Biochip & its Technology

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***Abstract-*"Biochips"-The most exciting future technology is an outcome of the fields of Electronics, Computer science & Biology. It is a new type of bio-security device which track information accurately regarding what a person is doing, and who is to accurately track information regarding what he is doing, and who is actually doing it. It's no more required with biochips the good old idea of remembering pesky PINs, Passwords, & Social security numbers (SSN). No more matters of carrying medical records to a hospital, No more cash/credit card carrying to the market place; everything goes embedded in the chip…. Everything goes digitalized. No more hawker tricks on the internet….! Biochip has a variety technique for secured E-money transactions on the net. The power of biochips exists in capability of locating lost children, downed soldiers, and wandering Alzheimer patients. A simple ID chip is already walking around in tens of thousands of individuals, but all of them are pets. Companies such as AVID (Norco, Calif.), Electronic ID, Inc. (Cleburne, TX.), and Electronic Identification Devices, Ltd. (Santa Barbara, Calif.) sell both the chips and the detectors. The chips are of the size of an uncooked grain of rice, small enough to be injected under the skin using a hypodermic syringe needle. They respond to a signal from the detector, held just a few feet away, by transmitting out an identification number. This number is then compared to database listings of registered pets.**

Keywords— Biochip, SSN, Hypodermic syringe, Bio-security device

1. INTRODUCTION

A biochip is a collection of miniaturized test sites (micro arrays) arranged on a solid substrate that permits many tests to be performed at the same time in order to achieve higher throughput and speed. Typically, a biochip's surface area is no larger than a fingernail. Like a computer chip that can perform millions of mathematical operations in one second, a biochip can perform thousands of biological reactions, such as decoding genes, in a few seconds. Biochips are any microprocessor chips that can be used in Biology.

The biochip technology was originally developed in 1983 for monitoring fisheries, it's use now includes, over 300 zoos, over 80 government agencies in at least 20 countries, pets (everything from lizards to dogs), electronic "branding" of horses, monitoring lab animals, fisheries, endangered wildlife, automobiles, garment tracking, hazardous waste, and humans. Biochips are "silently" inching into humans. For instance, at least six million medical devices, such as artificial body parts (prosthetic devices), breast implants, chin implants, etc., and are implanted in people each year. And most of these medical devices are carrying a "surprise" guest — a biochip. In 1993, the Food and Drug Administration passed the Safe Medical Devices Registration Act of 1993, requiring all artificial body implants to have "implanted" identification — the biochip. So, the yearly, 6 million recipients of prosthetic devices and breast implants are "biochipped". To date, over seven million animals have been "chipped". The major biochip companies are A.V.I.D. (American Veterinary Identification Devices), Trovan Identification Systems, and Destron-Fearing Corporation.

II. THE BIOCHIP TECHNOLOGY

The biochip implant system is actually a fairly simple device. In today world, biochip implant is a small (micro) computer chip, which is inserted under the skin, for the purpose of identification. The biochip system is actually radio frequency identification (RFID) system, which is using low-frequency radio signals for communication between the biochip and reader. The reading range or in other words activation range, between reader and the biochip is small, we can say normally between 2 and 12 inches.

1) Size

The size of Biochip is equal to a size of an uncooked rice grain size. It can ranges from 2inches to 12inches.

Figure.1. Size of Biochip

2) Components of the biochip

The implant system of biochip consists of mainly two components the transponder and reader.

2.2.1 The transponder

The transponder is the actual biochip implant. By nature it is

a passive transponder, meaning it naturally contains no battery or energy of its own. In comparison with an active transponder, it would provide its own energy source, for example a small battery. Because the passive biochip is without battery, or nothing to wear out, it has a very long life, up to 99 years, and with no maintenance cost. Being passive, it is inactive until the reader activates it by sending it a low-power electrical charge to it. The reader can "read" or "scans" the implanted biochip and receives back its data from the biochip (in this case particularly an identification number). The communication between biochip and reader takes place via low-frequency radio waves.

The transponder of biochip consists of four parts:

(A) Computer Microchip:

The microchip stores in it a unique identification number which is 10 to 15 digits long. The storage capacity of the microchips is very limited, capable of storing just a single ID number. AVID (American Veterinary Identification Devices) claims that their chips are using an nnn-nnn-nnn format, which has the capability of over 70 trillion unique numbers to be stored. The unique ID number is encoded with laser onto the surface of the microchip before assembly. Once the number is encoded in it is impossible to alter the number by any way. The microchip with number also contains the electronic circuitry necessary to transmit the ID number to the "reader".

(B) Tuning Capacitor:

The capacitor actually stores the small electrical charge (which is less than 1/1000 of a watt) which is sent by the reader or the scanner, and activates the transponder. The "activation of transponder" allows it to send back the ID number which is encoded in the computer chip. Because the "radio waves" are used for communication between the transponder and reader, the capacitor is "tuned" to the same frequency as that of the reader.

(C) Antenna Coil:

This is a very simple, coil of copper wire wrapped around a ferrite or iron core. This is a tiny, primitive, radio antenna which "receives and sends" signals from the reader or the scanner.

(D) Glass Capsule:

The glass capsule actually "houses" the microchip, antenna coil and capacitor in it. It is a small capsule; basically the smallest measuring is 11 mm in length and 2 mm in diameter, which is about the size of an uncooked grain of rice. The capsule is made up of biocompatible material like soda lime glass. After the assembly, the capsule is sealed hermetically (which mean air-tight), so no body fluids can even touch the electronics inside. Since the glass is very smooth and susceptible to movement, a material like a polypropylene polymer sheath is attached to one of the end of the capsule.

The compatible surface is provided by sheath, by which the body tissue fibers bond or interconnect which in result into a permanent placement of the biochip.

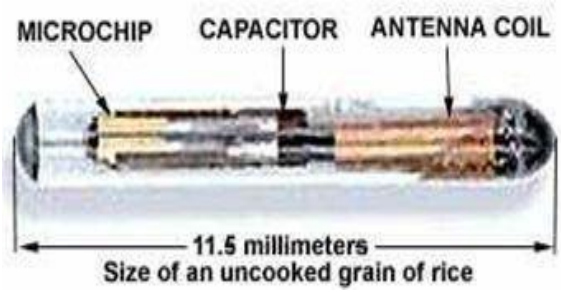

Figure.2. Transponder

The biochip is inserted into the body of human with a hypodermic syringe (shown below in figure). Injection is very safe and simple, when compared to common vaccines. We do not need anesthesia and even not recommended. Generally in dogs and cats, the biochips are usually injected behind the neck i.e. between the shoulder blades. Trovan, Ltd., a company markets an implant, featuring a patented "zip quill", which we can simply press in, no syringe is required. According to the AVID "Once biochip is implanted, the identity tag is impossible to retrieve.
"The ID number can never be altered."

Figure.3.Hypodermic syringe

2.1.2 *The reader*

The reader consists of an "exciter" coil which is used to create an electromagnetic field via radio signals, which provides the necessary energy (less than the 1/1000 of a watt) to "activate" or "excite" the implanted biochip. The reader also contains a receiving coil which receives the transmitted code or ID number sent from the "activated" implanted biochip. This takes place at fast speed i.e. in milliseconds. The reader contains the necessary software and components to decode the received code and display all the result in an LCD display. The reader can also include a RS-232 port to attach a computer.

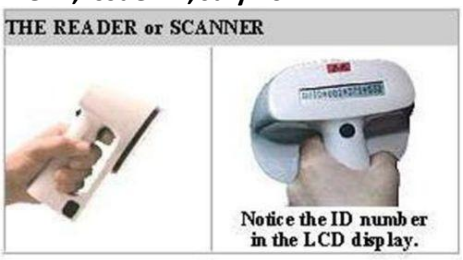

Figure.4. Reader

III.WORKING OF A BIOCHIP

The reader actually generates a low-power, electromagnetic field, particularly in this case via radio signals, which "activates" the implanted biochip. The "activation of biochip" enables it to send the ID code back to the reader via radio signals. The reader then amplifies the received code, converts it into digital format, decodes it and displays the ID number on the reader's LCD display screen. The reader must be in range between 2 and 12 inches near the biochip for communication. The reader and biochip can communicate with every kind of material, except metal.

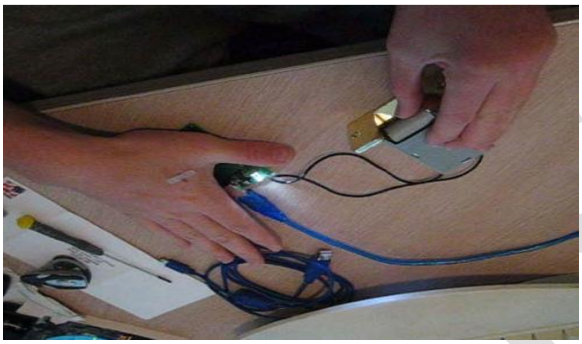

Figure.5. Working of a Biochip

IV.THE APPLICATIONS OF A BIOCHIP

- **A biochip can store and update financial, medical, demographic data, basically everything about a person:**

  An implanted biochip can be scanned to pay for groceries, obtain medical procedures, and conduct financial transactions. Currently, the in use, implanted biochips only store one 10 to 15 digits. If biochips are designed to accommodate with more ROM & RAM there is definitely an opportunity.

- **With a biochip tracing of a person/animal, anywhere in the world is possible:**

Once the reader is connected to the Internet, satellite and a centralized database is maintained about the bio chipped creatures, it is always possible to trace out the person.

- **A biochip leads to a secured E-Commerce systems:**

The world is very quickly going to a digital, through the Internet. The E-money future, however, isn't necessarily secure. In the wrong hands, this powerful tool can turn to be very dangerous. Hackers have already broken into bank files that were 100% secure. A biochip is the possible solution to the "identification and security" dilemma faced by the digital economy. This type of new bio-security device is capable of accurately tracking information regarding what users are doing, and who are to accurately track information regarding what users are doing, and who is actually doing it.

V. MEDICINAL IMPLEMENTATIONS OF BIOCHIPS

(1) Biochip as Glucose Detector:

The Biochip can be integrated with a glucose detector. The chip will allow diabetics to easily monitor the level of the sugar glucose in their blood. Diabetics currently use a skin prick and a hand-held blood test, and then medicate themselves with insulin depending on the result. The system is simple and works well, but the need to draw blood means that most diabetics don't test themselves as often as they should. Although they may get away with this in the short term, in later life those who monitored infrequently suffer from blindness, loss of circulation, and other complications. The solution is more frequent testing, using a less invasive method. The biochip will sit underneath the skin, sense the glucose level, and send the result back out by radio-frequency communication.

Proposed principle of Glucose detection:

A light-emitting diode (LED) in the biochip starts off the detection process. The light that it produces hits a fluorescent chemical: one that absorbs incoming light and re-emits it at a longer wavelength. The longer wavelength of light is then detected, and the result is sent to a control panel outside the body. Glucose is detected because the sugar reduces the amount of light that the fluorescent chemical re-emits. The more glucose there is the less light that is detected.

(2) Biochip as Oxygen sensor:

The biochip can also be integrated with an oxygen sensor .The oxygen sensor will be useful not only to monitor breathing in intensive care units, but also to check that packages of food, or containers of semiconductors stored under nitrogen gas, remain airtight.

Proposed principal of Oxygen sensor in Biochip:

The oxygen-sensing chip sends light pulses out into the body. The light is absorbed to varying extents, depending on how much oxygen is being carried in the blood, and the chip detects the light that is left. The rushes of blood pumped by the heart are also detected, so the same chip is a pulse monitor.

(3) Biochip as a Blood Pressure sensor:

In normal situations, The Blood Pressure of a healthy Human being is 120/80 mm of Hg. A Pressure ratio lower than this is said to be "Low BP " condition & A Pressure ratio more than this is "High BP" condition. Serious Effects will be reflected in humans during Low & High BP Conditions; it may sometimes cause the death of a Person. Blood Pressure is checked with BP Apparatus in Hospitals and this is done only when the patient is abnormal. However, a Continuous monitoring of BP is required in the aged people & Patients.

Proposed principal of Blood Pressure sensor in Biochip:

A huge variety of hardware circuitry (sensors) is available in electronics to detect the flow of fluid. It's always possible to embed this type of sensors into a biochip. An integration of Pressure (Blood Flow) detecting circuits with the Biochip can make the chip to continuously monitor the blood flow rate & when the pressure is in its low or high extremes it can be immediately informed through the reader hence to take up remedial measures.

VI. TYPICAL PROBLEM OF BIOCHIPS

Problem before the world

A chip implant would contain a person's financial world, health care, medical history — it would contain his electronic life too". If cash no longer existed and if the whole world is totally chip oriented; — there would be a huge "black-market" for chips! As there is no cash, all criminals would cut off hands, fingers and heads, stealing all the chips.

"It is very dangerous because when kidnappers get to know about all these chips, they will skin people to find them by any way." (From New York Times, June 20, 1999)

The typical solutions already proposed by different people:

The Biochip must retain its data only if it is placed into a fluid medium like blood & not in any other medium. This technique is not suitable for dealing identification of dead bodies (murdered by the kidnappers) as it loses all the data about the social security number. The data in the Biochip can get erased if it is exposed to sunlight/air.

This technique is not suitable for transplantation of biochip from genuine body to the fraud in darkness (by means of infrared light) or in the vacuum (by means of oxygen cylinders).

Solution to the problem

The existing model of Biochips consists of only ROM component inside it and is capable of accommodating the data such as Passport number, security number, bankcard number etc., which are normally permanent in nature. The installation of RAM component in addition to ROM & storing the Financial, Bankcard details which causes the problem is a mere solution. As we know RAM is volatile and it needs to be continuously charged in order to retain the data, Current can be supplied to the chip either from the electrical energy produced in the cells or by converting the heat energy in our body to electrical energy.

If the chip is taken out from the human body once, RAM will immediately loses the Power supply from the human body; thus all information in the RAM is lost and therefore it is useless for the kidnappers. However this will not affect the data stored in ROM i.e. Social security number that can be used to detect the address of the dead bodies that were unidentified.

VII. CONCLUSION

A chip implanted somewhere in human bodies might serve as a combination of personal diary, credit card, passport, driver's license. While traveling we no longer needed to worry about losing the credit cards. Chips inserted into human bodies also give us extra mental power.

The really fascinating idea is "The day in which we have chips embedded in our skins is very near". "This is just science fiction stuff". "It is a true example to prove science really starts with fiction".

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