Secure Smartphone Unlocking using NFC

Utsav Jambusaria\textsuperscript{a}, Neerja Katwala\textsuperscript{a}, Dharmeshkumar Mistry\textsuperscript{a}

\textsuperscript{a}D.J. Sanghvi College of Engineering, U-15 Bhakti Vedant Swamy Marg, Mumbai, 400056, India.

Abstract

In today’s world, smartphones are ubiquitous. Gone are the days when phones were synonymous with making calls or sending text messages. Phones are now used for almost anything but that. In more ways than one, our lives have started revolving around them. Phones now contain every confidential and often intimate detail about their owners, from personal chats, to passwords or bank account details. It has thus become imperative to ensure that all this is accessed by only the right person. Despite the obvious necessity, people still loathe to keep a conventional pass code or pattern for their phones because the thought of having to repeatedly enter the same is irritating. The aim of our contribution is to introduce an innovative way to unlock smartphones by using NFC (Near Field Communication) enabled tattoos that are both, highly convenient and secure. We have also provided a working example of an accessory based on the same principle to vouch for its effectiveness in real life usage.

Keywords: smartphones; phones; unlock; NFC; tattoo

1. Introduction

Smartphone security has come a long way, from the humble beginnings of a pass code, to fancy patterns and face unlock, and most recently fingerprint scanners. They have all been used with varying degrees of success, as they all had their drawbacks. While face unlock could not be used in dark surroundings, fingerprint scanners failed if the user’s fingers were in anything but a pristine condition. Patterns and pass codes seem the simplest, but even then, users complain about having to repeatedly enter them, especially if they use their phones often. At such times, it is simply not quick enough.

The reason why only a measly 36% of users bother keeping any such security measure is just that. A leading mobile company claims that it takes users 2.3 seconds\textsuperscript{[3]} to access their phone, and when considered with the sheer number of times people access their phones, one can understand why.
We can thus see, that for the success of any such method, the following criteria are absolutely imperative:

- A low or quick, overall response time taken to fully unlock the phone.
- The ability to work flawlessly in all environments.
- Security, i.e. it should not be easy to bypass for potential intruders.
- Efficiency in terms of power, as one wouldn’t want unlocking their phone to consume a lot of their phone’s battery.

The greatest challenge we face in trying to implement this NFC based unlocking scheme, is the lack of a wide NFC support. As of now, only the highest end phones have an integrated NFC chip that allows for this mode of communication. Also, this would require one to enable their phone’s NFC at all times, thus leading to a potential loss of battery even when this scheme is currently not in use.

2. NFC

NFC, which is short for near field communication, is a high frequency wireless communication technology that enables the transfer of data between two compatible devices\( ^5 \) within a short range of under 10 centimetres. The shorter range has certain significant advantages over technologies like Bluetooth, like a greater level of security and a much quicker set up time (a connection typically takes about a tenth of a second to get established). It can also be used when one of the devices is not powered by a battery. This concept will be explained in detail in the further section.

2.1. NFC Tags

An NFC enabled device can also communicate with NFC ‘tags’. NFC tags\(^1\) have a small amount of memory, an antenna and they can be programmed as required. These tags do not have their own power source, and they draw power for transferring their data from the other device, via magnetic induction.
Customised data can be written, or programmed into blank NFC tags. Certain types also allow for the data to be rewritten, just like CDs and DVDs. Security is provided via means of encryption, and hence the data cannot be illegally manipulated.

These tags are generally of a very small size (most being about an area of 2 square centimetres), and hence can easily be integrated in other everyday materials. This makes it easier to incorporate them in day to day objects, without making much of a fuss about it.

3. NFC enabled digital tattoos

A new and innovative solution to this problem was introduced which uses a phone’s NFC to unlock it by coming into the close proximity of a special digital tattoo\(^2\) that can simply be stuck onto a user’s arm, using very little power at that.

Each tattoo is imbued with an identification code, which when first detected by the NFC radio of the phone causes a quick setup to initiate, thereby syncing the code with the phone. Hence each time the tattoo comes within a detectable range of the phone, the code is verified and the phone unlocks itself.

This tattoo is adhered to a user’s skin using a high quality adhesive, which is so mild on the user’s skin that it would be impossible to distinguish in just a matter of minutes. Each tattoo has a life of up to five days, and it is built to withstand the rigours of daily life while also having a strong resistance to water. The internals of the tattoo are built using semiconductors that provide the flexibility\(^7\) to bend in accordance to the user’s skin. After every five days, the spent tattoo can be replaced with a new one, and the process of syncing with the phone repeats itself.

This scheme is backed up with the regular pass code lock to provide access to the phone in the unfortunate event of the loss or destruction of the currently synced tattoo. This ensures that the user does not manage to lock himself out of the phone in any situation.

Biometric systems, like fingerprint or retina scanners have a much higher error rate than the NFC based unlocking system. Also, those systems require additional hardware inbuilt in the phone, which is much costlier than the NFC chip and tags required for our system. Thus, despite the obvious outlay caused by having to replace the tattoos often, the overall system proves to be more cost efficient than biometric systems. And with the technology picking up pace, one would expect costs for NFC tags, and hence the tattoos to reduce even further.
4. **Motorola Skip™- Wearable accessory to unlock your phone based on NFC**

The Motorola Skip™ is a practical example[4] that is based on the same concept of using NFC for the authentication and unlocking of a smartphone. Released as an add-on accessory for the Moto X[6], the Skip™ comprises of two components- Skip™ clip and Skip™ dots. As already revealed, the overall concept used here is completely the same. Both these components have NFC tags inbuilt into them, which can be individually synced with a particular phone.

The Skip™ clip is essentially a foldable strip[8] of fabric, with a pair of magnets at either end that allows it to be clipped onto the user’s clothes. This ensures that users can carry one with them at all times, without inconveniencing themselves in any obvious fashion. Bringing the phone within the range of the tag is enough to unlock it right away.

The Skip™ dots are highly similar to that tattoos we introduced, except that these are actually stickers which can be affixed on any desk, or the dashboard of a car. The phone remains unlocked (without its screen being necessarily awake) at all times, as long as it is kept on one of these dots. The idea here is that if there are certain places one finds themselves at, for a significant period of every day, like an office desk for example, then these dots can be fixed there to provide quick access at those particular places. This even removes having to move the phone in any way to unlock it. As long as it is there, it’s ready to go.

5. **Future Scope**

As discussed, keeping your smartphone secure is a very fundamental need considering the valuable data that may be found stored inside. However, users would loathe to waste even a few more seconds of their time to unlock a phone to that end. With the advent of technologies like NFC, this entire process just got a lot easier while maintaining the standards of security. NFC coupled with nanotechnology might soon make it possible to have such unlocking tags affixed under the user’s fingernail, or even permanently embedded beneath the skin. Ways must first to found to ensure that the life of these devices exceeds the yet nascent level of 5 days (as is the case for the NFC tattoos), to make these methods practically appealing and worthwhile.

6. **Result and Conclusion**

We found that this method of unlocking a smartphone using NFC has various temporal and convenience benefits. Apart from being extremely secure, it solves almost all of the problems associated with conventional unlocking
systems. The major drawbacks however, are the lack of availability of NFC in current smartphones, and the tattoo life is too short to be implemented extensively in daily life. Nevertheless, the rate of advancement in both these fields is commendable enough to hopefully provide us with a viable solution.

Acknowledgements

We would like to thank our honourable principal Dr. Hari Vasudevan of D. J. Sanghvi College of Engineering and Dr. Narendra Shekokar, Head of Department of Computer Engineering, for giving us the facilities and providing us with a propitious environment for working in college. We would also like to thank S.V.K.M. for encouraging us in such co-curricular activities.

References

1. www.electronics.howstuffworks.com/nfc-tag1
2. blog.gsmarena.com/unlock-digital-tattoo/
3. www.consumerreports.org
5. en.wikipedia.org/wiki/Near_field_communication
9. www.leganerd.com
10. www.smithsonianmag.com
11. www.cnet.com