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Combination of Fingerprint and Hidden Load Cell (CFH)

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***Abstract*—** The aim of this project is to improve the implemented security policy in the use of fingerprint readers in areas with important data by combining applications system and hardware. In order to ensure safety can be enhanced using a fingerprint reader combined load cell where the user is allowed to enter certain areas should identify where is the load cell is placed or hidden areas. If the use is authorized to access the area they would be able to identify where the load cell is placed. The pressure shall exceed the limit set by the system to allow the fingerprint reader responded by giving the user permission to process fingerprints. Among the advantages of using this system is not able to identify the intruder why fingerprint reader does not work. In addition, the use of load cells placed on an area that cannot be seen with the naked eye, for example in the wall or floor. Next combination of fingerprint and hidden load cell system can save lot of money for organization from buying other surveillances system to ensure the safety of their data secure.

Keywords—component: fingerprint, hidden load cell (pressure sensor)

I. INTRODUCTION

In general, pressure sensors have a wide range of applications, for example in the petrochemical industry, automotive industry, consumer electronics, and process for private interests. Among the main areas that need to be monitored as technology and in medical industry. Security is the main thing that should be emphasized in the organization to keep the company and customer data from being stolen by unscrupulous secure room and a server room because this area there are a variety of confidential information that needs to be maintained and if the opposite happens, it can tarnish the image and reputation of an organization in stages.

The unique nature of a fingerprint makes it ideal for use in automated recognition systems. A fingerprint is made of a series of ridges and grooves. Once a fingerprint is captured the system locates the minutia points. These minutia points occur where the lines of the ridges begin, end, branch off and merge with other ridge lines. These points are then mapped and a line is drawn between each point. This creates a map of how each point relates to the other points.

When develop a system or application need to relate with CIA stand for (Confidentiality, Integrity & Availability) and these three elements very important while a business' assets may be measured in terms of its employees, buildings or cash on hand, the vast majority of its assets are stored in the form of information, whether it be electronic data or written documents.

If this information is disclosed to unauthorized individuals,

is inaccurate or deceptive, or is not available when required, the business may suffer significant harm such as the loss of customer confidence, contract damages, regulatory fines and restrictions, or a reduction in market share.

The major issue regarding Data Theft is due to weak security system and not to efficient. For example, the system can access another area. Violators may be subject to the Data Protection Act, 1984 for attempting to retrieve data without the owner's knowledge. Various technologies developed to overcome any problems that may happen because of weakness and some way to manipulate the existing system.

Nowadays are many functions to indicate people access secure area and one of the methods using pressure sensor without combining other device such as fingerprint. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. Next, the use of the sensor can be implied or modified when an object is touching an area and will emit a signal to the parties concerned.

As this method need to apply for secure area by using combination of finger print and hidden load cell, this is best way because it help the admin or CEO in the organization to identify and monitor all the movement their worker. If any incident happen in secure area, all the evidence will capture and help to reduce time to investigate what happen in the organization..

II. LITERATURE REVIEW

2.1 Introduction

Combination of fingerprint and hidden load cell is a combining biometric identification (or verification) and verification of and individual (or claimed by identity) by using certain physiological or behavioral trait associated with the person. Traditionally, password and ID card (token based security) have been use moderate access restricted system. However, security can be easily breached in this system when a password is divulged to an authorized user or an impostor steals a card. Furthermore, simple passwords are easy to guess and difficult password may be hard to recall (by legitimate user).

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points. These minutia points occur where the lines of the ridges begin, end, branch off and merge with other ridge lines. These points are then mapped and a line is drawn between each point. This creates a map of how each point relates to the other points.

Fingerprint recognition represents the oldest method of biometric identification. To improve security of biometric by combining hidden load cell can help the process authenticate longer from usual. Load cell technology is allows a robot to tell when it collides with something, or when something pushes against it. Pressure sensors (load cell) can be used to measure force, and in some cases, to determine the contour of an applied force. This process allow authorized user access the secure area by using fingerprint but when exit the user need to identify where the hidden load cell are located. By combining this process, the user need give a predetermined pressure to activate the fingerprint scanner and put their thumb as usual.

2.2 Fingerprint

Fingerprint being the oldest and easily available trait of biometrics, offers an infallible means of personal identification. The matching accuracy using fingerprint has been shown to be very high as compared to other existing biometric traits. Unlike face and voice patterns, fingerprints are persistent with age and can't be easily distinguished. Therefore, fingerprint is one of the most researched and matured field of biometric authentication. The first known example of biometrics in practice was a form of fingerprinting being used in China. Fingerprints are incomparably the most sure and unchanging form of all other forms of signature. A fingerprint is constituted by a set of ridge lines which often run parallel, sometimes terminates and sometimes intersects.

The unique nature of a fingerprint makes it ideal for use in automated recognition systems. A fingerprint is made of a series of ridges and grooves. Once a fingerprint is captured the system locates the minutia points. These minutia points occur where the lines of the ridges begin, end, branch off and merge with other ridge lines. These points are then mapped and a line is drawn between each point. This creates a map of how each point relates to the other points. The map is then stored as a data stream called a minutia template in a database for future comparison with other presented fingerprints. It is important to note that during the entire process no fingerprint images are stored on the system and a

fingerprint image cannot be recreated from the minutia template.

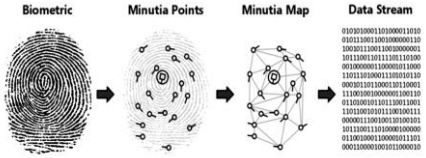

Figure 1: Process fingerprint scanner identify the pattern

(Source Journal: Automatic Fingerprint Recognition System Using Fast Fourier

Transform and Gabor Filters)

In the field of fingerprint identification, different types of work have been done so far.

There are several method used today such as:-

• **Fast Fourier Transform and Gabor Filters**

It is used to enhance and reconstruct the information of the fingerprint image, as well as to extract two fundamental types of minutiae, ending points and bifurcations. Finally the extracted features are used to perform the fingerprint recognition.

• **Fusion and Context Switching Frameworks**

This algorithm not only gives reconstructing the whole fingerprint image, but also the reconstructed fingerprint image contains few spurious minutiae. This algorithm reconstructs the image continuous phase from minutiae. Most of the fingerprint extraction and matching techniques restrict the set of features to two types of minutiae: ridge endings and ridge bifurcations.

Based on research by Gualberto Aguilar, Gabriel Sánchez and Karina Toscano by using Minutiae based feature extraction method most relevant because it simple and good accuracy However, compare with Fast Fourier Transform and Gabor Filters, probability failure fingerprint scanner to capture the pattern very high.

Table 1 Fingerprint method

Method	Detection of pattern	Respond time with the system	Probability Failure
Fast Fourier Transform and Gabor Filters	Low	Low	High
Fusion and Context Switching Frameworks	High	High	Low

2.3 LOAD CELL (PRESSURE SENSOR)

Pressure sensing (load cell) allows a robot to tell when it collides with something, or when something pushes

against it. Pressure sensors (load cell) can be used to measure force, and in some cases, to determine the contour of an applied force.

Pressure sensors monitor leaks on compressed air equipment and are used in the chemicals industry and food industry, or they are used as fill level sensors in the application area of household appliances. The primary sensor element within a smart sensor may not be made of a conventional transducer material. Nonlinear and hysteretic materials, previously discarded as being too unreliable or unstable for sensing applications, may now be applied in a sensor that contains its own dedicated microprocessor the need to burden a central processor with a complex constitutive model or filtering algorithm is thereby avoided.

The measurement of pressure is generally associated with fluids, either liquids or gases. A container filled with a liquid has a pressure (due to the weight of the liquid) at a point in the liquid of:

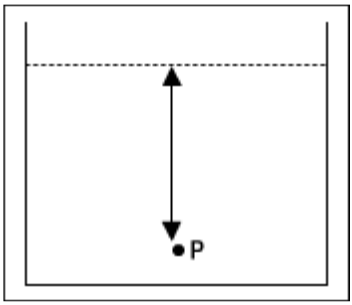

Figure 2: Pressure at any given point in a confined liquid is determined by the weight of the liquid and the distance from the point to the surface.
Source (http://www.sensorsmag.com/sensors/pressure/fundamentals-pressure sensortechnology-846)

Static pressure. Pressure, P, is defined as force, F, per unit area, A.The weight per unit volume, V, is given by:

w = mg/V

Where:

m = mass

g = gravitational acceleration

Thus, the density of a liquid determines the pressure, P, exerted for a given height. Mercury is 13.6 3 denser than water, so would exert a pressure 13.6 3 that of water for a column of the same height. It should be noted that the pressure due to the height of a column

of liquid is in addition to the atmospheric pressure acting on the surface of the liquid.

2.4 Pressure Sensor (Load Cell) Acceptance Criteria

Thus, the density of a liquid determines the pressure, P, exerted for a given height. Mercury is 13.6 3 denser than water, so would exert a pressure 13.6 3 that of water for a column of the same height. It should be noted that the pressure due to the height of a column of liquid is in addition to the atmospheric pressure acting on the surface of the liquid.

Table 2: Pressure Sensor Acceptance

No	Criteria	Definition
1	Stability	Ability of an instrument to retain its performance throughout its specified operating and storage life
2	Drift	Undesired variation in output over a period of time
3	Accuracy	Average measurements obtained will a particular instrument with an accepted reference value or level or with the true value of the magnitude of the quantity measured
4	Repeatability	A measure of the variability precision of result obtained by the same operator using the same instrument in successive measurements of a constant measured parameter.
5	Hysteresis	The maximum difference in signal output at a given value of the input variable observed when the input value is approached from zero and when the input value is approached from full scale
6	Response time	The time required for the change in pressure indication to reach change in steady-state pressure
7	Dead band	The maximum value by which a monitored pressure can change from an initial value without initiating any statistically significant change in the pressure indication

III. METHODOLOGY

Rapid application development (RAD) is a software development methodology that uses minimal planning in favour of rapid prototyping. The "planning" of software developed using RAD is interleaved with writing the software itself. The lack of extensive pre-planning generally allows software to be written much faster, and makes it easier to change requirements.

For this project, the method was determine that used to running the double authentication system by using Combination of fingerprint and hidden load cell. At this phase, describes desired features and operations in detail, including graphic user interface layouts, process diagrams, programming and other documentation. The detailed design phase modifies the logical design and produces a final detailed design, which includes technology choices, specifies system architecture, meets all system goals for performance, and still has all

of the application functionality and behaviour specified in the logical design. This system will allow user access the secure area by using fingerprint scanner to authenticate user (unique ID @ pattern) and all information stored as name, time and date will be saved automatically into the log report. Data that is stored serves as the reference or evidence to be used if any aggression occurs.

The next process, once the users have been given permission to access the area, they should identify where the hidden the load cell located. The use of hidden load cell is activated fingerprint scanner. The burden can be touched @ pressed until the light turns green fingerprint scanner. If the load is not sufficient, CFH will not respond to a fingerprint scanner. Only authorized user only can know how much pressure is needed and where the burden is placed.

If sufficient weight is given, the user is not allowed to access the fingerprint scanner. The same process will be done by the fingerprint scanner to read the fingerprint pattern and if matching, authorized user will given permission to exit from the secure area. All the log report will be saved into Excel and the report will keep a record of all past and current.

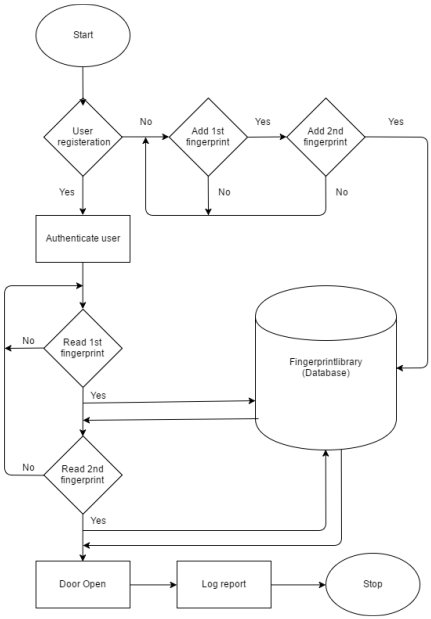

Figure 3: Process access secure area

Figure 3 show the process how the user needs to register their unique id (biometric pattern). The 1st function add fingerprint is to capture pattern from user and the 2nd process of is to authenticate 1st fingerprint need similar with 2nd reading. If the first and second readings are accurate, it will store the user information in database (fingerprint library).

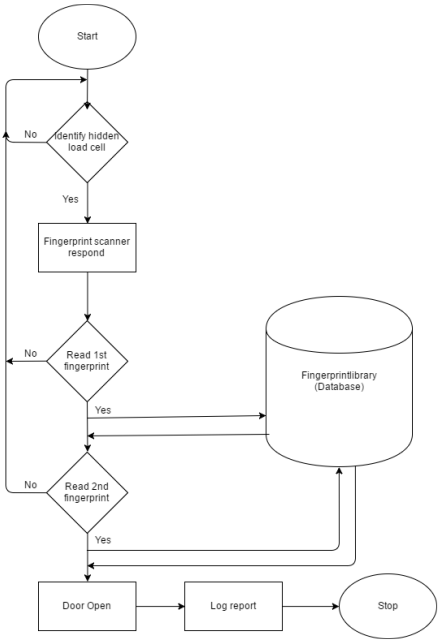

Figure 4: Process exit secure area

Figure 4 above show the process combination of fingerprint and hidden load cell for process exit from secure area. The process show that the authorize user need to identify hidden load cell to activate the fingerprint scanner. If this process success, the user need to put the thumb print and fingerprint scanner will authenticate (read) user has been exit from secure area.

IV. RESULT

The result for this project was concluding by did the testing and questionnaires. The purpose of testing is too familiar with developing and troubleshooting a basic circuit and work independently on a project starting from planning, design until development process combination of fingerprint and hidden load cell. There are several testing has been that developer use such as:-

- Fingerprint testing
- Hidden load cell testing
- Fake fingerprint testing

Table 3: Fingerprint testing result

NO	Fingerprint Testing	Success Rate (Percentage %)
1	Test 1	100%
2	Test 2	100%
3	Test 3	80%
4	Test 4	100%
5	Test 5	100%

From table 3 show that 5 testing taken to ensure that all patterns are taken correctly. Testing was conducted using 5 different patterns and individual. Each pattern can be read except in row 3 which shows the reading of 80%

Table 4 Hidden Load Cell testing result

NO	Hidden Load Cell Testing	Success Rate (Percentage
1	Test 1	100%
2	Test 2	800%
3	Test 3	80%
4	Test 4	100%
5	Test 5	100%

Compared with the table, the second and third row shows the reading percentage is 80%, which means that pressure is placed not enough to ignite the fingerprint scanner. However, this problem occurs probability ratio is 1/5. If this problem occurs, users only need to make a stronger pressure until it reaches a value of 100% or fingerprint scanner turn on to green light.

Table 3 Full result after comparison tool used

No	Fake Fingerprint Testing Tools	Success Rate	Full Result	Probability over 5
1	Scotch tape	40%	Success	1:5
2	Paper	0%	Failed	0:5
3	Hot glue stick	50%	Success	2:5
4	Glue	80%	Success	3:5
Tools	**Advantages**		**Disadvantages**	
Scotch tape	None		Pattern is easily done using simple tools and low cost.	
Paper	Thick hard surface fingerprint scanner reads the pattern is formed and makes it difficult for intruders to access		None	
Hot glue stick	Requires precision to form a pattern. Pattern imperfect results invalid.		Using simple tools and low cost	
Glue	Requires precision to form a pattern.		Using simple tools and low cost	

By referring to all the test had been made, can concluded that the combination of fingerprint and hidden load cell fulfill the objective of the project. Table 1 below shows the functional testing.

V. CONCLUSION

Double layer authentication by using combination of fingerprint and hidden load cell that has been develops by using Arduino board and visual basic 2010. The objective of the system is identify and authenticate related personnel in protecting secure area from intruder by using fingerprint and pressure sensor (load cell). Unauthorized entities are not allowed to have access. Authorize user need to identify hidden load cell located, if not fingerprint scanner cannot integrate with system. There application strengths are:-

- Able to identify or verifying a person
- Ensure that only authenticated user can be granted access
- Increase the use of fingerprint security

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