

# Intelligent DNA Phenotyping Global Recognition and Oblivious Image-Processing Device (iDROID)

Abishek Raj VG<sup>1</sup>, Arvind Kumar N K<sup>2</sup>, Matan P<sup>3</sup>, Varun Raman C<sup>4</sup>, Sathyamoorthy K<sup>5</sup>, Gokula Krishnan V<sup>6</sup>

UG Scholars, Department of Computer Science and Engineering, Panimalar Institute of Technology, Chennai,

Tamil Nadu, India <sup>1,2,3,4</sup>

Assistant Professor, Department of Computer Science and Engineering, Panimalar Institute of Technology, Chennai,

Tamil Nadu, India<sup>5</sup>

Associate Professor, Department of Computer Science and Engineering, Panimalar Institute of Technology, Chennai,

Tamil Nadu, India<sup>6</sup>

**ABSTRACT:** This paper is about making present recognition systems SMARTER. The current recognition systems are completely hardware tag dependent, that is, they require some form of hardware to track someone, either as an accessory or as a biological microchip (RFID) etc. Recent trends have proven the act of allowing common devices to interact with the internet (Classically known as The Internet of Things) brands them to be smarter than their alternatives. The main aim of this paper is to create a digital identity for every human just by using respective DNA and also eliminate any hardware components used by the present tagging /recognition systems and make the target oblivious to the whole operation. This is where iDROID comes into play. iDROID is a recognition device which uses image processing and DNA Phenotyping for tagging, locating and validating any human being. iDROID would potentially create a world where credit cards, debit cards, driver's license, passports and other kinds of I.D obsolete. Anyone can be made purely digital. Truly Unique. Truly Binary.

**KEYWORDS:** DNA Profiling, DNA Phenotyping, Morphology, Genome-Wide Association Study (GWAS), Single-Nucleotide Polymorphisms (SNPs), Non-Hardware Tagging, Oblivious Target Scanning, Image Processing Unit (IPU), Variable Number Tandem Repeats (VNTRs).

## I. INTRODUCTION

In the uber-digital planet that we currently inhabit, mostly everything around us has become "Digital". It has been well established that "Sharing is good, with digital tech, it's easier". The iDROID is here to take complete advantage of just that, by providing a form of identification for humans as a separate entity, digitally. Apart from sounding all sci-fi, the iDROID is basically just a DNA based tracker. Let us now see why we use DNA for this purpose. Although 99.9% of human DNA sequences are the same in every person, a bit of the DNA is different that it is possible to distinguish one individual from another, unless they are monozygotic ("identical") twins. The traditional method used by forensic to identify individuals by DNA is DNA Profiling or DNA typing. DNA Typing uses repetitive ("repeat") sequences that are highly variable, called Variable number tandem repeats (VNTRs). DNA typing proves useful when there is evidential material such as fingerprint or blood sample or even hair or skin cells of the target. Although DNA typing, given its pros is very useful to identify each individual uniquely, it doesn't prove useful for this application of tracking and complete tagging. DNA phenotyping is the process of predicting an organism's phenotype using only genetic information collected from genotyping or DNA sequencing. Phenotyping is the composite of an organism's observable characteristics or traits, such as its morphology, development, biochemical or physiological properties, behaviour, and products of behaviour. A phenotype results from the expression of an organism's genetic code. DNA phenotyping uses

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many of the same scientific methods in which significant genetic variants associated with a particular trait are discovered using a genome-wide association study (GWAS) approach, in which hundreds of thousands or millions of single-nucleotide polymorphisms (SNPs) are tested for their association with each trait of interest. Predictive modelling is then used to build a mathematical model for making trait predictions about new subjects

## II. EXISTING SYSTEM

### A. Hardware Tagging

The primary drawback of presently used Recognition systems use hardware tagging, that is, they use a piece of hardware, either the target has to be wearing it as an accessory or he/she would have to be biologically implanted with a microchip which is an Integrated circuit or RFID into the human body. The downsides of this approach are plenty, as in scenarios where the Hardware is lost or damaged. The hardware component could simply be removed to conceal the target from the recognition systems. There are possibilities for in-compatibility issues, infections, et cetera due to foreign physical particles in the human body. The component undergoes Hardware failure.

### B. Non Oblivious Target scanning

Another important issue is that the target being scanned through hardware tagging is aware of the scanning source and can easily remove or destroy it.

### C. Inconsistency in Image processing:

The Image processing technology on hasn't been developed that much and hence the quality of the image obtained and in turn the preciseness of the face detection derived could be very off. This problem is overcome by coupling the Image processing module along with the DNA phenotyping module to get precise facial structures which then can be verified and analysed from the database

### D. Practically difficult & expensive to implement

The existing hardware tag based recognition systems are very expensive and can be restricted to only certain objectives. Moreover, the targets are supposed to carry this hardware component everywhere which not only makes it expensive to the public but also very inconvenient for usage. Due to the above mentioned issues and then some, these recognition systems are advertised as more of a Business model and Security accessory rather than a cheap, easily accessible form of security system for public.

## III. PROPOSED SYSTEM

iDROID is potentially just a single complete device with two main modules. A DNA phenotyping module, which helps in identifying the target through DNA and predict the physical characteristics, especially facial prediction [Shriver's Algorithm], which should result in a comparable mathematical model. And secondly, an Image processing module which should be able to surveillance the input photograph or video frame result in a set of characters or mathematical parameters. Potentially the results from both modules could be compared and cross referenced with the pre requisite DNA Data Base. This is done at every equal interval to continuously track the target with just the two mathematical end parameters.

### Conspicuous Features of iDROID

- It eliminates the practice of physical tagging.
- The complete recognition process is oblivious to the target.
- DNA can be used to uniquely identify people because humans differ from each other on their DNA sequence or the Lengths of repeated regions of DNA [Electrophoresis technique]
- It could potentially replace all physical verification methods (Passports, Driver's license, Aadhaar cards, SSNs etc.)

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- Since there is no hardware component for every individual, the cost is limited to the development of the modules for iDROID and database for the DNA.
- DNA Phenotyping can be used to generate the facial features of the person. An Imageprocessing unit coupled with this can verify for the face and traverse through the prerequisite
- Database to find close match.[Shriver's Algorithm]

## Scope of iDROID

### A. To Recognize the Person

Primary Usage is global recognition of any individual through the DNA phenotyping and the Image recognition module. Being extensively said that iDROID is smart recognition device, claiming it to be primarily a security device is an understatement. The iDROID is constructed keeping all the following possible applications that the iDROID could effectively replace existing practices.

### B. To monitor the Attendance data

Since the iDROID device comes with DNA phenotyping module a data base and an image recognition module. The iDROID can be used to monitor the attendance of a group of people (students, staff, team members, et cetera) without actually any physical actions like tagging through a Biometric Reader, Swiping an entry card, etc.

### C. For general monitoring and surveillance purposes

It goes without saying that if a person can be tracked continuously only using his/her genetic information and also without him/her knowing. It could be used for surveillance and monitoring applications which could come in handy for managing employees, etc.

### D. For immediate Medical support

Continuously tracking a target has an added advantage of knowing his behavioural and physical/biological vitals all along. Thus if a person got injured or was in any accident, the system would be capable of informing the nearest hospital for support, without using any actual hardware on the target.

### E. GO Wallet-less

Since the iDROID can detect you individually and store any kind of information about you, it could be fed with Bank account details, Driver's license details and even Passport/Visa verification details, all digitally so, theoretically you would only have to carry yourself( just your face) everywhere and can make transactions and verify yourself on the go.

## IV. iDROID's CONCEPTUAL BLOCK DIAGRAM

### A. Phenotyping Module

DNA phenotyping is the process of predicting an organism's phenotype using only genetic information collected from genotyping or DNA sequencing. Phenotyping is the composite of an organism's observable characteristics or traits, such as its morphology, development, biochemical or physiological properties, behaviour, and products of behaviour. A phenotype results from the expression of an organism's genetic code. DNA phenotyping uses many of the same scientific methods in which significant genetic variants associated with a particular trait are discovered using a genome-wide association study (GWAS) approach, in which hundreds of thousands or millions of single-nucleotide polymorphisms (SNPs) are tested for their association with each trait of interest. Predictive modelling is then used to build a mathematical model for making trait predictions about new subjects. The Phenotyping module consists of a database which holds just the completed Mathematical Parameters derived from the DNA Barcode or DNA phenotyping process from the Pre-requisite genetic Data from central database. This contains mainly physical deductions such as Physique of target, Facial features of the target, etc.

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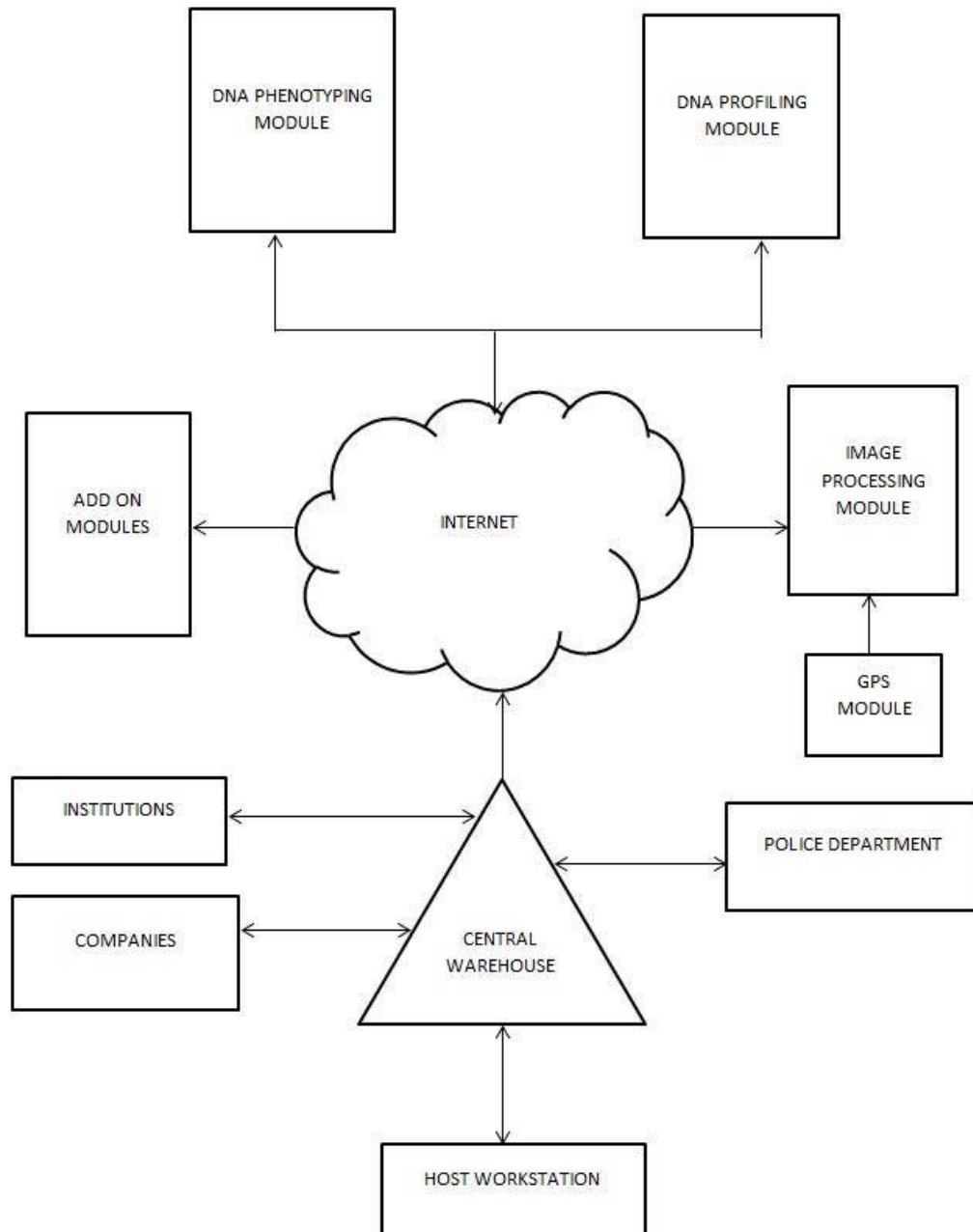


Figure 1. Block Diagram of iDROID

## B. DNA Profiling Module

This module gives extra assurance and is present just a fool proof system to the DNA phenotyping module. This profiling module takes raw evidential data (IF AVAILABLE) like Fingerprints, or Blood Sample, body tissue, hair, et

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cetera and derives the DNA profile out of it. It then uses repetitive sequences that are highly variable, called variable number of tandem repeats (VNTRs), to be more precise uses short tandem repeats (STRs) also known as micro/mini satellites. Unrelated humans are extremely unlikely to have same VNTRs.

## C. Image Processing Module

Image processing usually refers to digital image processing. In imaging science, image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image.<sup>[1]</sup> Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Images are also processed as three-dimensional signals with the third-dimension being time or the z-axis. The image processing modules use high resolution cameras (Potentially multiple cameras for 3D capture-down the line improvement) to capture multiple shots of the target or in suitable conditions captures video frames and is given as input. The resultant output is a set of logical characteristics and mathematical parameters which indirectly define the physical deductions of the target such as Physique and Facial features. All the three above mentioned modules are integrated and coordinated of optimal function through a Raspberry PI system.

## D. Central Database

Central database data warehouse that contains complete DNA digital information in form of Digital barcodes, each mapped to respective data items representing the vitals and all other information of the target.

The central database is the key module required and can be implemented through cloud computing so it can be accessed from anywhere in the world. The Central Database is controlled through a high performance workstation (Preferably multiple workstations or a supercomputer for large scale applications) which is used to monitor the target and this is where the iDROID's results can be viewed and verified.

## E. GPS module

A GPS tracking unit is a device, normally carried by a moving vehicle or person, that uses the Global Positioning System to determine and track its precise location, and hence that of its carrier, at intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location database, or [Internet]-connected computer, using a cellular (GPRS or SMS), radio, or satellite modem embedded in the unit. This allows the asset's location to be displayed against a map backdrop either in real time or when analysing the track later, using GPS tracking software. Data tracking software is available for smartphones with GPS capability.

## V. BRIEF METHODOLOGY

### A. Software side (Back end)

Human facial diversity and DNA uniqueness is crucial to this paper. Hypothetically the DNA data (cheek-scraping) of all the people, say a particular city is collected and stored in the Central Warehouse. Through DNA phenotyping and using Shriver's Algorithm, the facial features and physique of an individual can be gleaned from the DNA data. To fool proof this approach, we extrapolate through DNA profiling, where the subject's fingerprints are collected through biometric devices. The basic details such as name, age, sex and possibly the bank details, Aadhaar Number, Social security number, Passport, Driver's License, et cetera should be coupled with the above DNA data in the Data Warehouse.

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## B. Hardware side (Front end)

The Image Processing Unit (IPU) does the primary task of tagging. Through multiple cameras (possibly Pi cameras) located throughout the city integrated with individual GPS modules function as a singular tagging device that keeps tag on the target obliviously. With the data from both front end and back end modules, cross referencing between DNA derived data (predicted features), and the physically obtained data from the IPU (genuine features) can be done, to partially or completely (potentially) find a match.

## V. CONCLUSION

Since the iDROID is just a conceptual proposal, it's is bound to have many issues. The main problems it may face during implementation are security issues. Since the proposal suggests that all the information of every individual be uploaded into the central warehouse, including passport details and bank details, it becomes easier to crack into personal data files and infiltrate important information. The second issue would be the Oblivious Scanning process. Since the proposal depends on image processing, and for precise image processing, we require high quality photo equipment but it poses a problem of cost and also size. Also in order to improve precision, 3D modelling using multiple capture vantage points could be set but this increases the cost and moreover it is impossible to apply for every scenario. But out of all these problems, the most important con would be that in order for the person to be tracked, we need to capture his image to a certain amount of precision. Cases could be the person could use a disguise or cover his/her face or could evade completely from the iDROID's line of sight. In conclusion, iDROID is the first of its kind, hardware free tracking device and it is bound to have some negativities associated with it could be resolved during further iterations of implementation.

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