1. INTRODUCTION
1. WIRELESS SENSOR NETWORKS

A wireless sensor network is a distributed collection of nodes with resource constraints and capable of operating with minimal user attendance. Some of the potential applications of wireless sensors include environmental monitoring, military surveillance, search-and-rescue operations, tracking patients and doctors in a hospital, and other commercial applications. Wireless sensor nodes operate in a cooperative and distributed manner. Such nodes are usually embedded in the physical environment and report sensed data to a central base station.

A wireless sensor network normally consists of a large number of sensor nodes that organize themselves into a multihop wireless network.

Each node has one sensor, embedded processors, and low-power radio, and is normally battery operated. Sensors have limited energy resources and their functionality continues until their energy is drained. Therefore, energy for sensor networks should be managed carefully to extend the lifetime of sensors. The sensing element of a sensor probes the surrounding environment.

After performing signal processing of the observed data, sensors communicate this data, typically using radio-based short haul links, to a cluster head.
ABSTRACT

In the last two decades, underwater acoustic communication experienced significant progress. The traditional approach for ocean-column monitoring is to deploy oceanographic sensors, record the data, and recover the instruments. But this approach failed in real-time monitoring. The ideal solution for real-time monitoring of selected ocean areas for long periods of time is to connect various instruments through wireless links within a network structure. Basic underwater acoustic networks are formed by establishing bidirectional acoustic communication between nodes such as autonomous underwater vehicles (AUVs) and fixed sensors. The network is then connected to a surface station which can further be connected to terrestrial networks such as the Internet.
The Java Ring is an extremely secure Java-powered electronic token with a continuously running, unalterable real time clock and rugged packaging, suitable for many applications. The jewel of the Java Ring is the Java iButton -- a one-million transistor, single-chip trusted microcomputer with a powerful Java virtual machine (JVM) housed in a rugged and secure stainless-steel case. The small and extremely rugged packaging of the module allows it to attach to the accessory of your choice to match individual needs.

Dallas Semiconductor Corp. produced the first stainless-steel-encapsulated memory devices utilizing the Dallas Semiconductor, employed in a variety of self-contained memory devices. Originally called "touch memory" devices, they were later renamed "iButtons." Packaged like batteries, iButtons have only a single active electrical contact on the top surface, with the stainless steel shell serving as ground.

Data can be read from or written to the memory serially through a simple and inexpensive RS232C serial port adapter, which also supplies the power required to perform the I/O. The iButton memory can be read or written with a momentary contact to the "Blue Dot" receptor provided by the adapter. When not connected to the serial port adapter, memory data is maintained in non-volatile random access memory (NVRAM) by a lifetime lithium energy supply that will maintain the memory content for at least 10 years.

All the applets currently loaded in a Java iButton are effectively executing at zero speed any time the iButton is not in contact with a Blue Dot receptor. NVRAM memory is metallurgically bonded to the barrier substrate through which all electrical contacts are made. The Java-Powered iButton is an attractive solution for companies that would like to execute custom Java applications on-the-fly or on-button for security purposes and sufficiently secure for many applications.

2. JAVA RING
The Java Ring is an extremely secure Java-powered electronic token with a continuously running, unalterable real-time clock and rugged packaging, suitable for many applications. The jewel of the Java Ring is the Java iButton -- a one-million transistor, single chip trusted microcomputer with a powerful Java Virtual Machine (JVM) housed in a rugged and secure stainless-steel case. The Java Ring is a stainless-steel ring, 16-millimeters (0.6 inches) in diameter that houses a 1-million-transistor processor, called an iButton. The ring has 134 KB of RAM, 32 KB of ROM, a real-time clock and a Java virtual machine, which is a piece of software that recognizes the Java language and translates it for the user's computer system.

A Java Ring is a finger ring that contains a small microprocessor with built-in capabilities for the user. The Java Ring could have a number of real-world application. The Java Ring is a wearable computer that can be used to authenticate users to services on the Internet. A user only has to push the ring on her finger on a Java Ring reader for about a second. Internet services like e-banking or door opener can be secured and personalized without entering name and password.

3. HISTORY
In the summer of 1989, Dallas Semiconductor Corp. produced the first stainless-steel-encapsulated memory devices utilizing the Dallas Semiconductor 1-Wire communication protocol. By 1990, this protocol had been refined and employed in a variety of self-contained memory devices. Originally called "touch memory" devices, they were later renamed "iButtons." Packaged like batteries, iButtons have only a single active electrical contact on the top surface, with the stainless steel shell serving as ground.

Data can be read from or written to the memory serially through a simple and inexpensive RS232C serial port adapter, which also supplies the power required to perform the I/O. The iButton memory can be read or written with a momentary contact to the "Blue Dot" receptor provided by the adapter. When not connected to the serial port adapter, memory data is maintained in non-volatile random access memory (NVRAM) by a lifetime lithium energy supply that will maintain the memory content for at least 10 years. Unlike electrically erasable programmable read-only memory (EEPROM), the NVRAM iButton memory can be erased and rewritten as often as necessary without wearing out. It can also be erased or rewritten at the high speeds typical of complementary metal oxide semiconductor (CMOS) memory, without requiring the time-consuming programming of EEPROM.

The Java Ring is a wearable computer that can be used to authenticate users to services on the Internet. A user only has to push the ring on her finger on a Java Ring reader for about a second. Internet services like e-banking or door opener can be secured and personalized without entering name The Java Ring is an extremely secure Java-powered electronic token with a continuously running, unalterable real-time clock and rugged packaging, suitable for many applications. The jewel of the Java Ring is the Java iButton -- a 16 mm one-million transistor, single-chip trusted microcomputer with a Java virtual machine (JVM) housed in a rugged and secure stainless-steel case.
Designed processor features a high-speed 1024-bit modular exponentiator for RSA encryption, large RAM and ROM memory capacity, and an unalterable real-time clock. The packaged module has only a single electrical contact and a ground return, conforming to the specifications of the Dallas Semiconductor 1-Wire bus. Lithium-backed non-volatile SRAM offers high read/write speed and unparalleled tamper resistance through near-instantaneous clearing of all memory when tempering is detected, a feature known as rapid zeroization. Data integrity and clock function are maintained for more than 10 years. The 16-millimeter diameter stainless steel enclosure accommodates the larger chip sizes needed for up to 128 kilobytes of high-speed nonvolatile static RAM. The small and rugged packaging of the module allows it to attach to various accessories (key fob, wallet, watch, necklace, bracelet, etc.)

Within this there is a mask-programmed ROM, a continuously running true-time clock, and 6 kilobytes of NVRAM memory with expansion potential up to 128 kilobytes; the Java ibutton supports a true Java stack, full-length 32-bit Java integers, and garbage collection. This feature mix provides support for relatively high-end Java applets with substantial computing requirements. While the Java ibutton can support the commerce models that have traditionally been the province of credit cards, its greatest promise appears to lie in its capacity to interact with Internet applications to support strong remote authentication and remotely authorized financial transactions. The use of Java promotes compatibility with these applications by providing a common language for all application programming.

4. COMPONENTS OF JAVA RING
1. Java Virtual Machine (JVM)

2. RAM

3. ROM

4. real-time clock

5. iButton

6. Blue dot receptor

5. JAVA VIRTUAL MACHINE (JVM)
A Java virtual machine (JVM), an implementation of the Java Virtual Machine Specification, interprets compiled Java binary code (called bytecode) for a computer's processor (or "hardware platform") so that it can perform a Java program's instructions. Java was designed to allow application programs to be built that could be run on any platform without having to be rewritten or recompiled by the programmer for each separate platform. A Java virtual machine makes this possible because it is aware of the specific instruction lengths and other particularities of the platform.

The Java Virtual Machine Specification defines an abstract -- rather than a real -- machine or processor. The Specification specifies an instruction set, a set of registers, a stack, a "garbage heap," and a method area. Once a Java virtual machine has been implemented for a given platform, any Java program (which, after compilation, is called bytecode) can run on that platform. A Java virtual machine can either interpret the bytecode one instruction at a time (mapping it to a real processor instruction) or the bytecode can be compiled further for the real processor using what is called a just-in-time compiler.

6. IBUTTON
Java Ring

The iButton is a computer chip enclosed in a 16mm thick stainless steel can. Because of this unique and durable container, up-to-date information can travel with a person or object anywhere they go. The steel iButton can be mounted virtually anywhere because it is rugged enough to withstand harsh environments, indoors or outdoors. It is small and portable enough to attach to a key fob, ring, watch, or other personal items, and be used daily for applications such as access control to buildings and computers, asset management, and various data logging tasks. An iButton is a microchip similar to those used in a smart card but housed in a round stainless steel button of 17.35mm x 3.1mm - 5.89mm in size (depending on the function). The iButton was invented and is still manufactured exclusively by Dallas Semiconductor mainly for applications in harsh and demanding environments.

Like a smart card, an iButton does not have an internal power source. It requires connection to a reader (known as a Blue Dot Receptor) in order to be supplied with power and to receive input and send output. Unlike some smart cards, there are currently no contacts less iButtons: they require physical contact with a reader to function.

There are iButtons that measure temperature (for food storage and transport); have an electronic ID (for physical access to buildings); and store e-cash (for purchases both in stores and via the web). For e-commerce applications, the iButton can support JavaCard 2.0/OpenCard standards in addition to proprietary software.

iButtons have an advantage over conventional smart cards in term of durability and longevity. The stainless steel casing gives iButton a far greater ability to survive in a range of temperatures -- all versions are functional from -40 C to +70 C -- and in a much
harsher range of environments (such as exposure to salt water and long term exposure to physical impacts) than the plastic smart card. For e-commerce and personal ID usage, iButtons can be mounted on a range of personal accessories: watch, ring, key chain, or dog tag.

Among the major successes for the iButton have been its use in Turkey as an e-purse for the mass transit system; in Argentina and Brazil for parking meters; and in the United States as Blue Mailbox attachments that improve postal efficiency.

7. COMPONENTS OF iBUTTON
7.1 The Can and Grommet

An iButton uses its stainless steel 'can' as an electronic communications interface. Each can has a data contact, called the 'lid', and a ground contact, called the 'base'. Each of these contacts is connected to the silicon chip inside. The lid is the top of the can; the base forms the sides and the bottom of the can and includes a flange to simplify attaching the button to just about anything. The two contacts are separated by a polypropylene grommet.

7.2 The 1-Wire Interface

By simply touching the iButton to the two contacts described above, you can communicate with it through our 1-Wire protocol. The 1-Wire interface has two communication speeds: standard mode at 16kbps, and overdrive mode at 142kbps.
7.3 The Address

Each iButton has a unique and unalterable address laser etched onto its chip inside the can. The address (e.g. 2700000095C33108) can be used as a key or identifier for each iButton.
8. iBUTTONS MODELS

Fig 8.1 ibutton

Fig 8.2 key fobs

Fig 8.3 watches
9. ARCHITECTURE

![Diagram of the iButton Structure](image)

*fig9 Layout of the iButton Structure*
10. BLUE DOT RECEPTOR

10.1 PC 1-Wire Connectivity

The DS1402D Blue Dot Receptors are jButton reader/probes that provide a convenient pipeline into the PC for jButton-to-PC communication. The receptor's cable connects to a USB, serial or parallel-port 1-Wire adapter, whichever type of port you wish to use. The receptor itself easily affixes to any accessible spot on the front of the PC. The user can elect a quick information transfer with a momentary touch of the jButton to the Blue Dot. For hands-free operation the jButton can be snapped into the Blue Dot and remain there.

Each receptor contains two Blue Dots to accommodate instances where multiple jButtons are required for a transaction. A company's policy may, for example, require both an employee and a supervisor to authenticate access to sensitive information stored on a network server.
10.2 USB Port Adapters

The DS9490R USB Port Adapter and the DS1402D-DR8 Blue Dot Receptor connect to any standard universal serial bus (USB) port. The DS9490R connects to the USB port and then the DS1402D-DR8 connects to the DS9490 through an RJ-11 connection.

The DS9490 USB Port Adapter comes with the following features:

- USB port
- Internal 64-bit address
- Communicates to all iButtons; can read but not write to DS198x EPROM iButtons

10.3 Serial Port Adapters

The DS9097U RS-232 Serial Port Adapters and the DS1402D-DR8 Blue Dot Receptor connect to any standard RS-232-C serial port. The DS9097U connects to the serial port and then the DS1402D-DR8 connects to the DS9097U through a RJ-11 connection. The DS9097U is not a pass-through device. A serial port must therefore be dedicated to perform iButton communication.
The DS9097U RS-232-C COM Port Adapter comes in three versions:

- **DS9097U-S09**
  - 9-Pin RS-232-C port
  - Communicates with all iButtons, can read but not write to DS198x EPROM iButtons

- **DS9097U-009**
  - 9-Pin RS-232-C port
  - Has internal 64-bit address

Communicates with all iButtons, can read but not write to DS198x EPROM iButtons

- **DS9097U-E25**
  - 25-Pin RS-232-C port
  - Communicates with all iButtons

Has 12V—power port to enable writing to DS198x EPROM iButtons
10.4 Parallel Port Adapter

The DS1410E Parallel Port Adapter and the DS1402D-DB8 Blue Dot Receptor combine to form a PC interface that consumes no other resources. The parallel-port signal lines pass through the DS1410E when iButton communication is not occurring. Peripherals, such as printers, can be reattached by first connecting the DS1410E to the PC parallel port, and then connecting the peripheral cable to the other end of the DS1410E. The DS1410E also comes with an internal 64-bit address.
10.5 Other Readers/Probes

Two other probes are available for communicating with jButtons through our adapters. The DS9092GT is a Handheld Touch Probe with tactile feedback. It can be connected to either the DS9490R USB port adapter or the DS9097U serial port adapters.

The DS1402-RP8 and DS1402-BP8 are Touch-and-Hold Probes that allow you to just touch an jButton or snap it in place for hands-free operation. The DS1402-RP8 works with the serial port adapters and the DS1402-BP8 works with the parallel port adapter. The DS1404 is a Touch-and-Hold Probe Cradle designed to hold either the RP8 or BP8 probe.
11. WORKING

Primarily the Java ring is your key to completely reliable identification for access to computers, networks, e-mail and so on. The Java Ring can give secure access to Internet accounts and e-mail, Automatic Teller Machines, restricted areas, and can also contain information on inventory, processes, maintenance, and delivery.

The heart and soul of the Java powered ring is the iButton developed by Dallas Semiconductor. The ibutton is a small chip contained in a protective case such as the Java Ring, a keychain, bracelet, watch, wallet, or badge.

The identification is based on two important elements: possession of the ibutton and the entering of a Personal Identification Number (PIN). You press your ring to the reader and the ring provides its own PIN, which even you don't know. The ring's key number is a 1024 bit piece of mathematical data that includes 308 decimal digits, too hard for even Einstein to crack on a good day.

If the compartment containing the iButton is tampered with, data is subsequently erased. The validation system currently works like ATM validation in that no entry, access, or transactions are permissible until the PIN number is validated.

Besides personal computer access, many companies currently utilize the iButton technology to control physical access to restricted areas within their
facilities. These companies include hospitals, laboratories, offices and banks. Transit fare carriers in Turkey use iButtons, Ryder keeps track of truck maintenance with iButtons, the U.S. Postal Service uses iButtons for mailbox identification, and cows in Canada wear them to keep track of vaccination records.

To use this technology yourself, you primarily need an iButton, which can be contained in a number of aforementioned devices (the Java Rings are available in many custom sizes for about $65, which you can order). Next, you need the Connectivity Pack, which consists of a Blue Dot Receptor which can be connected via a serial or parallel port on your computer. These Blue Dot Receptors are available for less than $20. Finally, you need the software, which you can download free of charge.
12. APPLICATION

- Although Java Rings aren't widely used yet, such rings or similar devices could have a number of real-world applications, such as starting your car and having all your vehicle's components (such as the seat, mirrors, and radio selections) automatically adjust to your preferences
- Personalized services.
- Providing security
12.1 Personalized services

12.1.1 e-banking

This demonstration shows how an e-banking application (Jini client) tries to connect to a bank server (Jini service) to retrieve the current account balance of that user. Since all bank data must be treated confidential, the bank server interacts with the security infrastructure that is installed at the bank, before it responds to the application. The bank’s security infrastructure demands that the user must authenticate herself to get the permission. Therefore an authentication scheme is started at user side that asks the user to push her Java Ring on the Java Ring reader. Inside the Java Ring resides a Java interpreter that executes cryptographic routines to perform that task. After the authentication process on the Java Ring, the bank knows the identity of the user and that she is really the one, she pretends to be. Then the bank service can send the confidential and personalized data to the e-banking application that displays the current account balance.

12.1.2 Coffee making

At the San Francisco conference, the rings were used for the mundane purpose of providing attendees with their preference in coffee. First the rings were personalized by pressing a special terminal called a Blue Dot receptor with the signet of the ring. The signet activated a computer where attendees filled out an online questionnaire that took personal information and coffee preferences and stored them back into the ring. In Java One’s Hacker Lounge, Sun had a fully automated coffee factory that took orders from an interface that read the customer's Java Ring. Clearly, the coffee demonstration was merely the thin end of the wedge;
12.2 Providing Security

The Java Ring implements one of the best security techniques known. Security is enhanced if it is supplied by something you have and something you know - in the way bank cards and PINs combine to get money from a cash point. Sun was trying to drive home the point that Java programmers could write small applications - applets - that could be loaded into the ring and used to support a wide variety of security applications such as digital signatures. The Java Ring is far more than a hacker's fashion statement. More than 21 million iButton devices are currently in use around the world. They can be found in medical information bracelets, in Schlage locks, in Ryder rental trucks, in every US postbox, in the cash safes of Taco Bell stores and in Federal Reserve banks in the US. Other applications are in the vending machines of Canada, the gas stations of Mexico City, the parking lots of Buenos Aires and the buses and ferries of Istanbul, according to Oliver Mills of Topsoft, UK agents for Dallas Semiconductor security devices. "They are inexpensive and rugged and offer almost uncrackable security for the data held within," Mills says. Sun's downsized computing phenomenon, which it has christened "knuckletop computing", could open the door for many new personal cyber devices, including key chains, watches, pendants or anything wearable that could contain a chip. They are nearly indestructible - you can take then swimming or run them through the laundry - and they will remain unscathed, unlike smart chips on credit cards. The iButton has a 10-year lifespan and if anyone tries to pry it open to get at your digital signature or other secrets, the memory in the chip automatically zeros itself. Importantly, you won't need more than one. The iButton supports multiple applets that can be loaded dynamically as you need them - to log into your PC, to get money from an ATM, to start your car or to exchange contact data with a business acquaintance. This Java Ring lets you roam both the real world and cyberspace with your personal preferences and personal data if not at your fingertips then at least close to your third knuckle. Sun provided the scenario of starting
your car with a Java Ring: the seats and mirrors would adjust automatically to the right position, your favourite radio station would tune in, and the car would compensate for your individual driving style, providing economy or performance as you prefer. With the combined ingenuity of Java developers, the number of uses for Java-enabled personal accessories seems limitless.

12.2.1 Car security

The Sun concept car's security is based on a Java ring that contains a profile of the user. You connect the Java ring to a ring receptor in the car, and the car knows, based on your profile, what you are allowed to do. For example, a ring given to a mechanic or valet allows that person to see the dashboard and drive 40 miles per hour within a one block radius, but no faster or farther. In a family where both the husband and wife drive the car, each has individualized settings, so that when they enter the car, their environments are configured to the profiles on their rings. Java rings are authorized through Personal Identification Numbers (PINs) so that no one can steal a person's ring and run off with the car.

Sun representatives are also talking to automakers who are developing automated rental cars. In this potential market, a driver can use his or her ring to access a vehicle and simply leave it when done. Billing, reservations, vehicle monitoring, vehicle location, and all other functions are done via wireless communication. The net result is a very inexpensive rental car for local use by residents and tourists. This will create a new business for rental car companies competing for business travelers in the saturated airport rental car market.
All of the Sun concept car's software features are speech-enabled using the Java Speech API, so that drivers can switch between applications using speech commands. Drivers ask the email reader to read a message and hear it through the car's speakers. Or they can ask the navigation system to zoom in and out to show them where they are. The maps plotting the car's position are up-to-date since they are not stored locally in the car, but instead accessed from an Internet site.

The car has a speech-enabled calendar and address book, and SunLabs expects to integrate the Java Telephony API into the network so that drivers can verbally instruct their cell phone to make a call, hands

12.2.2 The postal security device

For over 10 years, Dallas Semiconductor also has been designing, making, and selling a line of highly secure microprocessors that are used in satellite TV descramblers, automatic teller machines, point-of-sale terminals, and other similar applications requiring cryptographic security and high resistance to attack by hackers. The U.S. Postal Service's (USPS) Information Based Indicia Program Postal Security Device Specification, intended to permit printing of valid U.S. postage on any PC, provided the first opportunity to combine two areas of expertise when a secure microprocessor was designed into an iButton.

The resulting product, named the Crypto iButton, combines high processor performance, high-speed cryptographic primitives, and exceptional protection against physical and cryptographic attack. For example, the large integer modular exponentiation
engine can perform 1024-bit modular exponentiations with a 1024-bit exponent in significantly less than a second. The ability to perform large integer modular exponentiations at high speed is central to RSA encryption, Diffie-Hellman key exchange, Digital Signature Standard (FIPS 186), and many other modern cryptographic operations.

An agreement between Dallas Semiconductor and RSA Data Security Inc. provides a paid-up license for anyone using the Crypto iButton to perform RSA encryption and digital signatures so that no further licensing of the RSA encryption technology is required. High security is afforded by the ability to erase the contents of NVRAM extremely quickly. This feature, rapid zeroization, is a requirement for high security devices that may be subjected to attacks by hackers. As a result of its high security, the Crypto iButton is expected to win the FIPS 140-1 security certification by the National Institute of Standards and Technology (NIST). A special operating system was designed and stored in the ROM of the Crypto iButton to support cryptography and general-purpose financial transactions -- such as those required by the Postal Service program.
13. KEY POINTS

- Authentication is crucial to most applications, since billing and privacy is based on it.
- A very easy and convenient way for users.
- It is more secure than using passwords, since passwords are short or can be guessed.
- It is easier for administrators to maintain the security infrastructure, since only password can be forgotten.
- A ring is a personal thing that the user and only the user carries along anytime and anywhere, so that she can authenticate herself in every situation.
- It is more secure than using password since passwords are short and can be guessed

It is also possible to use a tag on the key ring or a watch instead of a ring.
14. CONCLUSION

Dallas Semiconductor has produced more than 20 million physically-secure memories and computers with hard-shell packaging optimized for personal possession. The Java iButton, therefore, is simply the latest and most complex descendant of a long line of products that have proven themselves to be highly successful in the marketplace. With its stainless steel armor, it offers the most durable packaging for a class of products that likely will suffer heavy use and abuse as personal possessions. The iButton form factor permits attachment to a wide variety of personal accessories that includes rings, watchbands, key fobs, wallets, bracelets, and necklaces, so the user can select a variation that suits his or her lifestyle.

While the Java iButton can readily support the commerce models that have traditionally been the province of credit cards, its greatest promise appears to lie in its capacity to interact with Internet applications to support strong remote authentication and remotely authorized financial transactions. The use of Java promotes compatibility with these applications by providing a common language for all application programming.

At the Java Internet Business Expo held last August, Sun Microsystems' CEO Scott McNealy displayed an early prototype of the Java Ring, using it to open a presentation door on stage. That powerful symbolism of Java being embedded in all shapes and sizes and opening doors to the future now provides the "magic" driving force for the Java Ring. The Java Ring stands poised to open the doors of opportunity for truly personal computing in the information age.

- Used in personal computing.
- Highly secure
- Highly durable
Java Ring

- A very easy and convenient way for users.
- Personalized services.
- Highly secure and durable
- Tamper proofing
- Indestructible
- Support multiple applets

This Java Ring lets you roam both the real world and cyberspace with your personal preferences and personal data.
15. REFERENCES

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