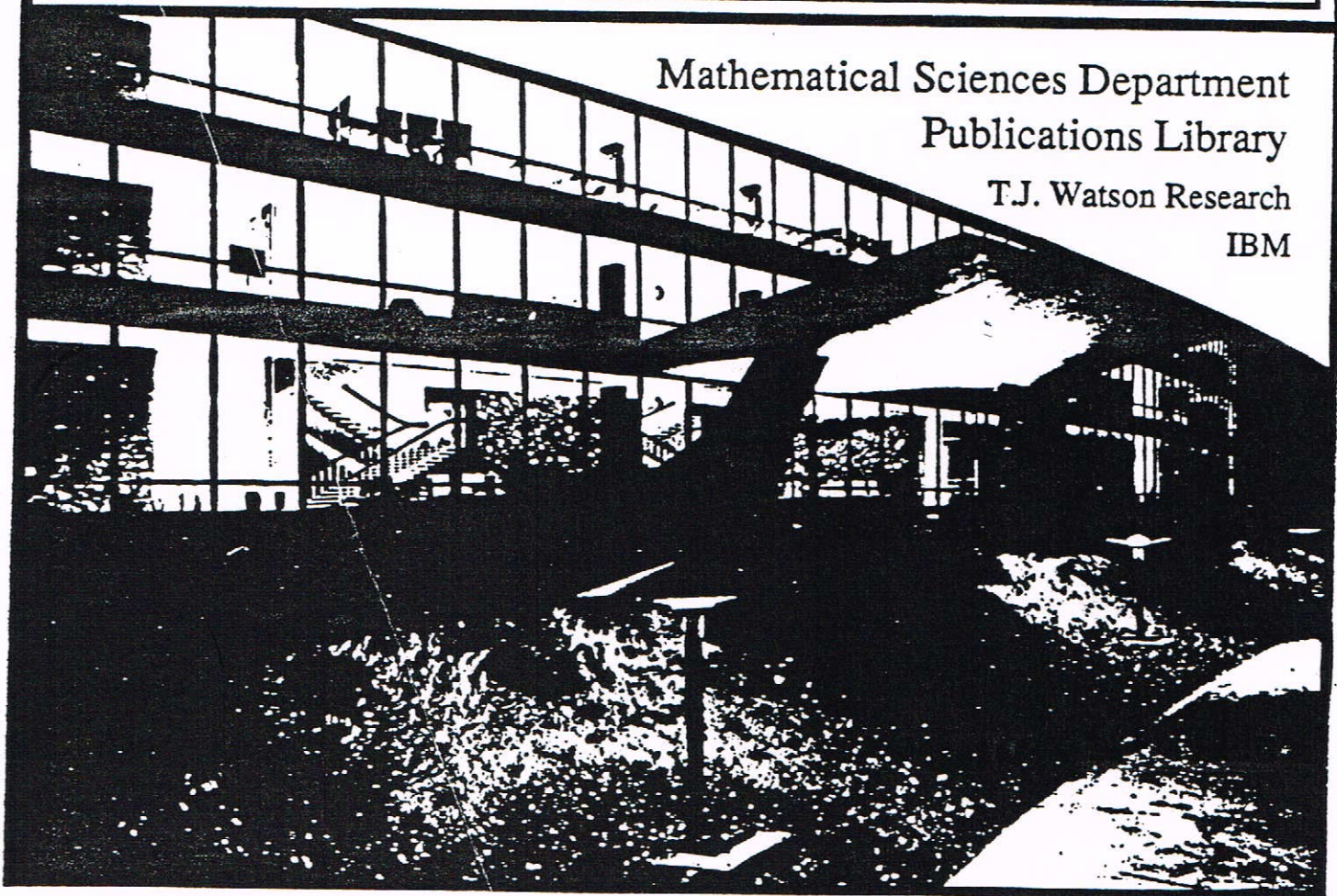


## A High Tech, High Security Employee Identification Badge

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# A High Tech, High Security Employee Identification Badge

August 25th, 1987

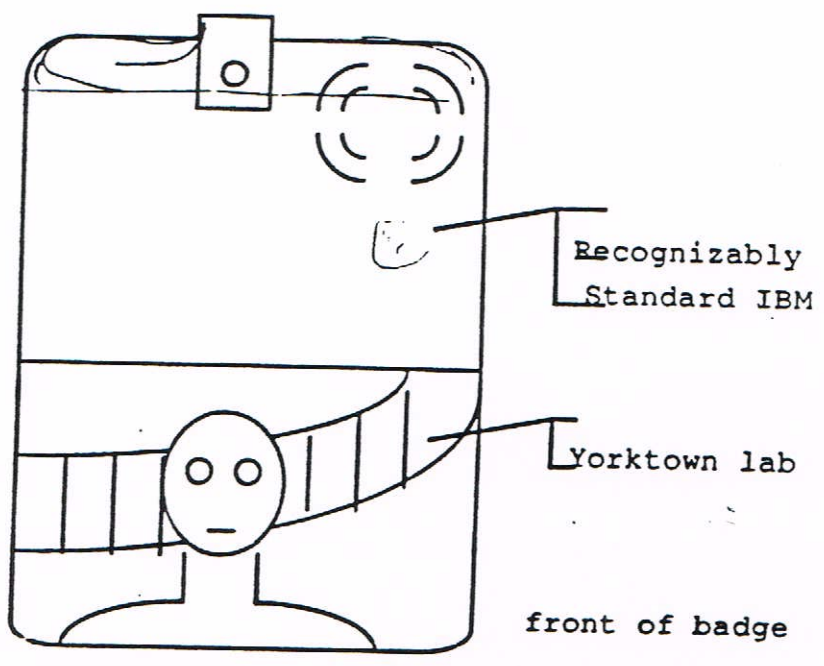
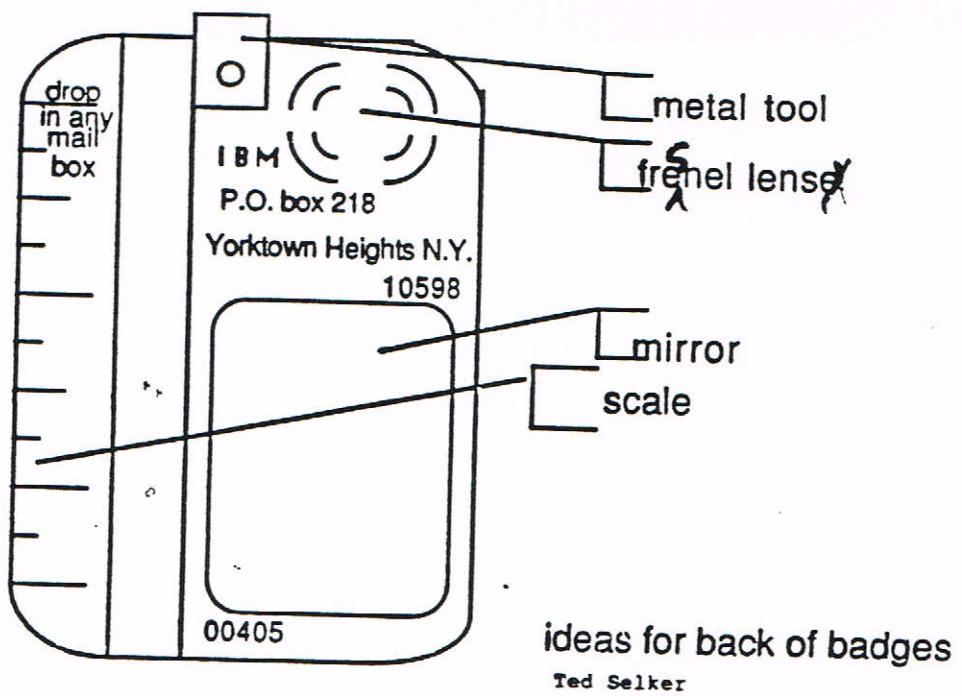
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## Abstract

This report describes ideas for an identification badge that would increase security of locations using it and provide useful personal services functions. Security would be increased by the use of an animated display that identifies the origin and status of the wearer and by passwords which would enable the badge for a time period. Personal services functions include calendar and reminder, watch, and notepad.

Per 5.2



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I have asked  
But something  
to discuss with  
me to you  
etc

Please discuss  
with  
Selker  
Thurston etc

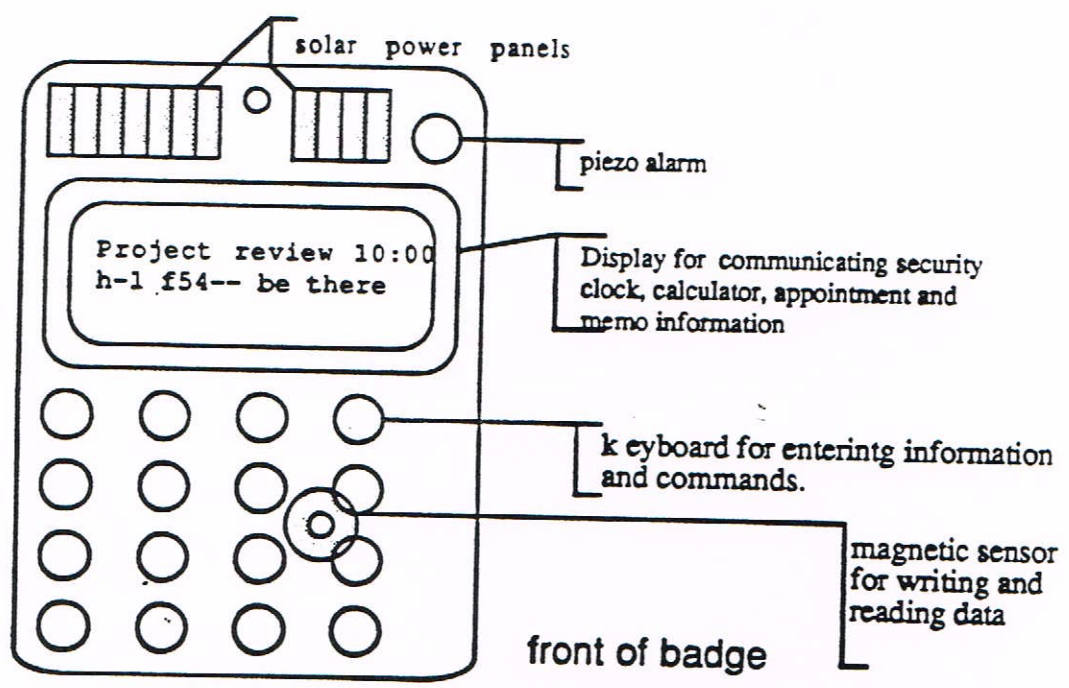
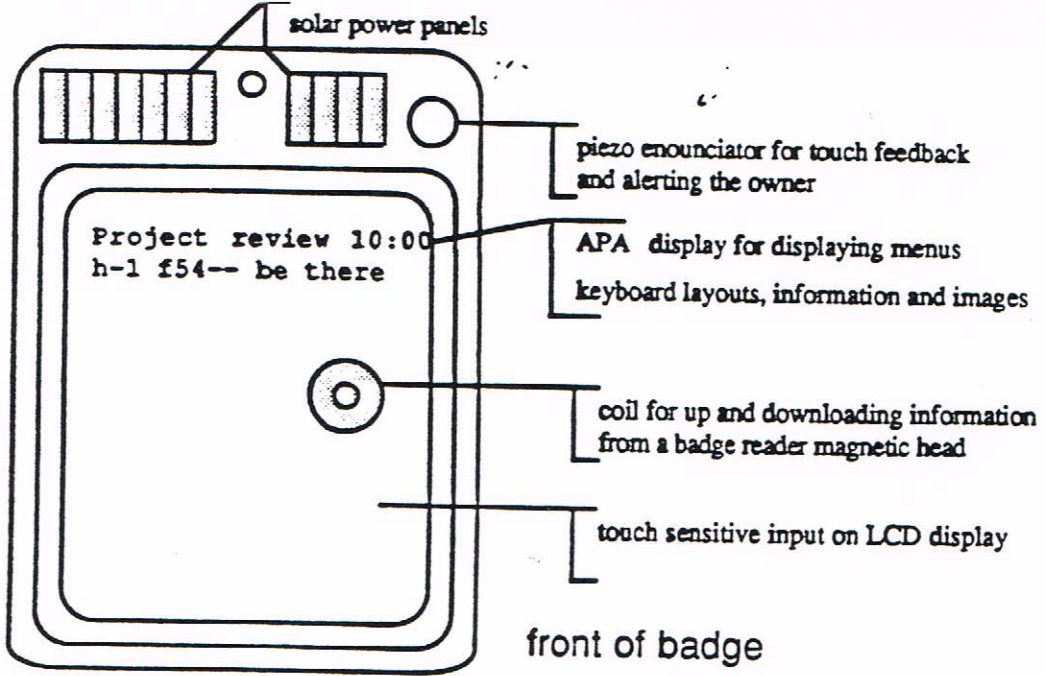
TO: *RS*

HANDLE	PREPARE REPLY	DISCUSS WITH ME	FOLLOW-UP DATE
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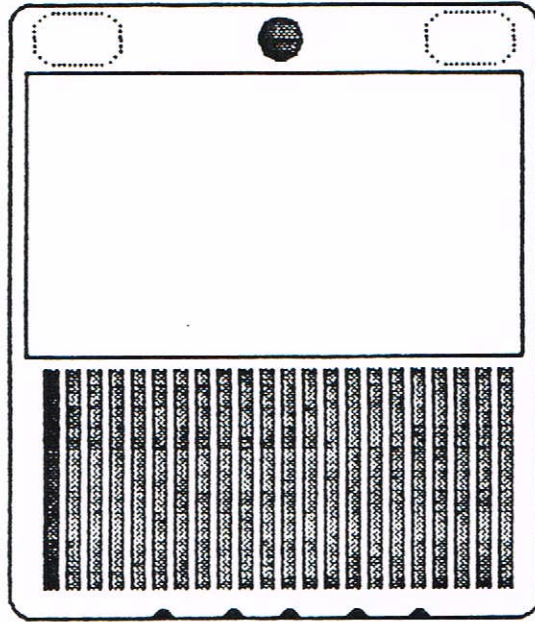
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FROM: ABE PELED



# The High-Tech Badge

Infrared detector



Sound maker



Touch Sensitive  
LCD Display



Solar Cells



External  
connections



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A "smart" employee identification badge the size of current identification badges and the thickness of a credit card calculator, could provide new security functions as well as personal services functions.

This report proposes and describes such a badge, the High-Tech badge, and a variant of it, the Visi-Tech badge; a simpler badge is sketched to illustrate what is possible with a less ambitious application of technology. This section summarizes the features of the badges; later chapters provide more detail.

### 1.1 Common Features

Each badge would contain a computer chip containing a processor, working memory, permanent memory, a clock, a Liquid Crystal Display (LCD), a sound generator, connections for a badge reader and PC interface, an infrared or sonic detector, and a solar cell or battery for power.

The front of the badge has a bitmapped LCD. The display has an animated picture showing what location the employee is from. Other features enhance security in other ways.

The normal employee photograph ID is on the back side of the badge. The printed name and photo are still required in situations where the badge is physically handed to someone to examine.

The back can also have an area which is either an electrical connection to a serial interface or has a coil sensitive to a badge reader's head. The sonic enunciator could serve this function as well.

### 1.2 High-Tech Badge

The High-Tech badge includes a touch sensitive area over the LCD or includes a separate keyboard.

The LCD normally displays a graphical representation of some identification of the company or location, animated under certain conditions.

The badge can be used as a schedule reminder, calculator, memo pad, and watch along with other functions.

A later chapter, "Inside The Badge" on page 7, describes each component in detail. Another, "Security Considerations" on page 5 describes the security features. Yet another, "Personal Services" on page 9 describes the personal services that might be available.

The badge is both an employee identification device and a personal services tool. As an ID device, it improves the ability of security personnel to identify a person's authority to be where they are. As a useful device, the badge is more valuable for an employee to wear or carry.

### 1.3 Visi-Tech Badge

The Visi-Tech badge is a security-only version of the High-Tech badge. It omits external connections for interface to a PC or host system (but leaves a connection for use in a badge reader), and omits the personal services functions. The display is animated and shows the same kind of distinctive display. It has no other functions.

It would be less expensive to produce (and sell) and would be most useful for employees that have no business need for the extra functions. (Such employees might work in cafeterias, or do certain kinds of clerical work.)

### 1.4 Simpler Badge

The simpler badge is like the High-Tech badge with the following modifications:

- The display is one or two lines of LCD text only. The display would have some distinctive animated activity.
- The processor is much simpler.
- Additional functions would be more limited and might include only a calculator, reminder, memos, and watch.

The packaging and processor might be taken almost completely from current credit card calculator technology and packaging. (See the *SeleTronics Personal Directory* in "Related Devices On the Market" on page 13 for an example of a related product.)

The advantages of the simpler badge are:

- essentially existing technology; at most it is a re-packaging of existing functionality, altering the microcode for new features; and
- shorter development time.

Disadvantages are:

- Does not take advantage of available technologies;
- Less security; and
- May be less usable.

## 2.0 How The Badge Might Be Used

This chapter presents several scenarios which illustrate how the High-Tech and Visi-Tech badges might fit into the lives of different kinds of users. Information presented here is discussed in more detail in later chapters.

### 2.1 Typical User

Theodore is a financial professional with Interactive Products Systems Division headquarters. His job involves working with financial and product forecasting data. Let's look at a typical day with Theodore and his High-Tech badge.

He arrives at work at 7:28 amid a rush of others. As he approaches the guard station, an infrared or sonic signal hits the badge and the display animates in a distinctive way, with the letters "IPSD" across the top and a logo moving around. The guard sees the badge, but more important he sees that there is an appropriate animated picture for his location and lets Theodore through.

Right behind Theodore is Bob from another company location. His badge also activates but shows a different logo. The guard asks him to stop and sign in.

Meanwhile, Theodore moves to his work area. Within a few seconds after leaving the guard station the display stops being animated but the image remains visible.

At his desk Theodore activates his personal computer and puts his badge in a slot in the front. The PC reads his employee ID and unlocks so that he can access the sensitive data held in it. The PC sends his day's calendar to the badge.

At 9:50, the badge signals that a meeting is coming up at 10:00. He presses a key on the badge and reads the meeting location and purpose on the badge display.

During the meeting, he adds a new item to his schedule and enters it into the badge using the touch sensitive keypad. When he returns to his office he can let the PC read the new scheduled item if he wishes.

During the day, the distinctive display on his badge tells those around the building that he belongs. At one point, Theodore attends a confidential meeting. At the door a guard triggers a portable infrared or sonic transmitter and the badges of those entering the meeting animate for a few seconds.

### 2.2 A Product Designer

Cathy is a product designer in a product development lab in the Environmental Systems Products Division.

Cathy badges in a back door. Since her work environment requires a higher level of security than Theodore's, her badge is not normally enabled. Just before she badges in she enters a password which enables the badge for general building access for 10 hours.

(One Saturday she had inadvertently left the badge attached to some dry cleaning. Since the badge is active for only 10 hours after entering the password, it would have been useless to anyone who might have taken it.)

Cathy's work area is inside a secure room deep in the basement of the building. As she approaches the secured door, she removes her badge and enters a special password using the touch sensitive area. The password activates the badge for access to the lab for only a few minutes. It is a different password than the one that activates the badge each day for 10 hours.

Cathy then inserts her badge into a badge reader at the door. The reader and the computer to which it is attached verify that she can enter the room. Had she not entered the password into the badge itself she would not have been admitted.

The badge reader activates a special mode in her badge which causes a different distinctive animated sequence to start and to run while she is in the product lab. When she badges out to go to lunch, the special display is disabled and the animation turned off. It is thus obvious that anyone in the product lab without a special animated badge does not belong there (or has not properly badged in) and also obvious when an employee fails to badge out of the lab.

When she goes through regular building entrances and exits the badge shows the regular display of other employees. The special product laboratory display is visible only inside the lab; there is no way to tell that the badge is special when Cathy is outside the lab.

### 2.3 Building Staff

Robert is a member of the building cleaning staff. His badge has none of the special features to remind him of meetings. Since he is a contract employee, his badge is kept at the guard station. Each day when he arrives the badge is enabled for the amount of time he will be working around the building and then given to him. If he inadvertently leaves with the badge it is useless.

The badge animation shows that he belongs in the areas he works in but that he is "special" and should not be in, say, secured product laboratories.



This chapter reviews the security features of the High-Tech and Visi-Tech badges and considers some special situations and environments.

### 3.1 Uses In Standard Environments

A "standard environment", as the term is used in this report, is the kind of security environment probably encountered by most employees of large corporations.

Security personnel need to be able to tell at a glance if someone belongs where they are and, if not, whether they constitute a problem. The information on a regular badge that typically provides this is the color of the badge or the background in the photo and in special situations some addition to the badge. (Personal identification information is typically needed at other times by security and other personnel. It is here considered separate from the need to identify that a person should be where they are.)

An animated facility dependant display on the front makes it easier to tell if someone belongs where he is. Advantages of a 'live' image are that it is less easily duplicated than a glued on photo, and that it can identify the employee as being from a specific location.

### 3.2 Inactivation After Elapsed Time

The usefulness of the badge might last only for some time period which can be set when the badge is issued. When the time period has expired the badge is useless unless the employee enters some access code. Thus, a lost badge would rapidly become unusable. The time periods might be years for a standard corporate environment, 8-10 hours for a more secure environment, or minutes for a high security environment.

An inactive badge wouldn't look inactive. It just wouldn't allow itself to be used to enter secure areas.

### 3.3 Moving Display on Signal

A continuously moving display might be an irritant, especially in a room full of people all wearing them.

An infrared or sonic detector on the front of the badge would cause the display to activate when a special signal is received. Note that the signal is transmitted *to* the badge and no information ever goes *from* the badge except when manually inserted into a special reader.

Building lobby areas could be outfitted with transmitters which would cause the badges to be active there. Guards could carry small transmitters which would

make badges active in their vicinity. Otherwise, the display would show a static display which would identify the company or division and location. (It also might be useful to let the employee turn on the display, say to demonstrate to someone that their badge was indeed real.)

The infrared or sonic signal might select one of several alternate animated displays. A guard could further check that a given badge is valid by signalling for an alternate animated display; the signal might possibly including information to be displayed. (Thus no conceivable fake of a badge could work short of a complete duplication.) Also, the signal sent in a lobby area might change every few seconds causing a change in the display. Every badge in view would then change in lock step. One that didn't is obviously either broken or a fake.

Optionally, the badge might animate the display for a short time after entering it into a badge reader. Thus a guard watching an entrance without an infrared or sonic transmitter could verify that all employees badged in properly.

### 3.4 Uses In High Security Environments

Versions of the High-Tech and Visi-Tech badges would be useful in high security environments. The badge might only function for entry to a high security area if the employee had recently entered an additional password into the card. This would assure that a lost or stolen card was not being used.

Further, the ability to enter the secured environment might last only for minutes after the employee enters the password. Thus, a lost badge would rapidly become unusable.

When the badge is used to enter a high security area the badge reader might signal the badge to enter a mode in which a special animation is continuously displayed. The animation shows that the person is supposed to be in the area. When the badge is used to badge out of the area, the special display goes away. It is thus only visible within the bounds of the secure area and it is not obvious that the badge is in any way special when worn outside the area.

Under certain circumstances, a badge might make noise when entering a high security area if not authorized for that area. For example, a military contractor often

This chapter describes each of the components of the High-Tech badge. (The Visi-Tech badge contains a subset of these.) Options and possible variations are discussed. There is some duplication of material covered in other chapters.

### 4.1 Processor

Functionally this has to be a processor with a real time clock, enough I/O for the keyboard, serial interface, display and enunciator, ability to access ROM for stored programs and personal security information and RAM for user data.

### 4.2 Read-Only Memory

The Read-Only Memory (ROM) holds the operating system, the data for the animated display, and (possibly) the employees name and employee number. It thus needs to be easily set when the badge is issued but impossible to reset. Some method of burning a ROM and then sealing it so that it cannot be tampered with is needed. (See "Packaging" on page 6.)

### 4.3 Liquid Crystal Display (LCD)

The badges use LCDs similar to those used in pocket TV sets. A color LCD could display the employee picture too.

### 4.4 Power source

The main power for the unit could hopefully come from a solar cell. In low light situations, the badge would shut down and maintain status information using a small battery or capacitor. The battery would not drive the display. If some non-volatile RAM is used then a battery could be omitted.

If sufficient power cannot be obtained from a solar cell then a flat foil battery might be a good substitute.

### 4.5 Sonic or Infrared Detector

A small infrared or sonic detector on the front of the badge is used to detect the presence or absence of a strong signal. It need not be terribly complex.

A detector that could read some information across the infrared or sonic link would be useful for high security environments, but the necessary bandwidth is very low.

### 4.6 Keyboard

The keyboard is one of two types:

1. *Touch sensitive area:* On the High-Tech badge, the best keyboard is touch sensitive and recognizes stroked letters. The finger would mark a letter by stroking its shape. (Such devices are used in at least one calculator watch today.)

The keyboard would be transparent and lay over the display. The display then provides the necessary markings for simulated keys, menus, and stroked letter inputs. In addition, one or two buttons might be necessary for controlling what mode the display was in.

2. *Separate keys:* A simpler keyboard would be a thin film or raised dimple keyboard commonly used on credit card calculators. Since calculators on watches have 12 keys in an area 1 x 1/2 inch, placing 16 keys in 1.5 x 2 inches should be feasible. However, a keyboard that does not share space with the display leaves much less space for the solar cells and might thus require the use of a battery to power the display.

### 4.7 Audible Alarm

Some kind of noise maker or vibrator is needed for the alarm function. Piezoelectric crystals are commonly used for this. It should allow at least some degree of control over the loudness of the sound; control over the pitch would be highly desirable.

### 4.8 External Connection

An external connection is needed for:

- Validating a user when he badges in or out;
- Downloading personal schedule information;
- Uploading changes to the personal schedule;
- Uploading notepad notes;

and other such uses. The connection can be done several ways:

1. A set of metallic connections on the back or bottom could provide computer access to the badge. A program in the badge could read data from the connections. A 'reset' function might invoke a ROM routine which would read a program from the connections and start it.
2. A coil in the badge could allow a magnetic recording head to access memory in the badge. This might be the same head as used for reading mag-

## 5.0 Personal Services

Personal services come in two flavors: those that assist the employee in his job, and those that make the badge more useful to the employee and thus more apt to carry or wear the badge.

When the badge is used for personal services, it detects a key press (or special stroke) and puts up a menu of services. When nothing has been done for some number of seconds (or upon request) the card again starts up the distinctive location dependant display. When a personal service has been selected the touch sensitive display changes, say, to look like a calculator keyboard. (If a separate keyboard is used, the display would show which keys do what.)

This chapter lists some possible personal services. It is not intended to be exhaustive nor to suggest that these functions are mandatory.

### *Reminder and Daily Schedule*

Programs and times could be down loaded from a PC, host connection to the badge or set through the keyboard. At appropriate times the badge would make a sound to remind of a an appointment, meeting or event. The display would then tell what and where. Controls would also allow turning off alarms or setting alarm loudness. New information entered by the user should be able to be uploaded to the PC or host.

### *Notepad*

The badge could be used to take notes of things to do later, like a small pocket notepad. This would require the touch sensitive screen rather than the alternate dimpled keyboard.

### *Calculator*

There is enough space for keys for a 6-8 function calculator.

### *Watch*

The display could be set to show the time. It could do this as part of the standard identification display, even placing the time at the bottom of the display upside down for easy visibility while being worn.

A world time mode could display a world map and show the time in several selected time zones.

### *Rolodex*

The badge could hold ones personal phone book. A phone with a reader could auto dial a number.

### *Project accountant*

Could allow a person to enter the code of a project to which work should be assigned as they are starting and stopping projects, or days that are vacation or holidays. This could be uploaded to a PC or mainframe and used later to make out a time card.

### *Stopwatch*

A simple stopwatch is often useful and is a simple addition given the hardware needed for a watch and reminder.

### *Countdown timer*

Another useful clock related function counts down from a given number of minutes.

### *Data repository*

Information such as airline flight schedules (for flights the user is actually taking), phone numbers for associates, or other data could be downloaded from a personal computer.

The following parts of the High-Tech badge seem to have some possibly interesting research issues involved with their design:

### *Power*

Powering the LCD from a solar cell might be the single hardest part of the design; a flat battery might be needed in early models. Other possibilities include charging a battery when the badge is left overnight on a dresser, or while it sits in a badge reader in a PC.

### *ROM Security*

The ROM needs to be set once easily and then forever be "impossible" to modify.

### *Touch screen*

The screen needs to be small, have high resolution, and be viewable from a wide angle of positions; further it needs to be touch sensitive or have a transparent touch sensitive overlay.

### *Personal services functions*

What functions and how is the interface done?

### *Packaging and integration*

How do all the needed functions get put onto one (or two) low power chips?

## A.0 Related Devices On the Market

This chapter describes commercially available devices that illustrate the kind of compact packaging that is currently possible. Some of these have functions similar to, but simpler than, the personal services functions of the High-Tech badge. One has a programmable graphics LCD.

- **Small Size**

*TI-1786 Solar Credit Card*

Priced at \$5.95 in discount catalogs, this device is 0.1" thick and has 7 functions plus memory.

*Casio RD-90*

This unusual device is credit card sized, and 1/8 inch thick. It has an FM radio on one side and a solar-powered 5 function calculator with memory on the other side.

See also the SeleTronics Personal Directory PD-100 below.

- **LCD**

*Pocket LCD TV Sets*

The market is full of these. The lowest price we've seen is \$49.95 at discount, which includes a small LCD but not much else. Color ones sell for under \$200.

*Casio FX-7000G Graphics Calculator*

This device is an 82 function programmable scientific calculator with text entry, prompts, etc. It has a 16 column by 8 line LCD that is also a 96x64 dot bit-mapped display. Programs can draw arbitrary graphics. It costs \$70.00 at a local office supply store (not discount).

- **Personal Services**

*Seiko Day Filer*

The Day Filer is priced at \$100 in an electronics catalog. It is a pocket sized device with a small Qwerty keyboard, function keys, and a two line 20 character (total) display. Its functions are: a schedule of up to 40 appointments; appointment reminder; note pad with up to 100 lines of phone numbers, addresses, and other such

notes; an alarm clock; a four function calculator; and a calendar.

*SeleTronics Personal Directory PD-100*

This is another electronic reminder. This one is the size of a credit card, has 32 keys including the full alphabet, a 2 line 20 character display, 2K of data for names, addresses, etc., a calculator, metric units converter, and has a password to prevent unauthorized use. It costs \$34.95.

*Seiko Touch Sensitive Watch*

We've heard about this device but not seen a price or advertisement. It combines a watch, a calculator, and other functions. It has no keyboard but uses the face of the display as a touch sensitive input area. Input numbers are stroked using the finger on the display.

*Casio Data Bank CD-40*

One of us (dns) has been wearing one of these for a year. It has 16 keys on the front and another 8 along the sides. It has:

- Four function calculator plus memory;
- Some 20 world time zones, each separately settable for offsets from the hour and for daylight time;
- Stopwatch with lap timer;
- Phone number list, with up to 10 names and numbers;
- Three daily alarms; and
- Date and time.

*Seiko RC4000 Wrist Terminal* This is a watch which contains 2K of data storage for phone numbers, appointments, calendar, etc. It can upload and download from an IBM PC, Apple II, or Commodore 64. It costs \$199.

*Seiko RC4400 Pocket Terminal* This is a pocket sized device similar to the RC4000 but larger in size. It contains 2K of data storage for phone numbers, appointments, calendar, etc. It can upload and download from an IBM PC, Apple II, or Commodore 64. It costs \$149.

Copies may be requested from:

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