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Using biometric-based identification systems in Brazil: A review on low cost fingerprint techniques on-the-go

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A B S T R A C T

Automatic authentication has become an essential service in several public areas. However, although the technology related with this kind of service has evolved, the price tag of its use is not affordable for most countries. In the so-called "under developed" counties, such as Brazil, South Africa and India, for example, registration systems are often paper-based and/or cover only a fraction of the population. Thus, the reality is that there is an increasing gap into the usage of such technologies amongst different countries and it can be a factor that makes development more difficult and, therefore, less inclusive. One of the main technologies used for automatic identity prediction is based on biometrics analysis, which can distinguish physical or behavioural features to help overcome the traditional paper-based identity systems. Despite the limitations already mentioned, Brazil is known to have introduced several different uses of biometric-based technologies for authentication. However, the use of these technologies is not always ideal and, since the population size is a key factor, it is essential to select the most affordable option which is not necessarily the most adequate for the country's needs. This paper will focus on establishing what biometric-based solutions exist in Brazil today, highlighting the main challenges, as well as briefly proposing a new prototype for mobile fingerprint acquisition.

1. Introduction

It is now well accepted that automatic identity verification is an established and reliable part of the user identification process in many countries. However, the reality in a lot of poor, or developing countries, is that there is still no reliable way to verify identification (ID), since they cannot afford the latest and more effective technology and, thus, are forced to use outdated paper-based systems. Despite the cost issues, it is now common to see governments adopting automatic data analysis for identification, such as iris, fingerprint or other biometric processing, as the basis for national ID, elections and payment of benefits (Jain and Ross, 2015).

The main difference between paper-based and automatic-based biometric systems is the theoretical guarantee of an authentication which will be reliable and can be tracked, if necessary. Another recent important player in this scenario is the popularisation of mobile devices, which has been used, more often than not, as a means of substitute paper-based systems,

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such as bank transactions and purchases in general. A downfall of this sort of technology is privacy concerns and personal data protection. Thus, combining automatic biometric-based systems with mobile usage for private and secure transactions is a very popular trend (Ibrahim and Abubakar, 2016).

Although Brazil has a growing economy and has an increasing world profile, the reality is that its continuing underinvestment in basic services (security, health, transport) still defines it as an under-developed unit in terms of its problems with access to emerging technology. Following the aforementioned trend, the 2014 FIFA World-Cup and the 2016 Olympics have generated new interest by local government in investing to develop its own solutions for identity verification and protection, aiming to take real steps towards "smart cities".

However, this will require the development and deployment of appropriate technology-focused solutions which, in turn, means that important engineering challenges will need to be addressed and core expertise built up and nurtured within Brazil. One of the areas within which enormous opportunities are arising in this respect is that of the security of citizens. In particular, improving effective crime investigation, detection and prevention through the exploitation of technological "smart" solutions is likely to pay substantial dividends both in terms of quality of life for all citizens and economic impact. This type of scenario is promoting opportunities for more effective and efficient support for security initiatives, and is encouraging a desire for greater collaboration between academic and public service agencies.

This paper aims to consider the main challenges of employing biometric data in Brazil by highlighting several aspects of its use, as well as proposing a new and cost-effective technique for fingerprint acquisition on the go and in challenging environments, that can have a significant impact on the work of the local police for fighting crime.

Our approach is to explore the deployment of biometric technologies in a way that integrates two complementary perspectives. First, we will show how biometrics can substantially increase the security of individual citizens in their everyday lives, easily and cost-effectively, and how this is currently not being fully explored in Brazil. Secondly, we will demonstrate one way in which biometrics can support more effective crime detection and prevention.

2. Biometrics usage around the world

The increasing use of automatic biometric-based identification systems has encouraged their development, with regards to improving effectiveness, reliability, and guarantee of service, as well as helping decrease the gap between poorer countries with regards to more sophisticated identification systems. This technology can also improve the lives of minority groups because, as already mentioned previously, it provides a more robust identification system. A few examples can be seen below:

- The use of biometrics systems in the Nigerian federal pension system eliminated nearly 40% of the beneficiary roll. This not only increases efficiency and accountability, but also has the potential to improve services (assuming the funds saved are redirected accordingly) (Aranuwa and Ogunniye, 2012).
- India has introduced an ID programme that covers just over 240 million people, and has contributed to the rapidly falling costs of the new technology. However, many programmes are still in the early stages, and only a few of the 160 cases have had impact studies conducted so far (Tandon, 2005).
- South Africa has already been using this technology in electronic transfers and ATMs to distribute pensions and social grants for over 20 years (Wall et al., 2015).
- The Pakistani national identification agency has deployed a systems that reliably verifies who is entitled to the disaster relief funds resulting from the 2010 floods, through the use of Visa cards (Jacobsen, 2015).

Despite the above examples, most uses of automatic biometrics-based systems can be found in well-developed and prosperous countries, such as members of the European Union (Caldwell, 2015; Labati et al., 2015) and the USA (Farrell, 2016). This is understandable as they are mature democracies that have strong protection laws that legislate for the appropriate use of this type of data (Bustard, 2015). Relative to alternatives, biometric identification can increase inclusion, privacy and efficiency.

Biometric authentication combined with PINs or numbers conveys no significant personal information. In some cases, this can be preferable to more "human" processes, involving personal knowledge or intrusive questioning. In the absence of a functioning identification system, completing a biometric exercise to create one may be no more costly than a paper-based alternative, and may save greatly in the long run due to more automation and reduced fraud.

3. Brazil and biometrics usage

Brazil has a long history of attempting to adopt automatic means of identity verification.

There has been a plan for a Civil Identification Registry (RIC) since 1997 (with the signing of a new law) which intended to have a unique identification system for the 27 regions of the country by 2020. Despite the federal law being nearly 20 years old, there are still obstacles to its implementation. These registrations are made at city council level and the fact that the cities will "lose" that income to the federal level is the main problem this scheme faces.

In 2014, the Ministry of Justice took over the project and since then there has been a smartcard prototype launched, containing digitised face, fingerprint and iris information linked to an Automated Fingerprint Identification System (AFIS) (Lenharo, 2014). However, despite the fact that the fingerprint is considered standard practice in identity registration in Brazil, there is growing concern regarding threats to privacy, since this information would be held in a centralised database.

Once the RIC is established as the new national ID, a proposed bill under discussion would make the use of the ID-based biometrics registration mandatory, after allowing one year for issuing agencies to improve the technology, and setting a six year cut-off after which non-biometric ID cards would be rendered invalid.

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