Contents

DrugCipher: Record, Track and Validate Pharmaceutical Products

By: F. A Muhammad, S. Ododa, Y. A Hassan

October 2022

1 Abstract

Just as the blockchain has been successfully utilized in the Finance industry to abstract the problems of facilitating payments; We propose **DrugCipher** a modern, easy, and sophisticated means of tackling the most significant issues challenging the medical/pharmaceutical industry which is the problem of authenticating the validity of pharmaceutical products. **DrugCipher** introduces an effective means of battling this worldwide problem, by utilizing the power of securely generated and Serialized QR codes whose contents are encrypted and permanently store on the blockchain. Credits to the immutability of decentralized blockchain infrastructures, the validity of these products can be tracked from the manufacturing stage until they reach the intended patients.

2 Introduction

Globalization, trade feasibility, and rising demands for intellectual property are all facilitators of economic growth; however, they've also created opportunities for criminal networks to expand the scope and scales of their operations, utilizing cheap labor and well-defined trade routes to distribute counterfeit pharmaceutical products. This in turn has led to massive economic decline; Trade in counterfeit goods has not only damaged economic growth but also undermined good governance, the rule of law, and citizens' trust in government, which has ultimately threatened political stability. In addition, in some cases, such as that of fake pharmaceuticals, counterfeit goods can have serious health and safety implications for citizens. Although several approaches have been employed to tackle this issue, all efforts have seemed futile or yielded minimal results.

What is required is an electronic log system that is based on cryptographic proof rather than trust or mutable persistence systems. Our Proposed solution is a decentralized system that generates a unique computational proof of the chronological order of pharmaceutical products. Products whose metadata are technically impossible to tamper with can be tracked from their prospective source of production up to their point of dissemination and validation.

3 Why DrugCipher

DrugCipher introduces a safer and more reliable means of eradicating the problems of drug counterfeiting in the ever-growing world of the pharmaceutical Industry; although prior solutions to validating pharmaceutical products where the focus is placed on validating the content of pharmaceutical products alone; **DrugCipher** extends this solution to enhance mainstream adoption, enabling users to have total control over products they consume; and to do this **DrugCipher** is built from the ground up to be intuitive and seamless for both end users (consumers) and the manufacturers alike. In order to abstract the complexities of a technically demanding solution like this, **DrugCipher** divides its technologies into two sections i.e The core implementation and a platform. For the platform, **DrugCipher** utilizes web and mobile devices to deliver a simple and user-friendly platform for users and manufacturers respectively. The core implementation of **DrugCipher** is fundamentally based on two technologies, which we discuss in detail below.

3.1 Secured QR Codes

Secured Qr Codes (SQRC) are advanced Qr codes technologies that are generally made of two kinds of information, public information, and private information. The public data can be read by any reader such as a smartphone much like a normal QR code. While the private data is encoded with a password that can unlock the information, where a proprietary scanner is required to scan the password and reveal the encrypted data. These encrypted lookup codes can point an authorized reader to a location from where they can access the information of a particular product. **DrugCipher** utilizes Qr Codes to distinguish the identity of each product, by embedding images that are undetectable to the human eyes or regular cameras, when these products are being validated, the Qr scanner sorts for the hidden images before processing them through a series of algorithms producing a result based on the validity of the scanned image's quality.

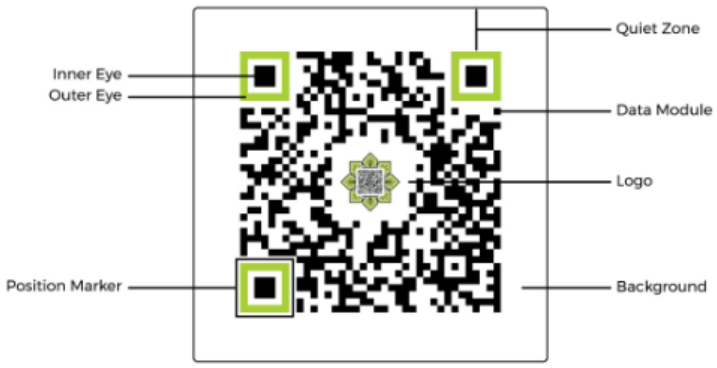

Figure 1: Graphical illustration of the components of a secure Qr code.

3.1.1 Error Correction Levels

Encoded in the QR code is one of four QR code error correction levels. The higher the correction level, the more damage a QR code can sustain while remaining scannable. It's like a stored backup of the QR code. The lower the correction level, the more space is left for size and data.

3.2 Blockchain

DrugCipher encrypts and stores all product information on the blockchain, to enable ultimate assurance against data interference or manipulation from external entities. Building upon the NEAR Protocol; a layer one blockchain platform, **DrugCipher** is able to achieve top-tier performance, committing thousands of

drug pieces of information in seconds. With the blockchain, products information such as the 'date created', 'expiry date', 'name', 'serial id', and 'manufacturer's information cannot be mutated once committed to the blockchain, thus implying the uniqueness of **DrugCipher** with respect to similar platforms, since with blockchain persistence no singular entity has control over the state of the data store on the chain.

3.3 Artificial Intelligence

DrugCipher utilizes AI in detecting images embedded within secure Qr codes, since these images are generally hidden and cannot be detected by regular Qr code scanners, **DrugCipher** employs an artificial intelligence algorithm to detect this image and validate the authenticity of the Qr code by their quality.

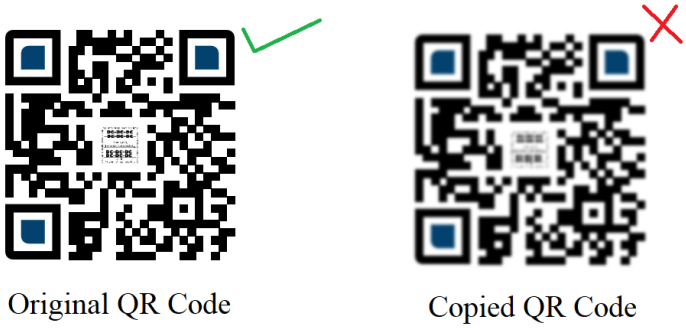

Figure 2: Diagram of How **DrugCipher** AI model for scanner works

4 DrugCipher: How it works

DrugCipher provides two platforms for manufacturers and patients respectively, allowing users from any of these categories seamless access to activities suited for their use case. To provide easy access to, as well as a flexible medium for consumers to validate drugs, **DrugCipher** provides a lightweight mobile app, with an inbuilt scanner for detecting and validating a particular product.

4.1 Manufacturers

Pharmaceutical manufacturers are provided a robust web interface, allowing them to create and authenticate their organization's profile, providing KYC and valid proof of licensing before they are allowed access to registering their pharmaceutical products onto the platform.

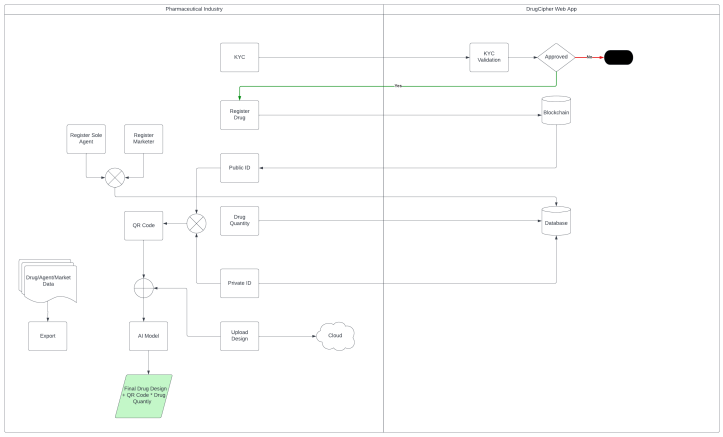

Figure 3: Activity diagram of how **DrugCipher** works for manufacturers

4.2 Patients

Using a simple mobile application, consumers have the ability to scan a pharmaceutical product and receive an instant response on the validity of that particular product as well as data relating to it. Since each product is created with unique meta-data that can be validated ones, it's simply impossible to clone a used Qr and receive a genuine response on the Qr code upon verification.

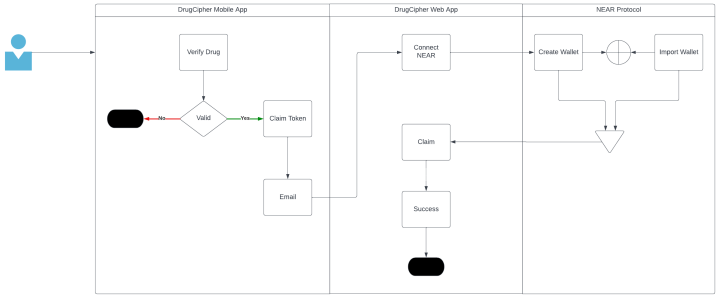

Figure 4: Activity diagram of how **DrugCipher** works for consumers

5 Summary

We've seen the influence of globalization and technology in almost every aspect of modern society and without a doubt, there's great demand for more sophisticated systems that automate and control the production and distribution of these numerous products which are distributed using multiple supply chains across the globe.