Product Introduction

LS-BMC™
(Lion Security Biometric Recognition Smart Card)

「Lion Security Co., Ltd」
The Only company to make Mass production possible of Biometric Smartcard

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I. Background

1. Market Growth of Biometric Authentication

- The market for using biometrics for identifying and authenticating people is trending up: Due to convenient usability and safety, the usage of biometrics is expanded to many fields, especially substituting for the authenticating means like public key certificate.

- The total global biometric authentication market will increase from 2 billion dollars in 2015 to 14.9 billion in 2024.

- Specially in the healthcare sector, it expects to be reached to 3.5 billion in 2024.
I. Background

2. Convenient Usability vs. Psychological Rejection and Anxiety

- There are still concerns about the possibility of leakage of information for biometric authentication.
- Public key certificate or other passwords can be changed even if they are leaked, but they cannot be changed if biometric data is leaked.
- People are still reluctant to the fact that they provide their biometric data to the service organization like financial institutions.

According to “theguardian” above, US government hack stole fingerprints of 5.6 million federal employees.

I. Background

3. Combination of Biometrics and Smart Card

- No hacking risk. No leakage risk: **LS-BMC™** can be a solution to their psychological rejection and anxiety.
- The smart card IC chip stores fingerprint data with strong encryption, and authentication is performed when the scanned fingerprint 1:1 matches within the fingerprint smart card itself.
- Since the biometric data is not stored in the DB of the service organization, no leakage risk.
- Even if the smart card is stolen, no one can access the encrypted fingerprint data.
II. LS-BMC™ (Lion Security Biometric Fingerprint Recognition Smart Card)

1. Feature and Standard

- LS-BMC™ conforms to ISO 7810, 7816 standard
- Within 0.84mm thick while keeping the fingerprint smart card module safely and superior flatness
- The cover sheet on the module is not peeled off, so Internal module and plastic cover sheet is not broken

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FPCB Module

Laminating of Module

LS-BMC™

 Thickness: 0.84 mm

- Protection layer: 0.06mm
- Print layer: 0.11mm
- CPU: 0.38mm
- Fingerprint sensor: 0.54mm
- FPCB: 0.13mm
- Print layer: 0.11mm
- Protection layer: 0.06mm

- (length) 53.98mm
- (width) 85.6mm
- Thickness: 0.84mm
II. LS-BMC™ (Lion Security Biometric Fingerprint Recognition Smart Card)

2. No Battery

- In the LS-BMC™, the battery is not built in to drive LS-BMC™
- Instead of battery, Energy Harvesting technology is applied: LS-BMC™ receives a small amount of power form the RF reader or smart phone and amplifies it to the necessary power to activate
- No battery, no charging, semi-permanent use
Through the interface between major components (IC Chip, CPU, Sensor), biometric authentication process is executed

In the early future, it is possible to extend to financial card: credit card, check card
## II. LS-BMC™ (Lion Security Biometric Fingerprint Recognition Smart Card)

### 4. Fingerprint Sensor Specification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRR</td>
<td>0.1% (rejection rate)</td>
<td></td>
</tr>
<tr>
<td>FAR</td>
<td>0.001% (unauthorized approval rate)</td>
<td></td>
</tr>
<tr>
<td>Authentication time</td>
<td>Less then 1 sec.</td>
<td></td>
</tr>
<tr>
<td>Input voltage</td>
<td>+1.8 ~ +3.3V</td>
<td></td>
</tr>
<tr>
<td>Max current</td>
<td>5mA/h (Image capture)</td>
<td></td>
</tr>
<tr>
<td>Min current</td>
<td>10uA/h (Deep sleep)</td>
<td></td>
</tr>
<tr>
<td>Data command interface</td>
<td>SPI interface supports speeds up to 12MHz</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>14 x 14 x 0.5 mm</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>Serial SPI + Interrupt</td>
<td></td>
</tr>
<tr>
<td>Active sensing area</td>
<td></td>
<td>9.6 x 9.6mm</td>
</tr>
<tr>
<td>Size sensing array</td>
<td></td>
<td>192 x 192 pixels</td>
</tr>
<tr>
<td>Pixel resolution</td>
<td>8 bit gray scale</td>
<td>256 level</td>
</tr>
<tr>
<td>Clock frequency</td>
<td>Serial SPI communication</td>
<td>Up to 12MHz</td>
</tr>
<tr>
<td>Operation temperature</td>
<td>With active finger detection</td>
<td>-20 ~ +60</td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
<td>-40 ~ +85</td>
</tr>
</tbody>
</table>
4. Fingerprint Sensor Specification (continued)

- MEMS (Micro Electro Mechanical Systems) sensor technology applies: it enables to scan high quality fingerprint image.

- Compared to semiconductor and optical sensor, MEMS sensor technology converts scanned fingerprint to binary image, using intelligent software algorithm, and avoids the image scanning distortion.

![Cross-sectional picture of fingerprint sensor](image-url)

**Minutia points**

- Ridge
- Valley
- Sensor’s cell

**Binary printing**

![Comparison of sensor types](image-url)

- Semiconductor sensor
- Optical sensor
- MEMS
II. LS-BMC™ (Lion Security Biometric Fingerprint Recognition Smart Card)

5. CPU

- STMICROELECTRONICS’ CPU is used in the current product and the dedicated CPU through ASIC process will be used from 2018
- Once ASIC’s CPU is used, the price of LS-BMC™ will be reduced by 30%~40%

**Current CPU: STM32F411**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>ARM 32-bit Cortex-M4 CPU with FPU, Adaptive real-time accelerator allowing 0-wait state execution from Flash memory, frequency up to 100MHz, memory protection unit, 125 DMIPS/1.25 DMIPS/MHz and DSP instructions</td>
</tr>
<tr>
<td>Memory</td>
<td>Up to 512Kbytes of Flash memory. 128Kbytes of SRAM</td>
</tr>
<tr>
<td>Clock, reset and supply management</td>
<td>1.7V to 3.6V application supply and I/Os POR, PDR, PVD and BOR 4- to 26 MHz crystal oscillator Internal 16 MHz factory-trimmed RC 32 KHz oscillator for RTC with calibration Internal 32 KHz RC with calibration</td>
</tr>
<tr>
<td>Power consumption</td>
<td>RUN: 100uA/MHz (Peripheral off) Stop (Flash in stop mode, fast wakeup time): 43uA type, 65uA max Standby: 2.4uA</td>
</tr>
<tr>
<td>Interface</td>
<td>Up to 13 communication: Up to 3 * I2C interface(SMBUS/PMBUS) Up to 3 UART (2 * 12.5Hbit/s, 1 * 6.25Mbits/s)</td>
</tr>
</tbody>
</table>
III. Competence

1. Mass Production

- Mass Production is available at the process of all stages
- Reasonable price possible, half price of other competitors

**Step 1**

**FPCB**
(Flexible Printed Circuits Board)

1. FPCB Data Input
2. Copper Plating
3. Laser Drill
4. Line Formatting
5. AOI & PSR
6. Gold Plating
7. Marking

**Step 2**

**SMD/COF**
(Surface-Mount Devices)/
(Chip On Film)

1. Solder Paste
2. Mount
3. Reflow
4. Bonding

**Step 3**

**SHEET**

1. Design
2. Plating
3. Printing

**Step 4**

**Laminating & Post-Laminating**

1. Laminating
2. Punching
3. Milling
4. Bonding
IV. Field of Application

1. Access Control

General ID Card Access Control

- Tag to reader
- Card Verification
  [uID, No.]
- Approval

Card Verification Process
(Just verify whether the card itself is valid)

LS-BMC™ ID Card Access Control

- Tag to reader
- Activate LS-BMC™
- Matching Process

User Authentication Process
(Card User verification)
IV. Field of Application

2. System Log in & Manager Approval Card

Biometric Authentication Log in (PC) / Information Security (System and Data Access)

Manager Approval Card

Authorized person’s final approval for the certain transactions: Blocking the source of damage caused by false approval

1. Site Access

- Website
- Bank home page
- Online market
- Public Membership Site

2. Fingerprint Authentication

Click fingerprint authentication menu
Fingerprint recognition program access
Authentication after card insertion

3. Sending encrypted/decrypted authentication values

4. Log-in succeed

Request transaction authorization
IV. Field of Application

3. Alternative means of Public Key Certificate

FIDO Biometric Authentication / Alternative means of Public Key Certificate

**UAF (Universal Authentication Framework):**
Biometric Authentication only with fingerprint recognition without password input

**U2F (Universal 2nd Factor):**
Biometric Authentication as an additional security measure to supplement your password

Biometric Authentication by Fingerprint recognition smart card, instead of biometric information in Trustzone

Biometric Authentication by Fingerprint recognition smart card, instead of PKI
IV. Field of Application

4. Financial Card (Credit Card & Check Card)

Credit Card · Check Card

Activation of Credit Card through biometric authentication

- More than 21,000 stolen and abused damages are reported per year, these kinds of damages would be dramatically reduced
- By reducing those friction with customers, customer satisfaction would be achieved
- Compensation liability insurance premium rate will be lowered

Enhancing corporate image
Reducing administrative costs
IV. Competitors

1. Competitor Status in Product Development Cycle

- All competitors are passing through the stage of 5, 6 and 7

Market Phase

9. Product Introduction
10. Market Development
11. Rapid Growth
12. Competitive Market
13. Maturity
14. Decline
15. Abandonment

Lion Security is forwarding to 10 stage.
## IV. Competitors

### 2. Domestic

- None commercialized: even if there are some “commercialization” articles related to fingerprint recognition smart cards, no companies commercialized

<table>
<thead>
<tr>
<th>Company</th>
<th>Article date</th>
<th>Media</th>
<th>Title of Article</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea Smart ID [KSID]</td>
<td>2016.12.13</td>
<td>Etnews</td>
<td>KSID supplies fingerprint recognition smart card to Woori Bank…Target sales of 19 billion KRW in 2017</td>
</tr>
<tr>
<td>Crucial Tech + Kona I</td>
<td>2016.05.25</td>
<td>ZDNet Korea</td>
<td>Fingerprint recognition credit card….How ripple effect will be…(Thin thickness. Low power consumption realization)</td>
</tr>
<tr>
<td></td>
<td>2016.05.24</td>
<td>Etnews</td>
<td>Fingerprint recognition smart card came out…Kona I-Crucial Tech, First commercialization of the industry</td>
</tr>
<tr>
<td>TelCuOn</td>
<td>2016.03.26</td>
<td>Datanet</td>
<td>The integration of biometric authentication and smart card…perfect secure authentication possible</td>
</tr>
<tr>
<td>Posco ICT + KSID + Zwipe</td>
<td>2015.02.16</td>
<td>Etnews</td>
<td>The first in Korea…Released smart card with fingerprint recognition function</td>
</tr>
<tr>
<td>Truegate</td>
<td>2001.11.12</td>
<td>HanKyung</td>
<td>TrueGate developed fingerprint recognition smart card</td>
</tr>
</tbody>
</table>

![Image of Smart ID card and Crucial Tech + Kona I card]
IV. Competitors

### 3. Overseas

- No Mass Production. No Commercialization as well

<table>
<thead>
<tr>
<th>Company</th>
<th>Article date</th>
<th>Media</th>
<th>Article summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zwipe</td>
<td>2017.01.17</td>
<td>BIOMETRIC update.com</td>
<td>ISG Group to sell Zwipe biometric access control and ID solutions</td>
</tr>
<tr>
<td></td>
<td>2016.10.31</td>
<td>BIOMETRIC update.com</td>
<td>Zwipe announces joint venture with Kuang-Chi Group</td>
</tr>
<tr>
<td></td>
<td>2016.06.20</td>
<td>BIOMETRIC update.com</td>
<td>Zwipe and Hitachi High-Tech announce partnership</td>
</tr>
<tr>
<td></td>
<td>2014.10.17</td>
<td>FindBiometrics</td>
<td>Introducing on-Card Fingerprint Biometric Payments From MasterCard and Zwipe</td>
</tr>
<tr>
<td>MeReal Biometrics</td>
<td>2016.11.29</td>
<td>BIOMETRIC update.com</td>
<td>MeReal Biometrics named Fintech Rising Star at India FinTech Awards</td>
</tr>
<tr>
<td>[Founded 2015, HongKong]</td>
<td>2016.11.04</td>
<td>BIOMETRIC update.com</td>
<td>French Casino Group piloting MeReal Biometrics smartcard</td>
</tr>
<tr>
<td>Morix Co., Ltd.</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>[Founded 1982, Janpan]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NXT-ID</td>
<td>2016.10.31</td>
<td>Yahoo Finance</td>
<td>Nxt-ID, Inc. and WorldVentures Demo the New flye Smart Card At Money20/20</td>
</tr>
</tbody>
</table>

- Kuang-Chi Group in China invested 8.9 million dollars to Zwipe, obtaining 20% of outstanding shares
- Pilot test is scheduled to be carried out with the support of parent company, Group Partouche in France
IV. Price Table

1. **LS-BMC™ Price Table Template**

<table>
<thead>
<tr>
<th>Qty</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,001~5,000</td>
<td>USD 40</td>
</tr>
<tr>
<td>5,001~10,000</td>
<td>USD 35</td>
</tr>
<tr>
<td>10,001~50,000</td>
<td>USD 30</td>
</tr>
<tr>
<td>50,001~100,000</td>
<td>USD 25</td>
</tr>
<tr>
<td>Over 100,000</td>
<td>USD 18</td>
</tr>
</tbody>
</table>

**MOQ: 1,000**