Messages from Modern Inventors to the Next Generation

Season2

6. *Finger Vein Authentication Technology: Enabling your Finger to Become the Ultimate KEY*

- Dr. Takafumi Miyatake, Hitachi, Ltd.

All that you can see when you look at your own finger is probably just fingerprints and furrows, isn't it? Now, new "Finger Vein Authentication Technology," which utilizes the individually distinctive patterns of finger veins found in large numbers internally within the finger and invisible to the naked eye, is used for quick personal identity verification. For biometric authentication applications, veins are advantageous in that they are hidden inside the body and therefore unlikely to be injured, and that there is little risk of forgery or theft since no one can easily see them. So this technology, which enables one's own finger to be used as if it were a real key, is widely used today, as the ultimate key that cannot be lost or stolen, for various applications ranging from entry to important facilities, login to PCs, and ATM banking.

Introduction of the product/technology

It is recognized that a light called near-infrared light is likely to pass through the tissues of the human body but to be absorbed by hemoglobin in the blood. The near-infrared light penetrating a finger causes the veins in the finger to appear as dark shadows in an image captured by a CCD camera. The vein pattern image is matched, for collation, with a registered template pattern of the user, thereby providing personal identification. This is the principle on which finger vein authentication technology is based.

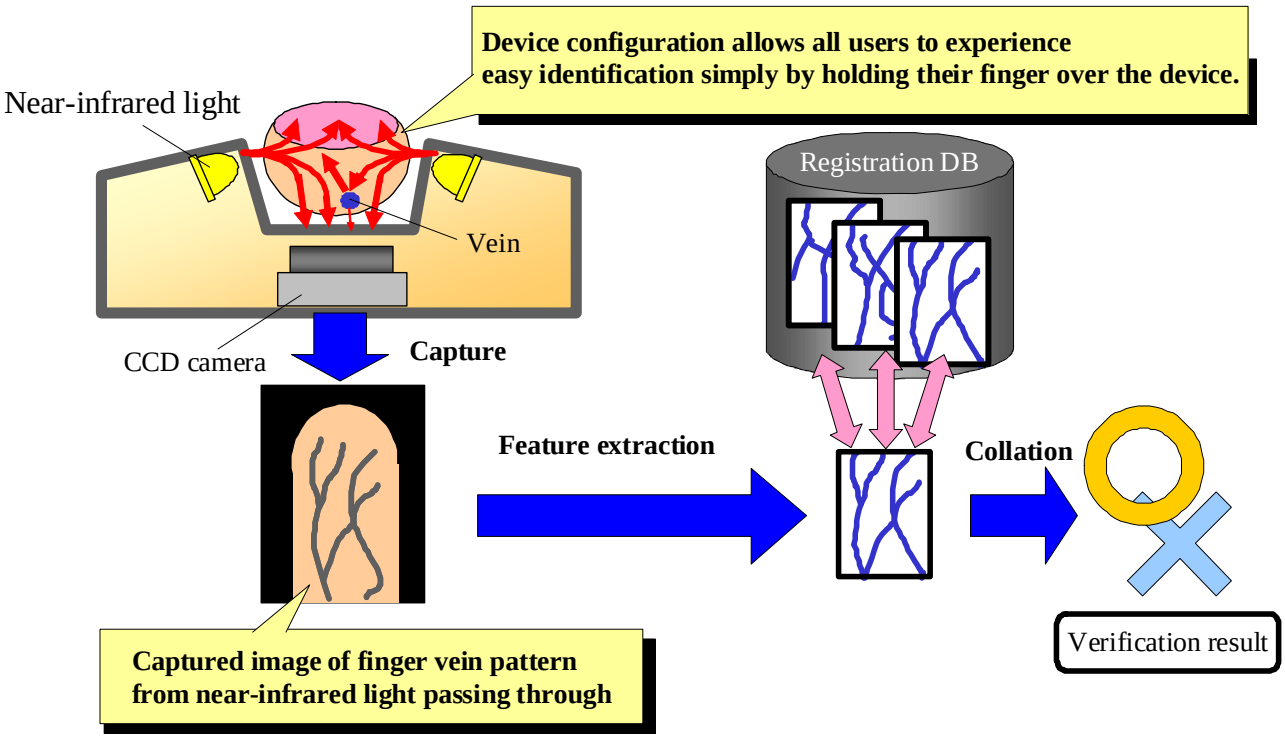
Finger vein authentication system used for the control of entry to facilities

What inspired you to invent or develop the product/technology?

In 1997, our group in the company started to discuss Internet security a decade later. One of our predictions was that it would become increasingly important to verify personal identity in a safe manner, as we envisioned commercial goods being marketed over the Internet. There are conventional ways to verify personal identity such as entering one's PIN (personal identification number) and presenting one's identity card. But such processes generally involve the risk of theft and use by others. Therefore, we needed to establish a theft-free system for identity verification.

Then we took notice of biometrics technology, which draws on the physical features of a person for identification. However, biometric methods are typically based on fingerprint, iris or face recognition, and therefore had a problem that the information may be easily stolen since it lies on the exterior surface of the body. I concluded that we could take advantage of some biological features found inside the body, rather than on the surface, to solve this problem. This idea led us to undertake the development of an authentication technology using finger vein patterns to determine identity, a challenge that had not been achieved anywhere in the world.

Basic principle of finger vein authentication (open device)



What specific ideas and difficulties have you faced in inventing or developing the product?

Following the basic experiments of the finger vein authentication principle, we tested a prototype model for commercialization by our factory, but this testing resulted in many persons found to have no veins captured at all. A laboratory-made trial product also showed similar findings, which was quite a surprise for us. Our team addressed this problem but failed to take effective measures even after three months of efforts, resulting in our factory stopping the commercial production.

Meanwhile, the top management of our laboratory requested the team to report on the project. On the evening before the day of our report, when we still had no specific plans, one fellow researcher in the team happened to apply the light source of a home appliance at hand to his finger, which caused his veins to appear differently in an image. The captured image showed a clear view of veins in two lines, rather than one line as is usually seen. At that very moment, we realized that we had been missing something in our imaging principle. While our team had focused mostly on the optical absorption property of hemoglobin, we should also have looked at the scattering of light*. That night we changed the light source at once into a less scattering one, and the next morning after verifying that veins as had never seen before could be displayed in an image, we reported the measures taken to our management. Later, our factory completed the finished product satisfactorily.

*A physical property of light by which an obstacle in the way of light causes a light of shorter wavelength to reflect, a light of longer wavelength to pass through, and a light of middle wavelength to reflect in different directions, respectively.

What gives you joy as an inventor/researcher/developer?

Now, I believe that an ultimate product form that contains our finger vein authentication technology, such as automobiles and cellular phones, could allow us to become a dominant player in the global market in this field. To this end, our team has been working to improve the technology by producing one device after another experimentally, including an unlocking device for opening automobile doors with a simple grip of the handle and a highly-miniaturized device capable of being embedded in cellular phones. At the time that I started this study, a documentary TV program mostly covering different successful stories of challengers, in which, for example, an engineer struggled through difficulties finally to meet his/her end, also began. The program inspired me as a researcher. Sometimes I talked with my fellow researchers about the popular TV program, saying "I wish that we could be on the program." I believe that the happiest time as a researcher is when one tackles actual difficulties while dreaming of a successful outcome in the future.

In addition, to make products that are useful to society, our team repeated a cycle of steps over and over; we traveled across the country to give a presentation and demonstration of trial products, listened directly to customers' voices, modified the trial products, and then revisited the same places for another session. I suppose you wonder how far researchers should commit themselves to a project. But I know that with a definite goal in mind, a researcher can take such action. The products thus developed were brought to people, and came into actual use nationwide, causing me to experience a great sense of accomplishment. Furthermore, this achievement, which also received acclaim from outside the company, earned a number of awards, among which the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology[*1)] and the National Commendation for Invention[*2)] were particularly honors for researchers, giving me great pleasure. Shown in the photo are my fellow researchers at the award ceremony of the Commendation for Science and Technology by MEXT.
Now, it's your turn. Why not try and challenge something new?

*1) Prizes for Science and Technology for those who have made distinguished achievements
*2) For those inventions that involve an outstanding inventive step in science and technology and exhibit a remarkable working effect

Members of the company's first research team on finger vein authentication