PALM VEIN TECHNOLOGY

ABSTRACT:

Palm vein technologies are one of the up coming technologies which is highly secure. It is the world’s first contactless personal identification system that uses the vein patterns in human palms to confirm a person’s identity. It is highly secure because it uses information contained within the body and is also highly accurate because the pattern of veins in the palm is complex and unique to each individual. Moreover, its contact less feature gives it a hygienic advantage over other biometric authentication technologies.

The palm secure works by capturing a person’s vein pattern image while radiating it with near-infrared rays. The PalmSecure detects the structure of the pattern of veins on the palm of the human hand with the utmost precision. The sensor emits a near-infrared beam towards the palm of the hand and the blood flowing through these back to the heart with reduced oxygen absorbs this radiation, causing the veins to appear as a black pattern. This pattern is recorded by the sensor and is stored in encrypted form in a database, on a token or on a smart card.

Veins are internal in the body and have wealth of differentiating features, assuming false identity through forgery is extremely difficult, thereby enabling an extremely high level of security. The Palm Secure technology is designed in such a way that it can only detect the vein pattern of living people. The scanning process is extremely fast and does not involve any contact meaning that PalmSecure meets the stringent hygienic requirements that are normally necessary for use in public environments.

The opportunities to implement palmsecure span a wide range of vertical markets, including security, financial/banking, healthcare, commercial enterprises and educational facilities. Applications for the device include physical admission into secured areas; log-in to PCs or server systems; access to POS, ATMs or kiosks; positive ID control; and other industry-specific applications. This paper also describes some examples of financial solutions and product applications for the general market that have been developed based on this technology. Typically palm vein authentication technology consists of a small palm vein scanner that's easy and natural to use, fast and highly accurate.

INTRODUCTION:

In the ubiquitous network society, where individuals can easily access their information anytime and anywhere, people are also faced with the risk that others can easily access the same information anytime and anywhere. Because of this risk, personal identification technology, which can distinguish between registered
legitimate users and imposters, is now generating interest.

Currently, passwords, Personal Identification Numbers (4-digit PIN numbers) or identification cards are used for personal identification. However, cards can be stolen, and passwords and numbers can be guessed or forgotten. To solve these problems, biometric authentication technology, which identifies people by their unique biological information, is attracting attention. In biometric authentication, an account holder’s body characteristics or behaviors (habits) are registered in a database and then compared with others who may try to access that account to see if the attempt is legitimate.

Fujitsu has researched and developed biometric authentication technology focusing on four methods: fingerprints, faces, voiceprints, and palm veins. Among these, because of its high accuracy, contact less palm vein authentication technology is being incorporated into various financial solution products for use in public places.

The Palm Secure sensor developed by Fujitsu is a biometric authentication solution offering optimum levels of security. Palm Secure detects the structure of the pattern of veins on the palm of the human hand with the utmost precision.

BACKGROUND:

The ability to verify identity has become increasingly important in many areas of modern life, such as electronic government, medical administration systems, access control systems for secure areas, passenger ticketing, and home office and home study environments. Technologies for personal identification include code numbers, passwords, and smart cards, but these all carry the risk of loss, theft, forgery, or unauthorized use. It is expected that biometric authentication technology, which authenticates physiological data, will be deployed to supplement - or as an alternative to - these other systems.

The Fujitsu Group has developed biometric authentication technologies based on fingerprints, voice, facial features, and vein patterns in the palm, and has also combined two or more of these capabilities in multi-biometric authentication systems. Although biometric authentication is already being used to some extent by companies and government authorities, for it to gain wider acceptance, it needs to be considered less intrusive, and concerns about hygiene need to be addressed.

For that reason, there is a market need for voice or facial recognition systems and other biometric authentication technology that can read physiological data without requiring physical contact with sensor equipment, and the development of such systems that are both practical and offer greater precision.

TECHNOLOGY:

Palm vein authentication works by comparing the pattern of veins in the palm (which appear as blue lines) of a person being authenticated with a pattern stored in a database. Vascular patterns are unique to each individual, according to Fujitsu research — even identical twins have different patterns. And since the vascular patterns exist inside the body, they cannot be stolen by means of
photography, voice recording or fingerprints, thereby making this method of biometric authentication more secure than others.

**PRINCIPLES OF VASCULAR PATTERN AUTHENTICATION:**

Hemoglobin in the blood is oxygenated in the lungs and carries oxygen to the tissues of the body through the arteries. After it releases its oxygen to the tissues, the deoxidized hemoglobin returns to the heart through the veins. These two types of hemoglobin have different rates of absorbency. Deoxidized hemoglobin absorbs light at a wavelength of about 760 nm in the near-infrared region. When the palm is illuminated with near infrared light, unlike the image seen by the human eye, the deoxidized hemoglobin in the palm veins absorbs this light, thereby reducing the reflection rate and causing the veins to appear as a black pattern. In vein authentication based on this principle, the region used for authentication is photographed with near-infrared light, and the vein pattern is extracted by image processing and registered. The vein pattern of the person being authenticated is then verified against the preregistered pattern.

**ADVANTAGES OF USING THE PALM:**

In addition to the palm, vein authentication can be done using the vascular pattern on the back of the hand or a finger. However, the palm vein pattern is the most complex and covers the widest area. Because the palm has no hair, it is easier to photograph its vascular pattern. The palm also has no significant variations in skin color compared with fingers or the back of the hand, where the color can darken in certain areas.

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**ADVANTAGES OF REFLECTION PHOTOGRAPHY:**

There are two methods of photographing veins: reflection and transmission. Fujitsu employs the reflection method.

The reflection method illuminates the palm and photographs the light that is reflected back from the palm, while the transmission method photographs light that passes straight through the
hand. Both types capture the near-infrared light given off by the region used for identification after diffusion through the hand.

An important difference between the reflection method and transmission method is how they respond to changes in the hand’s light transmittance. When the body cools due to a lowered ambient temperature, the blood vessels (in particular the capillaries) contract, decreasing the flow of blood through the body. This increases the hand’s light transmittance, so light passes through it more easily. If the transmittance is too high, the hand can become saturated with light and light can easily pass through the hand. In the transmission method, this results in a lighter, less-contrasted image in which it is difficult to see the vessels. However, a high light transmittance does not significantly affect the level or contrast of the reflected light. Therefore, with the reflection method, the vessels can easily be seen even when the hand/body is cool.

The system configurations of the two methods are also different. The reflection method illuminates the palm and takes photographs reflected back from the palm, so the illumination and photography components can be positioned in the same place. Conversely, because the transmission method photographs light that passes through the hand, the illumination and photography components must be placed in different locations. This makes it difficult for the system to be embedded into smaller devices such as notebook PCs or cellular phones. Fujitsu has conducted an in-depth study of the necessary optical components to reduce the size of the sensor, making it more suitable for embedded applications.

**COMPLETELY CONTACTLESS DESIGN MINIMIZES HYGIENE CONCERNS AND PSYCHOLOGICAL RESISTANCE:**

Fujitsu is a pioneer in designing a completely contactless palm vein authentication device. With this device, authentication simply involves holding a hand over the vein sensor.

The completely contactless feature of this device makes it suitable for use where high levels of hygiene are required, such as in public places or medical facilities. It also eliminates any hesitation people might have about coming into contact with something that other people have already touched.

**HIGH AUTHENTICATION ACCURACY:**

Using the data of 140,000 palms from 70,000 individuals, Fujitsu has confirmed that the system has a false acceptance rate of less than 0.00008% and a false rejection rate of 0.01%, provided the hand is held over the device three times during registration, with one retry for comparison during authentication. In addition, the device’s ability to perform personal authentication was verified using the following: 1) data from people ranging from 5 to 85 years old, including people in various occupations in accordance with the demographics released by the Statistics Center of the Statistics Bureau; 2) data about foreigners living in Japan in accordance with the world demographics released by the United Nations; 3) data taken in various situations in daily life, including after drinking alcohol, taking a bath, going outside, and waking up.
APPLICATIONS:
PRODUCT DEVELOPMENT FOR FINANCIAL SOLUTIONS:

Financial damage caused by fraudulent withdrawals of money using identity spoofing with fake bankcards has been rapidly increasing in recent years, and this has emerged as a significant social problem. As a result, there has been a rapid increase in the number of lawsuits filed by victims of identity theft against financial institutions for their failure to control information used for personal identification. The “Act for the Protection of Personal Information” came into effect in Japan on May 1, 2005, and in response, financial institutions have been focusing on biometric authentication together with IC (smart) cards as a way to reinforce the security of personal identification. Vein authentication can provide two types of systems for financial solutions, depending on where the registered vein patterns are stored. In one method, the vein patterns are stored on the server of a client-server system. The advantage of this system is that it provides an integrated capability for managing vein patterns and comparison processing. In the other type, a user’s vein pattern is stored on an IC card, which is beneficial because users can control access to their own vein pattern. Suruga Bank uses the server type for their financial solutions, and The Bank of Tokyo-Mitsubishi uses the IC card system.

In July 2004, to ensure customer security, Suruga Bank launched its “Bio-Security Deposit” — the world’s first financial service to use PalmSecure. This service features high security for customers using vein authentication, does not require a bankcard or passbook, and prevents withdrawals from branches other than the registered branch and ATMs, thereby minimizing the risk of fraudulent withdrawals. To open a Bio-Security Deposit account, customers go to a bank and have their palm veins photographed at the counter. In order to guarantee secure data management, the palm vein data is stored only on the vein database server at the branch office where the account is opened.

In October 2004, The Bank of Tokyo-Mitsubishi launched its “Super-IC Card Tokyo-Mitsubishi VISA.” This card combines the functions of a bankcard, credit card, electronic money and palm vein authentication. From a technical and user-friendly point of view, The Bank of Tokyo-Mitsubishi arrowed the biometric authentication methods suitable for financial transactions to palm veins, finger veins and fingerprints. The bank then mailed a questionnaire to 1,000 customers and surveyed an additional 1,000 customers who used devices in their branches. Finally, the bank decided to employ Palm Secure because the technology was supported by the largest number of people in the questionnaire.

The Super-IC Card contains the customer’s palm vein data and vein authentication algorithms, and performs vein authentication by itself. This system is advantageous because the
customer’s information is not stored at the bank. When a customer applies for a Super-IC card, the bank sends the card to the customer’s home. To activate the palm vein authentication function, the customer brings the card and his or her passbook and seal to the bank counter, where the customer’s vein information is registered on the card. After registration, the customer can make transactions at that branch’s counter and any ATM using palm vein authentication and a matching PIN number.

In 2006, Fujitsu reduced the Palm Secure sensor to 1/4 of its current size for its next generation product. By using a smaller sensor on existing ATMs there will be room on the operating panel for a sensor for Felica mobiles, a 10-key pad that meets the DES (Data Encryption Standard), as well as an electronic calculator and other devices. The downsized sensor can also be mounted on ATMs in convenience stores.

PRODUCT DEVELOPMENT FOR GENERAL MARKET:

In addition to product development for financial solutions, Fujitsu has started to develop product applications for the general market. Two products are in great demand in the general market. One is for a physical access control unit that uses Palm Secure to protect entrances and exits, and the other is a logical access control unit that uses Palm Secure to protect input and output of electronic data. This section describes the features of these applications.

ACCESS CONTROL UNIT USING PALM SECURE:

The Palm Secure access control unit can be used to control entry and exit for rooms and buildings. This unit integrates the operation and control sections. The operation section has a vein sensor over which the palm is held, and the control section performs authentication processing and issues commands to unlock the door. The system can be introduced in a simple configuration by connecting it to the controller of an electronic lock. Palm Secure units are used to control access to places containing systems or machines that manage personal or other confidential information, such as machine rooms in companies and outsourcing centers where important customer data is kept.

Due to increasing concerns about security, some condominiums and homes have started using this system to enhance security and safety in daily life. For both of these applications, the combination of the following features provides the optimum system: a hygienic and contactless unit ideal for use in public places, user-friendly operation that requires the user to simply hold a palm over the sensor, and an authentication mechanism that makes impersonation difficult.
LOGIN UNIT USING PALMSECURE:
The palm vein authentication login unit controls access to electronically stored Information. As with the units for financial solutions, there are two types: a server type and an IC card type. Because the PalmSecure login unit can also be used for authentication using conventional IDs and passwords, existing operating systems and applications can continue to be used. It is also possible to build the unit into an existing application to enhance operability. In the early stage of introduction, the units were limited to businesses handling personal information that came under the “Act for the Protection of Personal Information” enforced in April 2005. However, use of the units is now expanding to leading-edge businesses that handle confidential information.

OTHER PRODUCT APPLICATIONS:
Because of the importance of personal identification, we can expect to see the development of new products for various applications, such as:

- Management in healthcare
  - Access control to medication dispensing
  - Identification of doctors and nurses when accessing protected health records
  - Patient identification management
- Operator authentication
  - Settlement by credit card
  - Obtaining various certificates using the Basic resident Register Card
- Owner authentication
  - Retrieval of checked luggage
  - Driver authentication
- Attendance authentication
  - Checking attendance in schools
  - Clocking in and out of the workplace.

CONCLUSION:
This paper explains palm vein authentication. The Fujitsu Palmsecure is a palm-vein based authentication system that utilizes the latest in Biometric Security Technology. Answering a worldwide need from governments to the private sector, this contactless device offers an easy-to-use, hygienic solution for verifying identity. This technology is highly secure because it uses information contained within the body and is also highly accurate because the pattern of veins in the palm is complex and unique to each individual. Moreover, its contactless feature gives it a hygienic advantage over other biometric authentication technologies. This paper also describes some examples of financial solutions and product applications for the general market that have been developed based on this technology.