

BIOHACKING: EMBEDDING MICROCHIP INSIDE A HUMAN BODY

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Abstract: Biohacking is a practice of optimizing one's body and mind with the incorporation of medical, nutritional and electronic techniques. As a word itself suggests Bio and Hacking which means the application of IT hacks to the biological system. Embedded technology within the human body, also called biohacking and implanting an electronic device inside the human body is not entirely new technology. In fact, from the past many years we are using heart pacemakers to analyze heart rates reduce irregular heart rates. Then we have Brain pacemakers for the treatment of Parkinson's disease, epilepsy or mental disorders. Even microchips are being placed inside prosthetic knees and hips during restoring process. This paper aims to understand Microchip Implant technology, its realistic benefits and disadvantages. This paper also put some light on the RFID- Microchip Implant and procedure followed during implanting RFID in the human body. Through this paper, we are trying to depreciate uncertainty about microchip implant technology.

IndexTerms - Biohacking, Microchip Implant, RFID, Active RFID, Passive RFID.

I INTRODUCTION

Biohacking is a practice of optimizing one's body and mind with the incorporation of medical, nutritional and electronic techniques [1]. As a word itself suggests Bio and Hacking which means the application of IT hacks to the biological system. Bio-Hackers can be individuals, communities or small organizations that study biology and life science to enhance the natural condition of the human body. Biohacking highlights the attachment to hacker ethics and hacker culture [2]. It belongs to the hacker ethic that is purely based on positive principles such as universal admittance to information and generic quality of life enhancement.

Biohackers involve both professional and unprofessional scientists who believe in hacking themselves with technology & hardware often called as Grinders. A grinder is a type of biohacker that sees each part of the human body as hackable. Then comes DIY Biohackers who believes in innovating tools and resources obtainable to anyone by using blogs and forums. These biohackers accompany structured experiments on themselves outside of a regulated experimental environment, like labs or medical offices and share tips and techniques to support non-experts [3]. Nutrigenomics hackers focus on how the food you eat interacts with your genes. These hackers test different types of nutrients that affect the total genetic expression of the human body.

Embedded technology within the human body, also called biohacking. Implanting gadgets inside humans is not an entirely new concept. Embeddable inserts are the following sensible improvement of biohacking. Biology and Hacking refer to all kinds of implants in and interventions to the human body to enhance performance and health. Placing heart pacemakers in humans for prosthesis is now considered a straightforward procedure. On later occasions, we have started to utilize mind pacemakers for healing purposes to battle ailments like epilepsy, Parkinson's disease, and extreme discouragement [4]. Even Microchips are being set inside prosthetic knees and hips during therapeutic strategies to help in the get-together of post-usable investigation that can help restoration further. While medical innovations that utilize microchips abound, over the last decade we have begun to see the potential use of microchip implants for non-medical devices in humans, namely for control, convenience and care applications [5].

Biohacking or Microchip implant technology has been around for less than a decade. British professor Kevin Warwick, in 1998, is the first person to undergo an operational procedure to get a silicon chip inserted in his body. Later on, few companies implanted this microchip in their employees. Three Square Market, a technology company in River Falls and Wisconsin from the United States embedded chips in their employees. In order to make payment in ease Company president, Patrick McMullan inserted a microchip in his hands to make payments by just waving it. Sweden has been front in a row in case of microchipping. Around 3,000 peoples from Sweden have had microchips injected into their hands that can handle entry codes, buy train tickets and access certain vending machines or printers [6].

II EXPERIMENTAL WORK

A microchip implant is a process in which an electronic device is placed under the skin of a human. A microchip implant is usually shaped like cylinders. A small microchip, a copper antenna wire coil, and a bio-safe epoxy resin encased in lead-free borosilicate glass or soda-lime biocompatible glass.[10] Microchip implants can be performed on both animals and humans are field powered and have no battery or power source. Hence, they are inactive till they come within the field generated by a reader device, which implants interact with over a magnetic field. This paper mainly focuses on (RFID) Radio-Frequency Identification implantation process and application. Over the year microchip technology have been increasingly minimized to the point where it can be now fit on a fingernail. RFID size is similar to roughly a rice or grain. The following figure (Fig. 1) explains the elements of RFID chip and compares RFID chip size with rice grain.

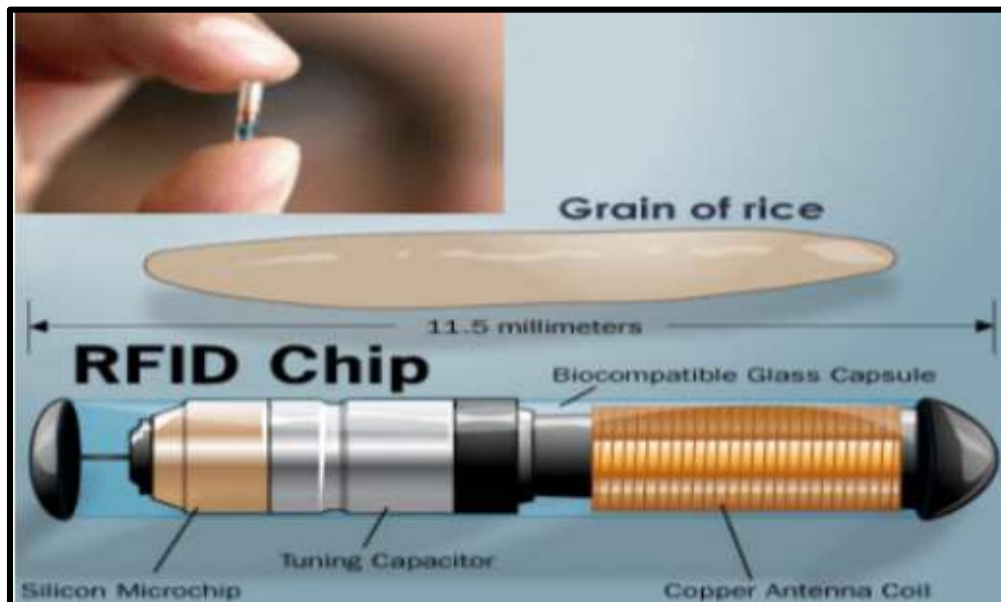


Fig. 1: Elements of RFID Chip

The RFID microchip is a tiny, two-way radio. RFID technology is used for automatic data collection and wireless communication. RFID system comes with three parts in it: a tag, a reader, and software that attaches the RFID measure to knowledge in the digital environment. Radio waves are used to read and capture information stored on a tag implanted in a human body. RFIDs usually come in three frequency families: 1. Low Frequency, 2. High Frequency, and 3. Ultra High Frequency. RFID can read an object from several feet away, can tell what object it is, where it is and even its condition. It can define 1000 items per second.

RFID technology comes in two types - a. Active RFID and b. Passive RFID. In an Active RFID system, Active tags come with their own transmitter and power source (usually battery). To transfer the information collected on their microchips, active tags broadcast their own signal. An active RFID system typically operates in the Ultra High-Frequency band. [13] Whereas Passive RFID system can operate in all three frequency families i.e. Low, High and Ultra High-Frequency bands. In a Passive RFID system, the radio signals from the reader antenna and a reader are sent to the tag. The passive tag uses a transmitted signal to reflect energy to the reader and to power on. [12]

In two types of tag that is active tag and passive tag, passive tags are currently being implanted in the human body for real-life application use. [14] When the reader triggers the passive tag, the passive tag transmits its own signal that also provides the power for the tag to react to the trigger signal. The passive tags produce information something like an ID number. Once the ID number read is complete, the software will attach it to individual information. Personal implanted RFID tags include a unique identifier for every individual that can be connected to information about an individual. The following figure (Fig. 2) describes the working of a typical Passive RFID system. [15]

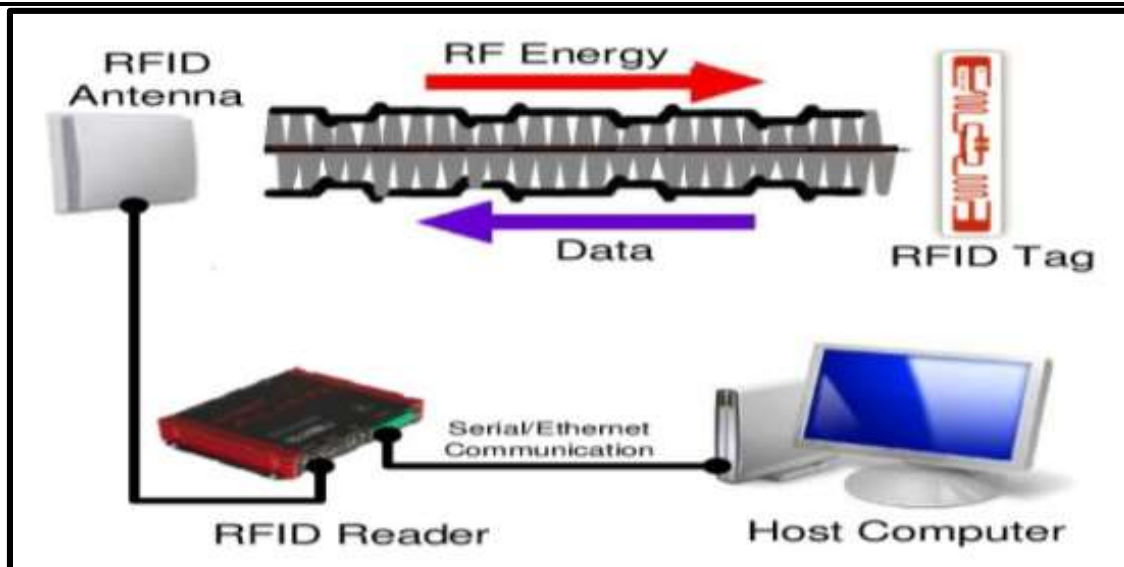


Fig. 2: Passive RFID System

Now the question is How to implant RFID in a Human Body?

So far RFID technology till now was limited to an identification tag. This identification function is used by biohackers for Access Control such as an open door for car keys, and other authentication processes. After the improvement of RFID technology, data storage and data sharing abilities are been used for Passwords, Public Transport, Pin Numbers, Contactless Payment, Storing Cryptocurrency and so many. Further improvement of RFID technology will lead to more integrated fusion between Human and Internet-of-Things, and as a staple of several DIY-cybernetics biohackers, most of these developments are likely to come from DIY-hacks.

Few biohacker startups trade entire injection equipment that comes with RFID implants pre-loaded in a piercing needle that is ready for injection. This kit makes the process of implanting RFID very simple such that without even the help of professional piercer implantation can be performed but it is highly recommended to do implantation with the help of a professional piercer. So for RFID implantation, we need hardly four elements and those are:

1. RFID tag
2. Piercer's needle
3. Forceps,
4. Lidocaine, ice, or anything you can use to numb the pain.

Steps to be followed for chip implanting process, [17]

1. Select injection site most in case injection site should be webbing between the index finger and the thumb. After proper sterilization and sanitation, use lidocaine to numb the injection site.
2. To pinch and hold the skin on the injection site use forceps, it is highly recommended to take the help of professionals.
3. Use the piercer's needle to carefully make a hole of about 4cm at a 45° angle into the skin pinched by the forceps.
4. Now gently remove the piercer's needle so that you have a hole that resembles a "pocket" because the forceps are still holding part of the skin.
5. The next step is to smoothly push the RFID into the hole.
6. Remove the forceps.
7. Close the cut until bleeding stops. Properly take care of the injection site until the wound heals.

Even though the process seems to be easy it has the side effect of etching the skin. It is necessary to take proper care while implanting RFID in a living body. Because of high risk, it is been casted and also concern is taken that it is apparent to the radio frequency. In the whole implanting process problem may occur that chip may move from the place under the skin to solve this problem special material is used that allows the tissue to grow around it so that chip will remain intact. [11] To activate the microchip radio frequency waves

are used. Again to repeat performing implanting process is highly dangerous unless it is not done under the strict observation of professionals. The following picture (Fig. 3) shows a clear idea of the RFID implanting process.



Fig. 3: RFID Implanting

III RESULTS & DISCUSSIONS

Microchip implants for transactions were understood as being safer than using a debit card since it was pointless to rob someone that didn't carry cash or cards. On the other hand, there was a clear concern about being hacked or in other ways have their information stolen digitally. Another major issue was the lack of knowledge about this technology, something that had resulted in misinformation and skepticism for the technology. With this said, the most important features would end up being safety aspects, both in terms of technical and health-related safety. Some research also proposes that implanted chips are susceptible to security risks and raise the potential for identity theft given that it is relatively effortless to hack a microchip implant. [17] This could result in a threat to the person's own life. This section of the paper explains about realistic benefits of microchip implant technology as well as it also explains how technology can lead into disadvantages.

3.1 Realistic Benefits:

- **Identification:** In many countries, passports have a microchip for identification at the airport. But instead of a passport if a microchip is implanted in the human arm will change identification infrastructure not only at the airport but also at train stations, bus stations, scanning the arm will be much easier. Similarly replacing a driver's license and ID with a chip then all the police just need to scan your arm and you can completely skip your wallet. [9]
- **Memberships:** In Barcelona, Spain one of the clubs named Baja Beach Club implanted an RFID microchip for VIP clients. The reason for implantation is easy to access membership features and payment facilities. With a microchip in the body, it was convenient for the workplace to control like who can be where and when, there is no need for a key card. The same approach can be followed in libraries, gyms, hotels, restaurant reservations, reward card management, and any other place where an access identity card is required. [7]
- **No more body mix-ups:** Every year unfortunately about 28,000 babies get mixed up in hospitals with the wrong parents. Not only the babies even at the funeral homes sometimes bodies also get mixed up and that creates a huge mess. Microchip implants will help in case of inability to identify a person's identity.
- **Infant and elder safety:** In the United States, 2000 children are kidnapped each day. About 1.6 to 2.8 million youth is run away from their home. Even elders having mental conditions escape from their homes, rest home or get lost. With microchip implants, it is very easy to track them. This technology is a solution for millions of parents and caregivers. [19]
- **Child Abductions:** Child abduction is a very serious problem each country dealing with and almost 74% of abduction result in murder. To stop kidnappers Brazilian millionaires are ready for a microchip implant. About 75% of British parents want a device to keep track of their children's location.

- **Health Metadata:** Sometimes whenever a patient arrives in a hospital because of some emergency, in most cases the patient doesn't carry his medical history. Even the patient from the accident lost his consciousness till he reaches a hospital. In such cases, if a doctor doesn't know the patient medical history and treats him with the wrong treatment that will end up in huge arguments even chances of the patient losing his life. Enters Microchip implant technology simple scan can tell the doctor a patient entire medical background like what medicine patient has taken in past, what patient is allergic to, what operations he has undergone.[18]
- **Theft Prevention:** Using RFID implantation for payments, access control, security doesn't make much difference by using RFID in a plastic card but it does make a striking difference in the case of stolen, it is easy to lose your RFID plastic card or wallet get stolen but once the chip is in a body then its hard to stole body part and even it's hard to secretly scan your card when it is inserted in the body.
- **Law Enforcement & Gun Control:** Microchip implantation can also useful for gun control. For example, In case your gun is stolen from your home or office but can't be used only the owner of the gun can fire from the gun. This can also be useful in the situation where your kids accidentally pick up your gun for play. Microchip implant for gun control can also protect from gun getting stolen, GPS reading in weapon chip will keep a track of where the weapon is, where it has been used or even who used the weapon which indirectly supports the law enforcement. [8]

3.2 Realistic Disadvantages:

- **Uncertainty:** Microchip implant technology is absolutely an outstanding technology but till now only a few of the entire population inserting a chip in the body what entire population goes for microchipping in such case we are uncertain about its effects. Uncertainty about having a microchip in the body for a longer time. There is no clear picture of what problem may arise and we will not get it until we try. [20]
- **Can't commit minor crimes:** Once the chip is implanted in the body then it keeps track of all the actions you perform. For example, minor crimes like speeding or not wearing a helmet.
- **Data Leaks:** Whenever new technology evolves threats always will be on a high point. It is concerning if so much of data is stored on one single chip then the chip will be a prime target for hackers or others who wants steal data for bad purpose. Even it is more concerning if the information on the chip is not only readable but also writable then there are high chances of data impersonation. [21]
- **Replacement Hardware:** It is absolutely a true fact that microchip implant technology is going to evolve over the year. In case it is possible to have new hardware requirements for new features but the concern is there is no easy way to replace earlier inserted hardware. [22]
- **No Universal Standards:** In every place like subway, library or for payment we have different standards for identification then we need to implant different RFID chips for subway, different for a library, different for credit/debit card.
- **Medical Treatment:** Incompatibility of Microchip implant with strong magnet medical equipment. For example, for MRI(Magnetic Resonance Imaging) process you can't take anything metal into it and it includes pacemakers, aneurysm clips, dental implants, hip/knee replacements, *and* embedded microchips. In fact, FDA has already stated issues regarding adverse tissue reactions from microchipping, electrical hazards. [23]

IV CONCLUSION

The attitudes in society are changing and the idea of implanting a chip into a human body is becoming more acceptable. Still, there is sparse research that delves into the life of current implantees so that society can gain insights into what it is like to be microchipped. Today, there is not yet enough information for people who are considering getting an implant to decide whether the technology is positive or potentially detrimental to them and for society. RFID chips are already widely implemented. Their applications range from animal tracking, product tracking, inventory, access and passport control and many others. But the thought of having a chip inserted into your body is a bit strange. In fact, it is not that different than other implanted devices we use today like pacemakers. In the current time implanting a microchip in the body is a purely voluntary process and it is specially used for high-risk patients like diabetics, Alzheimer's patients and cardiovascular disease. If human microchipping is not done mandatorily, and not used for tracking or frisking, people usually seem

quite open to the possible applications. Microchip Mass implantation however needs to undergo many debates about health and privacy issues.

We have numerous case studies to go on which demonstrate the successful deployment of microchip devices and corresponding applications but for the time being, implantation for non-medical applications has been dropped for all but the hobbyist implantees, systems engineering researchers and artists. This does not mean that the possibility for microchip implant technology has gone, we may still be waiting for that next generation who may ask for implant just like the current generation has asked for iPod, iPhone and iPad. How the next generation goes about achieving risk-return might be using a completely new paradigm. If the risk-taking behavior is successful the dividends are purported to be great, but equally, if the risks taken are not calculated the effects might well be detrimental and have long-term repercussions for humanity, for which there will be no turning back.

One thing is clear that despite the arrival of the implantable microchip, we have not yet seen it unleashed in all its fullness. As a community of stakeholders, we have a great deal of thinking to do between now and then but perhaps not a commensurate time to act. There are now numerous other companies, including Positive ID and VeriTeQ who are deploying applications for RFID implants in the 'care' space. The potential for function creep is there for care-style applications to be underpinned by services that are principally oriented around consumer control.

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