

Proposed Bimodal Biometric System for New Born Infants & Mother With Implementation of Sensor & Security Modules on Raspberry pi

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ABSTRACT: - New born swapping and abduction in hospitals which are challenging issues which occurs all over the world. Traditional methods to combat this problem have their own drawbacks, here a real time solution is provided by proposed model having five modules on a Raspberry Pi. Implemented module consisting of two cameras for providing real time security against culprit who lifts the baby from cradle. Additionally a temperature sensor is used which gives the continuous updates about the baby's health to medical staff and parents. The results of implemented modules shows that we can get the real time alert about culprit which will be easy to find out person who lifts the baby from cradle and also continuous data of temperature of baby's body for providing time to time attention towards health. Proposed system has modules for scanning and matching of foot prints of baby and hand impression of mother which provides a low cost solution to the newborn swapping rather than the expensive DNA procedures.

KEYWORDS: Fingerprint, LCD Display, Raspberry PI etc.

I. INTRODUCTION

The newborn swapping and child abduction are challenging issues. Traditional methods of identification of such child have some drawbacks. Biometric system is a pattern-recognition system recognizes a person based on feature vector derived from a specific biological characteristics such as Physiological biometric identifiers include fingerprints, hand geometry, ear patterns, eye patterns (iris and retina), facial features, and other physical characteristics. Behavioural identifiers include voice, signature, key stroke, and others. The Present method of footprint, fingerprint acquisition in hospitals is inked footprint of the newborn along with the fingerprint of the mother. This is stored in a file which forms the medical database. This method of image acquisition is offline. Another method of practice is to tie a number band around the hands/legs of the newborn as a measure of identity. This number band is same as the one which is also tied to the mother of the infant.

Here, a newborn personal authentication system is proposed for this issue based on bimodal biometric system. At the time child kidnapping or abduction, mixing of babies, multiple claims for an infant in any hospitals, birthing centers causes emotional breakdown and confusion. This raises a question on the effectiveness of the offline method and the method of tying number bands (ID bands). This eventually leads to the DNA test at times. Hence, biometrics can be used to solve such identity issues. In the online system, by a digital source and computers are used for processing and storage. The newborn's footprint images captured using a high resolution camera. The fingerprint of the newborn's mother acquired by a fingerprint scanner. wherein footprint of newborn and finger print of their mother is used for recognition.

The image acquisition done in the primary health centre. Further, implementation of bimodal authentication in hardware as embedded system enhances the overall performance of the system as a standalone device. A complex IC that integrates the major functional elements such as programmable processor, on-chip memory, accelerating function hardware eg: GPU, both hardware and software, analog components into a single chip or chipset is called system on chip (SoC). Thus, reduce overall system cost, increase performance, lower power consumption and reduce size. and draws low power.

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The Raspberry Pi is to build a low-cost device. It works in Linux platform, In this paper, discusses about the implementation of bimodal biometric (fingerprint and footprint) in Raspberry Pi. Debian Linux platform optimized for ARM architecture is been used. An open source computer vision Open CV is used for biometric programming. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. It takes the advantage of the hardware acceleration of the heterogeneous compute Platform. The Open CV library is installed from repository by following few commands to execute the installation of dependencies, downloading and decompression of OpenCV, compilation and installation of Open CV in Debian Linux. Appropriate algorithms are used for reliable recognition process of Newborn is employed also temperature sensor is provided with above system for continuous health monitoring with camera is placed on baby's cradle for security to avoid baby swapping.

II. LITERATURE REVIEW

Biometric identification technique is very effective to solve identity issue. There are various parameters on which we can categorize biometric identification techniques, some of them is based on hand geometry include finger knuckle print, keystroke analysis eigenpalm and eigenfinger, infant and mother fingerprint matching among these techniques, finger print matching of mother and infant is very effective because it uses raspberry pi which enhances the performance and uses various algorithm such as SIFT, GUO, Hall's and RANSAC. There are some technology which based on facial features such as face recognition by using age progression and facial digital image out of which age progression is very effective as it provide importance clues used in computing framework and uses algorithm such as AAM, HOG, Phog and FD.

To avoid the problems facing during matching of kids and mother after the newborn swapping and child abduction Biometric identification techniques is a great tool. While discussing of all the available biometric authentication systems, technique of matching of fingerprint and footprint of mother and infant is very effective because it is low cost solution to the newborn swapping. The use of various algorithms such as SIFT, Fingerprint enhancing algorithm, GUO, Hall's algorithm and RANSAC & implementation on raspberry pi enhances the overall performance to shoot out the problem.[1]

III. PROPOSED WORK

Swapping & abduction of infants in any hospital leads to emotional stress for the parents due to the lack of real time security and time consuming baby-mother identification techniques, to eliminate these problems in hospitals biometric authentication systems, consisting the matching of fingerprint and footprint of mother and infant is very effective, with our proposed system we can provide a solution to above said problem where footprint of newborn and finger print of their mother will be used for recognition. This concept will be further enhanced by developing a prototype to be implemented on a raspberry Pi (a single board computer). We are going to implement a system which use biometric pattern recognition system recognizes a person based on a feature vector derived. In this system we are going to add features like measuring of temperature. Feature extraction algorithm for matching of fingerprint and footprint biometrics using Open CV on Raspberry pi is implemented also provide real time monitoring by placing the camera on baby's cradle and also at the entrance door of the baby care unit. It enhances performance, consumes less power, and reduces overall system cost and size. Also we build a camera on the cradle and a weight sensor below due to which if anyone put the baby from cradle the camera immediately capture the image.

The block diagram of bimodal newborn authentication using raspberry pi is shown in fig. The above system is divided in to four modules.

- 1) *Raspberry pi*: - It consists of Raspberry pi module in the center of system. The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras.
- 2) *Camera interfacing*: - Camera is used for capture the image of person on the baby's cradle and the entrance of the child ward room is placed.
- 3) *Temperature sensor*: - Temperature sensor is used for monitoring body temperature of baby in critical condition.
- 4) *LCD Display*: - LCD Display is used for the displaying the output or corresponding result of the proposed system.

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5) *Fingerprint and footprint matching*:-Scanner is used for mother fingerprint scanning and baby's Footprint for scanning of baby's footprint. Switch used for detection of weight of the baby if anyone put baby from the cradle switched get open and give command to the camera to capture the image of the person. This is Send to the internet by using Wi-Fi module.

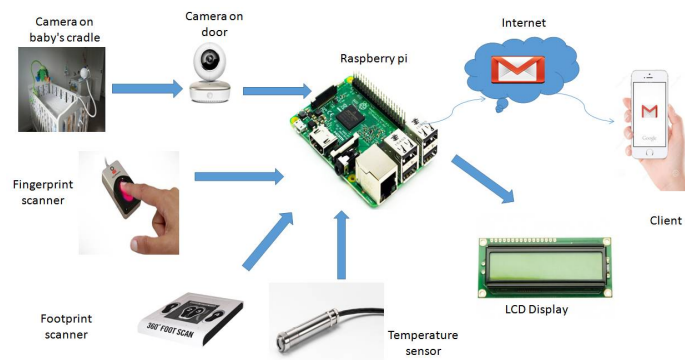


Figure 1 Proposed system of fingerprint and newborn footprint feature extraction on raspberry pi

Raspberry pi is the heart of the whole proposed system. We described finger print scanner, camera weight sensor as an input to the proposed system at the output end we connect a display on which we can get the result of given command to the system. The whole process is perform with the help of Wi-Fi module as the system use internet for transmitting data online at the server where we can store large amount of data and to the parents personally.

Debian Linux platform optimized for ARM architecture will be use. An open source computer vision Open CV is used for biometric programming. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. It takes the advantage of the hardware acceleration of the heterogeneous compute Platform. The Open CV library is installed from repository by following few commands to execute the installation of dependencies, downloading and decompression of OpenCV, compilation and installation of Open CV in Debian Linux. Appropriate algorithms are used for reliable recognition process of Newborn is employed

IV. IMPLEMENTED WORK

In proposed work of biometric based authentication system the block diagram consists of five modules out of which the work on three modules is completed.

a) Module 1: Raspberry PI

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and *playing* high-definition video, to making spreadsheets, word-processing, and playing games.

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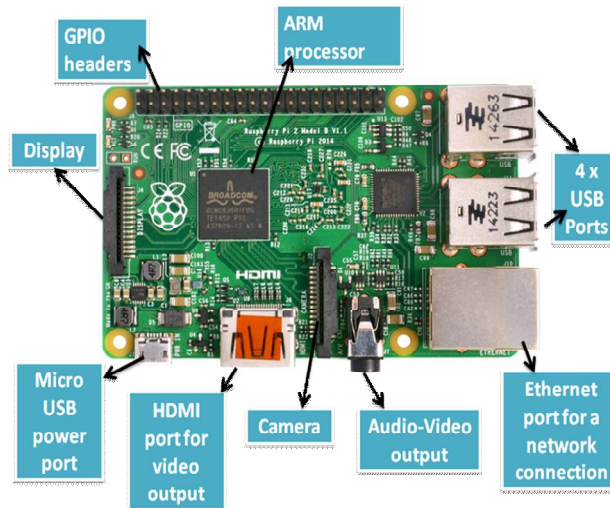


Figure 2 Raspberry pi module

What's more, the Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infrared cameras. We want to see the Raspberry Pi being used by kids all over the world to learn to program and understand how computers work.

Programming with python:

You will not normally log into to the computer as root, but can instead use the sudo command to provide access as the super user. If you log into your Raspberry Pi as the pi user then you are logging in as a normal user. You can run commands as the root user by using the sudo command before the program you want to run.

For example if you want to install additional software on Raspbian then you normally use the apt-get tool. To be able to update the list of available software then you need to prefix the apt-get command with sudo. "sudo apt-get update".

b) Module 2: Camera interfacing

The raspberry pi camera module is capable of taking HD photo and video and can be controlled programmatically. The flex cable insert into the connector situated between the ethernet and HDMI port. The flex cable connector should be opened by pulling the tabs on the top of the connector upwards then towards the Ethernet port. The flex cable should be inserting firmly into the connector, with care taken not to be bend the flex at too acute an angle. The top part of connector should push towards the HDMI connector and down.

Switch placed below the cradle used for detection of weight of the baby. These placed at the bottom of cradle if anyone put baby from the cradle switch get open and give command to the camera on the cradle to capture the image of the person and after few second the camera which placed above the entrance door of the room also take snap. This is Send on the mobile of child's parents through internet via e-mail and also the hospitals staff monitor by using Wi-Fi.

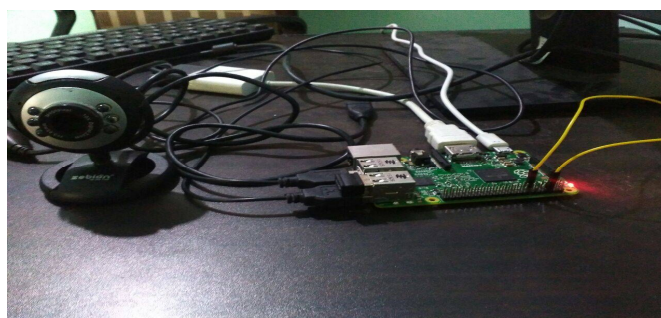


Figure 3 Camera interfacing with raspberry pi

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Output of programming:

We run the camera interfacing programme in the rasbian window of raspberry pi (credit card size computer)

```

pi@raspberrypi:~$ sudo python baby.py
Image Capture
Traceback (most recent call last):
  File "baby.py", line 74, in <module>
    s.login('baby.authentication@gmail.com', '1234567890@')
  File "/usr/lib/python2.7/smtplib.py", line 622, in login
    raise SMTPAuthenticationError(code, resp)
smtp.SMTPAuthenticationError: (535, '5.7.8 Username and Password not accepted. Learn more at\n5.7.8 https://support.google.com/mail/?p=BadCredentials 75sm90348Spfp.80 - gsmtpl')
pi@raspberrypi:~$ sudo python baby.py
Image Capture
Image Send
Image Capture
^Z
[1]+  Stopped                  sudo python baby.py
pi@raspberrypi:~$ sudo python baby.py
Image Capture
Image Send
^Z
[2]+  Stopped                  sudo python baby.py
pi@raspberrypi:~$ sudo python baby.py

```

Figure 4 Camera interfacing programme in rasbin window

After execution of programming the mail with image of person will send to the parent’s mobile through internet and on the hospitals monitor by using Wi-Fi module.

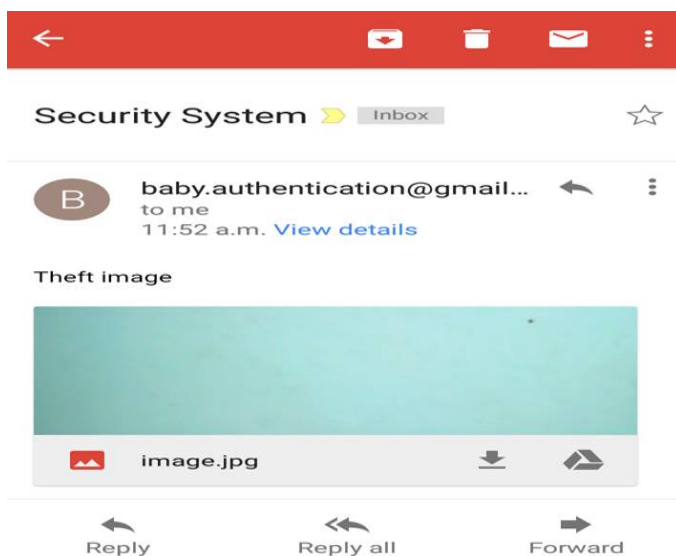


Figure 5 Captured image on mail

c) Module 3: Interfacing with temperature sensor

Temperature sensor is used for monitoring body temperature of baby in critical condition. The data port of the DS1820 is connected directly to the port GPIO4 of the GPIO interface of raspberry pi. GND and Vdd are at ground terminal the power supply accomplished a pull up resistor of 4k7between the 3.3 v connection 3v3 and GPIO. The resistor, a female connector to attachment to the GPIO ports and the wire connection is soldered. The circuit diagram for interfacing of temperature is as given below

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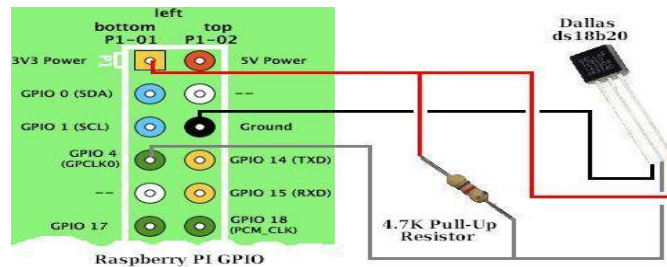


Figure 6 interfacing of temperature sensor with raspberry pi

Log on to your Raspberry Pi, and at the command prompt “sudo modprobe w1-gpio && sudo modprobe w1_therm” To load in the 1-wire communication device kernel modules required to use the temperature sensor. Since the Raspbian operating system was updated back at the end of January 2015 (kernel 3.18.8 and higher) which enabled Device Tree, the above steps do not result in the temperature sensor(s) being detected. Now you need to enter the following at the command prompt “sudo nano/boot/config.txt” to open the /boot/config.txt file for editing. Then scroll down to the bottom of the file, and add the line “dtoverlay=w1-gpio” Ctrl-X to save the amended file. Finally reboot the Raspberry Pi so that the changes take effect.

Output of programming:

Temperature sensor will appear with an address in the format 28-00000xxxxxx. Below you can see that our temperature sensor address was 28-00000283c6cd. Each DS18B20 temperature sensor has a unique hard-coded address so that you can connect up multiple temperature sensors when required and still read them individually.

```

pi@raspberrypi: ~
pi@raspberrypi ~ $ ls -l /sys/bus/w1/devices/
total 0
lrwxrwxrwx 1 root root 0 Jun 10 14:38 28-00000283c6cd -> ../../../../dev
ices/w1_bus_master1/28-00000283c6cd
lrwxrwxrwx 1 root root 0 Jun 10 14:38 w1_bus_master1 -> ../../../../devi
ces/w1_bus_master1
pi@raspberrypi ~ $ cat /sys/bus/w1/devices/28-00000283c6cd/w1_slave
8d 01 4b 46 7f ff 03 10 03 : crc=03 YES
8d 01 4b 46 7f ff 03 10 03 t=24812
pi@raspberrypi ~ $
    
```

Figure 7 Address generation of temperature sensor

Now paste the generated address in the programming of temperature sensor

```

pi@raspberrypi: ~
GNU nano 2.2.6 File: tempsensor.py Modified
import time

while 1:
    tempfile = open("/sys/bus/w1/devices/28-00000283c6cd/w1_slave")
    thetext = tempfile.read()
    tempfile.close()
    tempdata = thetext.split("\n")[1].split(" ")[9]
    temperature = float(tempdata[2:])
    temperature = temperature / 1000
    print temperature
    time.sleep(1)
    
```

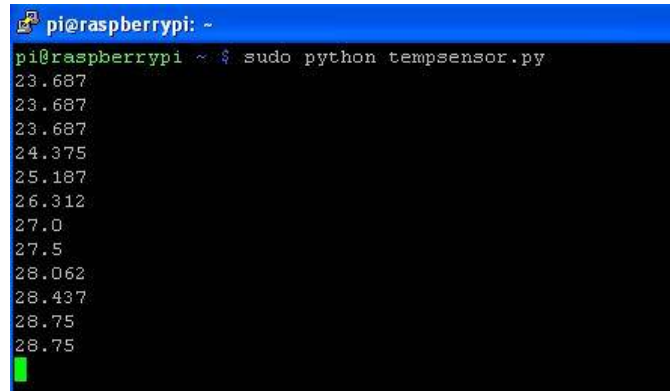
Figure 8 Execution of program

After execution of above programme the output of temperature sensor can be given as below.

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```
pi@raspberrypi: ~  
pi@raspberrypi ~$ sudo python tempsensor.py  
23.687  
23.687  
23.687  
24.375  
25.187  
26.312  
27.0  
27.5  
28.062  
28.437  
28.75  
28.75
```

Figure 9 Output reading of temperature sensor

V. RESULT

For the given problem definition with implemented modules along with Raspberry pi provides a compact size device which reduces the bulkiness of system and computes data at faster rate. Additionally here two cameras are providing real time security against culprit who lifts the baby from cradle by capturing snaps and second time by wall mounted camera while leaving the room which will be very useful to identify the culprit and sending a warning message to the server or parents. To monitor the baby's temperature, sensors are used which gives the continuous updates about the baby's health in intensive care unit due to which it is easy for medical staff to take care patient immediately.

VI. CONCLUSION

With compact size of assembly and higher computational rate, system provides results in quick time, security of baby is enhanced by using two cameras which can be handy to identify culprit in case of baby missing condition and by using temperature sensor medical staff and parents can get updated message about baby's health which makes system very effective for medical purpose.

VII. FUTURE SCOPE

The biometric system have five modules out of which the three modules are implemented successfully and the work on three modules of scanning and matching of fingerprints of mother and infant, LCD display is going on. After completion of remaining three modules and making a prototype, this system will be very useful for biometric identification and additional security of baby.

VIII. ACKNOWLEDGEMENT

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