Bio-IDiom – NEC's Biometric Authentication Brand

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Abstract

Digitization and big data are rapidly transforming the world, making it possible to offer each individual services and solutions tailored to their specific needs, a trend that will become ever more pervasive in the future. Key to the seamless integration of this technology in society — so that people can enjoy its benefits without worrying about security or access — is the use of biometrics, an authentication technology that identifies individuals based on physical and behavioral characteristics peculiar to that individual. In this paper we discuss Bio-IDiom — a biometrics brand launched by NEC in April 2018 — which can give us an idea of what that future society might look like. We also examine how multimodal biometrics can offer advanced safety and reliability by combining multiple biometric authentication technologies. Finally, we introduce some actual case studies where our multimodal biometric authentication solutions have been applied in real world conditions by our customers and partners.

Keywords

biometrics, face recognition, iris recognition, fingerprint recognition, palm print recognition, finger vein recognition, voice recognition, ear acoustic authentication, multimodal, digital transformation, smart city, value chain, AI

1. Introduction

The ubiquity of the Internet and the proliferation of smartphones have combined to create a world where everyone has at their fingertips a near-infinite collection of data. Instant acquisition and exchange of data has opened up a whole new world of possibilities for individuals, businesses, and organizations. In the not too distant future, the world will be inundated with an estimated 30 billion IoT devices and a few trillion sensors[1]. The number of contacts between humans and sensors will multiply exponentially, generating massive and continuous flows of data, far exceeding conventional human processing capability and increasing the importance of artificial intelligence (AI). Using AI to analyze data makes it possible to visualize that data in ways that humans can understand and conceptualize. Connecting humans, things, and events digitally will radically shift our paradigms, bringing forth new concepts, new ideas, and new meaning that will allow us to propose solutions that facilitate the sharing of deep knowledge and insight. NEC is committed not only to nurturing and fostering this digital transformation, but to ensuring that it supports human values and human ideals. (**Fig. 1**)

The accelerating digital transformation of society means that in the future our lives will be blessed with abundance and sustained by convenience. Biometrics will play a key role in that future world, where the sharing economy will spread into all areas of our lives, providing a safe and secure door between the real world and cyberspace (digital world). NEC aims to eliminate the risk of spoofing and malicious attacks by building a highly
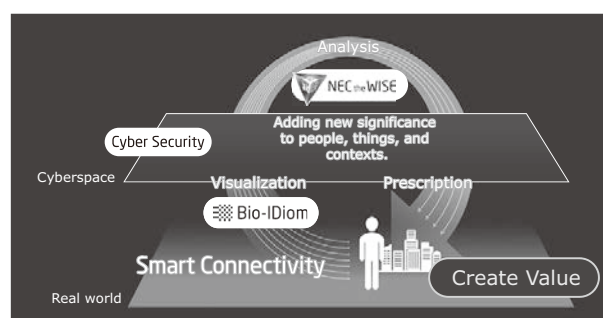

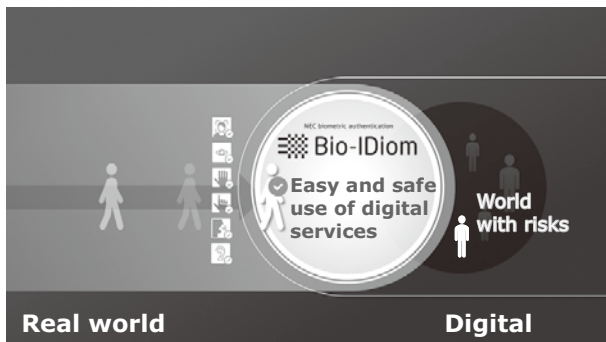Fig. 1 Biometrics and the Digital Transformation: NEC's perspective.

Fig. 2 Safer and more reliable biometrics based on digital technology.

Fig. 3 NEC's biometrics.

Fig. 4 Biometric technologies NEC focuses on.

advanced authentication system that turns each individual's critical bioinformation into a "key" to unlock the door to digital world. By combining multiple biometric technologies to meet different needs and requirements, we are confident that we can help build a society where everyone can enjoy the full benefits of digital technology without fearing for their privacy or security (**Fig. 2**).

2. Biometrics Brand – Bio-IDiom

2.1 NEC's biometric authentication technology

Biometrics is a method of authenticating an individual. It is a technology that identifies a particular individual based on physical and behavioral characteristics peculiar to that individual. Physical characteristics include the face, iris, fingerprint, palmprint, finger vein, etc., while behavioral characteristics include signature and voice (**Fig. 3**).

NEC's focus is directed on the area in the rhombus in **Fig. 4**. NEC's world-class authentication technologies — which include face, fingerprint, and iris recognition technologies — feature authentication accuracy that's been rated as number one in the world[2]. While convenience and authentication accuracy (security) tend normally to be at odds with one another, NEC has found a way to harmonize these two often contradictory elements. This achievement makes it possible for us to offer new values centering around the areas where the utilization of digital technologies is most in demand. Our customers can choose an authentication technology that best matches their specific needs and usage scenarios, as well as their social context. They can also take advantage of multimodal biometrics — which combines multiple authentication technologies.

2.2 Creating social value with Bio-IDiom

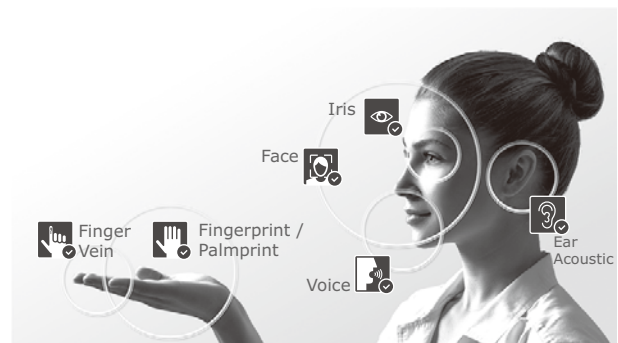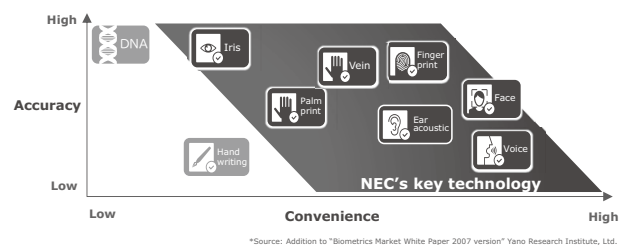The name "Bio-IDiom" will be applied to all biometric

products, services, and solutions deployed by the entire NEC group. The concept underlying the name is to emphasize that NEC's biometric technologies are focused on supporting the safety, security, efficiency, and equality of society as a whole, while maximizing the advantages of each technology (**Fig. 5**).

Instantaneous authentication of individual allows absolute trust to be established, helping to bring the world closer together. At NEC, we believe Bio-IDiom can help make this happen. Using biometrics for high-speed, high-precision authentication can make it possible to fulfill the potential of a world where humans, things, and events are merged into one. Starting out with fingerprint recognition, biometrics has evolved into an ever expanding array of possibilities and usage scenarios and in the future will continue to contribute to the creation of solutions for a wide range of social issues.

The name Bio-IDiom is derived from "bio" and "idiom." While there should be no need to explain what we mean by "bio," the term "idiom" is meant to suggest that Bio-IDiom combines multiple biometric authentication technologies that not only take safety to a higher level, but create a whole new value in biometrics — just as an idiom is a combination of words that creates a new meaning not deducible from each word alone. Moreover, by using upper and lower case letters — "IDiom" — we incorporated the meaning of ID or identification in "id-
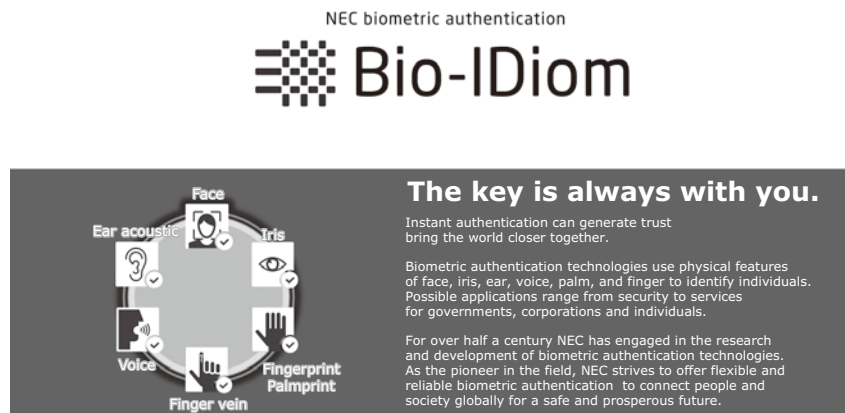
Fig. 5 The World We Want to Create with Bio-IDiom.

iom" meaning that Bio-IDiom authenticates the user while supporting a world where digital technology can be maximally utilized in the safest-possible manner.

In addition to coming up with the name "Bio-IDiom," we also created a symbol mark for it to let users utilize biometrics with an increased sense of intimacy. This checkered pattern mark reflects our hope that Bio-IDiom will envelope and enrich individuals and society while watching them over just like a checkered cloth that weaves the warp and weft together to make a larger plane.

3. Case Studies: NEC's Multimodal Biometric Solutions

Long before anyone else, NEC took the lead in research into fingerprint recognition technology in the 1970s. We've stayed out front ever since, leading the way in research and development of biometrics, concentrating on face recognition. Many of these authentication technologies have already been put into practical use around the world in such fields as criminal investigation, immigration, and national identification number systems.

At the same, biometrics is subject to a certain degree of ambiguity. By its very nature, the living organism presents a challenge to measurement. Shifting and mutable, the body never stays the same. Ever-changing physical constitutions and health conditions, variable measurement conditions, and different operating environments make it extremely difficult to assure precise and reliable biometric authentication. For example, some authentication systems cannot even be used in cases where an individual is sick. NEC has overcome this challenge by combining multiple proprietary biometric technologies to create customized solutions tailored to the specific needs of our customers. As a result, we are able to deliver maximum authentication accuracy without sacrificing convenience or ease of use.

Not surprisingly, Bio-IDiom's design — with its focus on increasing security with multimodal biometric authentication — as well as its successful deployment worldwide caught the attention of the Japan Institute of Design Promotion which named Bio-IDiom to the Good Design Best 100 in 2018[3]. Internationally too, Bio-IDiom has been highly acclaimed, receiving Germany's iF Design Award in 2019[4], one of the most important design prizes in the world.

To date, NEC has successfully introduced more than 700 multimodal biometric systems that combine multiple authentication technologies in over 70 countries. We will take a closer look at two of those cases below.

3.1 India's unique identification number program (Aadhaar)

With a population of 1.3 billion people, India faces a monumental challenge when it comes to creating a system that can efficiently identify and enumerate individuals so that everyone can enjoy equal access to the benefits of social services. To address this, NEC leveraged its high-precision multimodal biometrics that combines fingerprint, face, and iris recognition technologies to put together a large-scale biometric authentication system that does not involve storage and submission of documents solely reliant upon ID numbers (**Fig. 6**). This system is now used to prevent double registration and spoofing in food assistance, employment placement, and payment of taxes while simplifying procedures to support equal provision of public services and financial services to Indian citizens[5].

3.2 Los Angeles County Sheriff's Department

NEC's fingerprint recognition system has been utilized by criminal investigation services in various countries.
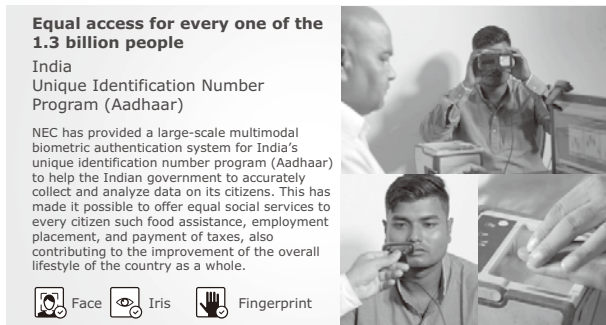
Equal access for every one of the 1.3 billion people

India
Unique Identification Number Program (Aadhaar)

NEC has provided a large-scale multimodal biometric authentication system for India's unique identification number program (Aadhaar) to help the Indian government to accurately collect and analyze data on its citizens. This has made it possible to offer equal social services to every citizen such food assistance, employment placement, and payment of taxes, also contributing to the improvement of the overall lifestyle of the country as a whole.

Face · Iris · Fingerprint

Fig. 6 Multimodal biometrics supports equal access to social services in India.

Making the whole region safer and more secure

Los Angeles County Sheriff's Department

Only after a week after its introduction to the LASD, our multimodal identification biometric solution contributed to the arrest of suspects and resolution in over one hundred unsolved cases, including two cold case homicides. Our multimodal biometric system can pick up even the slightest biometric clues left behind at crime scenes. This supports more efficient criminal investigation and enhances law and order by helping to narrow down criminal suspects.

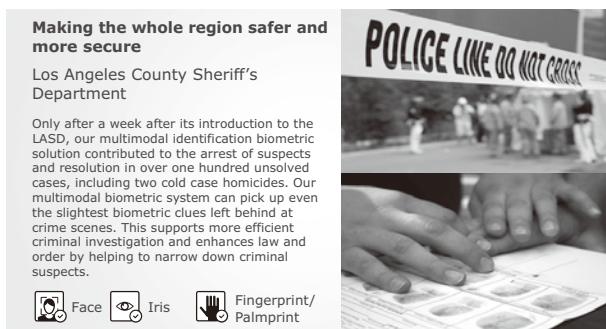Face · Iris · Fingerprint/Palmprint

Fig. 7 Multimodal biometric system used by the LASD.

To enable the Los Angeles County Sheriff's Department (LASD) to ensure the region's safety through the early resolution of increasingly complex and sophisticated crimes, NEC provided the LASD with a multimodal crime investigation system that combines multiple biometric technologies including fingerprint, palm print, face, and iris recognition. This system has contributed to the increased resolution of crimes and improved efficiency of investigations by helping the LASD to narrow down individuals who may be related to crimes based on the few clues left behind at crime scenes. The effectiveness of this system is evident in the fact that only one week after it was introduced, it helped uncover clues for many unsolved cases. This system is also connected to the databases of federal and state law enforcement agencies such as the California Department of Justice and FBI, making it the world's largest-scale service-based biometrics system for criminal investigation (**Fig. 7**)[6].

4. Conclusion

Building systems that combine AI technology with massive and wide-ranging digital data including bioinfor-
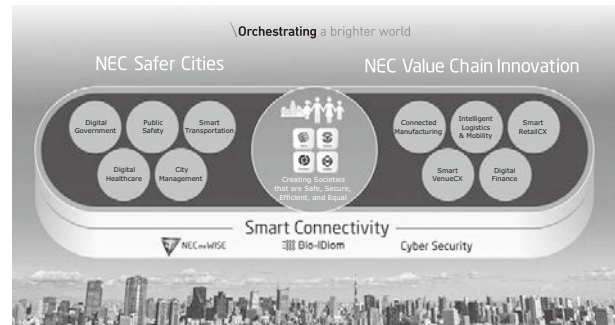
Fig. 8 Social Value Creation NEC is aiming at.

mation, NEC offers advanced solutions with the potential to predict events and analyze trends. The two main pillars of our business are NEC Safer Cities and NEC Value Chain Innovation. Biometrics and AI are maximally utilized in our public safety business, which includes the NEC Safer Cities. Similarly, the NEC Value Chain Innovation — which creates new value by connecting humans, things, and processes across the framework of industry — also takes full advantage of the power of biometrics and AI. Based on these two main pillars, we will continue to build and expand our range of solutions (**Fig. 8**).

As a Social Value Innovator, NEC is dedicated to helping achieve a society where people can lead brighter and more prosperous lives through the enhancement of safety, security, efficiency, and equality.

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