Research Intelligence

Microchip Implants

A New Frontier in Human Enhancement



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Introduction

In the 21st century, the concept of human enhancement has garnered significant attention, driving the integration of diverse scientific disciplines and propelling implantable devices to the forefront of innovation. These technologies act as a bridge between human biological systems and digital platforms, representing a major global shift with profound implications. One of the most prominent examples of this trend is subdermal microchip implantation, which aims to expand human capabilities—both physically and informationally.

Although microchip implantation is not a novel technology, it has long been utilized in various domains such as animal tracking, medical data storage, and military applications. Today, however, it is increasingly entering the realm of everyday life, particularly in Western societies. Individuals are opting to implant microchips for a range of purposes, including identity verification, contactless payment, and emergency access to health information.

Despite its growing adoption, this technology faces several ethical and societal challenges. Concerns include privacy risks, unauthorized surveillance, safety and health implications, and the inadequacy of existing legal frameworks to keep pace with rapid technological advancement.



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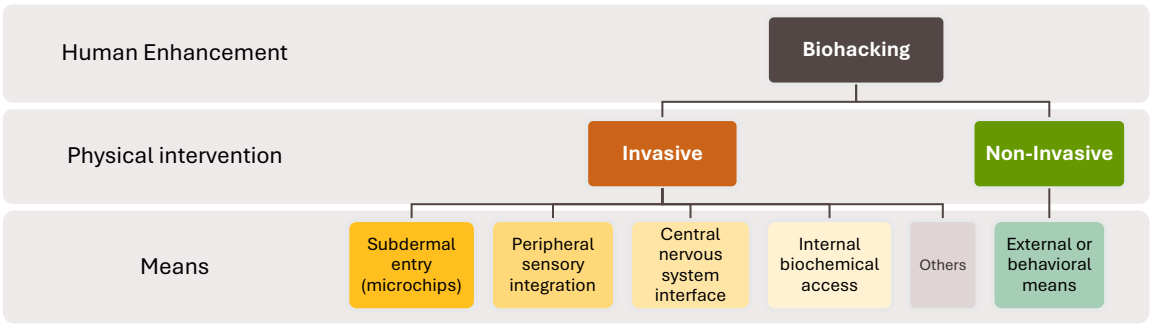
Exploring the Trend of Human Enhancement

Enhancing Human Potential through 'Biohacking'

Biohacking refers to a structured process in which individuals experiment with modifying their bodies and behaviors using knowledge, inventions, or technologies from various scientific disciplines, with the aim of enhancing physical and mental performance, improving health, and unlocking greater human potential. This practice can be broadly categorized into two approaches: **invasive physical interventions**, which involve penetrating the body through methods such as injections, implants, surgeries, or genetic modifications, and **non-invasive physical interventions**, which enhance human capabilities without physical intrusion, including the use of wearable technologies, dietary control, and mental training.

Figure 1

Human Enhancement through Biohacking Systems



Source: Krungsri Research

Biological Interventions for Human Enhancement

Invasive biohacking methods—those that involve direct physical intervention—can be grouped into four main categories based on the type of biological modification:

1) **Subdermal entry** involves implanting small devices under the skin, such as microchips, which are commonly used for identification, access control, and payment systems. These devices are classified as passive technologies because they do not rely on internal power sources like batteries, instead functioning through external scanners or readers that activate them when needed.

2) **Peripheral sensory integration** refers to the enhancement of sensory perception through implanted devices designed to augment or expand human capabilities. Examples include cochlear implants that improve hearing, subdermal magnets that vibrate or stimulate nerves in response to nearby magnetic fields—enabling users to perceive otherwise invisible phenomena—and vibration compasses that provide directional feedback through subtle vibrations. Collectively, these technologies work to enhance or introduce entirely new sensory experiences for the user.

3) **Central nervous system interfaces** are the most complex and high-risk form of human body intervention compared to others, as it requires surgical procedures to install devices that connect directly with the nervous system. Examples include: (1) brain–machine interfaces, which use neurostimulators that directly interact with brain tissue or the nervous system to link the brain with external machines or computers; (2) spinal cord stimulators, used to relieve chronic pain or restore certain nervous system functions, such as in patients with partial paralysis; and (3) pacemakers, which regulate the heartbeat. Although pacemakers do not connect directly to the brain, the heart is closely linked to the autonomic nervous system, making them a form of physical intervention that affects the central nervous system.

4) **Internal biochemical access** targets the body's internal biological functions. Examples include implanted devices such as artificial joints or sensors that measure temperature, humidity, blood sugar, or oxygen levels. It also covers genetic modification technologies that influence hormones, enzymatic processes, or DNA—such as CRISPR[1/]—as well as implanted hormone pellets that regulate internal biochemical systems.

Among the four categories of technology discussed, **subdermal microchip implants are the most likely to achieve widespread adoption.** This is because they are minimally invasive, do not interfere with the body's critical systems, are small in size, and operate without the need for internal batteries or power sources. They also carry relatively low risks, both in terms of surgical implantation and potential infection, especially when compared with other technologies that require deeper intervention in critical systems such as the nervous system, biochemical processes, or sensory perception.

1/ CRISPR, which stands for Clustered Regularly Interspaced Short Palindromic Repeats, is a precise and relatively easy-to-use gene-editing technology. It was developed from the natural defense system of bacteria, which can recognize and destroy the DNA of invading viruses. Scientists have adapted this mechanism into a powerful tool for editing genes in various living organisms, including humans.

Subdermal Microchip Implantation: From Past to Present

What is a subdermal microchip?

A microchip implant is a miniature electronic device designed to be embedded into the body of living organisms, including both humans and animals. These devices are extremely small; those commonly seen for human subdermal implantation are approximately the size of a grain of rice or smaller, typically measuring around 12 millimeters in length and 1–2 millimeters in diameter. This compact size allows for insertion beneath the skin through a relatively uncomplicated medical procedure.

Figure 2

Subdermal Microchip Implantation in Humans

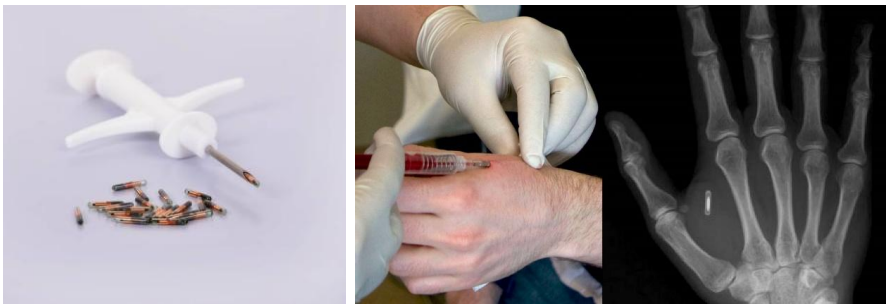


Image sources: (LHS) itnews.com.au, (RHS) cdn.idropnews.com

Most implanted chips operate using RFID (Radio Frequency Identification) or NFC[2/] (Near Field Communication) technology. These are short-range wireless communication systems that do not require an internal battery. Instead, they receive power from an external reader via electromagnetic waves when brought within a specified proximity. This enables the chip to function without an internal power source, which is a significant advantage for devices intended to remain inside the body for extended periods.

Currently, microchip implants are typically manufactured from biocompatible materials, such as bioglass or bioceramics, to minimize the risk of rejection by the body's immune system. This allows the device to remain in the body for long durations without causing harm. These microchips generally consist of three main components: 1) Integrated circuit – responsible for processing and storing data, 2) Antenna coil – a small coil that functions as an antenna for signal transmission and reception, and 3) Memory – used to record various types of data.

Background of RFID Microchip Implant Technology Used in Animals

The RFID technology industry developed miniature transponders for implantation in various types of animals during the period 1986–1996. However, these transponders had a significant limitation: a transponder produced by one company could not be read by a reader from another company.[3/] This led to the establishment of the ISO 11784 and ISO 11785 standards, which prompted manufacturers to gradually shift toward producing only microchips that complied with these standards.[4/] As a result, a unified global microchip standard was formed.

2/ NFC is a subset technology of RFID, specifically designed for short-range communication, typically within 4 to 10 centimeters. NFC operates in the High Frequency (HF) band at 13.56 MHz, which is one of several frequency ranges utilized by RFID systems.

3/ https://www.realtrace.com/en/legislation/

4/ https://wsava.org/wp-content/uploads/2020/01/Microchipping-The-Importance-of-ISO.pdf

Human RFID Chip Implantation

The implantation of RFID chips in humans began notably in 1998, when Kevin Warwick, a professor of cybernetics at the University of Reading, United Kingdom, initiated Project Cyborg. In this project, he implanted an RFID chip under the skin of his forearm, enabling him to control electronic devices in the laboratory through bodily movements—for example, unlocking doors or switching lights on and off.[5/] This made him the first human to receive an RFID chip implant.

From this starting point, the technology of human chip implantation has rapidly evolved throughout the 21st century, particularly in Europe and North America, with applications expanding in medicine, identity verification, and human–digital interface integration.

Table 1

Subdermal Microchip Implantation in Humans

Year	Events
1998-2002	Kevin Warwick, a professor of cybernetics at the University of Reading, United Kingdom, conducted two human chip implantation experiments under the names Project Cyborg (1998) and Project Cyborg 2.0 (2002). In the first project, he implanted an RFID chip under his skin to control electronic devices in the laboratory—such as doors, lights, and computers—based on proximity. In the second project, he implanted a more advanced chip directly into the nerves of his arm to experiment with signal transmission between the nervous system and a computer.[6/]
2004	The U.S. FDA approved the use of the VeriChip by Applied Digital Solutions for medical purposes in humans. This marked the first official approval of RFID chip implantation in humans in the United States. The chip was designed to store critical medical data and patient health records, helping to reduce errors in medical treatment.[7/]
	The Baja Beach Club in Barcelona, Spain, offered VIP customers the option to implant an RFID chip in their left upper arm for payment and access to exclusive areas within the club. This represented one of the earliest widespread commercial uses of RFID implants outside of medical contexts.[8/] The company VeriChip developed the VeriPay payment system, which identifies users via RFID readers and links the scanned ID code to a bank card, enabling payment through RFID scanning.[9/]
Mid-2000s	The Biohacker or "Grinder" community began to emerge, particularly in the United States and Europe. This subculture of biohacking focuses on self-implantation of chips and technological devices outside conventional medical systems, aiming to experiment with and enhance human capabilities. Examples include RFID or NFC chip implants and other performance-enhancing devices.[10/]
2015	Employees working at the Epicenter building in central Stockholm, Sweden—a hub for technology and innovation housing various companies—were given the option to implant RFID chips to replace employee ID cards. These chips could be used to open doors and operate office equipment such as photocopiers.[11/] This development marked the beginning of Sweden's emergence as one of the most accepting countries of human microchip implantation.
2017	Three Square Market (32M), a company based in Wisconsin, United States, initiated a voluntary program allowing employees to implant RFID chips for various purposes, including building access, use of photocopiers, logging into computers and mobile phones, storing business card information, medical data, and making purchases at the company's cafeteria. The RFID chips used in this program were supplied by Biohax Sweden, the same manufacturer that provided chips for Epicenter.[12/]
2018-present	Subdermal microchip implantation in humans has gained increasing popularity in the Scandinavian region, particularly in Sweden, where in 2018, reports indicated that more than 4,000 individuals were using this technology. These microchips enabled users to travel via SJ Railways, access office buildings, and make payments.[13/]

Source: Krungsri Research

5/ https://www.independent.co.uk/news/professor-has-world-s-first-silicon-chip-implant-1174101.html
6/ https://resna.stanford.edu/Tidbits/2005/warwick.txt
7/ https://californiahealthline.org/morning-breakout/fda-approves-first-implantable-identification-chip-for-medical-use/
8/ https://www.newscientist.com/article/dn5022-clubbers-choose-chip-implants-to-jump-queues/
9/ https://dta.today/onewebmedia/Baja%20Beach%20case%20study.pdf
10/ https://en.wikipedia.org/wiki/Body_hacking and https://en.wikipedia.org/wiki/Do-it-yourself_biology
11/ https://www.bbc.com/news/technology-31042477
12/ https://www.weforum.org/stories/2017/08/microchip-in-your-hand-rfid-32m/
13/ https://www.npr.org/2018/10/22/658808705/thousands-of-swedes-are-inserting-microchips-under-their-skin

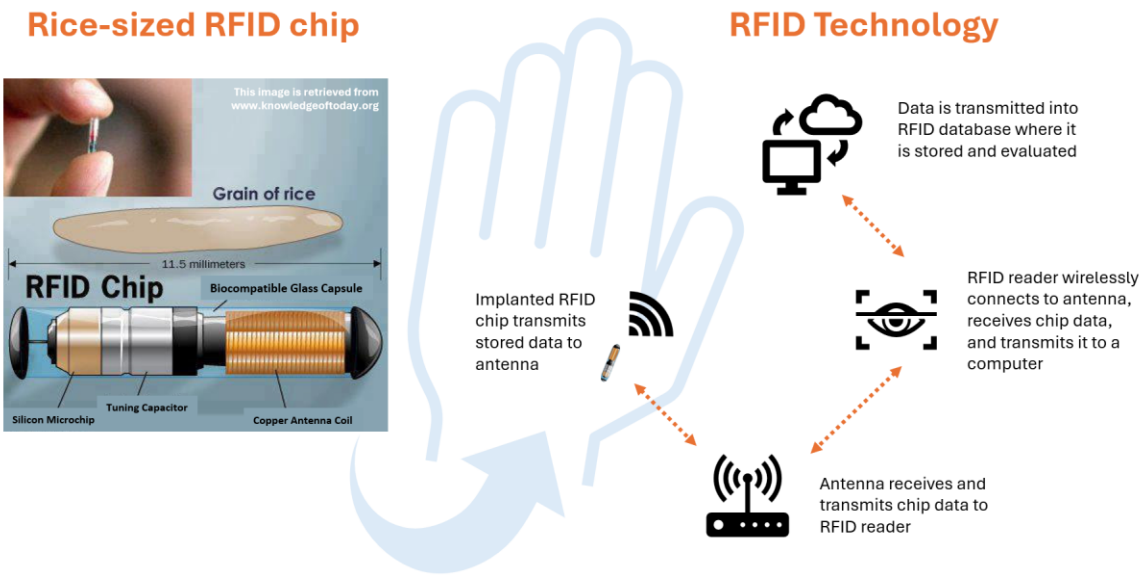
How Subdermal Microchip Technology Works

The functioning of RFID chips implanted under the skin involves a wireless data transmission process. The implanted chip transmits stored data to a signal-receiving antenna, which acts as an intermediary, receiving and forwarding the data from the chip to an RFID reader. The reader, wirelessly connected to the antenna, receives the data from the chip and transmits it to a computer system. In the final stage, the data is sent to an RFID database for storage and processing.

The entire system operates through electromagnetic induction, whereby the electromagnetic field generated by the RFID reader stimulates the subdermal chip, enabling it to receive power and transmit data—without requiring an internal battery or power source.

Figure 3

Mechanism of RFID Chip Functioning Under the Skin



Sources: (LHS) Knowledge of Today, (RHS) Krungsri Research

Commercial Beginnings for Medical Benefits

In the United States, RFID technology began to play a significant role in the medical field, particularly in 2004 when the U.S. Food and Drug Administration (US FDA) approved the use of implantable RFID chips for medical purposes for the first time.[7/] The chip, commercially known as VeriChip, was manufactured by Applied Digital Solutions, a company based in Florida, USA. This chip was capable of storing personal identification data and medical history, allowing medical personnel to quickly access critical information in emergency situations. Additionally, implanting the chip reduced the risk of equipment loss compared to other wearable devices that display personal information, such as medical bracelets.

The implantation of RFID chips can enhance the efficiency of medical treatment, especially in cases where patients are unable to communicate. According to a study by Wolinsky (2006),[14/] published in EMBO Reports, the first-generation VeriChip used with the initial group of 200 users contained a 16-digit identifier linked to each individual's medical records in a central database. Prior to subdermal implantation, the microchip underwent chemical treatment to prevent movement within the body. The procedure cost approximately 200–400 USD, with an annual fee for database access. The company charged 20 USD per year for basic data recording and 80 USD per year for comprehensive personal health records.

An illustrative case occurred in 2006 when a 44-year-old police officer in New Jersey suffered a severe accident while on duty. Upon arrival at the hospital, emergency medical staff scanned his body and detected an RFID chip that had been implanted two years earlier for identification purposes. The medical team was able to access the patient's health information via the online database and discovered a history of Type 1 diabetes. This enabled them to promptly monitor the patient's blood sugar levels while treating other injuries. This case study clearly demonstrates the practical benefits of chip implantation.

14/ https://pmc.ncbi.nlm.nih.gov/articles/PMC1618368/

Use Cases of RFID Chip Implants

Medical Applications

Medical use is arguably the most significant benefit of RFID technology. RFID chips can store identification data and critical information such as drug allergy history, blood type, chronic conditions, and emergency contact details. This enables medical personnel to quickly access essential data in emergency situations, particularly when patients are unconscious or unable to communicate.

The popularity and purpose of RFID chip usage in medical contexts vary across regions. In the United States, subdermal chip implantation began with Alzheimer's patients. For instance, in 2007, a project in Florida implanted chips in 200 patients to facilitate rapid access to vital medical information.[15/] This initiative aimed to enhance healthcare for individuals with chronic illnesses and cognitive impairments.

In contrast, Japan—a super-aged society where over 20% of the population is aged 65 or older—prefers non-invasive RFID applications to monitor and care for elderly individuals with dementia. Instead of implanting chips, patients may wear devices embedded with RFID chips or have chips placed in their slippers. These devices record location data, track behavior, and analyze daily activity patterns.[16/] Such data can indicate changes in the patient's health status.

Military Applications

Guggisberg (2011)[17/] advocated for the implantation of RFID chips in military personnel, viewing it as an innovation that enhances the efficiency of armed forces in areas such as personnel tracking, human resource management, medical care, and mission support. The chip contains essential personal and medical history data. Once the chip confirms that a soldier has arrived at an operational zone, the management system automatically updates various records, including unit personnel reports, activation of combat-zone entitlements, vaccination history, emergency contact information, life insurance, and last will and testament.

Upon arrival, soldiers receive messages and links via mobile phone containing airport maps, accommodation details, and other necessary information. Meanwhile, support units and family members receive confirmation messages regarding the soldier's safe arrival. In cases of injury, field medical units can immediately access medical data, including treatment history, blood type verification, and current medications, thereby facilitating rapid and informed medical response.

15/ https://abcnews.go.com/GMA/OnCall/story?id=3536539

16/ https://link.springer.com/chapter/10.1007/978-3-642-21535-3_46

17/ https://alu.army.mil/alog/2011/novdec11/PDF/How%20RFID%20and%20Smartphones%20Will%20Help%20Revolutionize%20Army%20Sustainment.pdf

Applications in Advanced Security Systems

In 2002, inventor William Marshall was granted U.S. Patent No. US6481140B1 for a firearm security system integrated with a microchip. Legally authorized gun owners would have a small microchip implanted beneath the skin. When the user grips the firearm, sensors installed on the weapon scan and read data from the chip, then process and compare it with a database of authorized users. If the data matches, the firearm becomes operational; if not, it remains disabled.[18/] This innovation aims to enhance safety by preventing unauthorized individuals from using firearms, thereby reducing the risk of accidents or misuse. It exemplifies the effective application of technology to improve weapon safety.

Additionally, in 2004, Mexico adopted RFID chip technology to enhance security at its newly established federal anti-crime data center. The Attorney General of Mexico and 160 other officials received rice-sized microchips implanted under the skin of their arms.[19/] These chips were used to control access to sensitive information and strengthen national security. The cost per person was approximately 150 USD.[20/] This initiative represents one of the first instances of subdermal chip technology being applied at an institutional level within a government agency to improve security and access control for critical data.

Personal Applications

In an article by Shamani Joshi (2021),[21/] three individuals who use subdermal microchips were interviewed. The first was an American man who utilized the chip to store his medical history and work portfolio, as well as to function as a digital wallet and a key to unlock his home. He spent six years deliberating before deciding to undergo the implantation.

The second interviewee was an Austrian woman and travel blogger who, in 2017, had 25 chips implanted throughout her body. These chips facilitated various functions, from storing payment information to starting her car. She was among the early adopters of chip-based payment storage.

The final interviewee was a Dutch man who had more than 31 chips implanted under his skin, primarily for storing email passwords and website login credentials. He expressed minimal concern about being tracked or hacked through the chips, citing technological limitations. Specifically, the microchips do not contain batteries and must be placed within very close proximity (approximately 2–3 millimeters) to an RFID reader to function. This makes them significantly harder to track or hack compared to smartphones.

18/ https://patents.google.com/patent/US6481140B1/en
19/ https://www.chron.com/business/technology/article/Microchip-implants-bring-security-to-Mexico-1662414.php
20/ https://www.informationweek.com/it-leadership/rfid-chips-implanted-in-mexican-law-enforcement-workers
21/ https://www.vice.com/en/article/inside-an-online-community-of-people-with-microchip-implants/

Benefits for the Financial Sector

The report The European Payments Landscape in 2030[22/] by Marqeta indicates that a considerable number of consumers in the United Kingdom are receptive to advanced payment methods, including those involving bodily integration—such as subdermal microchip implants in the hand for payment purposes. In 2021, a survey of 2,037 UK consumers aged 18 and above revealed that approximately half (51%) of respondents would "consider" implanting a chip in their hand for payment, citing various reasons: 23% would adopt the technology if there were clear medical safety assurances, 8% would do so if strong personal data protection measures were in place, while 20% felt comfortable using subdermal microchip payment methods.

This form of chip implantation facilitates seamless, rapid payments without the need to carry credit cards or smartphones. It is particularly beneficial for individuals who cannot conveniently carry items but require access to funds during daily activities—such as athletes or those training alone, including marathon runners or triathletes. With a chip implanted under the skin, users can simply bring their hand near a contactless reader to complete a transaction instantly.

Benefits of Subdermal Microchip Payment Technology for the Financial Sector

- **Customer Base Expansion Without Significant Investment**
  The NFC technology embedded in microchips operates on the same system as contactless payments via smartphones and credit cards. Therefore, banks and financial service providers can adopt it without substantial infrastructure investment, while still benefiting from expanded access channels and customer base growth.

- **Enhanced Convenience and Efficiency**
  This technology streamlines transaction processes, eliminating the need for chip users to carry cards or additional devices. It facilitates smooth and rapid payments and reduces the risk of card or financial data loss.

- **Improved Security**
  Subdermal chips feature encrypted data that is difficult to counterfeit and cannot be easily separated from the owner. This helps reduce fraud and enhances trust in the payment system.

- **Cost Reduction**
  Financial institutions can lower expenses related to the production and maintenance of plastic cards, as well as the cost of replacing lost or damaged cards. Operational costs are also reduced through simplified transaction procedures.

- **Greater Access to Data and Analytics**
  This technology enables financial institutions to collect accurate and continuous data on consumer spending behavior, leading to more tailored services and more precise customer risk assessments.

- **Identity Verification Support**
  Subdermal microchips can serve as highly accurate identity verification tools, benefiting processes such as Know Your Customer (KYC) and anti-money laundering (AML) compliance.

22/ https://www.marqeta.com/blog/european-payments-2030

Currently, a Polish-British fintech startup named ‘Walletmor’ offers subdermal microchips for payment purposes. It is recognized as the first and primary provider to commercially market subdermal payment chips. After launching its service in 2021, the company sold over 1,000 chips globally within one year, with the majority of customers located in Europe.

Figure 4

Homepage of the provider of subdermal microchips for payment, ‘Walletmor’



Source: Walletmor

Usage Concerns and Human Dignity

Although subdermal chip implantation enhances convenience and efficiency in daily activities, this technology raises multiple concerns and challenges. These include data security, personal privacy, health risks, and potential impacts on human dignity.

Usage Concerns

- **Health Risks**

  Subdermal chip implantation carries several medical risks. These include the possibility of infection at the implantation site and chip migration, which may affect surrounding tissues and organs. Over time, the body may reject the chip as a foreign object. Additionally, materials used in chip manufacturing—such as circuit boards, copper, or other metals—may degrade and release potentially harmful substances into the body.

- **Security Risks and Personal Data Theft**

  Once an RFID chip is implanted beneath the skin, sensitive personal data is stored within the body, making it vulnerable to cyberattacks. These risks include data theft or cloning, unauthorized scanning, and signal interception (eavesdropping) during transactions. Cybercriminals may exploit vulnerabilities in connected devices and networks to extract data from the chip.

  Beyond technical threats, physical risks also exist. For example, individuals may be coerced or threatened into performing transactions via the chip. It is often difficult and complex to determine whether such transactions were made voluntarily or under duress—especially in cases involving accidents or loss of consciousness.

- **Privacy and Rights Violations**

  RFID technology allows data to be scanned and read without notifying the chip owner, potentially leading to privacy violations, behavioral tracking, and misuse of personal information.

  A significant concern is the possibility of employers or government agencies mandating chip implantation, which could infringe upon individual rights and freedoms. Employers may gain excessive control over employees, resulting in perceived invasions of privacy. In response, at least 13 U.S. states have enacted legislation prohibiting mandatory human chip implantation to safeguard these rights.[23/]

23/ https://euroweeklynews.com/2025/06/03/us-eu-and-uk-racing-to-ban-mandatory-microchip-implants/

Challenges to Human Dignity

- ### Dehumanization

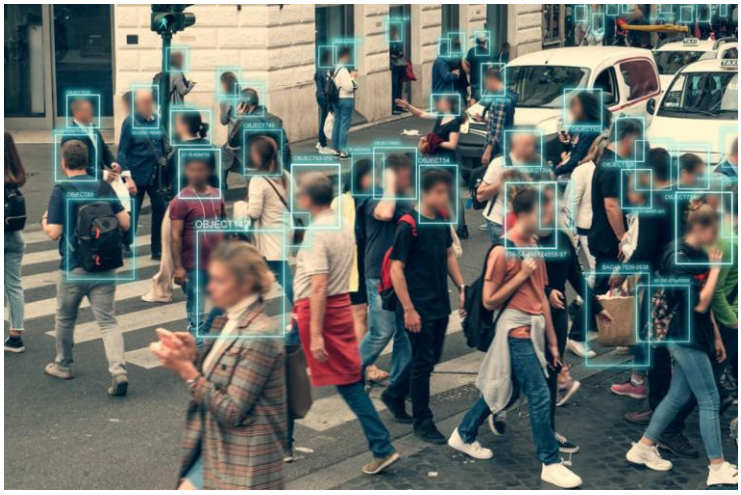
  Implanting chips in the human body may lead to a perception that human value is being diminished. When the human body is viewed merely as a "platform" or interface for technology, individuals may be categorized and treated more like objects or machines than sentient beings with emotions, feelings, and spirit. Both the Trades Union Congress (TUC) and the Confederation of British Industry (CBI) in the United Kingdom have expressed concerns regarding this issue.[24/]

  Moreover, embedding electronic devices into the body blurs the line between humans and machines—a phenomenon known as cyborgization. This development may deeply affect our understanding of identity and the essence of being human, raising philosophical and ethical questions about the boundaries of humanity and the evolving relationship between humans and technology.[25/]

- ### Individual Freedom and Autonomy

  Implanted chips that store personal data may compromise the privacy of the individual, as external parties or organizations with authority could potentially monitor and control such data at all times. This could lead to the emergence of a surveillance society and a reduction in civil liberties.

  Furthermore, if societies or organizations impose conditions requiring employees, customers, or service users to implant chips in order to access services, locations, or life opportunities—such as employment in certain sectors—this could constitute a violation of fundamental human rights and undermine personal autonomy in the digital age.



Source: westsideobserver.com

24/ https://warwick.ac.uk/news/knowledgecentre/business/work/microchipping/

25/ https://etica.uazuay.edu.ec/sites/etica.uazuay.edu.ec/files/public/uazuay-etica-ethical-issues-of-human-enhacement-technologies.pdf

Krungsri Research View

Although the use of implantable microchip technology can enhance human capabilities across various dimensions, it also presents significant challenges and concerns, as previously discussed. **Health risks remain a primary concern. Therefore, any application of this technology must be accompanied by clear accountability and be subject to oversight by medical professionals and other relevant experts to ensure safety and effectiveness.**

To protect chip-implanted individuals from malicious actors seeking to exploit the chip for unauthorized transactions or illegal activities, service providers should implement additional identity verification mechanisms to mitigate risks. For example, two-factor authentication—such as combining a PIN code with the RFID chip—along with emergency deactivation systems, could help reduce vulnerability.

Moreover, issues of privacy, data security, and informed consent remain critical challenges. Addressing these concerns requires not only technological advancement but also **robust legal and regulatory frameworks. Currently, legal standards vary across countries, creating regulatory gaps.** In the event of a malfunction or misuse, questions may arise regarding liability—whether it lies with the user, the technology manufacturer, or the medical and technical personnel involved. **Thus, if subdermal chip implantation becomes more widespread in the future, it is essential to establish clear boundaries of responsibility.**

From the perspective of payment technology, subdermal RFID chips still face limitations. Consumers may be less willing to adopt this technology compared to biometric payment methods—such as facial or palm recognition—which do not require surgical procedures or bodily intrusion. **Many consumers seek convenience but are unwilling to compromise physical safety, especially in a payment landscape that offers a wide range of technological alternatives.**

To make subdermal RFID chip payment technology as widely accepted as other payment options, financial service providers must clearly highlight its advantages. For instance, merchants do not need to invest in entirely new hardware when adopting this technology commercially, as current contactless payment systems using RFID or NFC are already compatible with implanted chips. Additionally, it offers convenience by eliminating the need to carry external devices, allows integration with health systems and personal data, and remains unaffected by physical changes in the user. In contrast, biometric payment methods—such as facial recognition—may fail due to changes like wearing glasses, growing facial hair, or injuries. These strengths position RFID chips as a competitive option for users who prioritize reliability and continuity.

Although subdermal chip implantation has been developed for over two decades, its adoption in daily life remains limited—particularly in the financial sector, where widespread acceptance is unlikely in the near future. This is due to the availability of diverse and highly convenient payment technologies. Many consumers may perceive that the benefits of RFID chip implantation do not outweigh the physical risks, making it an unnecessary option.

Nevertheless, subdermal chips offer distinct advantages in secure and precise identity verification. Therefore, this technology may be more suitable for applications in security and defense, such as tracking personnel, controlling access to restricted areas, and storing sensitive data requiring high levels of protection. In these contexts, safety and oversight take precedence over convenience, and military users are generally more willing to accept physical risks than the general public. As such, we may see increased adoption of this technology in national security applications in the near future.

References

ABC News. (n.d.). RFID implant coverage. https://abcnews.go.com/GMA/OnCall/story?id=3536539

Army Sustainment. (2011). How RFID and smartphones will help revolutionize Army sustainment. https://alu.army.mil/alog/2011/novdec11/PDF/How%20RFID%20and%20Smartphones%20Will%20Help%20Revolutionize%20Army%20Sustainment.pdf

BBC News. (2015). Technology and microchip implants. https://www.bbc.com/news/technology-31042477

California Healthline. (n.d.). FDA approves first implantable identification chip for medical use. https://californiahealthline.org/morning-breakout/fda-approves-first-implantable-identification-chip-for-medical-use/

Chron. (2004). Microchip implants bring security to Mexico. https://www.chron.com/business/technology/article/Microchip-implants-bring-security-to-Mexico-1662414.php

DTA. (n.d.). Baja Beach case study. https://dta.today/onewebmedia/Baja%20Beach%20case%20study.pdf

Euro Weekly News. (2025). US, EU, and UK racing to ban mandatory microchip implants. https://euroweeklynews.com/2025/06/03/us-eu-and-uk-racing-to-ban-mandatory-microchip-implants/

Google Patents. (n.d.). US6481140B1 RFID implant patent. https://patents.google.com/patent/US6481140B1/en

InformationWeek. (n.d.). RFID chips implanted in Mexican law enforcement workers. https://www.informationweek.com/it-leadership/rfid-chips-implanted-in-mexican-law-enforcement-workers

Marqeta. (2023). European payments 2030. https://www.marqeta.com/blog/european-payments-2030

New Scientist. (2004). Clubbers choose chip implants to jump queues. https://www.newscientist.com/article/dn5022-clubbers-choose-chip-implants-to-jump-queues/

NPR. (2018). Thousands of Swedes are inserting microchips under their skin. https://www.npr.org/2018/10/22/658808705/thousands-of-swedes-are-inserting-microchips-under-their-skin

PubMed Central. (n.d.). RFID and health. https://pmc.ncbi.nlm.nih.gov/articles/PMC1618368/

Realtrace. (n.d.). Legislation. https://www.realtrace.com/en/legislation/

Springer. (n.d.). Ethical and technical RFID discussion. https://link.springer.com/chapter/10.1007/978-3-642-21535-3_46

Stanford RESNA. (2005). Kevin Warwick's cyborg experiments. https://resna.stanford.edu/Tidbits/2005/warwick.txt

The Independent. (1998). Professor has world's first silicon chip implant. https://www.independent.co.uk/news/professor-has-world-s-first-silicon-chip-implant-1174101.html

University of Warwick. (n.d.). Microchipping in business. https://warwick.ac.uk/news/knowledgecentre/business/work/microchipping/

Universidad del Azuay. (n.d.). Ethical issues of human enhancement technologies. https://etica.uazuay.edu.ec/sites/etica.uazuay.edu.ec/files/public/uazuay-etica-ethical-issues-of-human-enhacement-technologies.pdf

VICE. (n.d.). Inside an online community of people with microchip implants. https://www.vice.com/en/article/inside-an-online-community-of-people-with-microchip-implants/

World Economic Forum. (2017). Microchip in your hand: RFID 32M. https://www.weforum.org/stories/2017/08/microchip-in-your-hand-rfid-32m/

WSAVA. (2020). Microchipping: The importance of ISO. https://wsava.org/wp-content/uploads/2020/01/Microchipping-The-Importance-of-ISO.pdf

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