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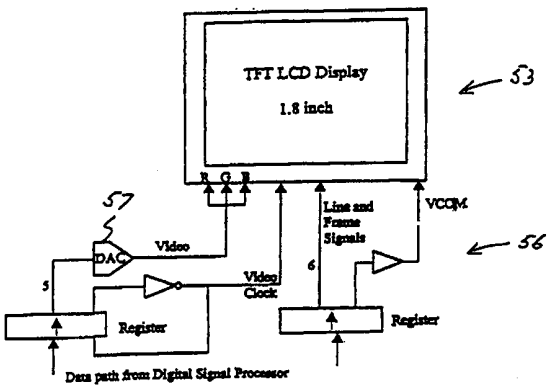
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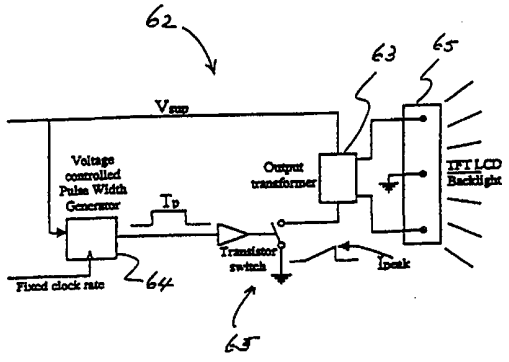
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(54) Title: A METHOD OF DRIVING AND BACKLIGHTING AN LCD OF CARD READER

(57) Abstract

A method of driving liquid crystal display (LCD) means (53) is disclosed which includes synthesising the video, frame and line signals (5, 6) which drive the LCD means in real time in digital signal processor (DSP) means, and applying the real–time synthesised signals to the LCD means. A method of backlighting liquid crystal display (LCD) means (53) is also disclosed which includes driving backlighting means (65) by high frequency, high voltage pulses supplied via a step–up transformer (63) from supply voltage means, wherein the pulses have a pulse width which is inversely proportional to the supply voltage.





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A METHOD OF DRIVING AND BACKLIGHTING AN LCD OF CARD READER

Technical Field

This invention relates to a reader and to improvements therein.

The invention has particular but not exclusive application to a portable smart card reader for reading and communicating with a smart card having image data, financial date and historical data stored therein. Exemplary of such smart cards is a driver licence smart card containing driver licence details and a digitally encoded image of the driver licensee, financial information such as a credit balance and driver history information and for illustrative purposes reference will be made to such an application. However it is to be understood that the invention has broader aspects and that some of the improvements of the present invention as exemplified in the reader, such as the method of driving the LCD device, can be utilised in other applications.

Background of Invention

It is known for a smart card to carry or contain identification means which uniquely identify the cardholder. Security of the identification means is addressed by various means in known systems.

International patent application PCT/AU97/00705 in the name of the present applicant describes such a system for use with a driver licensing system.

Summary of Invention

The present invention aims to provide an alternative to known systems and methods for reading and/or displaying stored data and/or information.

This invention in one aspect resides broadly in a smart card reader for reading a smart card having card data storage means for storing image data representative of an actual visible identity, the smart card reader including:-

a data processor assembly including processor means and data storage means;

interface means for receiving a smart card whereby the smart card reader can communicate with a smart card received therein, and

image display means for displaying the actual visible identity represented by the image data stored in the smart card;

wherein the image display means includes liquid crystal display (LCD) means and the processor means includes digital signal processor (DSP) means, the DSP means synthesising in real time the signals which drive the LCD means.

It is preferred that the DSP means synthesises in real time the video, frame and line signals for driving the LCD means.

It is also preferred that the image display means includes backlighting means for illuminating the LCD means;

the backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage.

In a further aspect this invention resides broadly in a method of driving liquid crystal display (LCD) means, the method including:-

synthesising the video, frame and line signals which drive the LCD means in real time in digital signal processor (DSP) means including a software driven processor chip, and

applying the real-time synthesised signals to the LCD means.

In a preferred embodiment the LCD means are included in image display means for displaying an image represented by image data stored in data storage means, the image display means also including the DSP means

programmed to synthesise in real time the signals which drive the LCD means and to apply the real-time synthesised signals to the LCD means.

It is also preferred that the image display means are included in a smart card reader for reading a smart card having card data storage means for storing image data representative of an actual visible identity, the smart card reader including:-

a data processor assembly including processor means and data storage means, and

interface means for receiving a smart card whereby the smart card reader can communicate with a smart card received therein;

the image display means displaying the actual visible identity represented by the image data stored in the smart card.

In a further aspect this invention resides broadly in image display means for displaying an image represented by image data stored in data storage means, the image display means including:-

liquid crystal display (LCD) means, and

digital signal processor (DSP) means programmed to synthesise in real time the signals which drive the LCD means and to apply the real-time synthesised signals to the LCD means.

The image display means may also include backlighting means for illuminating the LCD means;

the backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage.

In another aspect this invention resides broadly in a smart card reader for reading a smart card having card data storage means for storing image data representative of an actual visible identity, the smart card reader including:-

a data processor assembly including processor means and data storage means;

interface means for receiving a smart card whereby the smart card reader can communicate with a smart card received therein, and

image display means for displaying the actual visible identity represented by the image data stored in the smart card;

wherein the image display means includes liquid crystal display (LCD) means and backlighting means for illuminating the LCD means, the backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage.

In another aspect this invention resides broadly in a method of backlighting liquid crystal display (LCD) means, the method including:-

driving backlighting means by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means;

wherein the pulses have a pulse width which is inversely proportional to the supply voltage to thereby control the duration of the high voltage pulses and maintain a constant power supplied to the backlighting means.

In a preferred embodiment the LCD means constitutes image display means for displaying an image represented by image data stored in data storage means.

It is further preferred that the image display means is included in a smart card reader for reading a smart card having the data storage means for storing the image data representative of an actual visible identity, the smart card reader including:-

a data processor assembly including processor means and data storage means, and

interface means for receiving a smart card whereby

the smart card reader can communicate with a smart card received therein;

the image display means displaying the actual visible identity represented by the image data stored in the smart card.

In another aspect this invention resides broadly in image display means for displaying an image represented by image data stored in data storage means, the image display means including:-

liquid crystal display (LCD) means, and

backlighting means for illuminating the LCD means;

the backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage.

In another aspect this invention resides broadly in a portable licence reader for reading a licence card in the form of a smart card having card data storage means for storing image data representative of an actual visible identity of the licensee, the licence reader including:-

interface means for receiving a licence card whereby the licence reader can communicate with a licence card received therein;

liquid crystal display (LCD) means for displaying the actual visible identity of the licensee whereby a policing official can visually compare the displayed image with the actual face of the person in possession of the licence;

backlighting means for illuminating the LCD means, the backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage to thereby control the duration of the high

voltage pulses and maintain a constant power supplied to the backlighting means, and

a data processor assembly for controlling the licence reader and including digital signal processor (DSP) means and data storage means.

In a preferred embodiment the DSP means synthesises in real time the video, frame and line signals for driving the LCD means.

It is also preferred that the card data storage means stores data representative of financial and/or historical information associated with the licensee including credit data representative of the credit held by the licensee, wherein the licence reader data storage means stores credit data relating to the licensee, the credit data stored in the licence reader data storage means and the card data storage means being incremented or decremented when a financial event associated with the licence card is completed.

As used herein, the expression "financial event" includes the levying of a fine and the payment of a licence fee.

In a preferred embodiment the licence card is a driver licence and the portable licence reader is a driver licence reader.

Description of Drawings

In order that this invention may be more easily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention, wherein:-

FIG 1 is a schematic block diagram of the driver licensing system in accordance with the invention;

FIG 2 is a schematic block diagram illustrating the operation within a police station in the driver licensing system of the present invention;

FIG 3 is a schematic block diagram illustrating the operation within a police station in greater detail;

FIG 4 is a schematic block diagram illustrating the

operation within a central office in the driver licensing system of the present invention;

FIG 5 illustrates a hand held driver licence reader in accordance with the present invention;

FIG 6 schematically illustrates the face of a hand held driver licence reader in accordance with the present invention;

FIG 7 is a schematic block diagram illustrating the interaction of a driver licence and a hand held reader in accordance with the invention;

FIG 8 is a schematic block diagram illustrating the operation within a central driver licensing area in the driver licensing system of the present invention;

FIG 9 is a schematic block diagram illustrating the operation within a central bank card payment facility in the driver licensing system of the present invention;

FIG 10 is a block diagram of a smart card reader in accordance with the present invention;

FIG 11 is circuit diagram illustrating the drive for the LCD device, and

FIG 12 is circuit diagram illustrating the drive for backlighting the LCD device.

Description of Preferred Embodiment of Invention

As can be seen in FIG 1, a central computer 10 controls the driver licence system by being linked to a plurality of driver licensing facilities 12a, 12b ....12n, a plurality of central bank credit card payment facilities 14a, 14b ....14n, and a plurality of local police stations 11a, 11b ....11n. A plurality of driver licenses 13a, 13b ....13n are issued at each licensing facility 12 to drivers (not illustrated). Policing officers (not shown) associated with each local police station 11 carry hand held driver licence readers 15a, 15b, ... 15n which can operate independently in a manner subsequently to be described and which cooperate in a manner to be described with the system at each local police station 11.

The system uses a secure smart card as the driver's licence. Features offered by the use of smart card include:-

. secure, encrypted electronic storage of licence and driver information in the card

. electronic storage of visual image in the card chip - this cannot be overwritten or copied thus preventing fraud

. other facilities on the card include:-

- payment of traffic infringements on the spot from pre paid value on the card
- . payment of parking charges from pre paid value on the card
- renewal date for licence
- storage of vehicle registration details, including major vehicle component serial numbers to assist in control and prevention of theft
- enhancement of future expansion, this system allows for considerable expansion of data in both the card and the readers

Other aspects of the invention include:-

. central computer system for entry of driver and licence details in the card and the central database. Payment of initial licence fee.

. central image system for storage of image in the smart chip and for placement of a physical image on the card - this includes digitising and compression software

. readers in registry, police stations, police vehicles, hand held readers for police officers on foot, for reading licence details and for displaying the driver's image where required - these could be fixed or portable. These readers also capable of taking payments.

. readers for parking meters

. banks set up with readers for taking cash and placing credit on cards. Licence renewal fees can

be paid at banks. The bank computers modem transaction information to central police office.

As can be seen in FIGS 2, 3 and 4, local Police Stations have:

- Central Computer
- Terminals connected to card readers
- Modem to connect with the central office computer
- Serial port on computer to connect to portable readers and down load transaction data from hand held reader to computer

The station computer will enable local police officer and driver information to be stored and accessed. Information will be taken from cards through the readers into the computer. Transaction data is downloaded from the portable reader to the station computer. Terminals can be used for standard office work as well as reading data to and from the readers.

Hand Held readers illustrated in FIGS 5 and 6 are used by police officers in cars and on foot. These enable police to verify authenticity of a driver licence on the spot - after insertion of a licence card in the reader, the owner's facial image and details will be shown on the display allowing positive ID. Fines can be paid for on the spot by debiting the relevant amount from the card. Each transaction is stored in the reader with the driver's details, amount and the officers details.

In use the following steps are followed:-

. Officer inserts his card
. Enter PIN
. If PIN incorrect:
  - Display shows "incorrect re-enter PIN"
  - 4 chances, if still wrong card ejected
. If PIN correct:
  - Display shows "transaction approval"
. Driver's licence card can now be inserted
. Facial image and details are displayed on the screen for verification
. If a fine is to be imposed the amount is entered and

the card debited

All details are stored in the reader (officer ID, driver ID, type and amount of fine)

Transaction data is down loaded from the hand held reader into the station computers at the end of shifts. Data cannot be lost from the hand held reader until downloading has occurred and been verified by the computer.

FIG 7 is a detailed schematic block diagram of an operating system for a driver licence scheme utilising a number of licence card readers 20 in accordance with the invention. A driver licence card 21 includes data processing assembly 22 having a central processor or digital processing device 23 and data storage means 24 for storing identification data 25, image data 26 and credit data 27. Interface 28 provides communication between licence card 21 and licence reader 20.

Licence reader 20 includes a data processing assembly 41, user interface assembly or interface unit 29, and receiving means 30 for receiving a licence card 21.

Data processing assembly 41 is controlled by a central processor 31 and includes data storage means 32 for storing credit data 33 and licence data 34. A user interface assembly 29 includes input means in the form of keypad 35 and information display means 36. Display means 36 is driven by video driver 40 to generate an on screen image of the face of the driver to whom the licence card was issued. Receiving means or keyslot 30 includes an interface 37 for providing communication with a licence card 20. Interface means 38 is adapted to provide communication between licence card reader 20 and communication bus 39 for communication with the central computer assembly.

As seen in FIG 8, the card issue process involves a number of steps including:-

. Issue Card to staff Operator

- Enter operator detail at terminal

- Take picture of staff member
- All data and image files sent to central data base
- Image and relevant data sent to printer
- Data entered into smart card chip and printed on card
- Card given to operator

. Issue Card to Driver

- Enter Driver's details at terminal
- Take picture of driver
- All data and image files sent to central data base
- Image and relevant data sent to printer
- Data entered into smart card chip and printed on card
- Card given to driver

For a driver licence transaction an operator must "log-on" with an authorised smart card in the operator reader before they can access a terminal. The following driver licence transactions are then enabled:-

. Credit to card - a cash amount given to the Operator is added to the card

. Credit taken off card - this may be for a fine paid, a parking fee or a tollway fee.

As seen in FIG 9 which illustrates a central bank card payment facility the following steps can occur:-

. Teller logs on to terminal with authorised card.

. A driver's card is entered in the user's terminal.

. To add credit:

- Users pays cash
- This amount is credited to card by the teller
- The transaction information is stored in the bank's computer which contains driver details and card number, teller's card number, cash amount paid, date, time and bank details.

Banks are connected via modem to the central police office and all transaction data is sent to the police.

The operation of the licence reader will now be

described in greater detail with reference to FIGS 10 to 12. The sub-systems of the licence reader are best illustrated in Figure 10.

Processor and memory:

The central block in Figure 10 shows a 16-bit digital signal processor 50. This microprocessor is supported by random access memory (RAM) 51 and read only memory (ROM) 52. RAM 51 contains both program and data as the processor executes this program. ROM 52 contains programs that may be loaded into RAM 51 for execution, font data to permit Chinese or similar characters and other types of characters to be displayed on LCD display 53, and user data which includes information about the various transactions supported by the reader unit.

During execution, processor 50 is responsible for executing the user's application. This involves various activities most often utilising smart card licence 55. Compressed image data stored on a smart card licence 55 can be decompressed by a numerically intensive program running on processor 50 and the results displayed on LCD display 53. Financial credit stored on licence card 55 can be debited and under certain circumstances credited with new values. In personal identification applications the card holder's details are stored on licence card 55. All such information on licence card 55 is accessed by processor 50 and acted on according to the currently available application or program installed in ROM 52.

LCD display and LCD drive:

LCD drive 56 is best described with reference to FIG 11. LCD display 53 is a thin film transistor (TFT) device. The computational power of a digital signal processor 50 is utilised to synthesise high speed video, frame and line signals in real time to drive LCD display 53. The 16-bit DSP 50 has part of its computational load assigned to generating these signals via LCD drive 50, the circuitry of which is shown in Figure 11. Other

activities such as image processing are also performed by processor 50.

The image to be displayed on LCD screen 53 is stored in RAM 51. Processor 50 both calculates and outputs the line, frame and clock signals and develops the stream of video pixel values to digital to analogue converter (DAC) 57.

The image and text information to be viewed on LCD display 53 is held in RAM 51 and processor 50 keep LCD display 53 refreshed with the image and text information. Processor 50 takes binary display data from RAM 51 at a rate of between 20 and 50 repetitions per second, and formats it into the video signals which are sent via LCD drive 56 to actual LCD display 53. The programmable nature of processor 50 facilitates this function as well as executing the main application installed on the system.

Keypad:

Keypad 58 permits the user of the reader to enter new data and access data within the system or to update the records on a smart card licence 55 inserted in smart card socket 54 in accordance with the capabilities provided by the application installed on the system. Digital signal processor 50 regularly scans keypad 58 to detect which keys have been depressed.

Smart card licence and security card:

Smart card licence 55 and security card 59 communicate with processor 50 so that information on these cards can be accessed. Security card 59 is a small smart card which holds system specific information to assist with the security of data management within the system. Data access is made to the externally inserted smart card licence 55 is made via smart card licence socket 54. Both reading and writing is permitted through direct processor access as shown in FIG 10.

Real time clock:

Real time clock 60 is directly connected to processor 50. The day, month, year and time in hours, minutes and seconds is held within real time clock 60 which is backed up with a small Lithium Cell which provides for a 10 year memory for this information. Processor 50 can access or change the values held in real time clock 60.

Power supplies:

Power supply 61 shown in Figure 10 generates the various power supply voltages for use by the system. Power is taken from the NiMH 5-cell battery during periods when no external power is applied. When an external power supply is provided, the power sub-system can re-charge the batteries while powering the unit for normal operation if desired. Processor 50 can control the battery charging and can shut down the power supply if the application running on processor 50 initiates this action.

LCD backlight drive:

The LCD backlight drive is best described with reference to Figure 12. The LCD backlight drive 62 conserves power and the state of the backlight (ie on or off) is controlled by the application or program running on processor 50.

Fluorescent backlights used in the illumination of liquid crystal displays and in other applications are often driven by high frequency, high voltage pulses (of duration T_p as seen in Figure 12) supplied from a step-up transformer. Upon application of a supply voltage V_{sup} a ramp of current is generated in the primary of the step-up transformer, reaching a peak value of I_{peak} at the end of the on period T_p. The power delivered to the backlight in such systems is approximately $P = K_1 \times I_{peak} \times I_{peak}$ (for some constant K_1) in the limit of no losses in transistor switch 65.

Peak current, I_{peak}, is proportional to both the supply voltage V_{sup} and to the pulse duration T_p. Thus $I_{peak} = K_2 \times T_p \times V_{sup}$ for some constant K_2. V_{sup} may be the raw battery voltage or a regulated supply. In the latter case, there is a power loss due to the inefficiency of the supply generating circuitry and this decreases battery life in portable handheld equipment. In the case of simple direct connection to the raw battery supply, the brightness of the backlight will change with battery voltage as the battery is discharged during normal use. (A nominal 6 volt battery for example, might be below 5 volts at the end of its discharge cycle and as high as 9 volts during a fast charging cycle.)

Backlight drive 62 achieves a lower power consumption by allowing direct connection of the backlight drive transformer 63 to the raw battery voltage V_{sup} by controlling the pulse on-time period T_p to achieve constant backlight brightness. The pulse rate remains fixed during backlight operation. The pulse period T_p is varied in inverse proportion to the supply voltage V_{sup} to keep I_{peak} (and hence backlight power) constant. Voltage controlled pulse width generator 64 implements $T_p = K_3 \times (1/V_{sup})$ where K_3 is an appropriate constant. Thus

P = power in the backlight (which is proportional to the backlight brightness)

$= K_1 \times I_{peak} \times I_{peak}$

$=$ constant $\times (K_2 \times T_p \times V_{sup}) \times (K_2 \times T_p \times V_{sup})$

$=$ constant $\times (T_p \times T_p) \times V_{sup} \times V_{sup})$

$=$ constant $\times [K_3 \times (1/V_{sup})] \times [K_3 \times (1/V_{sup})] \times (V_{sup} \times V_{sup})$

$=$ constant

Voltage Controlled Pulse Width Generator 64 maintains a constant power into backlight 65 while extending battery life and hence maintains a constant brightness as battery voltage V_{sup} varies.

Serial Data Interface:

Serial data interface 63 permits digital signal processor 60 to communicate to a host computer to extract from the reader recent transactions made involving inserted smart cards. Thus the operating system can be updated in the field and this allows improvements, modifications, updates etc to be made to the reader without returning it to the factory.

It will be appreciated that the reader of the present invention has a number of advantages over known devices. These include:

. The backlight drive of the present invention reduces power consumption from the battery for a desired (constant) backlight brightness, thereby allowing a more useful life for readers in remote locations and improving the quality of viewing if standard batteries are used.

. Whereas with common LCD devices it is usual to generate the video, frame and line signals to drive a TFT LCD by employing either high speed logic, programmable logic, a gate array device or a custom developed application specific integrated circuit (ASIC), with the LCD drive of the present invention no custom designed LCD drive hardware is required. Moreover the use of a relatively cheap DSP to generate the signals produces a low cost driver with the flexibility of being software programmable.

. The control signals are fully programmable to permit optimisation of timing or the driving of most LCD screen types.

. The DSP can be programmed to adjust the frame rate from a maximum of about 50 Hz down to much lower values to minimise system power consumption. Screen

flicker can be controlled in a versatile and programmable manner.

- The drive circuitry connected directly to the LCD is very simple, relatively inexpensive and low power.

- The DSP permits the red, green and blue information to be time division multiplexed onto one single connection to the display and consequently the video circuitry (the register and DAC in Figure 11) is of considerable less complexity than that with separate red, green and blue drives.

It will of course be realised that whilst the above has been given by way of an illustrative example of this invention, all such and other modifications and variations hereto, as would be apparent to persons skilled in the art, are deemed to fall within the broad scope and ambit of this invention as is herein set forth.

Claims

1. A smart card reader for reading a smart card having card data storage means for storing image data representative of an actual visible identity, said smart card reader including:-

a data processor assembly including processor means and data storage means;

interface means for receiving a smart card whereby the smart card reader can communicate with a smart card received therein, and

image display means for displaying the actual visible identity represented by the image data stored in the smart card;

wherein said image display means includes liquid crystal display (LCD) means and said processor means includes digital signal processor (DSP) means, said DSP means synthesising in real time the signals which drive said LCD means.

2. A smart card reader as claimed in claim 1, wherein said DSP means synthesises in real time the video, frame and line signals for driving said LCD means.

3. A smart card reader as claimed in claim 1, wherein said image display means includes backlighting means for illuminating said LCD means;

said backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage.

4. A method of driving liquid crystal display (LCD) means, said method including:-

synthesising the video, frame and line signals which drive said LCD means in real time in digital signal

processor (DSP) means including a software driven processor chip, and

applying the real-time synthesised signals to said LCD means.

5. A method as claimed in claim 4, wherein said LCD means are included in image display means for displaying an image represented by image data stored in data storage means, said image display means also including said DSP means programmed to synthesise in real time the signals which drive said LCD means and to apply the real-time synthesised signals to said LCD means.

6. A method as claimed in claim 5, wherein said image display means are included in a smart card reader for reading a smart card having card data storage means for storing image data representative of an actual visible identity, said smart card reader including:-

a data processor assembly including processor means and data storage means, and

interface means for receiving a smart card whereby the smart card reader can communicate with a smart card received therein;

said image display means displaying the actual visible identity represented by the image data stored in the smart card.

7. Image display means for displaying an image represented by image data stored in data storage means, said image display means including:-

liquid crystal display (LCD) means, and

digital signal processor (DSP) means programmed to synthesise in real time the signals which drive said LCD means and to apply the real-time synthesised signals to said LCD means.

8. Image display means as claimed in claim 7, and including backlighting means for illuminating said LCD

means;

said backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage.

9. A smart card reader for reading a smart card having card data storage means for storing image data representative of an actual visible identity, said smart card reader including:-

a data processor assembly including processor means and data storage means;

interface means for receiving a smart card whereby the smart card reader can communicate with a smart card received therein, and

image display means for displaying the actual visible identity represented by the image data stored in the smart card;

wherein said image display means includes liquid crystal display (LCD) means and backlighting means for illuminating said LCD means, said backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage.

10. A method of backlighting liquid crystal display (LCD) means, said method including:-

driving backlighting means by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means;

wherein said pulses have a pulse width which is inversely proportional to the supply voltage to thereby control the duration of said high voltage pulses and maintain a constant power supplied to said backlighting

means.

11. A method as claimed in claim 10, wherein said LCD means constitutes image display means for displaying an image represented by image data stored in data storage means.

12. A method as claimed in claim 11, wherein said image display means is included in a smart card reader for reading a smart card having said data storage means for storing said image data representative of an actual visible identity, said smart card reader including:-

a data processor assembly including processor means and data storage means, and

interface means for receiving a smart card whereby the smart card reader can communicate with a smart card received therein;

said image display means displaying the actual visible identity represented by the image data stored in the smart card.

13. Image display means for displaying an image represented by image data stored in data storage means, said image display means including:-

liquid crystal display (LCD) means, and

backlighting means for illuminating said LCD means;

said backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage.

14. A portable licence reader for reading a licence card in the form of a smart card having card data storage means for storing image data representative of an actual visible identity of the licensee, said licence reader including:-

interface means for receiving a licence card whereby the licence reader can communicate with a licence card received therein;

liquid crystal display (LCD) means for displaying the actual visible identity of the licensee whereby a policing official can visually compare the displayed image with the actual face of the person in possession of the licence;

backlighting means for illuminating said LCD means, said backlighting means being driven by high frequency, high voltage pulses supplied via a step-up transformer from supply voltage means and including pulse width generator means for generating pulses having a pulse width which is inversely proportional to the supply voltage to thereby control the duration of said high voltage pulses and maintain a constant power supplied to said backlighting means, and

a data processor assembly for controlling the licence reader and including digital signal processor (DSP) means and data storage means.

15. A portable licence reader as claimed in claim 14, wherein said DSP means synthesises in real time the video, frame and line signals for driving said LCD means.

16. A portable licence reader as claimed in claim 14, wherein the card data storage means also stores data representative of financial and/or historical information associated with the licensee including credit data representative of the credit held by the licensee, wherein said licence reader data storage means stores credit data relating to the licensee, the credit data stored in the licence reader data storage means and the card data storage means being incremented or decremented when a financial event associated with the licence card is completed.

17. A portable licence reader as claimed in claim 16,

wherein the licence card is a driver licence and the portable licence reader is a driver licence reader.

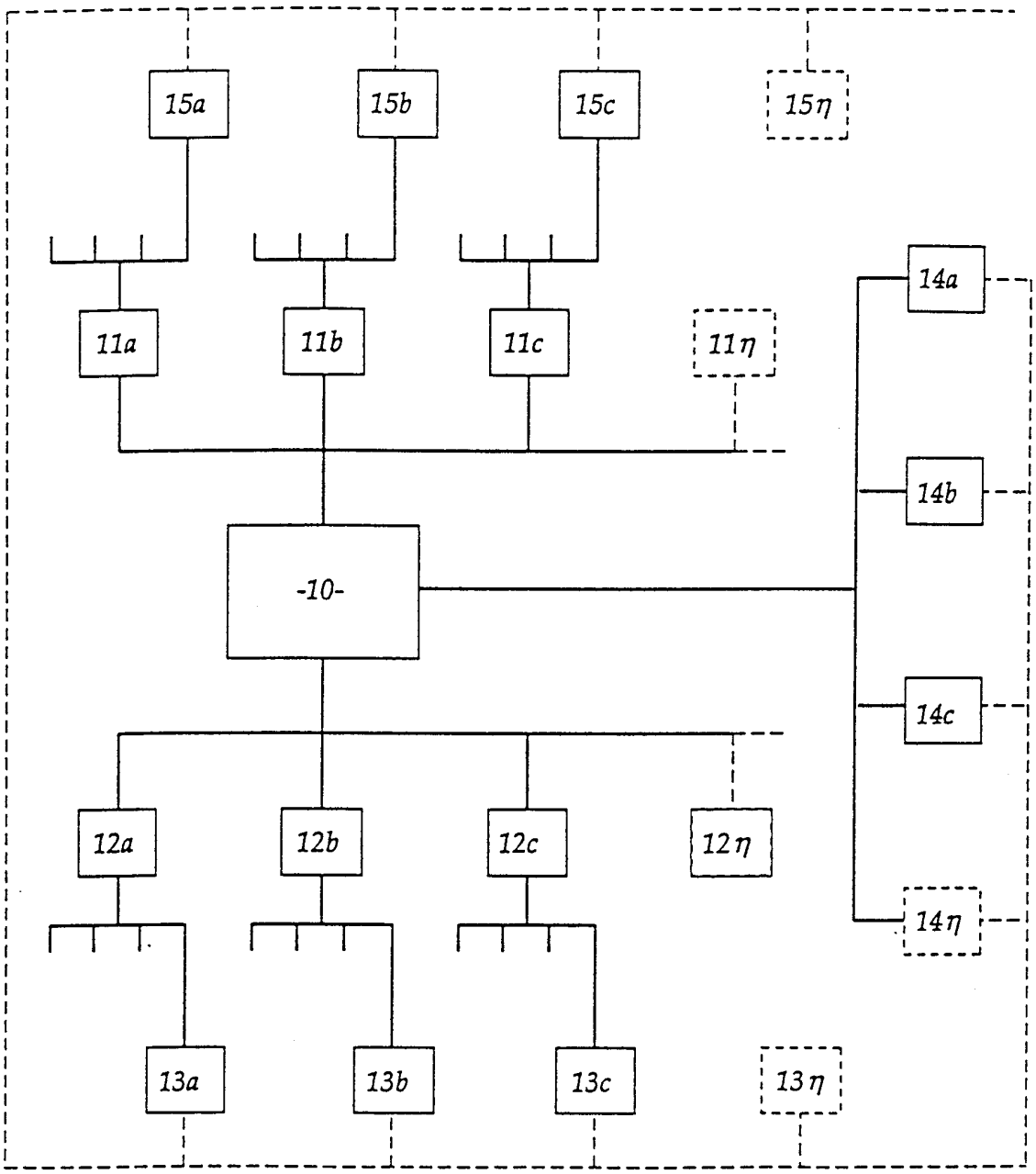

15a
15b
15c
15η
14a
11a
11b
11c
11η
14b
-10-
14c
12a
12b
12c
12η
14η
13a
13b
13c
13η

Fig. 1.

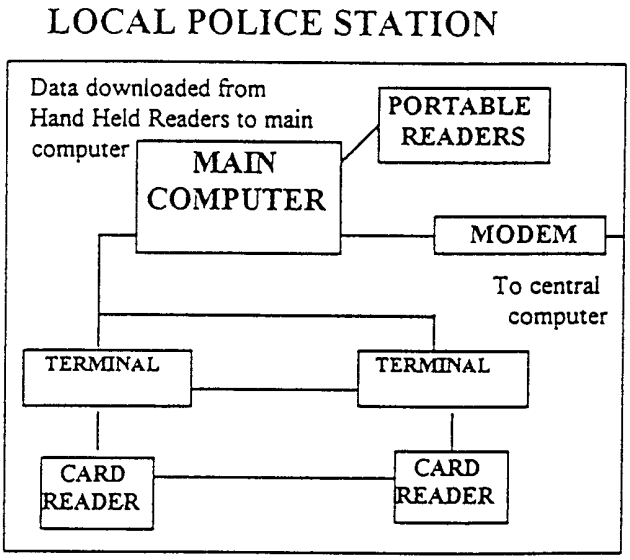

LOCAL POLICE STATION
Data downloaded from Hand Held Readers to main computer
PORTABLE READERS
MAIN COMPUTER
MODEM
To central computer
TERMINAL
TERMINAL
CARD READER
CARD READER

FIG 2

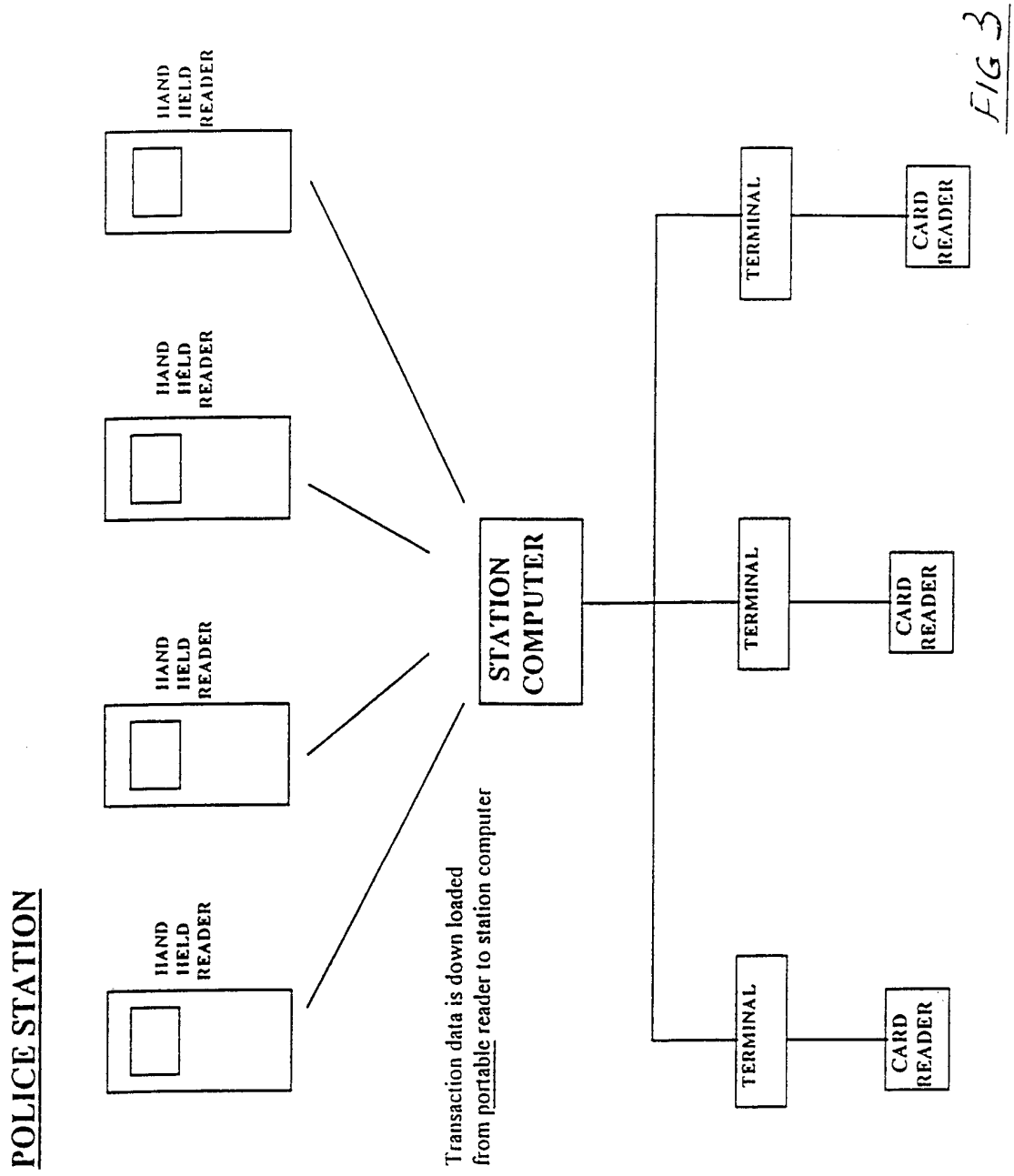

POLICE STATION
HAND HELD READER
HAND HELD READER
HAND HELD READER
HAND HELD READER
Transaction data is down loaded from portable reader to station computer
STATION COMPUTER
TERMINAL
TERMINAL
TERMINAL
CARD READER
CARD READER
CARD READER

FIG 3

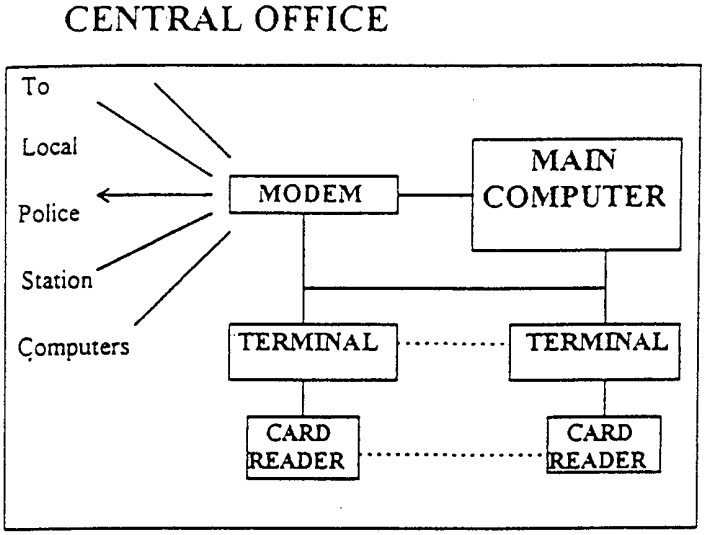

CENTRAL OFFICE
To
Local
Police
Station
Computers
MODEM
MAIN COMPUTER
TERMINAL
TERMINAL
CARD READER
CARD READER

FIG 4

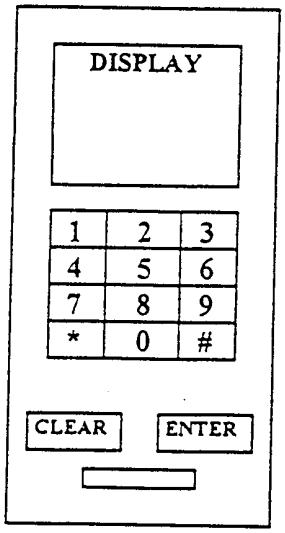

DISPLAY
1 2 3
4 5 6
7 8 9
* 0 #
CLEAR
ENTER

FIG 6

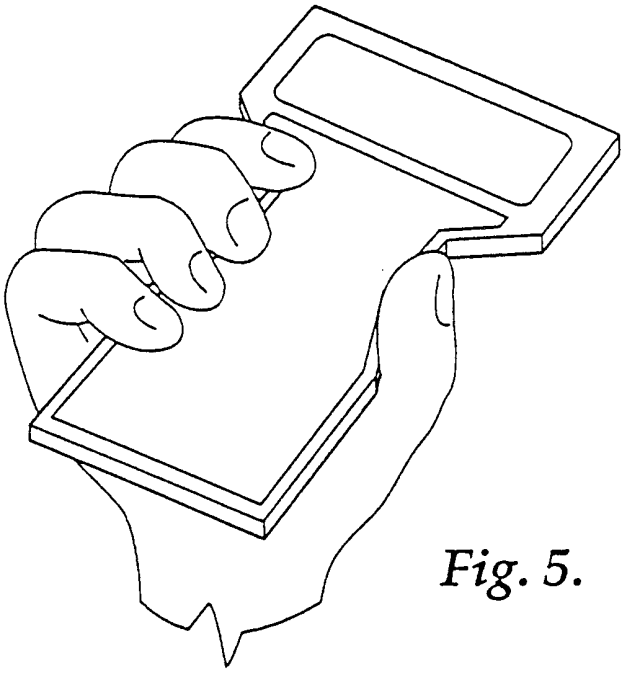


Fig. 5.

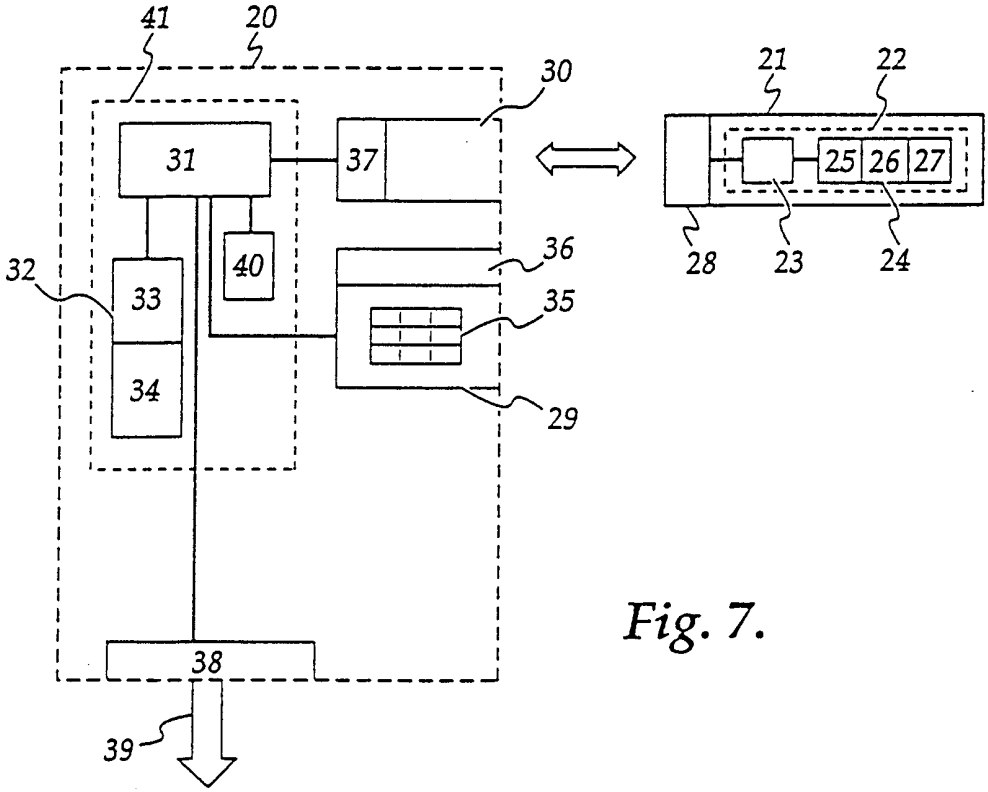


Fig. 7.

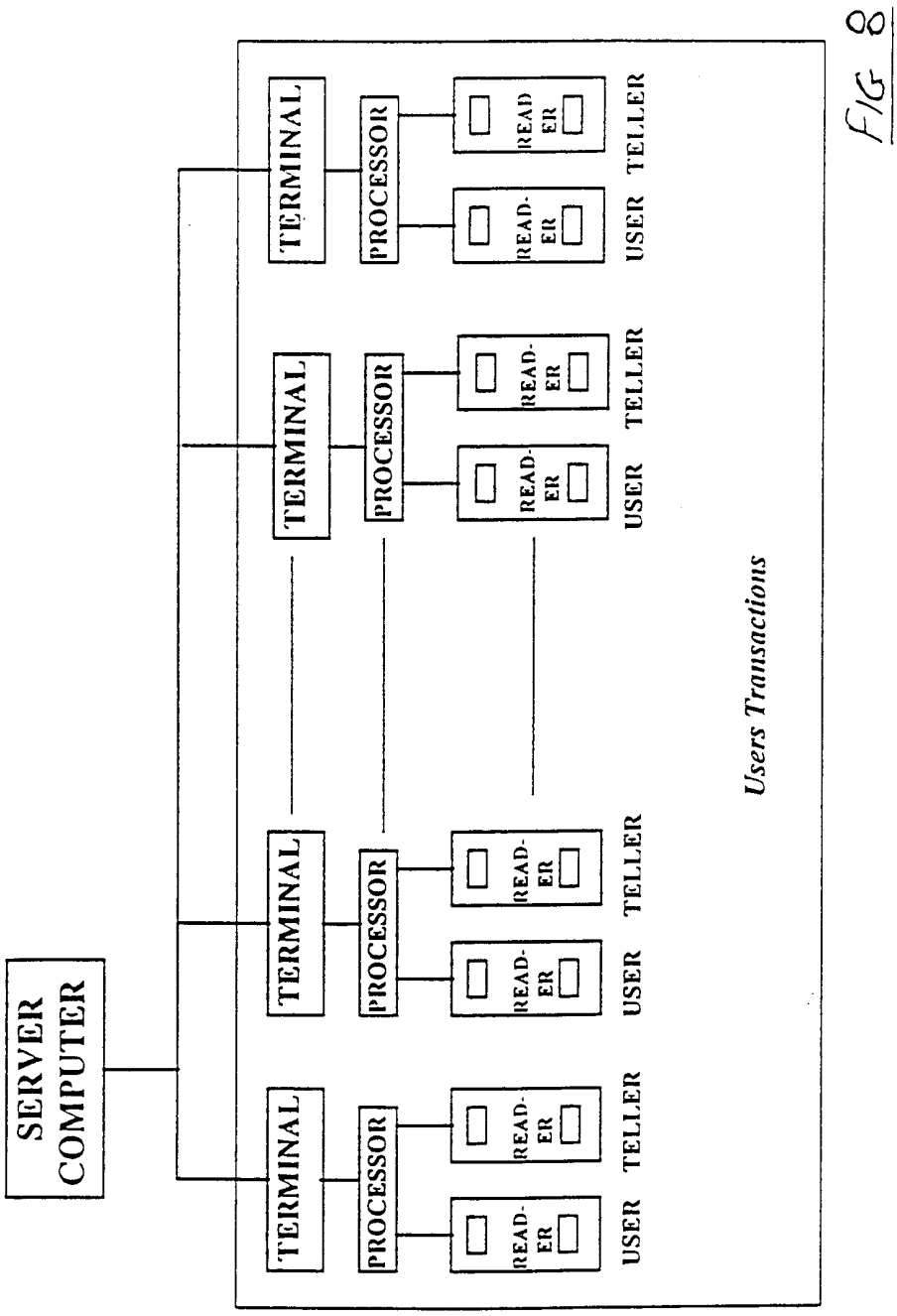

CENTRAL BANK CARD PAYMENT
SERVER COMPUTER
TERMINAL
PROCESSOR
READ-ER
USER
TELLER
Users Transactions

FIG 8

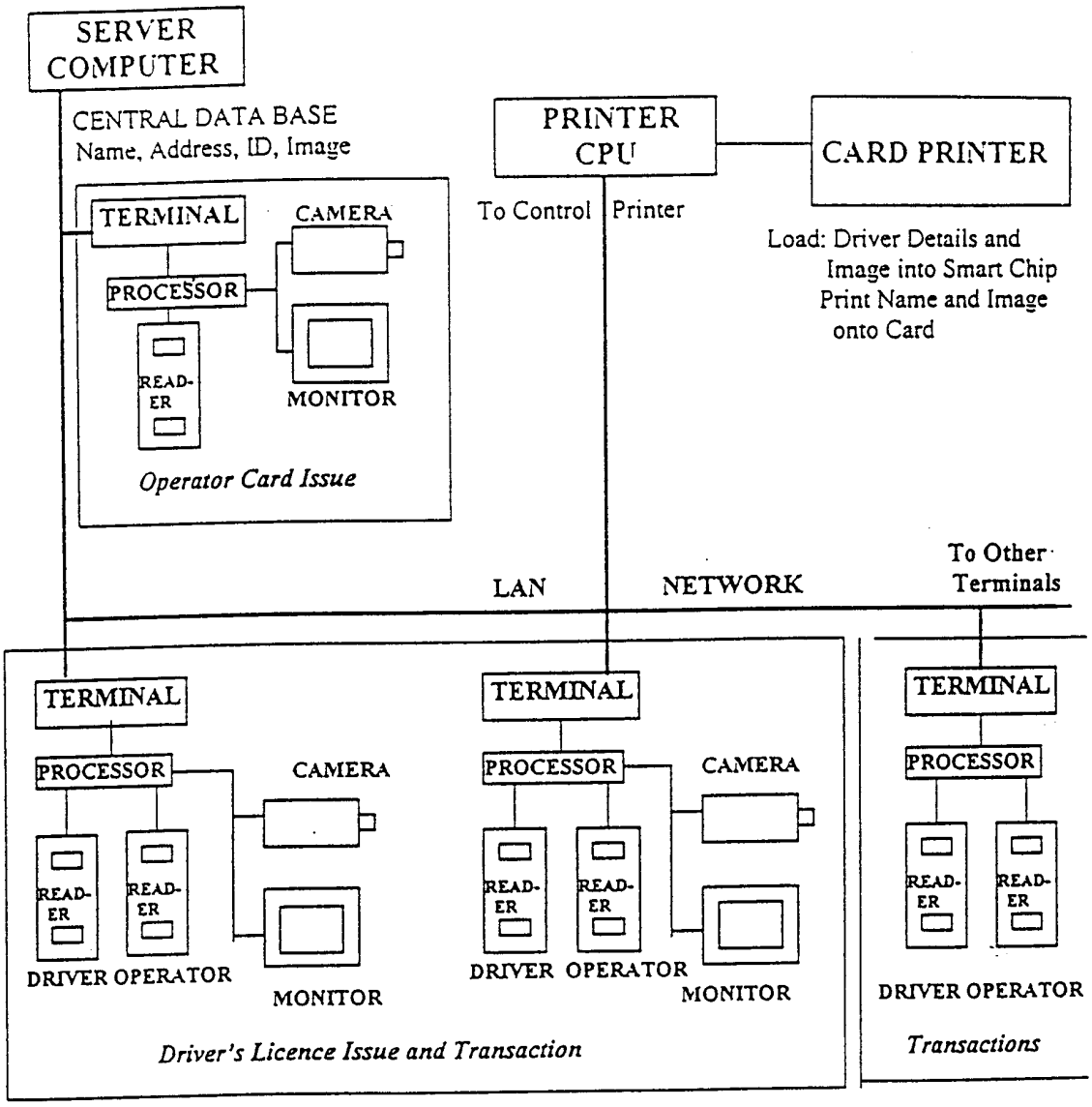

SERVER COMPUTER
CENTRAL DATA BASE
Name, Address, ID, Image
PRINTER CPU
CARD PRINTER
To Control Printer
Load: Driver Details and Image into Smart Chip Print Name and Image onto Card
TERMINAL
CAMERA
PROCESSOR
READ-ER
MONITOR
Operator Card Issue
LAN
NETWORK
To Other Terminals
TERMINAL
PROCESSOR
CAMERA
READ-ER
READ-ER
DRIVER OPERATOR
MONITOR
TERMINAL
PROCESSOR
CAMERA
READ-ER
READ-ER
DRIVER OPERATOR
MONITOR
Driver's Licence Issue and Transaction
TERMINAL
PROCESSOR
READ-ER
READ-ER
DRIVER OPERATOR
Transactions

FIG 9

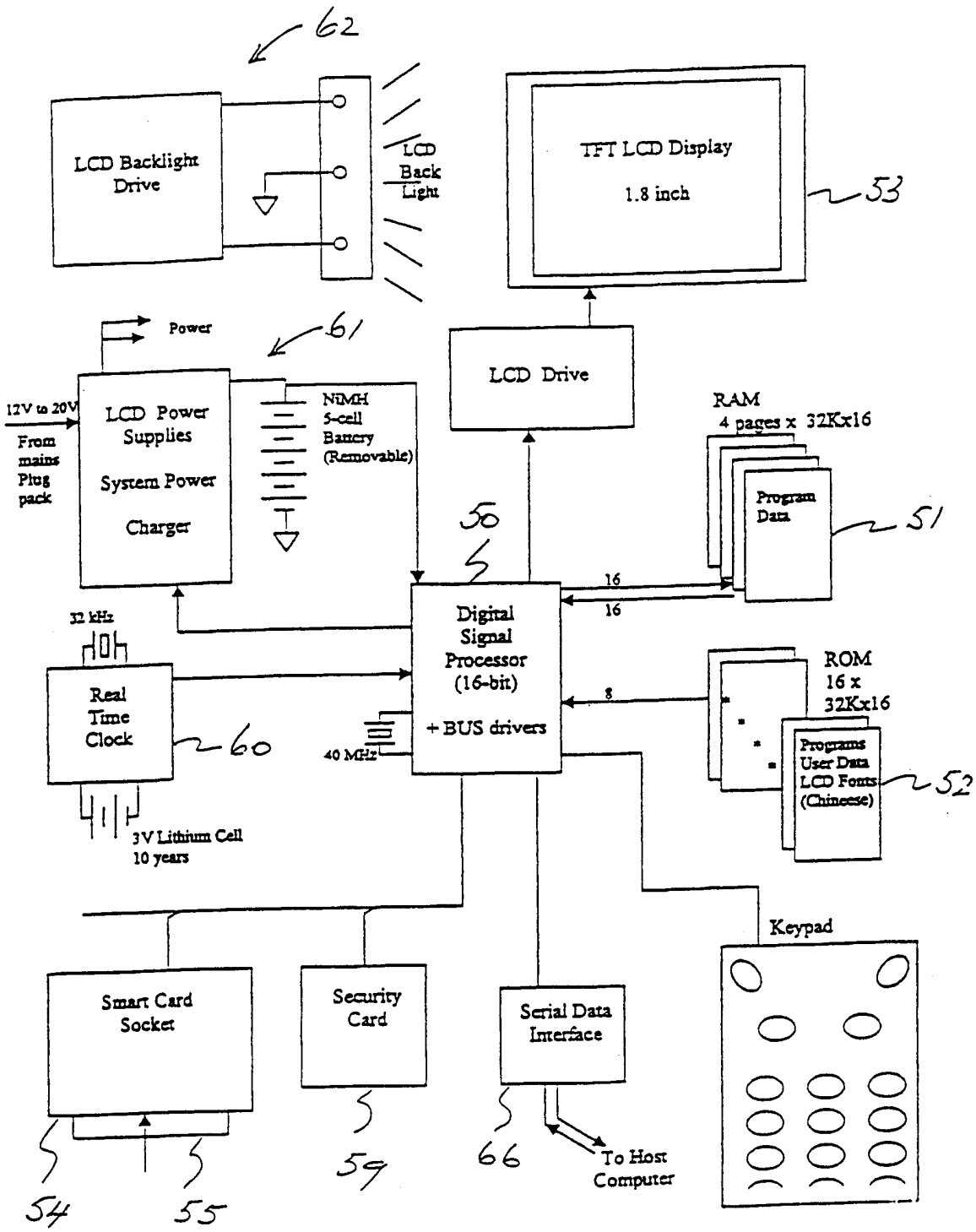

62
LCD Backlight Drive
LCD Back Light
TFT LCD Display
1.8 inch
53
Power
61
LCD Drive
12V to 20V
From mains Plug pack
LCD Power Supplies
System Power
Charger
NiMH 5-cell Battery (Removable)
RAM
4 pages x 32Kx16
Program Data
51
50
16
16
32 kHz
Digital Signal Processor (16-bit)
+ BUS drivers
8
ROM
16 x 32Kx16
Programs User Data LCD Fonts (Chinese)
52
Real Time Clock
60
40 MHz
3V Lithium Cell 10 years
Keypad
Smart Card Socket
Security Card
Serial Data Interface
59
66
To Host Computer
54
55

FIG 10

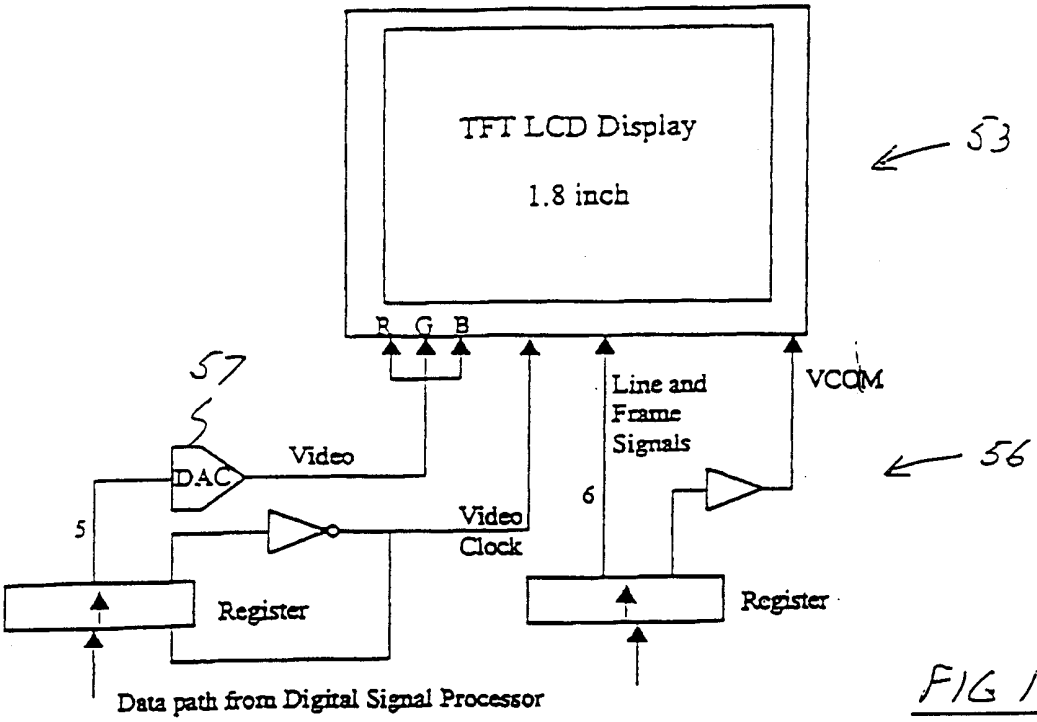

TFT LCD Display
1.8 inch
53
R G B
57
Video
DAC
5
Video
Clock
Register
Line and
Frame
Signals
6
VCOM
56
Register
Data path from Digital Signal Processor

FIG 11

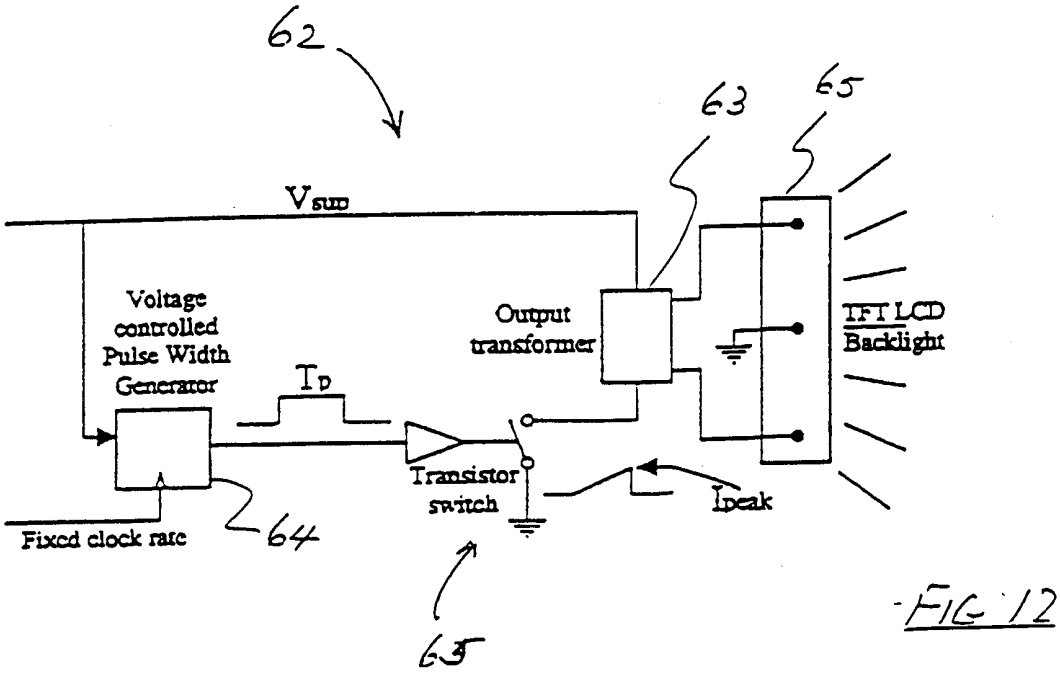

62
63
65
Vsup
Voltage
controlled
Pulse Width
Generator
Tp
Output
transformer
TFT LCD
Backlight
Transistor
switch
Ipeak
Fixed clock rate
64
65

FIG 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 99/00112

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: G09G 003/36, G09G 003/18, G06K 019/067, G09F 009/35, G09F 013/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC : G09G 003/36, G09G 003/18, G06K 019/067, G09F 009/35, G09F 013/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT, "LCD", "CONTROL", "DRIVE", "FRAME", "LINE", "VIDEO", "BACKLIGHT", "PULSE WIDTH" etc

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO,A, 93/19942 (INTELICARD TECHNOLOGIES, INC) 14 October 1993 page 4 line 30 to page 5 line 27 in particular in combination with any of the following document with relevance to the same claims	1, 2, 3, 6, 9
X	EP,A, 0195203 (ASCII CORPORATION) 24 September 1986 whole document, in particular, page 2 lines 5 to 8, page 7 lines 27 to 36, page 15 lines 24 to 27, page 27 lines 21 to 31 and figure 1	4, 5, 7
Y		1, 2, 6, 8

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 May 1999	16 JUN 1999
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929	Authorized officer **J.W. THOMSON** Telephone No.: (02) 6283 2214

INTERNATIONAL SEARCH REPORT

...ternational application No.
PCT/AU 99/00112

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Derwent Abstract Accession No. 95-236165/31, class WO3, JP 7143505 A (SHARP KK) 2 June 1995	
X	whole abstract and figure	7
Y		1, 2, 8
	Derwent Abstract Accession No 98-091601/09, class WO3 JP 09319339 A (SONY CORP) 12 December 1997	
X	whole abstract and figure	7
Y		1, 8
	For the citations below, for the purpose of the Y indication, the citations may be combined with any one or more of the first four citations with relevance to the same claims.	
	US,A, 5272327 (MITCHELL et al) 21 December 1993	
X	see column 5 lines 59 to 62, column 5 line 67 to column 6 line 4, column 4 lines 31 to 38, column 4 line 67 to column 5 line 1 in particular	13
Y		3, 8, 9
	US,A, 5440208 (USKALI et al) 8 august 1995	
X	see column 2 lines 31 to 46, column 3 lines 30 to 36, lines 59 to 67, column 5 lines 2 to 6 and column 6 lines 21 to 32 in particular	13
Y		3, 8, 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 99/00112

Box 1 Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

(1) Claims 1-8
Driving of LCD means
(2) Claims 9-16
Backlighting of LCD means, as reasoned on the extra sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

...ternational application No.
PCT/AU 99/00112

Box II continued

The inventions are as follows:-

1. Claims 1 to 8 are directed to the driving of LCD means via a digital signal processor. Such technique of driving LCD means comprises a first invention.

2. Claims 9-16 are directed to backlighting a LCD means via a hardware circuitry involving a step-up transformer that generates high voltage and frequency drive pulse(s) whose width is inversely proportional to a supply voltage which voltage supply powers both the transformer and associated pulse width generator means. It is considered that such backlighting arrangements comprises a second invention.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU 99/00112

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
WO	93/19942	AU	40266/93		
EP	195203	JP	61213896	US	4760387
US	5272327	CA	2096929	EP	572207

END OF ANNEX