Chapter 13
Embedding RFID Chips in Human Beings:
Various Uses With Benefits and Ethical Concerns

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ABSTRACT

RFID (Radio Frequency Identification) chips can contain a variety of information and are placed in debit and credit cards, embedded in products in the supply chain, planted in our pets as "microchips," and enable badge access to workspaces. They are being used in hospitals to ensure proper medications are given, help libraries keep track of holdings, and are used in many other ways. The fact that data can be transported easily and wirelessly presents many opportunities. Use in humans themselves, however, is a relatively new concept, and along with some benefits come several serious ethical questions that need to be addressed.

INTRODUCTION

Radio frequency identification (RFID) technology is hardly new considering its development can be traced back to the mid-1800s when a mathematician and scientist named James Clerk Maxwell proposed the idea of electromagnetic waves. In 1888 Heinrich Hertz, building on Maxwell's theories, invented a device capable of producing and detecting microwaves (Landt, 2001). These discoveries led to the

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identify friend or foe system (IFF), which used transmitters on British aircraft to transmit signals that were picked up by radar to identify aircraft as "friends," thus forming the essential basis for RFID technology (Rieback et al., 2006).

RFID uses radio frequency transmission in combination with tags, readers, and software to identify specific items. Today, RFID technology is used in many applications such as logging tolls at no-contact toll booths (Kalantri et al., 2014), tracking products in warehousing and logistics (Chang et al., 2008), and ensuring a beloved pet is returned home safely (Saeed & Green, 2019). Combining RFID with other technologies can also enable real-time monitoring in supply chains providing greater visibility of package movement for customers (Kumar et al., 2021). RFID chips are also usable in a variety of environmental conditions (Kaur et al., 2011) allowing their use in both indoor and outdoor applications.

Over the last quarter of a century, the idea of human RFID implants has been gathering increasing interest. There are many potential benefits to RFID implants from being able to pay for something without carrying an additional device, to conveying important information such medical or victim identification. However, ethical considerations such as privacy, security, and health concerns continue to prevent its widespread adoption and use. RFID technology, its uses, especially in regards to living beings, the benefits, and ethical implementations for human use thus require additional exploration and understanding. This paper will review RFID technology and address some of the ethical, legal, and moral concerns related to its use in humans.

THE TECHNOLOGY

An examination of how the technology works includes an understanding of components, necessary devices, network connections, radio frequencies, and various common usage.

Components and Devices

In brief, data are pulled by an *antenna* through wireless means, and a *transceiver* is required to read the data; together these are called an *interrogator*. Readers work to convey data via a third main component called a *transponder* (Amsler, 2021). This may be hand-held or affixed (Rouse & Shea, 2017). There are also integrated RFID readers, which include a port to enable an extra antenna ("The Beginner's Guide," 2019).

Tags are a kind of label affixed to an item to be scanned. As tags do not hold much information on their own (usually less than 2,000 KB each), they contain mostly unique identifying data (Amsler, 2021). EPCs (electronic product codes) store unique identification in each tag and can specify millions of products, manufacturers, and other data (Taghaboni-Dutta & Velthouse, 2006). Notably, tags are often hidden from plain view but can still be read even through materials such as plastic and cardboard that may encase a product (Kaur et al., 2011).

The three types of tags are *active* (possessing its own power source), *passive* (power coming from the antenna's electromagnetic waves), and *semipassive*, in which the circuitry is battery-operated and the reader takes care of communication power (Amsler, 2021). The technology can read and write data to and from a database without direct contact ("Technical Explanation," 2018). Some other facts may be of interest: