

**STRESS DETECTION USING GALVANIC SKIN
RESPONSE**

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This thesis is submitted as partial fulfilment of the requirements for the award of the
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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of the Bachelor Degree of Electrical Engineering (Hons.) (Electronics).

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Date : 15 DECEMBER 2016

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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Specifically dedicated to my family members, supervisor and friends throughout the progress of completing my Final Year Project. Thanks for all moral support, encouragement and advices

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LIST OF ABBREVIATIONS

GSR	Galvanic Skin Response
SCA	Skin Conductance Algesimeter
ECG	Electrocardiogram
EMG	Electromyography
HR	Heart Rate
PD	Pure Data
SVM	Support Vector Machine
k-NN	K-Nearest Neighbor
FL	Fuzzy Logic
ID3	Iterative Dichotomiser 3

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ABSTRACT

Galvanic Skin Response (GSR) is a method of measuring electrical conductance of the skin. Strong emotion cause stimulus to sympathetic nervous system, resulting more sweat being secreted by the sweat glands. From the data collected, we will have to analyse the data and graph to know at what point is the subject in stress or not stress. Different subject, different level of stress state depends on their physical and mental balance. Some subjects have strong emotion not only while they are stress, but also when they are very happy, very sad and also nervous. This is also triggered as strong emotion that the GSR sensor will detect any changes of emotion. We also have to see what type of activities that the subject are doing or undergo during the data is recorded. By placing the GSR at any two fingers on one hand, the GSR will start to detect any sweats or strong emotions of the subject. It will run the serial monitor after the Arduino coding is uploaded. The data will be displayed and analysed according to the activities that have been done. The data collected will be transferred to Matlab for further analysis. The graph is plotted from the Matlab for each subject out of 15 subjects. But only 9 subjects is counted. The results and graph are differ for every subjects although they went through the same activities. Every subjects does not have the same physical and mental state before, during and after the activities. Besides that, the amount of sweats secreted by each subject's body (sweat glands) and their emotion will also affect the data, results and graph. As we observed the subjects and the activities they were undergo, we knew how their emotion at that state was.

ABSTRAK

Tindak balas galvanik kulit adalah satu kaedah untuk mengukur kealiran elektrik kulit manusia. Emosi yang kuat menyebabkan perangsang kepada sistem saraf simpatetik, mengakibatkan lebih banyak peluh akan dikeluarkan oleh kelenjar peluh. Dari data yang telah dikumpulkan, kita akan menganalisis data tersebut dan graf untuk mengetahui pada nilai berapakah subjek berada dalam keadaan tertekan ataupun tidak. Subjek yang berlainan akan membawa kepada perbezaan tahap tertekan bergantung kepada keadaan fizikal dan mental subjek tersebut. Seseorang subjek mempunyai emosi yang kuat tidak hanya pada keadaan tertekan tetapi juga ketika subjek tersebut di dalam keadaan atau situasi yang menggembirakan, menyedihkan atau juga gementar. Keadaan ini menyebabkan pengesan tindak balas galvanik kulit akan mengesan sebarang perubahan emosi subjek tersebut. Kita juga perlu pantau keadaan semasa subjek tersebut menjalankan ujian ini untuk mengetahui bahawa subjek sedang melakukan aktiviti apa ketika data sedang direkodkan. Dengan meletakkan pengesan tindak balas galvanik kulit pada dua jari tangan yang sama, pengesan tersebut akan mula mengesan peluh atau emosi yang kuat selepas kod Arduino telah dimuat naik. Data akan dipaparkan dan dianalisis berdasarkan aktiviti yang telah dijalankan. Data tersebut dikumpulkan dan dipindahkan ke Matlab untuk analisis selanjutnya. Graf yang diplot dari Matlab adalah setiap subjek daripada 15 subjek. Tetapi hanya 9 subjek yang diambil kira. Graf yang telah diplot adalah berbeza bagi setiap subjek walaupun mereka menjalani aktiviti yang sama. Setiap subjek tidak mempunyai keadaan fizikal dan mental yang sama pada sebelum, semasa dan selepas aktiviti. Selain itu, jumlah peluh dan emosi setiap subjek juga mempengaruhi data dan graf. Disebabkan setiap subjek diperhatikan ketika mereka menjalani aktiviti, kita tahu pada ketika itu, bagaimana emosi mereka.

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Stress is a reaction to a stimulus that effect our physical or mental balance. Stress is one of the major factors that contributes to physical, emotional, mental and also behavioral changes. A disagreeable occasion triggering hormones, for example, adrenaline and cortisol to surge through the body. ‘Intense stress’; keeps us dynamic and careful. But ‘chronic stress’ (long-term) can have effects on health and it is the most dangerous level of stress. In some cases it is important to collect feedback in order to control this symptom because it can become dangerous in certain conditions. Therefore, a device to detect stress is necessary to build and gather the data to determine the level of the stress. There are various type of method to detect human stress by measurement of heart rate, voice (speech), pupil diameter, sweat production rate, muscle cardiovascular and body temperature. The circumstances and impact of stress as shown in Figure 1.1.

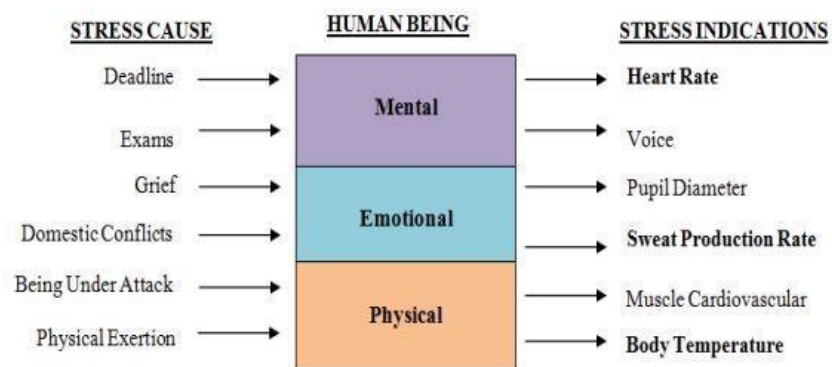


Figure 1.1: Stress Cause and Indication of Stress

Galvanic skin response (GSR), generally called skin conductance is an adjustment in the electrical resistance of the skin created by emotional stress, which increment of sympathetic nervous system activity, measurable with a mild galvanometer. As stress

levels increase, our sweat gland activity will increase and sweat secretion causes the skin conductance to increase. This project consists of utilizing galvanic skin response (GSR) sensor to detect the stress level in human body.

1.2 PROBLEM STATEMENT

Stress can be sorted into typical state or stressed state.

- i. How and when do we know a person is in which state?
- ii. How are we going to display the GSR signal.
- iii. How to determine whether a person is in stress state.
- iv. How to establish one threshold for each subjects due to the different amounts of sweats.

1.3 OBJECTIVE

From problem statement above, few objective has listed:

- i. To collect GSR signal for stress detection
- ii. To analyse the data from GSR Sensor.
- iii. To determine stress state using GSR signal.

1.4 SCOPE OF PROJECT

This project is to come out with how to analyse the data that we got from subjects. To investigate the GSR signal and data that can indicate the stress state. Creating a method to display the results in MatLab.

1.5 FINANCIAL COST

Table 1.1: Estimating Cost

No.	Hardware	Quantity	Price (RM)
1	MATLAB Software	1	-
2	GSR Sensor	1	RM 295.55
3	Arduino Uno R3	1	RM 50.00
	Total		RM 345.55

1.6 GANTT CHART

SCHEDULE / ACTIVITY	PSM1 (WEEK)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PSM 1 Briefing	█														
Find Supervisor and Project Title + Register Title		█													
Literature Review			█	█	█	█									
Resource and Financial Planning				█	█	█									
Abstract and Expected Result			█	█											
Problem Statement			█	█	█	█									
Objective and Scope of Study			█	█	█										
Methodology			█	█	█										
Proposal Preparing			█	█	█	█									
Submit Proposal, Slides and Evaluation Form							█								
Presentation Proposal (PSM1 Seminar)							█								
Logbook Report / Progress Report			█	█	█	█	█	█	█	█	█	█	█	█	
Submit Report + Logbook + Evaluation Form															█

Figure 1.2: PSM 1 schedule

SCHEDULE / ACTIVITY	PSM2 (WEEK)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Testing the project	█	█	█	█	█	█	█	█	█					
Collect Data	█	█	█	█	█	█	█	█	█					
Progression of the analysis			█	█	█	█	█	█	█	█	█			
PSM poster presentation & Demo (EXSELEN)												█		
Submit final draft + Logbook + Evaluation Form													█	█

Figure 1.3: PSM 2 schedule

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