A Novel Biometric Fingerprint IT System in Determining Newborn Baby Identity

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Abstract - This work presents totally new IT security system and novel method for biometric verification for new born babies in birthplaces based on fingerprint minutiae. Information system realized combines nowadays program languages such as: Java, Python considering object-oriented languages, C programing language for device programming as structural (line) and SQL as relationship database management system to store encrypted data. RSA as asynchronous algorithm and key store value for encrypted fingerprint minutiae. Information system implementing device for biometric identification of maternity as dual fingerprint scanner that provides data of mother and baby fingerprints on very moment of birth and in further process guarantee maternity over new born baby with 100% accuracy, generating unique ID reference and encrypting those data with cancelable biometrics we developed totally novel method in determining identity based on baby fingerprint minutiae.

Keywords - Biometry, Fingerprint, Security, Baby, Method, Information system.

1. INTRODUCTION

Biometry is science discipline and technology that measures and analyzes biological characteristics of people. It is part of advanced security systems widely used in today modern society and protection systems.

The highest in persistence in Biometry and the lowest possibility of compromising the data is fingerprint and minutiae, that is why the aim of this novel approach is based on it, implementing device for biometric identification based on this part of Biometry.

Technical problem that solves this work information system that prevents any possible steal or replacement babies identity and 100% accuracy in determining it and shows device which scans, put into storage encrypted personal data with one goal - to provide parenthood over each new born baby in hospital. Scanning finger minutiae from baby and mother, at the time, on vary moment of birth, generating unique reference and bound it with scanned data it is provided total care at this process, it is removed potential fear and it is guarantee identity. Encrypting these data, whole process is raised on a totally high level of security within everyone in birth place worldwide. This novel method removes in totally fear that almost every mother have in this period, and removes question: "Is this my baby?". This method presents new implementation of information technology security in system of public health and upgrading it to a higher level.

This novel method encapsulates three main parts: Informations system, device for biometric identification od new born baby and procedured needed to be realized so the new approach could be done. Sovling one huge human problem - possible steal or replace identity of new born babies, also removing severals fears that womans have at moment of birth, and make easier and relaxed actions to gynecologist, midwifes and nurses that bright moment such as new life on this world, with this method all this will be easy job to do.

In this work it will be also presented all funcionality that device posses, in will be showen in figures how the nuild our model, picture of a cross-state, how it is designet and developed. We will present possible advantages and benefits, what is qualitative leap in

public Health Care system, precicely in birth places over the globe.

It is possible to establish wireless comunnication and storage types for fingerprint scanned from mother an baby at moment of birth, both together and generated unique identity reference, which will be encrypted and will guarantee maternity in 100% over every baby. [5] [6] [7] [9]

2. SOLVING TECHNICAL PROBLEM

Main technical problem which has to be solved with this new method consists of:

- Building solution for our device - dual fingerprint scanner for scanning fingers of mother and baby, at vary the moment of birth. This device will be with small differences from today's existing classic fingerprint scanners, thus it would have two fields for scanning fingers of two different persons (mother and baby). After this process device will encrypt data and store them. [1] [2] [3] [4]

- It will be real effective during its work, device is highly practice and easy to work with, easy to control and to manipulate. Maintenance is easy, classic and similar like other fingerprint scanners. Besides its common purpose and scanning two fingers of different persons at the same moment it will provide unique ID reference (like Primary Key) which will be basic for every pair of scanned mother-baby. [5] [6]

- Information system (IS) that is realized presents optimal solution for this type of work defining strict procedure needed to be obeyed. Also IS will implement IT technology in public health system. [7] [8]

3. MAIN TECHNOLOGY OVERVIEW

According to today's known technical devices – various fingerprint scanners which use secure algorithms during its in their process of work to determine and to claim identity of individuals. Searching in Serbian National Patents base there are no similar devices which considers these aim, and concretely dual biometric scanners, which contains its own lightening, battery supply and no one Patent is

considering this Idea and solution on this way, with dual biometric scanner. [9] [10] [11]

Today's biometrics devices can scan one or more fingers from **one** person, repeat person, but there are not fingerprint scanners which scans fingers of two different persons at the same time on one device, specially not devices which during scanning make unique reference which will be connected to the record of fingerprint scanned and earlier stored data. [12]

This scanner will posses two fields for scanning one or more fingers of two different persons (mother and baby) and in that moment will generate unique ID reference which will be guarantee for that record of fingerprints. [13] [14]

The question which is asked in nowadays is: Can Biometry and its part – fingerprint scanning can be made over two persons at the same time with one device?

Surely it can, and it will be realize really high quality, that will be shown in this work and Patent – Innovation presenting. That is **Device for biometric identifying of Maternity**. In further development of functionality of this device will be implemented encrypted data, which will carry information about two persons (mother and baby) and bounded unique ID reference. [16]

Today's patents and devices and present scanners which are used don't have similar functions, and main thing they don't have fingerprint scanning of two persons at the same time. [17] [18]

Patent "Fingerprint identification device", where is completely described device which have function of scanning and give us data about fingerprint of person (is extractor software for *minutiae*[1]). [3] [4]

This device have two fields for scanning fingers of two different persons at the same time, which in the same time generates unique unchangeable ID reference which will be additional guarantee of

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[1] **M**inutiae – fingerprint specific points visible on a finger image

persons identity and guarantee on Parenthood over baby.

Throw this incoming question is about economy and time needed for scanning process both persons with all backend Information Technology (*IT*) in background of future system which now work with scanning one person? Device also gives optimal solution for resource usage in case of processing data acquired during process of fingerprint scanning, first of all considering memory usage and activity of microcontroller – Central processing Unit (*CPU*). [7] [8]

In final, regarding all this benefits, both hardware and software, device will totally provide qualitative jump in branch of Health Care system for every country where it be implemented, and never the less, in branch of IT industry – specific Biometry.

4. INFORMATION SYSTEM

The Information system created for this new method baby identification based on fingerprint consists of part of acquiring data, encrypt, store and verifying data. Next step is obeying procedures needed to be done. Figures shows USE Case and Sequence diagram for this Information system.
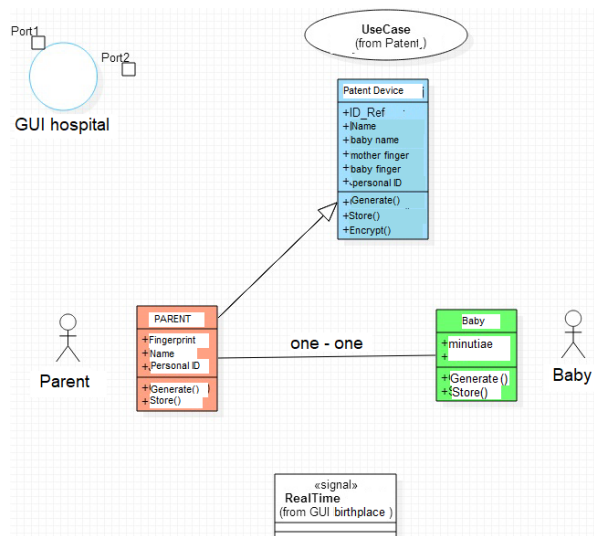

Figure 1 – Use Case diagram of Information system

This use case diagram shows who are participants of this new information system based on roles that they posses. They are strictly determine by every role they have in hospital and implementing it. This will help understanding out IT security system further more.
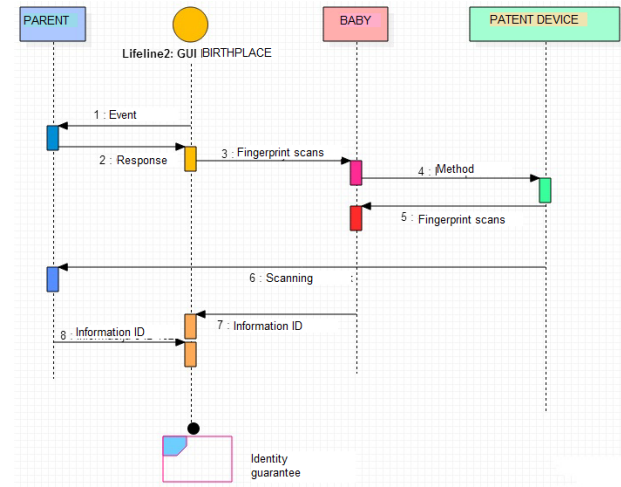

Figure 2 – Sequence diagram IS

4.1. CAN BABY FINGERPRINT MINUTIAE BE ACQUIRED?

Main purpose of our device in this system is emulation of a dual biometric fingerprint scanner has two fields for scanning fingerprints of mother and baby or two and more, at one moment, at very moment right new born is happened. Precisely one field is larger with classic scans resolution 500 dpi and second filed is physically smaller but with larger scans resolution – minimum 1000 dpi so it can make scans over baby fingerprint that is very small. [8] [12] [15]

Science fact, an axiom, in Biometry as branch of Advanced security systems, Discipline - Informatics and Computing, Science Field - Natural Sciences and Mathematics, **is that fingerprint is formed during prenatal period for every fetus and stays constant in shape of minutiae during whole life. [1] [2] [9] [10]**

According to many research realized on fingerprints of fetus, ultra waves and biometry scanning is that in totally summary minutiae on each finger is formed by the end of 7th month during pregnancy. This is important to mention that babies whom born before regular time of birth, during 8th, and especially **by ending of 7th month of pregnancy have formed fingerprint on each finger, both hands and foots fingers.** [1] [5] [16] [18]

This science fact is crucial and essential for our patent and this device, this research and this project realization that will provide qualitative jump in gynecology and midwifery and nursing in every hospital whole over the world. The 100% guarantee of baby identity and maternity over new born babies will be one moment scanning of fingerprint mother and baby at the moment of birth.

This is the most important because minutiae – ridges and valleys are the only biometry that is formed prenatally and it can be used for the purpose of biometry identity guarantee. Whole idea for Patent Innovation is based on this science fact confirmed both Biometry system as Computer science and gynecology – midwifery as branch of Health Care protection system. [1] [2] [6]

Other biometrics such as Iris recognition is unstable, because until 4th year old children pigmentation in eye is changing and became different in shape and in color both change, that is why it cannot be use in this purpose and for this goal. [5] [11]

Head, hand and body shape and size are rapidly changing since they normally grown up that clearly why they cannot be used. That is why this incredible science fact that fetus fingerprint is formed prenatal, by the end of 7th month in belly of pregnant mother and stays constant and same construction of minutiae, is so great that is amazing.[1] [6]

There are large number of various fears during birth process, both mother and people in medical Care system in birthplace. Reading and learning on study which was made in Australia and New Zealand from 2009 until 2011 year and 17 workshops with over 700 midwives this device can prevent part of one of those big fears – dealing with unknown (n=32). [6]

All the data received during process of fingerprint scanning mother and baby, together with unique ID reference are being encrypted and stored on device memory or on a server in encrypted form, never leave the device in opened shape and available for public, just for authorized nurses, doctors and midwifes in birthplaces. [5] [6]

Further on, during next time process of scanning when the confirm of parenthood, precisely maternity would be confirmed for each pair – person with baby, authorized person-representative of birthplace and mother would enter PIN[2] code that only they posses for their data. Changing of stored data will be disabled and identity of new born baby is guaranteed in 100% and there is no possibility of making mistake during this process with Patent device.

In every moment it is possible to check parenthood and maternity over every baby in each birthplace worldwide. Information stored on device or server with its backup copy are always in encrypted form and there is no possibility of corruption or deleting this data. Just possibility of archiving data is enabled after confirmation of mother that everything is normal and after leaving birthplace by these pair (mother-baby), that is moment when need for guarantee of maternity in birthplace is no longer necessary.

At that moment, leaving birthplace by mother and baby is final moment when last check is being done. At the same time device is doing scanning with mother and baby fingers at the same time, compares it with existing encrypted data stored at birth moment for that pair and if check if regular device confirm that fact – It is yours baby! There is no place for fear nor for mother, nor for nurses, doctors, midwifes. One huge human fear, reasonable fear for every mother in these moments and really fear for people who helps and work in birthplaces.

With this device and procedure possibility of making each mistake or error is being disabled. now device and system do the work of parenthood and baby identity guarantee in 100% in each case of new born baby. It prevents any possible steal or replace of baby

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[2] **PIN** – Personal Identification Number

identity, which unfortunately probably happened at some places and parts of World Continents, especially South-East Europe, Balkan Peninsula, Countries of former Yugoslavia. Now device it will be guarantee, prove and evidence of maternity for new born babies.

5. BENEFITS WITH THIS NEW METHOD

A novel system and this new biometric method which combines information system, device for biometric identification of newborn babies based on fingerprint will provide:

- to give prove and evidence of parenthood for every new born baby,
- excluding any possibility of replacing or sealing identity of new born babies,
- safe for all future parents in birthplaces,
- it is small size, low weight and it is portable
- has good proportion of price / quality, it is ambient friendly and do not pollute environment,
- widely field of appliance and usage.

To understand functionality and appliance of this device and its practice realization there are five pictures that shown device in various views and cross-section of this new device.

Figure 3 shows device for biometric identification of maternity in whole view with digital display, switch and two fields for fingerprint scanning. Figure contain remarks as follows:
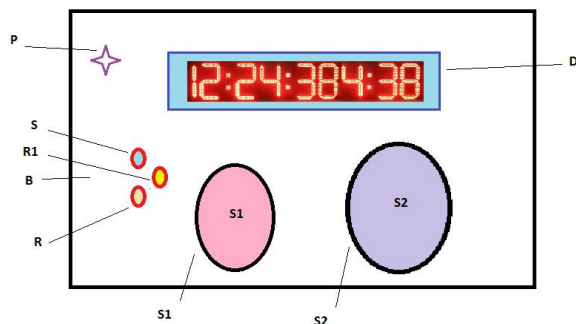

Figure 3 - Detail description of device functionality

After starting device and switching **P** in position on device give us reply on display that device is regular functioning and there is no errors. Pushing the button **S** device start fingerprint scanning on both fields s1 and s2 at the same time, requiring placing fingers mother and baby. After scanning and pushing **R1** button data will be stored and unique ID reference is shown on display - **D**. ID-reference can be both numeric and alphanumeric, considering number systems it can be octal - decimal, as a binary or hexadecimal. The main fact is that this ID is here unique.

6. POSSIBILITIES OF FURTHER DEVELOPMENT

This novel method implementing totally new device with essence idea about biometric identification of parenthood and scanning each born baby can be used as model in Public Health system every country. It is to further development of similar biometrics system in day-care centers and in preschool institutions where exists various problems regarding moving small children and keep eye on them in every moment. [15]

Beside this first purpose it can also can be used as a part of much larger Health Care system considering small children in place of Pediatrics, can provide basic data about possible allergy on some specifics of each child itself and can make improvement in that part of health care system at global level.

7. COUNLUSION

We can conclude that this novel model combine benefits from three various projects: One - Patent device, second - information system and third - Safe birthplaces project. It can improve the level of public health in Republic of Serbia and region SEE, but also rest of the world. System is completely modular, it can be updated and the most important in can be ground base for some future development in biometrics systems. The Device can be applied in dozen countries in battle with organized criminal and help prevent steal or replacement of new born babies, especially on territories with low IT infrastructure and technological development.

Each Biometry is eager to minimize both **FAR**[3] and **FRR**[4] in attend to be much more accurate and secure. This device accomplish that part since it combines two scanned data and its accuracy grows exponentially. In modern, nowadays IoT (Internet of things) most of the countries try to provide totally new quality of Health Care service, also to help staff in birth places, make process of birth much easier, relaxed in some way, how for future mothers the same for gynecology doctors, midwifes, nurses and every citizen.

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[3] **FAR** – False Accept Rate

[4] **FRR** – False Reject Rate