ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 4, Issue 6, June 2017

Digitalized Genetic Chips

[1] Nimitha S L Reddy, [2] Nayana H C, [3] Basavaraj I Neelgar, [4] Abhinav Karan
[1] PG Student, Dayananda Sagar University, Bangalore
[2] PG Student, Dayananda Sagar University, Bangalore
[3] Professor, Dayananda Sagar University, Bangalore
[4] Asst. Professor, Dayananda Sagar University, Bangalore

Abstract: **Wearable Technology, the future of accessorizing, is becoming less an extension of oneself and more a part of oneself. The power of wearable technology comes from connecting the human senses to sensors. Genetic chips which is a DNA Microarray has test sites on a solid substrate that permits many tests to be performed at the same time in order to achieve higher throughput and speed like a computer chip. The genetic chip using the Radio Frequency Identification (RFID) system communicates between the chip and the reader. This research basically incorporates the sensor technology for the real time data extraction for person identification, health monitoring, women safety monitoring.**

Index Terms **–- Sensors, DNA Microarray, Radio Frequency Identification (RFID), health monitoring..**

I. INTRODUCTION

The genetic implant system is a wearable device which is the advancement of "biochips". The genetic chips are micro computer chips which are inserted into the human body beneath the skin for the purpose of identification, health monitoring and many more applications. The genetic chip basically uses the Radio Frequency Identification (RFID) technology which uses the low-frequency radio signal for communication between the genetic chip and the Radio Frequency reader (RFID). Invented in 1983, the biochips were basically used in zoos', government agencies in various countries for the tracking of pets (everything from lizards to dogs), electronic "branding" of horses, monitoring lab animals, fisheries, endangered wildlife, automobiles, garment tracking, hazardous waste, and humans. These wearable devices are used in various medical devices such as the artificial body parts, breast implants, chin implants which are used for the continuous monitoring of the implants. A.V.I.D. (American Veterinary Identification Devices), the major genetic chip manufacturing company provides a unique ID in the nnn-nnn-nnn format to the genetic chip which is etched or encoded via a laser onto the surface of the microchip before assembly. Once the number is encoded it is impossible to alter. The microchip also contains the electronic circuitry necessary to transmit the ID number to the reader.

II. SYSTEM COMPONENTS

a. Transponder

A transponder is an automated transceiver which is used for the radio frequency identification. It is a passive device which does use any internal power source. It gets powered by the electromechanical signal which is transmitted by the Radio Frequency Identification (RFID) reader. The electrical current induced in the antenna by the incoming radio frequency signal provides just enough power for the complementary metal-oxide-semiconductor (CMOS) integrated circuit in the tag to power up and transmit a response. The reader "reads" or "scans" the implanted genetic chip and receives back data (in this case an identification number) from the genetic chip.

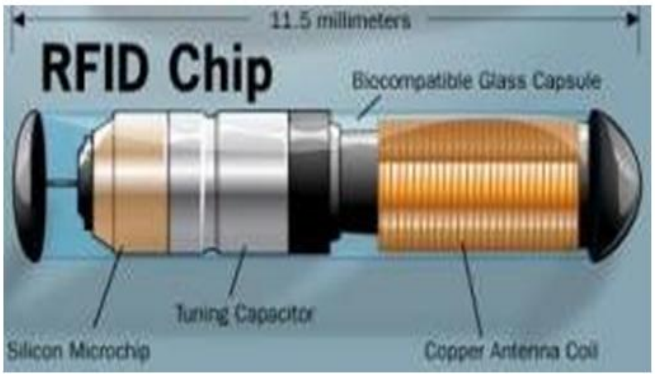

Fig 1: Transponder

b. Genetic chip

The genetic chip uses a unique identification number which is provided by the equipment manufacturer. This identification number will be sent to the reader when the transponder comes into the range of the reader. AVID (American Veterinary Identification Devices), claims their chips, using an nnn-nnn-nnn format. The unique ID number is "etched" or encoded via a laser onto the surface of the microchip before assembly. Once the number is encoded it is impossible to alter. The microchip also contains the electronic circuitry necessary to transmit the ID number to the "reader".

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c. Antenna Coil
The Antenna coil is basically present in the reader which transmits the radio frequency signals. The transponder uses the electrical energy from these signals to power the genetic chip.

d. Tuning Capacitor
The tuning capacitor is an electrical charge storage device which is sent by the reader or the scanner antenna coil. This charge stored in the capacitor will be used by the transponder to activate and send the unique identification number as response to the reader. The frequency of the radio waves which are used for the communication between the genetic chip and the reader is the same frequency to which the frequency of the capacitor is tuned to.

e. Glass Capsule
The glass capsule is basically the casing provided to incorporate the genetic chip, the antenna coil and the tuning capacitor. The glass capsule having the dimensions of 11mm in length and 2mm in diameter will be made of a biocompatible material such as the lime glass. The capsule is hermetically sealed after the assembly so that the body fluids are prevented from entering the capsule. The capsule is coated with the polypropylene polymer sheath to make it insusceptible to movement providing a compatible surface to which the body tissue fibers can bond with resulting in a permanent placement of the genetic chip.

f. Reader
The reader consists of an exciter coil creating an electromagnetic field. This electromagnetic field generated by the reader will be used by the tuning capacitor for powering the genetic chip. The energy provided by the coil will be 1/1000 of a watt which is enough to charge the tuning capacitor. The reader also receives the transmitted signal from the transponder which will be the unique identification number generated by the equipment manufacturers. The controller on the reader side uses the Wi-Fi protocol to transmit the received data from the reader end to mobile phones.

III. TECHNOLOGY

The RFID stands for the Radio Frequency Identification referring to small electronic devices that consist of a chip and an antenna capable of carrying up to 2000 bytes of data. A basic RFID system consists of three components:

- An antenna or coil
- A transceiver (with decoder)
- A transponder (RF tag) electronically
- Programmed with unique information
- The antenna emits radio signals to activate the tag and to read and write data to it.

The RFID reader emits the radio waves in ranges of anywhere from one inch to 100 feet depending upon its power output and the radio frequency used. When the transponder passes through the electromagnetic zone created by the RFID reader, the tuning capacitor stores the electric charge which will enough to drive the transponder. Once powered, the transponder then detects the reader's activation signal and sends the unique identification id in response.
The reader than decodes the data which is sent by the tag's integrated circuit which is in the encoded form. The data is then passed on to the controller in the reader's side. A reader contains a high frequency module (transceiver), a control unit and a coupling element to the transponder. The reader is in turn connected to the controller to which the reader sends the received data. The transponder consisting of a coupling element and an electronic microchip represents the actual data carrying device of the RFID system. The power required to activate the transponder is supplied to the transponder through the coupling unit as is the timing pulse and data.

Types of RFID tags:
RFID tags come in three general varieties: passive, active or semi-passive.

(i)Passive tags: Passive RFID tags do not have internal power supply. The antenna in the RFID reader will induce the electrical current through the radio frequency signal which provides enough power for the complementary metal oxide semiconductor (MOSFET) integrated circuit in the tag to power up and transmit the unique identification id as response. The antenna coil in reader does the work of transmitting the outbound backscatter signal as well as the collecting power from the incoming signal.

(ii) Active tags: The active RFID tags contain their own power source which is used to power the integrated circuits and to send the response signal to the reader. The active tags are capable of conducting a session with a reader which makes the active tags more reliable than the passive tags.

ISSN (Online) 2394-6849

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(iii) Semi-Passive tags: Also called as the semi- active tags are similar to active tags in that they have their own power source, but the battery only powers the microchip and does not power the broadcasting of the signal.

The transponder being one of the main components of the RFID system comprises of a chip and an antenna mounted on to a substrate or an enclosure. The chip in the transponder consists of a processer, memory and radio transmitter. The transponders use the radio frequency signal to communicate with the reader. The readers are then interfaced to the controller which transmits the data to the mobile phones using Wi-Fi protocol. The memory in the chip varies from a few characters to few kilobytes.

The transponders can work in three modes. In the Read Only(R/O) mode the device can only read the data. The Read Write(R/W) mode is used in application which requires data to by store in the transponder and can be updated dynamically. The Write Once Read Many times (WORM) mode allows for an identification number to the transponder once. The information is stored in the memory, it cannot be changed but the transponder can be read many times.

There are different frequency bands which passive technology operates within. Low and High RFID operate on the inductive coupling principle. That is, the energy is transferred from the reader to the tag through shared magnetic field. The amount of transferred energy is proportional to the size of the transmit-ting and receiving antennas as well as the tag ability to operate at the resonance frequency.

Frequency:
The factors deciding the optimal choice of a frequency include:

A. Transmission Mode:
RFID tags basically use two kinds of data transmission, depending on the behavior of electromagnetic fields at the frequency used. In lower frequencies (such as 125–134kHz in the LF band or 13.56MHz in the HF band), inductive coupling is used, while in frequency bands above (UHF with typical frequency ranges of 433MHz,
865–956MHz and 2.45GHz), wave backscattering
is the main means of transmission.

B. Behavior of tagged goods and environment:
Properties of some materials may be an obstacle to RFID application at a given frequency, as they may corrupt data transmission either by absorption or by ambient reflection of the signals. Typically, conductive materials such as goods containing water, or metal surfaces may be the source of problems. However, absorption and reflection being frequency-dependent, failure at one frequency does not rule out applicability at other frequencies. Electromagnetic disturbance can also have external sources, which is also a common though also frequency-dependent problem in an industrial environment.

IV. SYSTEM DESIGN

The low power electromagnetic field generated by the transmission of the radio signals by the antenna coil in the reader. This electromagnetic field charges the tuning capacitor which then powers the transponder. Once the transponder then transmits the unique identification number which will be received the antenna coil in the reader side.

Fig 2: Identification System

The Genetic chip is inserted into the subject with a Trovan, Ltd., markets an implant, featuring a patented “zip quill”, which you simply press in, no syringe is needed. According to AVID “Once implanted, the identity tag is virtually impossible to retrieve. The number can never be altered.” The details of an individual are stored in the genetic chip. Once the individual enters into the range of the RFID reader transmitting the Radio signals, the details of the individual is read by the reader and this data is logged into the controller and transmitted to the mobile phone through Wi-Fi. The micro controller compares both the pre dumped information and the information present in the Reader

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Fig 3: Implantation of the Genetic chip into Human Body

Password is incorporated using the keypad to make the system robust and secure. The buttons pressed in the keypad will be shown on the LCD display. Once the password provides matches to the predefined password, the data of the individual will be displayed on the LCD. The data will also be sent to the mobile phones through the Wi-Fi module using the Wi-Fi protocol along with the photo of the individual.

The main component of this technology is thetransponder which in most cases comprises of a chip and antenna mounted onto a substrate or an enclosure. The chip consists of a processor, memory and radio transmitter. These transponders communicate via radio frequency to a reader, which has its own antennas. The readers can interface through wired or wireless medium to a main computer. Transponders are also known as smart or radio tags. The memory will vary, depending on the manufacturer, from just a few characters to kilobytes. Transponders can either be Read Only (R/O) which are pre-programmed with a unique identification or they can be Read Write (R/W) for applications that require data to be stored in the transponder and can be up-dated dynamically. Another form of transponder is Write Once

Read Many times (WORM). This will allow for an

identification number to be written to the transponder once. The information is stored in the memory, it cannot be changed but the transponder can be read many times. The two most common types of RFID technologies are Active and Passive.

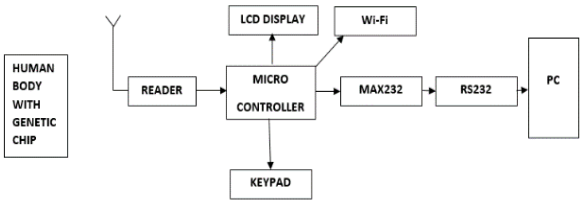

Fig 4: Block Diagram of the System

V. SOFTWARES

Visual Studio:

Fig 5: Data Page of an Individual

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop console and graphical user

interface applications along with Windows Forms applications, web sites, web applications, and web ser-vices in both native code together with managed code for all platforms supported by Microsoft Windows, Windows Mobile, Windows CE, .NET Framework, .NET Compact Framework and Microsoft Silverlight.

Visual Studio includes a code editor supporting IntelliSense as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger.

In future it must be implemented using the advanced J2EE & J2ME coding.

VI. CONCLUSION

The system designed with the aim of identifying the individual can also be applied to various other applications.

- Passport verification system
- Quick and easy Driving License
- Provides information of the individual in emergency Health issue conditions

- This card will help the traffic police/department to easily check the validity and other related issues of a driving license.

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