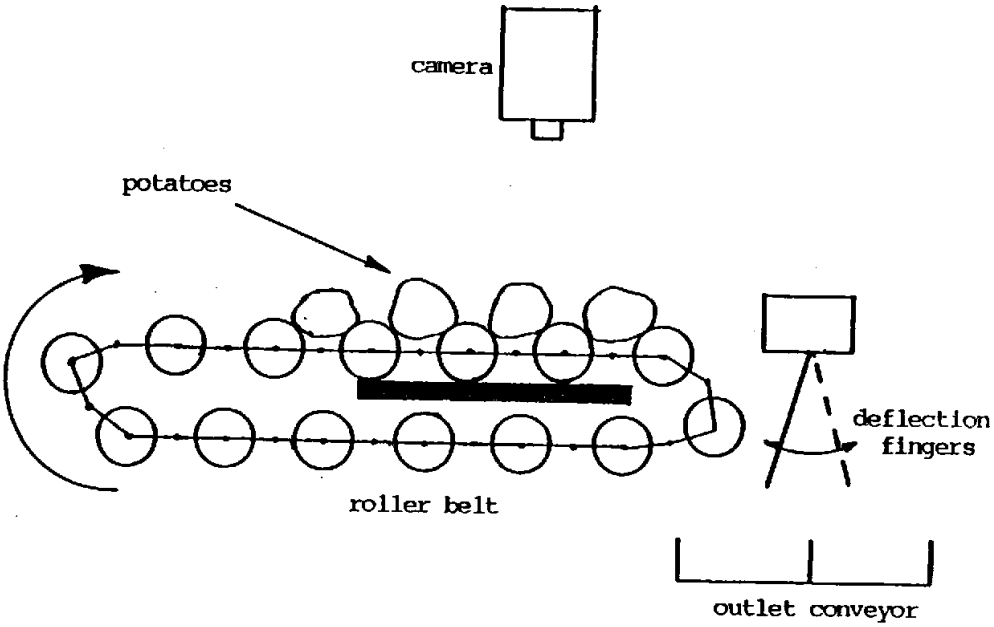


Figure 1. Simplified diagram of grader mechanics, side view.

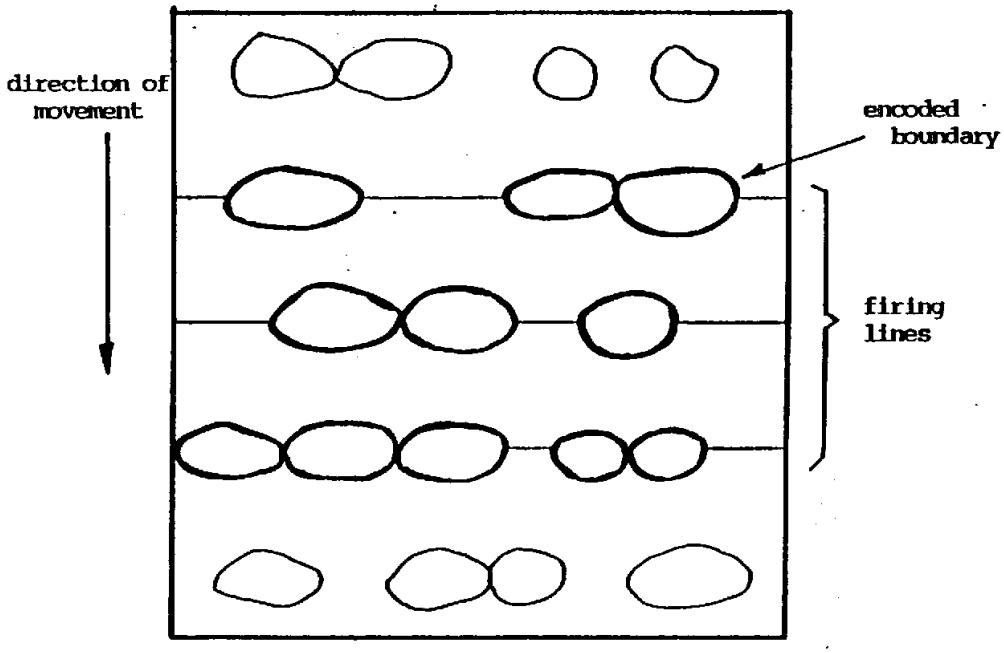
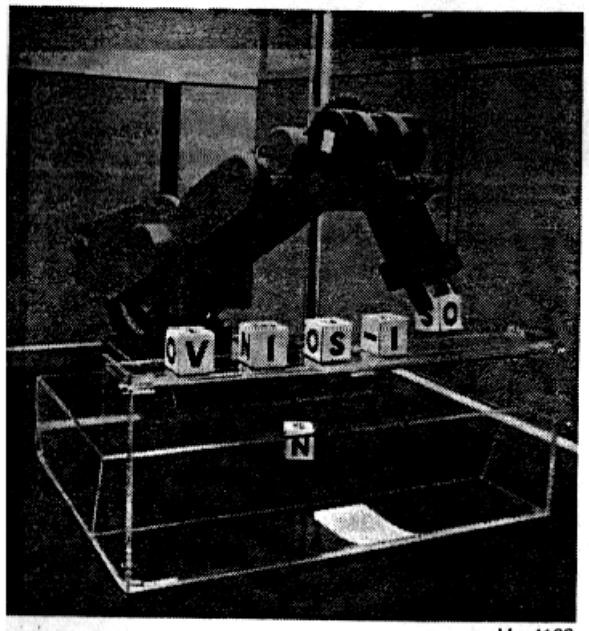


Figure 2. Diagram of a displayed image from the framestore.



M—4109

Figure 1. Image Processing for Robotic Vision

M—4110

Figure 2. The DT2851 High Resolution Frame Grabber and DT2858 Auxiliary Frame Processor plug right into expansion slots in the backplane of the host PC AT, but connect to each other directly over an external I/O port.

IMAGE PROCESSING FOR ROBOT VISION

1. GENERAL DESCRIPTION
2. THE VISION SYSTEM
3. OBJECT LOCATION
4. LETTER RECOGNITION
5. ROBOTIC MANIPULATION

軟 體 概 述

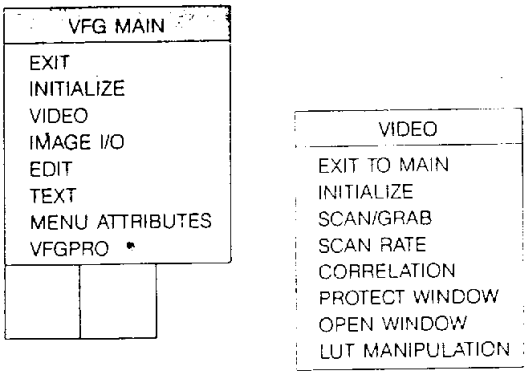
選擇軟體之考慮因子

* Nature of application
* Required efficiency
* Programming abilities
* Loyalty
* Cost

選 擇 類 別

- Major catagories
  - Menu driven
  - Command driven
  - Driver / Libraries

Menu Driven Software



Command driven

```
DT2800                                  \ configure for DT2801

INTERGER DIM[ 50 , 2] ARRAY FOR.DATA    \create array called FOR.DATA

11 12 A/D.TEMPLATE.TWO.CHANLS           \ collect channels 11 & 12
FOR.DATA.TEMPLATE.BUFFER                \buffer data into FOR.DATA
50.TEMPLATE.REPEAT                      \acquire 50 samples
.5 CONVERSION.DELAY                     \set clock
A/D.INIT                                \init template
A/D IN> ARRAY                           \begin sampling
FOR DATAXSECT[ 1 ]                      \take a cross section

Y.AUTO.PLOT                             \plot it
```

Libraries

```
int DATA.ARRRAY(50)

acquire_data()
    {
    AX_INIT();
    AX_RESET();
    AX_SET_AD_CLOCK();
    AX_AD_BURST(1,11,2,DATA.ARRAY(0));
    AX_WAIT_FOR_COMPLETION(DATA.ARRAY);
    }
```

Software Selection

- Menu Driven
  - Easy to use
  - Short learning curve
  - Generally inflexible
  - Generally not fully functional

- Command Driven
  - More complex than menu driven
  - More flexible than menu driven
  - General purpose
  - may have more features than necessary

- User written Drivers / Libraries
  - Most difficult approach
  - Generally yeild most effieient program
  - Can have long development cycle
  - Requires high level programming ability
  - Requires some knowledge of host and acqusition products

軟 體 基 本 功 能

- IMAGE ACQUISITION
  - CLEAR, SINGLE FRAME, CONTINUOUS ACQUISITION
- IMAGE ARCHIVING
  - SAVE, RETRIEVE
- ZOOM AND PAN
  - H/W VS. S/W
- CONTRAST MANIPULATION
  - LUT MANIPULATION
- IMAGE INTEGRATION
  - FRAME TO FRAME
- MOTION DETECTION
  - FRAME TO FRAME (REFERENCE) DIFFERENCING
- LINE ANALYSIS
  - LENGTH, STATISTICS, HISTOGRAM
- REGION ANALYSIS
  - AREA, STATISTICS, HISTOGRAM
- FILTERING
  - CONVOLUTION
    - LOW PASS, LAPLACIAN
  - PSEUDO-CONVOLUTION
    - EDGE DETECTION, MEDIAN FILTERING
- GEOMETRIC TRANSFORMATION
  - TRANSLATION, ROTATION, SCALING, WARPING
- SPECTRAL ANALYSIS
  - 1-D AND 2-D
- PSEUDO COLOR PROCESSING
  - LUT MANIPULATION
- TRUE COLOR PROCESSING
  - COORDINATE TRANSFORMATION
- IMAGE COMPRESSION
  - B/W VS. COLOR
- IMAGE EDITING
  - LINE VS. REGION
  - CUT, COPY, PASTE

VSILOG IP SOFTWARE

Display and Acquisition	• Look-up Table Control • Zoom, Pan, Scroll • Row, Column and Pixel Access • Frame Grabbing
Utilities	• Image Editing • Disk Copy • Command Recording
Point-to-Point Operations	• Arithmetic and Logic • Thresholding, Anamorphosis • Histogram Equalization
Measures	• Histogram, Image Statistics • Shape/Size Measure • Individual Analysis
Neighborhood Operations	• Convolution (general kernel) • Elementary Filters (Smoothing and Enhancement) • Median Filter
Frequency Operations	• Fourier Transform (1-D and 2-D)
Geometric Operations	• Symmetry, Rotation,Translation • Geometric Corrections • Cut and Paste
Mathematical Morphology	• Erosion, Dilation, Opening, Closing • Thinning, Thickening, Hit-or-Miss • Morphological Filters • Skeleton, Skeleton by Zone of Influence • Labelling • Hole filling, Ultimate Erosion, Watersheds
Edge Detection	• Sobel, Prewitt, Compass Gradient • Laplacian of Gaussian, Recursive Laplacian and Gradient • Zero-Crossing Detection • Non-maxima Suppression • Threshold with Hysteresis • Edge Linking, Polygonal Approximation

參、影像處理在農業上之應用

一、生物體之測量

二、農產品性質測定與選別

三、農業機械之自動控制

四、農產品加工

一、生物體之測量

〔應用例〕

- 染色體分析
- 洋菇栽培品種形態測量與辨別
- 生物細胞之體積與個數自動量測
- 作物之營養診斷
- 植物生長過程之量測
- 植物葉片特徵之抽取與辨別
- 動物精子活力之檢定
- 生物細胞之自動分類

二、農產品性質測定與選別

〔應用例〕

- 水果選別機之品質檢定
- 種子尺寸之自動量測
- 豬隻屠體脂肪量之測定
- 食品或水果內部之非破壞檢驗
- 米質檢定與選別
- 草莓苗之影像選別
- 種苗箱中之缺株判斷
- 蛋殼裂痕之判斷
- 玉米粒裂痕之判斷
- 依茶葉形狀檢定其品質
- 種苗之特徵判斷

三、農業機械之自動控制

〔應用例〕

- 水果採收機器臂之視覺系統與控制
- 田間曳引機之行進控制
- 葡萄藤剪枝作業之機器視覺系統
- 田間施藥與施肥機械之自動控制
- 洋菇之自動採收機械

四、農產品加工

〔應用例〕

- 蝦子去頭機之機器視覺系統
- 桃子去核機器之感測機構
- 牡蠣分離機械之機器視覺系統
- 雞排或魚排之加工與分切