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PATENT OVERVIEW: DEVICE FOR FINGERPRINT IDENTITY GUARANTEE

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Abstract:

The patent device named "Device for biometric identification of maternity" is a dual fingerprint scanner that provides data of mother and baby fingerprints at the very moment of birth and further guarantees the maternity of a newborn baby by generating a unique ID reference and encrypting that data with the highest level of protection. For the first time, we enrolled qualitative research that proves a baby's identity at the very moment of birth based on the fingerprint minutiae. No one has done it until today! The realised technical solution scans, processes, stores, saves and encrypts personal data with one main purpose - to prove maternity of every newborn baby with 100% accuracy. By fingerprint scanning of both the mother and the baby's fingerprints simultaneously at the very moment of birth, ID is generated and stored. This allays potential fear of babies being replaced. Every identity is guaranteed. By encrypting this data, the whole process is raised to the highest security and confidentiality levels in maternity wards worldwide. In each case, the fear that almost every mother has in this period is allayed as well as the question: "Is this my baby?"

Keywords: biometrics, patent, fingerprint, identity, babies, maternity wards, algorithm.

Introduction

We can see various definitions of *Algorithm*[1] in different science fields and disciplines. As for a computer science algorithm, it is a step-by-

[1] *Algorithm* - stems from the name of a Latin translation of a book written by al-Khwarizmi, a Persian (Oaks, nd) mathematician, astronomer and geographer. Al-Khwarizmi wrote a

step set of commands, instructions and operations to be performed. The purpose of algorithms is to provide calculation, automatisation of actions and data processing.

An algorithm is a set of steps as explained. One has to learn how to make algorithms using pseudo-codes or real codes and that is why people who develop algorithms need to have programming knowledge. In order to optimize algorithms, the knowledge of mathematics is necessary, as well. Good news is that learning about algorithms can be as simple as you want it to be, and as easy as you are able to aquire (IEEE, 2018).

This Patent Device – Device for Biometric Identification of Maternity – the algorithm as a software part has been developed in an effort to solve a huge human problem and prevent possible undesirable events from happening, e. g. stealing or replacing the identity of newborn babies; it also allays the fear that all expecting mothers have, and makes that bright moment of bringing new life to this world easier and more relaxed to gynecologists, midwives and nurses.

This work presents all the functions that the device possesses. The figures show how the model is made, what the cross-section looks like, how it is constructed and implemented, what possible advantages and benefits are and the essence of a qualitative leap in health care systems, particularly in maternity wards worldwide. There is a possible wireless communication and different storage types. Fingerprints are scanned from a mother and a baby at the moment of birth, simultaneously, and the unique ID reference is generated, which will be encrypted and will guarantee maternity of every newborn baby with the probability of 100%.

This invention belongs to the field of applied information technology. The biometric system, i.e. the biometric device consists of a dual fingerprint scanner which scans two fingers of two different persons at the same time (one of a mother and one of a baby), and subsequently generates a unique Identification (ID^2) reference for each “mother-baby relationship” for every newborn baby in maternity wards (Lalovic et al, 2017).

According to the International classification of patents, this patent is classified with symbol G06F21/00 which belongs to biometry systems – devices for fingerprint scanners.

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book titled „*On the Calculation with Hindu Numerals*“ in about 825 AD, and was responsible for spreading the Indian system of numeration througout Europe.

[2] *ID – IDENTITY* (unique data for each fingerprint scanning process)

Material and methods

Technical issue

The technical issue which needs to be set, examined and solved with this algorithm of the Patent Device consists of three partial tasks as follows:

- Writing one optimal algorithm for emulating and executing every function that the device for biometric identification of maternity possesses. In future, the realization will give recommendations for transferring that pseudo-code into an accurate programming language, probably the C programming language, since it has to be structural and low level, not an object-oriented (OO) and high level programming language as JAVA or C++ are . It is very important that the algorithm realization is applicable for each existing platform of both hardware and software, and the C programming language is a proper choice for that (Lalovic et al, 2017).

- Modeling and building solution of the device - dual biometric fingerprint scanner for scanning fingers of the mother and the baby, right at the moment of birth, during the first baby's moments in this world. The device will be slightly different from today's existing classical fingerprint scanners, since it would have two fields for scanning fingers of two different persons (the mother and the baby). The two scanning fields can be physically divided during the process of device construction or they can be mapped by software definition on the scanning surface which existing scanners possess (NIST, 2014).

- It will be an effective device since it is highly practical and easy to work with, easy to control and manipulate. The device maintenance is easy, classical and similar to that of other fingerprint scanners. Besides its common purpose of scanning two fingers of different persons at the same time, it will provide a unique ID reference (similar to a Primary Key) which will be the basis for every scanned mother-baby pair (Lalović et al, 2016, pp.65-81), (Lalović et al, 2015, pp.293-302), (Oaks, nd).

Experiment

Modern well-known technical devices for scanning fingerprints use different algorithms and methods in their process of work to determine the identity of individuals.

The search through the National Base of Patents for similar devices, notably dual biometric scanners with their own power supply, did not give any results; namely, none of the Patents consider this idea and solution

in this way, with a dual biometric scanner (http://www.zis.gov.rs/pocetna.1.html, 2017), (http://www.epo.org/index.html, 2017).

The existing devices scan one or more fingers of **one** person only (we are emphasizing the fact that it is only one person) and there are no fingerprint scanners which scan fingers of two different persons at the same time using one device, especially not devices which generate a unique ID reference during scanning which will be connected with the record of fingerprint scanned and stored data (http://www.epo.org/index.html, 2017).

This scanner contains two fields for scanning one or more fingers of two different persons (the mother and the baby) and momentarily generates a unique ID reference which will be a guarantee for that record of fingerprints.

There is Patent confirmation П-2009/0253, International classification G 07 D7/12 (2008.04) for a device named “Hand mobile device for checking travel and personal documents, reading biometric data and face recognition of persons which carry those documents” which has only one function of scanning a fingerprint of one person at one moment (http://www.zis.gov.rs/pocetna.1.html, 2017).

Milestones of innovation

The main goals that we have accomplished are these:

The device can generate a unique ID reference and 100% guarantees the identity of each newborn baby and a bound record for the baby’s mother.

The device functions as a dual biometric scanner with two fields for scanning fingerprints of the mother and the baby or two babies (one after another) if they are twins, or three or more, simultaneously, at the very moment of birth. Precisely, one field is larger with the classic scan resolution of 500 dpi and the second filed is physically smaller but with a larger scan resolution – of minimum 1000 dpi so it can make a scan of a baby fingerprint that is very small (http://neurotechnology.com, 2017), (Chungkeun et al, 2012, 1253-1254).

It is a scientific fact in biometry that a fingerprint is formed during the prenatal period for every fetus and stays constant in the shape of minutiae during the whole life (Jain et al, 2008), (Keith et al, 2014), (NIST, 2014).

Many researches have done fingerprints minutia of a fetus; ultra waves and biometry scanning of the minutiae on each finger are formed by the end of the 7^{th} month of pregnancy. It is important to say that

babies born before the regular time of birth, during the 8th month and especially by the end of the 7th month of pregnancy have fingerprints on each finger as well as on each toe already formed, the fact which can be used to guarantee identity. (Jain et al, 2008), (Grzybowski & Pietrzak, 2015, pp.117-121), (Gutiérrez-Redomero et al, 2014, pp.199-207).

This scientific fact is essential for this device, this research and the realization or the Project that will provide a qualitative leap in gynecology, midwifery and nursing in every maternity ward all over the world.

In fingerprints, ridges and valleys are the only biometry that is formed prenatally and can be used for the purpose for determining baby's ID. The idea for the Patent Innovation is based on this scientific fact confirmed by both biometry systems and computer science and gynecology – midwifery as a branch of health care protection systems (Jain et al, 2008).

Here we cannot use other biometrics such as iris recognition because it is unstable. Why? Until the 4th year in humans, the pigmentation in children's eye is changing and becoming different. The shape and color both change which makes it impossible to be used for this purpose.

Other body features such as head, hand and body shape and size are rapidly changing since they normally grow up so it is obvious why they cannot be used. That is why this amazing scientific fact that a fetus's fingerprint is formed prenatally by the end of the 7th month in a uterus of a pregnant mother and stays constant with the same construction of minutiae is so important (Jain et al, 2008), (Dahlen& Caplice, 2014, pp.266-270).

If the procedure for the device is followed, the possibility of making any mistakes is excluded. Now the device and the system guarantee baby's identity 100% in each case of a newborn baby.

This is how we prevent any possible theft or replacement of the baby's identity, which has unfortunately probably happened at some places and parts of the World, especially in South-East Europe, in the Balkans, in the countries of former Yugoslavia. Now the device will guarantee, prove and serve as evidence of maternity for newborn babies.

Here, the authors took maternity with purpose because the maternal instinct is the strongest instinct in nature. To give respect to that natural instinct, the inventor decided to compare the mother's fingerprint with the baby's and make a unique ID reference that no one could change nor delete in the device.

The milestones gained from the patent will be:

- we got proof and evidence of maternity for every newborn baby

- we have no possibility of replacing or stealing identities of newborn babies
- all parents get safety
- device is of compact construction and practical for handling throughout the process
- device has its own energy supply with batteries
- device is of small size, low weight and it is portable
- device has a good price/quality ratio
- device is environmentally friendly
- device has a wide range of application and usage.

Research & Development

Description and figures showing the preview of the device

Finally, the visual representation of the software algorithm and the device preview are shown in eight figures. The first two figures represent the software algorithm where the logic, method and the sequence diagram can be seen.

For a better understanding of the functionality and usage of the device and its practical realization, there are three figures (1-3) that show the device in various views, use a case diagram and a cross-section of the Patent device.

Figure 1 shows Algorithm1 i.e. the algorithm for the determination of maternity identity and a new scan of the minutiae. It starts after powering the device and choosing option 1 on the device display.

Algorithm1 for the determination of the identity of maternity in the pseudo-code is defined as follows:

```
01  START
02  LOOP 1 TO 3
03  FIELD-1 F1 SCAN
04  IF F1 OK THEN GOTO GENERATE UNIQE ID
        ELSE IF LOOP < 3 GOTO END
05  LOOP 1 TO 3
06  FIELD-2 F2 SCAN
07  IF F2 OK THEN GOTO GENERATE UNIQE ID
        ELSE IF LOOP < 3 GOTO END
```

08 GENERATE UNIQE ID
09 GENERATE PIN
10 ENCRYPTING DATA
11 GENERATING HASH VALUE
12 STORE AND SAVE DATA
13 DISPLAY SUCCESS MESSAGE
14 END.

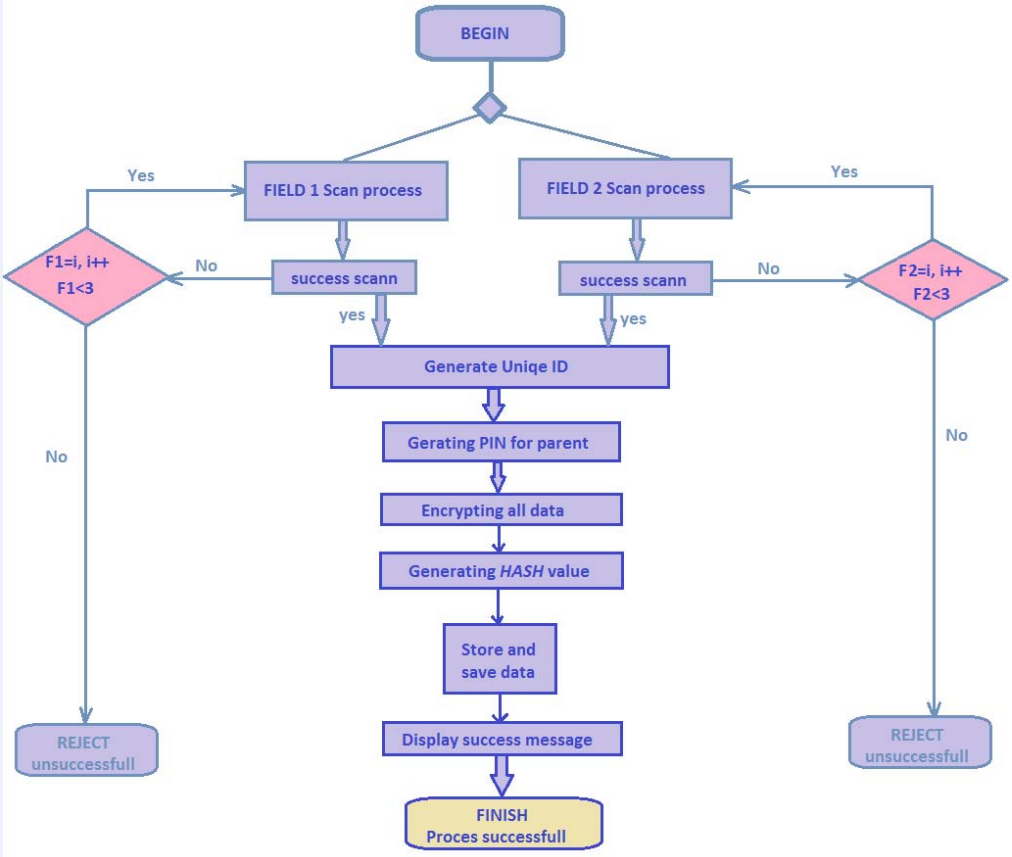

Figure 1 – Device algorithm for data acquisition
Рис. 1 – Алгоритм устройства для сбора данных
Слика 1 – Алгоритам уређаја за аквизицију података

After starting the device and choosing option 2, the software initializes Alrogithm 2 – algorithm for checking the identity of maternity. Figure 2 shows all functionality, logic and behavior of this algorithm. Based on the Figure preview, the conclusion can be derived about the possible usage of both cases and a sequence diagram of procedures and activities of the software.

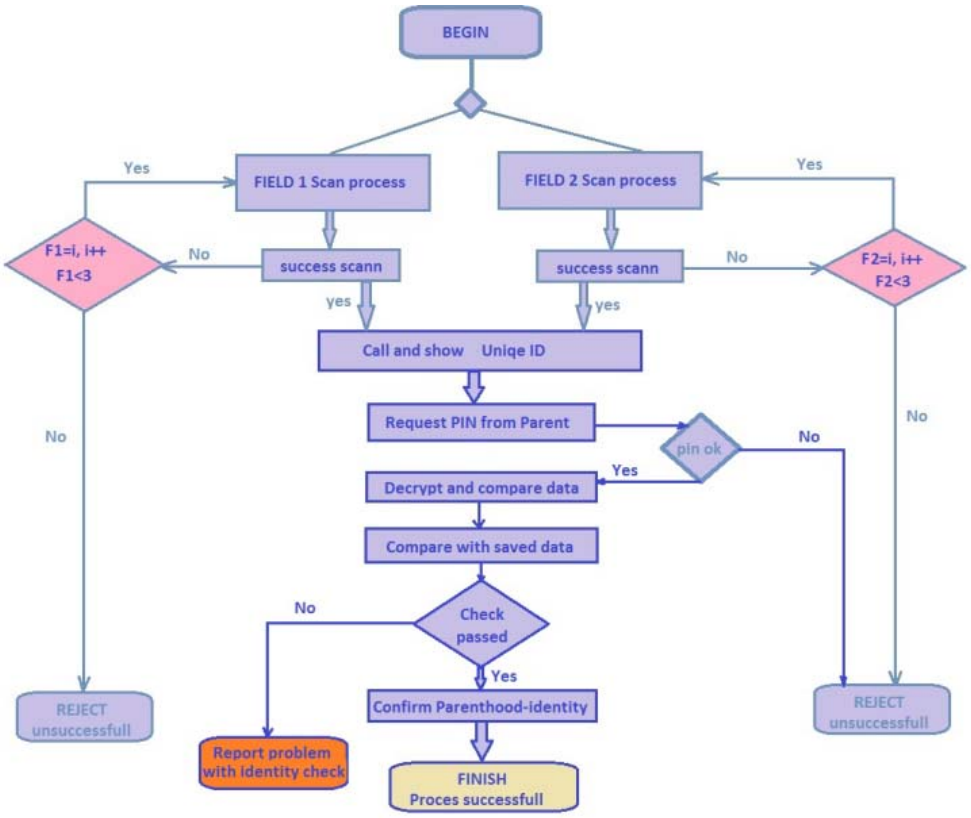

Figure 2 – Device algorithm for data verification
Рис. 2 – Алгоритм устройства для проверки данных
Слика 2 – Алгоритам уређаја за верификацију података

Algorithm 2 for the identity check of maternity in the pseudo-code is defined as follows:

01 START

02 LOOP 1 TO 3

03 FIELD-1 F1 SCAN

04 IF F1 OK THEN GOTO CALL AND SHOW UNIQE ID

ELSE IF LOOP < 3 GOTO END

05 LOOP 1 TO 3

06 FIELD-2 F2 SCAN

07 IF F2 OK THEN GOTO CALL AND SHOW UNIQE ID

ELSE IF LOOP < 3 GOTO END

8 CALL AND SHOW UNIQE ID

09 ENTER PIN

10 IF PIN VALID THEN GOTO DECRYPT AND COMPARE DATA

ELSE GOTO END

11 COMPARE WITH SAVED DATA

12 CHECKING AND COMPARING DATA

13 IF CHECK OK THEN GOTO CONFIRM PARENTHOOD IDENTITY

ELSE GOTO REPORT PROBLEM WITH IDENTITY

14 CONFIRM PARENTHOOD IDENTITY

15 END.

Figure 3 shows the device for biometric identification of maternity as a whole with the digital display, the switch and two fields for fingerprint scanning. The figure contain the following notification:

B – Body of the device.

I – Ignition switch which can be in two positions (on/off), and can be connected with timers for delayed on/off.

D – Display of the device for displaying all current device activities in real time, such as start of scanning, success of process, and results of a unique ID reference generated during the process of fingerprint scanning.

S – Set button for starting the scanning process and reading the acquired parameters by fingerprint scanning.

R – Reset button for resetting the acquired and processed data, after storing it.

R1 – Command button with a purpose of saving and storing data after the scanning process.

S1 – Field for fingerprint scanning of a baby's finger, much smaller than the field for mother's fingerprint scanning.

S2 – Field for fingerprint scanning of a mother's finger, larger that the S1 field.

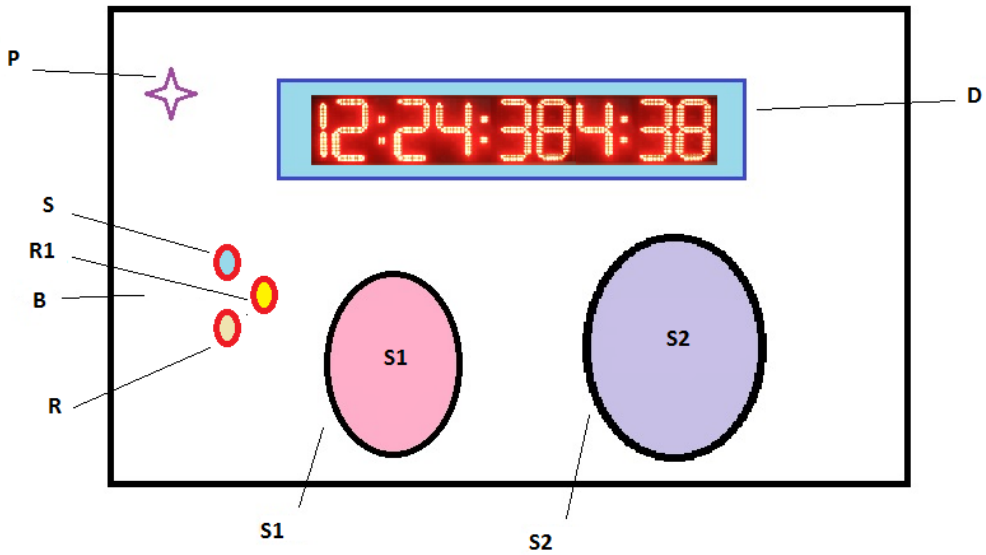

Figure 3 – Front view of the device
Рис. 3 – Изображение устройства (вид спереди)
Слика 3 – Фронтална слика уређаја

Description how the device functions

The device works as follows: putting P in the position on the device gives the information on the display that device is in function regularly and that there are no errors. Pressing the S button makes fingerprint scanning on both fields of the device start (S1 and S2) simultaneously, requiring that the fingers of the mother and the baby be placed in appropriate fields.

After scanning and pressing the R1 button, the data will be stored and a unique ID reference is shown on the display D. The ID reference can be both numeric and alphanumeric, considering that the numeral systems can be octal, decimal, binary or hexadecimal. The main fact is that the ID is unique.

Discussion - possibilities of further development

The software algorithm of the device for the biometric identification of maternity is realized in the pseudo-code in this work. It is also shown in details in Figures 1 and 2 which show the essence of the idea and programming. In future development, it can be written in a concrete programming language such as C.

This device with its essential idea about biometric identification of maternity can find place in further developments of similar biometry systems in day-care centers and in preschool institutions where there are various problems regarding the security of small children and keeping an eye on them in every moment.

Also, it can be a part of a much larger health care system regarding small children in pediatric institutions, where the device can provide basic data about possible allergies of each child and can improve that part of health care system globally.

Conclusion

This breakthrough proves that it is possible to guarantee babies' identities based on their fingerprints. Babies have their own IDs!

It can now be shared and used in different ways in different areas of social and health care systems. The system is highly modular, it can be updated and, what is most important, it can be a basis for some future development in the area of biometric systems.

This patent device can be applied in many countries in a fight against organized crime and it can help prevent thefts or replacements of newborn babies, especially in territories with low IT infrastructure and technological development.

Every type of biometrics tries to minimize both FAR[3] and FRR[4] in attempt to be much more accurate and secure. This device has accomplished that part since it combines two scanned data and its accuracy grows exponentially.

In developed countries, it can provide a new quality of health care services, help the staff in maternity wards, make the process of birth much easier and relaxed for future mothers as well as for gynecologists, midwives, and nurses: to put it shortly - for everybody!

[3] FAR – False Accept Rate
[4] FRR – False Reject Rate

Conflict of interest

None, since the Article's author is also the Patent owner.

References

Chungkeun, L., Hang, S.S., Jongchul, P. & Myoungho, L. 2012. The optimal attachment position for a fingertip photoplethysmographic sensor with low DC. *IEEE Sens. J.,* 12(5), pp.1253-1254. Available at: http://dx.doi.org/10.1109/JSEN.2011.2164904.

Dahlen, H.G. & Caplice, S. 2014. What do midwives fear? *Women and Birth*, 27(4), pp.266-270. Available at: http://dx.doi.org/10.1016/j.wombi.2014.06.008.

Grzybowski, A. & Pietrzak, K. 2015. Jan Evangelista Purkynje (1787-1869): First to describe fingerprints. *Clinics in Dermatology,* 33(1), pp.117-121. Available at: https://doi.org/10.1016/j.clindermatol.2014.07.011.

Gutiérrez-Redomero, E., Rivaldería, N., Alonso-Rodríguez, C. & Sánchez-Andrés, Á. 2014. Assessment of the methodology for estimating ridge density in fingerprints and its forensic application. *Science & justice,* 54(3), pp.199-207. Available at: https://doi.org/10.1016/j.scijus.2013.11.004.

http://www.epo.org/index.html. Accessed: 01.10.2017.

http://www.zis.gov.rs/pocetna.1.html. Accessed: 01.10.2017.

http://neurotechnology.com. Accessed: 01.10.2017.

-IEEE, 2011. Using Fingerprint Authentication to Reduce System Security: An Empirical Study, pp.32-46. In: *Security and Privacy (SP), IEEE Symposium*, Berkeley(CA), 22-25 May. E-ISBN: 978-0-7695-4402-1.

Jain, A.K., Flynn, P. & Ross, A.A. (Ed.), 2008. *Handbook of Biometrics*. Springer US. Available at: https://doi.org/10.1007/978-0-387-71041-9.

Keith, M., Persaud, T.V.N. & Torchia, M. 2014. *Before We Are Born, 9th ed*. Elsevier UK / Saunders. ISBN: 9780323313377.

Lalovic, K., Andjelic, S. & Tot, I. 2017. How to guarantee baby identity based on fingerprint biometry. In: *BISEC 2017 - IT Conference*, Belgrade, October.

Lalović, K., Maček, N., Milosavljević, M., Veinović, M., Franc, I., Lalović, J. & Tot, I. 2016. Biometric Verification of Maternity and Identity Switch Prevention in Maternity Wards. *Acta Polytechnica Hungarica,* 13(5), pp.65-81. Available at: http://dx.doi.org/10.12700/APH.13.5.2016.5.4.

Lalović, K., Milosavljević, M., Tot, I., & Nemanja, M. 2015. Device for Biometric Verification of Maternity. *Serbian Journal of Electrical Engineering,* 12(3), pp.293-302. Available at: http://dx.doi.org/10.2298/SJEE1503293L.

-NIST, 2014. *Fingerprint Compression.* [Internet]. Available at: https://www.nist.gov/programs-projects/fingerprint-compression. Accessed: 10.10.2017.

Oaks, J.A., *Was al-Khwarizmi an applied algebraist?* [Internet]. Available at: http://pages.uindy.edu/~oaks/MHMC.htm. Accessed: 30.05.2008.

ОБЗОР ПАТЕНТА: УСТРОЙСТВО ИДЕНТИФИКАЦИИ ЛИЧНОСТИ ПО БИОМЕТРИЧЕСКОМУ ОТПЕЧАТКУ ПАЛЬЦА

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ВИД СТАТЬИ: обзорная статья
ЯЗЫК СТАТЬИ: английский

Резюме:

Патент под названием «Устройство биометрического установления родительства» это двойной сканер для снятия отпечатка пальца, который содержит данные о отпечатках пальцев матери и младенца с момента рождения ребенка и в течение дальнейшего процесса безошибочно идентифицирует мать новорожденного ребенка с помощью генерирования однозначных ИД сведений и их кодирования с наивысшей степенью защиты. Данное исследование посвящено первому качественному устройству, которое с уверенностью может установить идентитет новорожденного ребенка на основании минуций (признаков) отпечатка пальца. Этого до сих пор никто не делал! Осуществленное техническое решение сканера, который сканирует, сохраняет и кодирует данные изображено на рисунках, приведенных в статье. Целью изобретения данного устройства является полноценная защита и надежное безошибочное средство идентификации матерей каждого новорожденного ребенка. При одновременном сканировании отпечатков пальцев матери и новорожденного ребенка, непосредственно после его рождения, ИД генерируется и архивируется. Таким образом, потенциальная опасность от подмены новорожденного ребенка полностью ликвидирована, так как теперь идентитет каждой личности с точностью можно установить. Шифровование сведений также, как и весь процесс доведены до наивысшего уровня безопасности и конфиденциальности между всеми участниками родильных домов во всех точках мира. Страх, который испытывает каждая роженица: «Мой ли это ребенок?» навсегда останется в прошлом.

Ключевые слова: биометрия, патент, отпечаток пальца, идентитет, новорожденные дети, родильный дом, алгоритм.

ПРЕГЛЕД ПАТЕНТА: УРЕЂАЈ ЗА ГАРАНЦИЈУ ИДЕНТИТЕТА НА ОСНОВУ БИОМЕТРИЈЕ ОТИСКА ПРСТА

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ОБЛАСТ: информатика, патент
ВРСТА ЧЛАНКА: прегледни чланак
ЈЕЗИК ЧЛАНКА: енглески

Сажетак:

Патент под називом „Уређај за биометријску идентификацију родитељства" је дуални биометријски скенер отиска прста који садржи податке о отисцима прстију мајке и бебе на самом рођењу. Генерисањем једнозначне ИД референце и шифровањем тих података постиже се највиши ниво заштите. По први пут је спроведено квалитативно истраживање које доказује идентитет тек рођене бебе на основу минуција отиска прста Тиме је онемогућена замена беба и гарантован сваки идентитет. Шифровањем тих података цео процес је подигнут на виши ниво безбедности и поверљивости између свих учесника у породилиштима широм света.

Кључне речи: биометрија, патент, отисак прста, идентитет, бебе, породилишта, алгоритам.

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