



Fig. 3.3 The GEC ic Card and Coupler electronics are totally sealed making them ideal for use in harsh environments.

turing equipment which acts as a deterrent to all but the largest criminal organisations.

- (2) Protection against easy access to the electronics, and hence data storage area, by complete encapsulation of the electronics.
- (3) Protection against the probing of data lines between microprocessor and memory by incorporating both the elements on a single micro-electronics chip.
- (4) Protection of the application program through the ability to 'blow' a software fuse thereby destroying the means by which the card can reload a new program.
- (5) Sumcheck protection against the alteration of memory contents.
- (6) Protection against altering and adding to the dialogue between the card and a terminal by authentication software specifically designed for the card.
- (7) Protection against using recorded dialogue to establish authentic communication and against rerouting messages by verification software specifically designed for the card.
- (8) Protection, through encryption, against deciphering dialogue between the card and terminal.
- (9) Positive personal identification of the card holder by comparison of a personal characteristic (e.g. signature, fingerprint, facial features)

of the legitimate card holder stored on the card with the same feature of the person presenting the card at an access point. The comparison can be carried out within the card, thus maintaining complete secrecy of reference data.

- (10) Protection, by the card invalidating itself when repeated attempts are made to gain access by continued keying in of possible personal identification numbers or forging of signatures.

In totality, the security offered by the ic Card is virtually unrivalled by any other low cost computing based product.

3.4 APPLICATIONS

Applications for the smart card can be divided broadly into three categories: data carrier, where the card is used as a convenient portable and secure means for storing data; conditional access, where the card is used as a secure means of identifying the holders entitlement to gain access to a site, a computer, a software package or a service; and financial, where the card is used to replace credit cards, cheque books or money. Each card is by no means restricted to one application only. A card can accommodate several different functions spanning all three categories. For instance, one card could be used to hold medical data, provide access to a computer system and act in a financial capacity.

As a data carrier the card has many applications in the medical field. Used as a general medical card, the ic Card could contain such information as the holder's address, date of birth, name and address of his/her doctor, allergies, recent medical history, serious complaints, drugs being taken and donor wishes. The card could be carried by the individual and in the case of an emergency, for example the holder collapsing in a street or being involved in a road accident, would provide immediate medical information to the ambulance crew (Figure 3.4) or the doctor in a hospital casualty department. The speed with which vital information would be available could well save lives. The card is also particularly suited to patients requiring regular treatment or regular monitoring e.g. diabetics, dialysis patients. In these applications the card allows key information to be provided easily and quickly to the doctor at each appointment and data can be easily added to the card.

Military applications include electronic identity tags for servicemen and women. The card can contain details of the holder, service records, medical history, entitlements etc. The card is particularly suitable for data logging. At remote or unattended sites it could be used to record temperature, events etc. Periodically it could be collected and returned to a central point for the logged information to be read off the card.

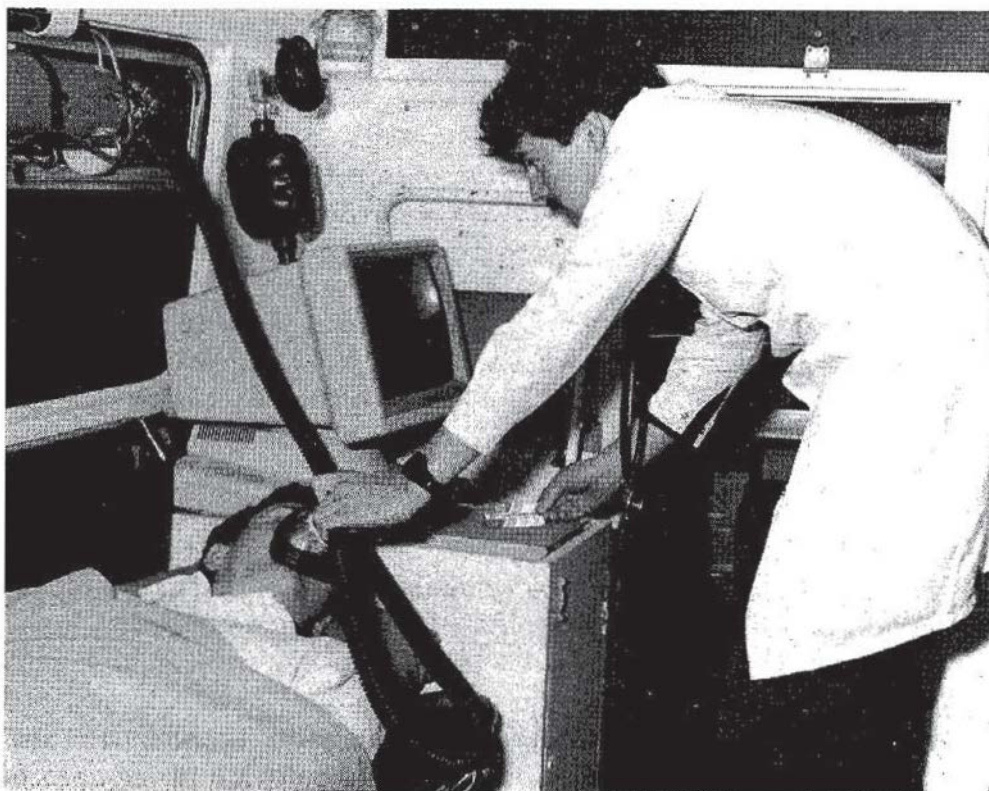


Fig. 3.4 The GEC ic Card could contain medical details about the holder. In the case of an emergency it could provide vital medical information to an ambulance crew or doctor in a hospital casualty department.

As a maintenance record, the card could be conveniently attached to equipment. The paperwork that goes with military and high value industrial equipment is often considerable. The smart card provides an easily updatable compact way of storing such data.

There are many industrial applications for the card. For example, it could be used to program computer-numerically-controlled (CNC) machines replacing punched cards or magnetic tapes. Alternatively a card could be used to store a record, for monitoring purposes, of the progress of manufactured components throughout stages of their manufacture. In the automobile industry, such a card might subsequently form the basis of a vehicle's servicing record.

In the airline field the card could be used as an electronic ticket with a complete analysis of the passenger's preference for 'smoking' or 'non-smoking' seat, as well as dietary needs. For regular travellers it could log the number of trips flown with a particular airline to give a free or reduced fare flight after a number of trips have been made.

In the area of secure access, the card can act as an electronic key to control access of personnel to facilities where sensitive work is carried out

or data is held. The most common type of security access devices are keys, badges and magnetic cards. These all suffer from the same basic drawbacks that they can be easily duplicated and when stolen or passed on to someone else, either wilfully or through coercion, they can allow entry because there is no link with the person to whom the device was issued. The ic Card overcomes these weaknesses because it is very difficult to reproduce and has the capability of storing a digitised personal characteristic of the owner (e.g. fingerprint). With suitable verification equipment, this data can be used at the point of entry to identify whether the cardholder is the legitimate owner of the card. The card also has the benefit that it can easily be individually personalised to allow access to only certain facilities depending on the security clearance of the card holder. Additionally, as the cardholder progresses through a security system, a log of the person's movements can be stored on his card as a security audit trail.

Computers often hold sensitive information and access to this information has to be controlled. The smart card offers a solution. It can hold a cryptographic key to allow access to various areas of a database depending on the card holder's level of authority.

The smart card also offers a solution to the problem of unauthorised copying of software. By storing a key part of a software program in the card, the complete program will only be able to run with the smart card present.

Direct Broadcasting by Satellite (DBS) and Cable Television are going to become more widespread in future years. The smart card offers a means for payment and the key for reception. Customers will be able to purchase an ic Card that will provide the necessary key to unscramble the picture. Cards and decoding equipment could be supplied through TV rental companies. After, for instance, an interval of one month the key required to decode the signal can be changed so that the user has to return to the rental shop to have, upon payment, the card updated with the new key. Viewing time statistics could be simultaneously collected.

Banks' major clients can use the ic Card as the key to secure access of the bank's mainframe computers for corporate cash management. The card is a secure token for individual companies to access their bank accounts and financial services from remote personal computers on their own premises. This service could later be extended into home banking.

In the general financial area the card can be used in a number of ways. It can be used to replace the cheque book. At a point of sale the smart card has the capability to compare the card holder's personal identity entered by means of a four digit number, or characteristics of a digitised signature, with a secretly held reference in the card. A correct comparison will then allow the automatic transfer of funds from the purchaser's bank account to the retailer's bank account.



Fig. 3.5 The GEC ic Card can be used as the means for paying for goods at a retail outlet.

The card can also be used as an electronic wallet replacing cash. Here the card will have prepaid amounts which can be used for payment of low value purchases in shops (Fig. 3.5), at vending machines and car park entry points by the automatic deduction of the appropriate amount. The payment made will be held securely within the vending machine, probably on another smart card, for subsequent reconciliation.

As an electronic token, the card is equivalent to the electronic wallet but instead of cash, holds units of consumption such as electric and gas units and telephone charge units. In applications such as these the card could also provide additional facilities. In the case of the electricity/gas card it could monitor and store when units are being used; information which could be extracted from the card when next the token value is replenished. In the case of the telephone card it could also hold telephone numbers for speed dialling.

In the longer term the card could be used as a social services card carrying individuals' child allowance, pension entitlement or social security entitlement. It could be used as a driving licence, tax disc and log book, readable electronically through the car windscreen. One day it is envisaged there could even be an 'electronic' passport where the card is simply laid

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