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Emotion Regulated Auto System Shutdown (ERASS)

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Abstract— In search of innovation for developing new advancement, we neglected human health which is also very important. 'Mental stress' is a problem in today's era which every individual suffers. The motive behind developing Emotion Regulated Auto System Shutdown (ERASS) is to reduce mental work load. ERASS makes use of a simple stress meter which works on the principle of galvanic skin response which converts skin resistance to a particular value of voltage. This voltage changes with change in emotional activity of the subject. This threshold values differs from subject to subject. The impulse from the stress meter is fed up in a microcontroller, which in turn switches OFF computer system, if stress level persists or increases. The aim behind designing such a system is to reduce mental stress and in turn helps stress management to a level. It is expected that developing ERASS does helps to overcome mental stress.
Keywords— Emotion Regulated, Galvanic skin response, Mental stress, Microcontroller, Stress meter, Threshold values.

I. INTRODUCTION

Blood is carried from the heart to all parts of the body in blood vessels. Each time the heart beats, it pumps blood into the vessels. Blood pressure is created by the force of blood pushing against the walls of blood vessels (arteries) as it is pumped by the heart [1], [5], [11].

Hypertension, also known as high or raised blood pressure [2], [10], is a condition in which the blood vessels have persistently raised pressure. The higher the pressure in blood vessels the harder the heart has to work in order to pump blood [12]. If left uncontrolled, hypertension can lead to a heart attack, an enlargement of the heart and eventually heart failure [4]. Blood vessels may develop bulges (aneurysms) and weak spots due to high pressure, making them more likely to clog and burst [2]. The pressure in the blood vessels can also cause blood to leak out into the brain. This can cause a stroke. Hypertension can also lead to kidney failure, blindness, rupture of blood vessels and cognitive impairment [12].

II. SURVEY AND COSTING

A. Survey

Globally cardiovascular disease including high blood pressure accounts for approximately 17 million deaths a year, nearly one third of the total. Of these, complications of hypertension account for 9.4 million deaths worldwide every year. Hypertension is responsible for at least 45% of deaths due to heart disease, and 51% of deaths due to stroke [12], [5].

In 2008, worldwide, approximately 40% of adults aged 25 and above had been diagnosed with hypertension; the number of people with the condition rose from 600 million in 1980 to 1 billion in 2008.The prevalence of hypertension is highest in the African Region at 46% of adults aged 25 and above, while the lowest prevalence at 35% is found in the Americas. Overall, high-income countries have a lower prevalence of hypertension - 35% - than other groups at 40% [12], [5].

In 2008, 1 billion people were smokers and the global prevalence of obesity has nearly doubled since 1980. The global prevalence of high cholesterol was 39% and prevalence of diabetes was 10% in adults over 25 years. Tobacco use, unhealthy diet, harmful use of alcohol and physical inactivity are also the main behavioral risk factors of all major noncommunicable diseases, that is cardiovascular disease, diabetes, chronic respiratory disease and cancer [12], [5].

If appropriate action is not taken, deaths due to cardiovascular disease are projected to rise.

B. Costing

In certain low- and middle-income countries, current health expenditure on cardiovascular diseases alone accounts for 20% of total health expenditure [12], [5].

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Over the period 2011-2025, the cumulative lost output in low- and middle-income countries associated with noncommunicable diseases are projected to be US$ 7.28 trillion. The annual loss of approximately US$ 500 billion due to major noncommunicable diseases amounts to approximately 4% of gross domestic product for low and middle income countries. Cardiovascular disease including hypertension accounts for nearly half of the cost [12], [5].

Regarding the Indian patients there is approximately Rs 4000/- is required for the medicine and checkups of blood pressure disease. Mostly the use of tobacco and alcohol is considered here to reduce hypertension for which most of people invest money for no use. In-house treatment cost differently where as ayurwadic, unani and many more fields having the same treatment way which cost on monthly basis to maintain or put the blood pressure within safe limit to avoid heart attack issues.

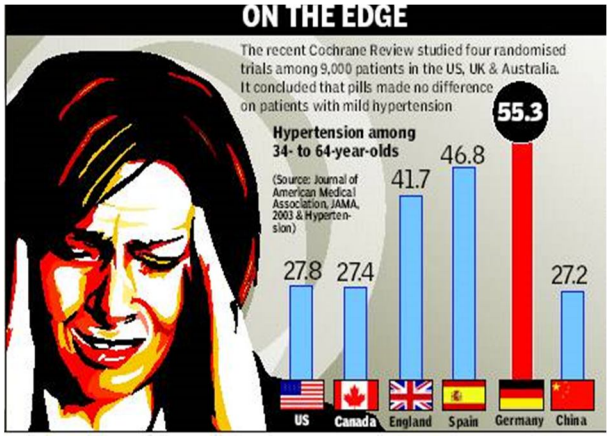

Fig. 1. Article from The Sunday Times, dated September 02, 2012

C. Classification of Blood Pressure for Adults

TABLE I: Classification of blood pressure for adults

Classification of blood pressure for adults		
Category	Systolic, mm Hg	Diastolic, mmHg
Hypotension	< 90	< 60
Desirable	90–119	60–79
Prehypertension	120–139	or 80–89
Stage 1 Hypertension	140–159	or 90–99
Stage 2 Hypertension	160–179	or 100–109
Hypertensive Crisis	≥ 180	or ≥ 120

III.MATHEMATICAL RELATION

Paper It has been observed as the hypertension is directly affects on blood pressure and blood pressure is affected by the heart pumping action which will increase or decrease blood flow [20].

Mathematically we can say

$$H_t \propto B_P$$

$$B_P \propto F_b$$

H_t = hypertension, B_P = Blood Pressure, and F_b= Rate of Blood Flow due to pumping action of heart.

$$B_P = \frac{1}{k} F_b$$

$\frac{1}{k}$ = Factors affecting Blood flow

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The blood flow increases increase the permeability of skin, where as permeability is conductivity of skin to electrical current.

There for

$$F_b \propto P_s$$

P_s= permeability of skin

$$F_b = A.P_s$$

A=Multiplying factor depends upon different locations at skin

$$B_P = \frac{A}{k} P_s$$

$$B_P = \frac{A}{k} C_s$$

C_s= conductivity of skin to electrical current.

Where as

$$C_s \propto \frac{1}{Rs}$$

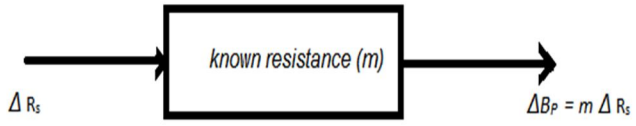
R_s= Skin Resistance to electric current

There for in the two cases the B.P and Resistance relationship is as given below

m= Known resistance

The case of high B.P

$$\Delta B_P = m \Delta R_s$$



The case of Low B.P

$$\Delta B_P = \frac{1}{m} \Delta R_s$$

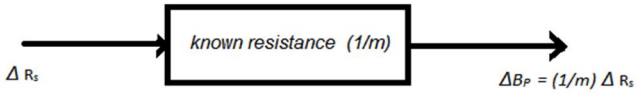


TABLE II
Relation between resistance and conductivity with blood pressure

B.P	Conductivity	Resistance
high	high	low
low	low	high

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Table III
Factors affecting resistance and Value of resistance

Factors affecting resistance	Value of resistance
thin skin	low
thick skin	high
dry skin	high
moisturized skin	low
sweating	low
temperature	high for high

IV. SYSTEM DESIGN AND IMPLEMENTATION

A. Requirement

Hardware Requirement

1) Arduino UNO (AtMega328) [19].
2) Conducting electrodes
3) Potentiometer(1M)
4) Relay (12V)
5) IC BC547
6) Connecting wires

Software Requirement

1) Arduino IDE
2) HyperTerminal

B. Block Diagram and Working

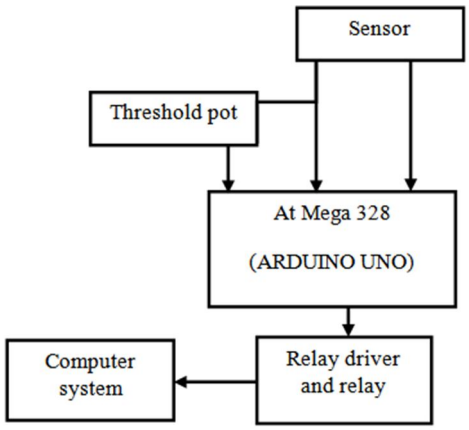

Fig. 2. Block Diagram of ERASS

1) Initially a sensor is prepared for measuring Galvanic Skin Response. In other word the skin resistance.
2) The sensor consists of metal strips embedded in a Velcro strap. These sensors are simply used for measuring the skin resistance, which in turn would help us measure the skin resistance.
3) Arduino Uno is a micro controller based board which is required for project.
4) The Arduino board consists of microcontroller ATmega328.
5) This board receives analog inputs from our sensors at pins A0 and the other at pin connected to a pot resistor.
6) The main function of this board is to receive the analog input from our sensor.
7) This board also converts analog data into digitized form.

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8) For doing this initially, a series of data is recorded from the subject.
9) Ever since the readings for every individual changes, a threshold value is set depending on the varying values.
10) These values are fed up in software called, 'Arduino Uno 1.0.1', [19].
11) And hence a series of such values are obtained also the value of threshold is set.
12) Whenever the sensor is attached to subject, it instantly gives us a value for his/her external body resistance.
13) This analog data, if crosses its threshold value, the Arduino is programmed such that it knocks out the rest of the execution of the program and the loop is broken, resulting in an output to the result.
14) A normal relay is used here in order to transfer the output of the microcontroller to the computer system hardware.
15) The output from the pins of the Arduino once fed up in the relay, the relay then acts as a switch box circuit.
16) It means that the relay performs certain function which switches to different tasks depending upon the type of input provided.
17) Here, the relay has been provided for the restart button of the computer.
18) Once the reading of a subject changes above the threshold value, the relay gets in active stage where it directly switches off the system.
19) And once the subject comes back to his/her normal state, the values again relax below the threshold.
20) This time the relay switches of to low mode and then restarts the system.
21) Thus implementation of Emotion Regulated Auto System Shutdown is successful.
22) It is also noteworthy that with implementation of ERASS, we have successfully implemented our concept and also the basic need of people working under high stress condition.

Fig. 3. Arduino and sensor plate setup

Fig. 4. Shaving blade trick

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C. Flowchart

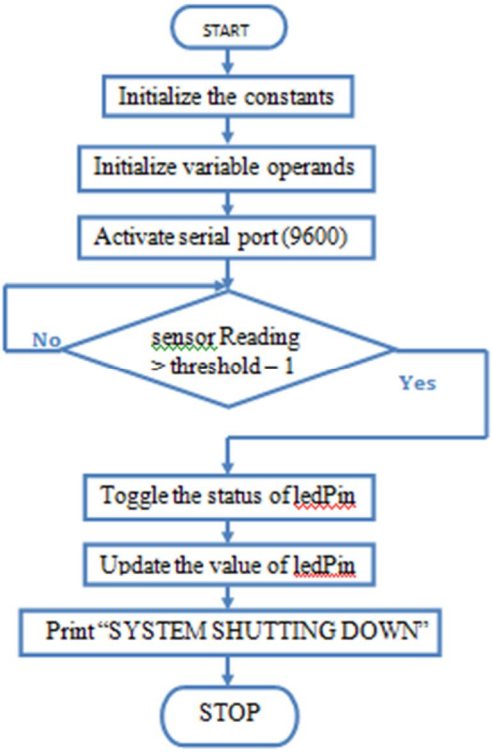

Fig. 5. Flow chart

V. RESULTS

TABLE IV
B.P READINGS WITH MEASURED SKIN RESISTANCE VARIATION FOR CASE-I

CASE	PRADNYA AUTADE			
SYS	141	135	136	156
DIA	78	73	111	144
PULS	73	75	89	153
R1	66	76	87	99
STATE	NORMAL		EXCITED	

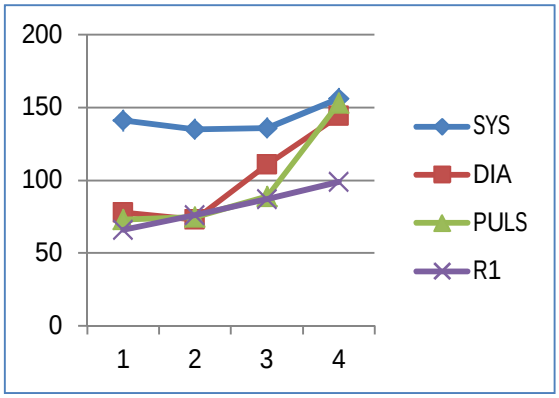

Fig. 6. Relation between blood pressure and skin resistance of CASE-I

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Table V

B.P readings with measured skin resistance variation for CASE-II

CASE	NAMITA CHAUDHARY			
SYS	107	109	104	129
DIA	67	59	64	106
PUL	83	76	81	72
R1	56	59	78	89
STATE	NORMAL		EXCITED	

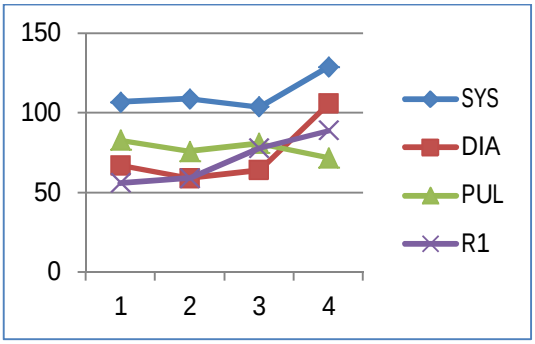

Fig. 7. Relation between blood pressure and skin resistance of CASE-II

VI. CONCLUSION

I.T. industries are completely dependent on computers. With increasing technologies the work load has also increased to such an extent that 90% of employees suffer. This device will not only benefit the I.T. firms but also other fields where stress level is high.

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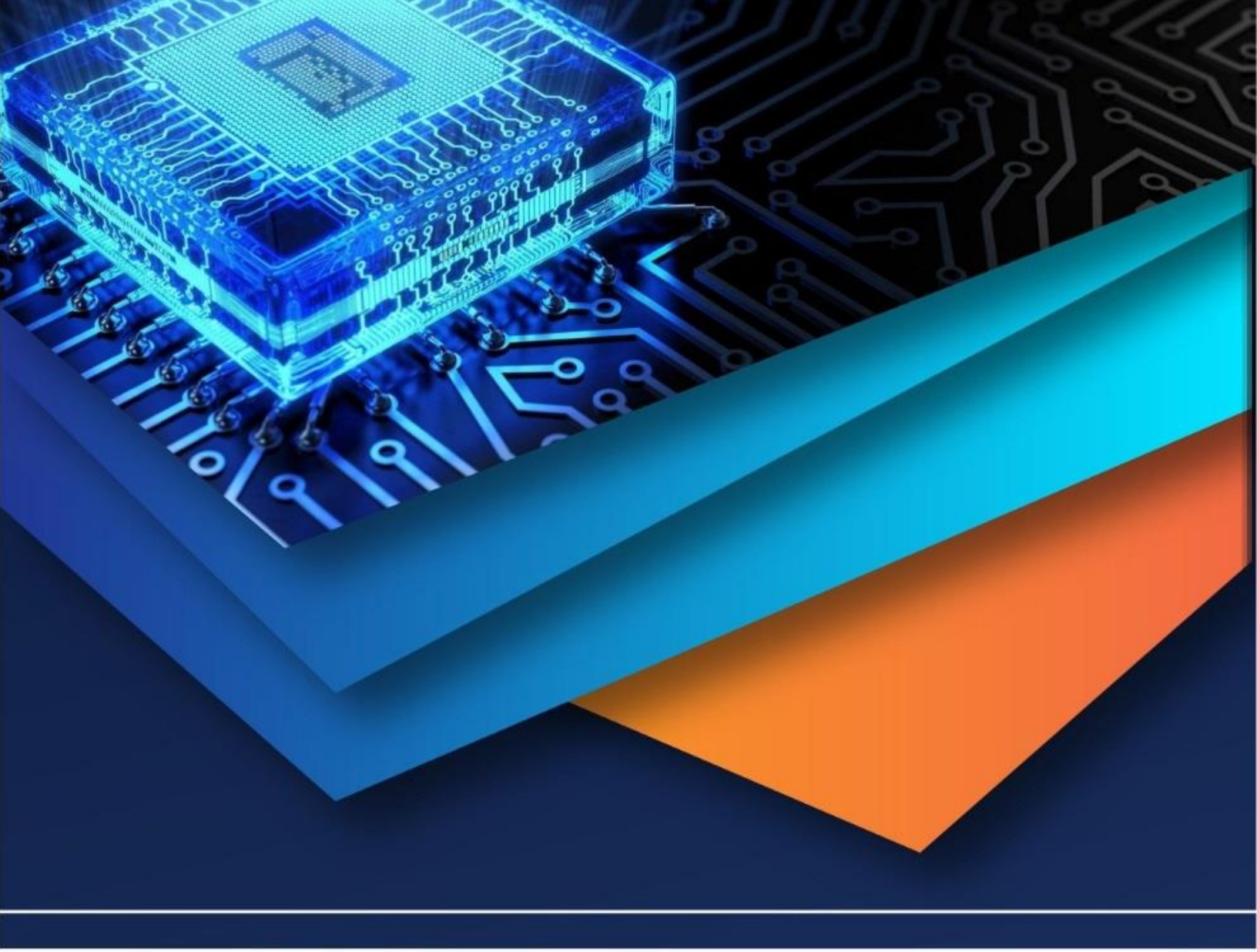

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