STRESS METER USING SKIN RESISTANCE AND MUSCLE STRENGTH

B.Tech. MINI Project Report

PRANATHI KAVURU
K. PRANNOY KOUNDINYA
SHILPA ANBALAGAN

DEPARTMENT OF BIO-MEDICAL ENGINEERING
GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Affiliated to Jawaharlal Nehru Technological University)
HYDERABAD 500 090
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STRESS METER USING SKIN RESISTANCE AND MUSCLE STRENGTH

Project Report Submitted in Partial Fulfillment of
the Requirements for the Degree of
Bachelor of Technology
in
BioMedical Engineering
by

PRANATHI KAVURU(Roll No. 07241A1120)
K. PRANNOY KOUNDINYA (Roll No. 07241A1121)
SHILPA ANBALAGAN (Roll No. 07241A1128)

DEPARTMENT OF BIO-MEDICAL ENGINEERING
GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Affiliated to Jawaharlal Nehru Technological University)
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Department of BioMedical Engineering

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Certificate

This is to certify that this project report entitled ***STRESS METER USING SKIN RESISTANCE AND MUSCLE STRENGTH*** by PRANATHI KAVURU(Roll No. 07241A1120)K. PRANNOY KOUNDINYA (Roll No. 07241A1121)SHILPA ANBALAGAN(Roll No. 07241A1128)submitted in partial fulfillment of the requirements for the degree of Bachelor of Technology in BioMedical Engineering of the Jawaharlal Nehru Technological University, Hyderabad, during the academic year 2010, is a bonafide record of work carried out under our guidance and supervision.

The results embodied in this report have not been submitted to any other University or Institution for the award of any degree or diploma.

(Guide) (External Examiner) (Head of Department)

Ch.Prathyusha
Assistant Professor

T.Padma

A C K N O W L E D G E M E N T

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Signature	Signature	Signature
PRANATHI KAVURU	K.PRANNOY KOUNDINYA	SHILPAANBALAGAN
(07241A1120)	(07241A1121)	(07241A1128)

A B S T R A C T

All muscles are not created equally strong and the conditions that stretch them vary from person to person. This equipment consists of sensors or two probes made of conducting materials into the fabric that register the mechanical excitation of the muscle fibers that pass the signals to an electronic analysis system. People's muscle tension changes with their stress level – the greater the stress, the more likely the muscles are to produce a synchronous twitching effect. At the same time, skin offers some resistance to current and voltage. At relaxed state they offer more resistance and at higher stress they offer less resistance. This resistance changes with the emotional state of the body. Though this is barely perceptible, the electrodes register the change. In this equipment, two probes are left to calibrate stress. As you increase your grips on these wires, the LED dot jumps into lower order. The stronger the grip, the lower the position of the dot. If you can not keep a steady hand, the LED dot oscillates up and down. By this the stress of the person can be determined.

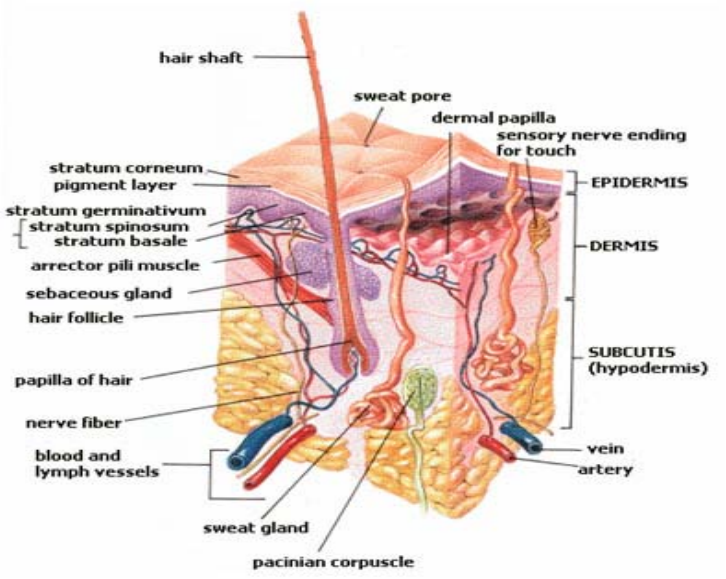
LIST OF FIGURES

C O N T E N T S

1. INTRODUCTION

1.1 SKIN:

The skin is the outer covering of the body. In humans, it is the largest organ of the integumentary system made up of multiple layers of ectodermal tissue, and guards the underlying muscles, bones, ligaments and internal organs. Human skin is similar to that of most other mammals except that it is not protected by a pelt and appears hairless though in fact nearly all human skin is covered with hair follicles. There are two general types of skin, hairy and glabrous skin.



1.2SKIN STRUCTURE:

Skin is composed of three primary layers:

* The epidermis, which provides waterproofing and serves as a barrier to infection.

* The dermis, which serves as a location for the appendages of skin.

* The hypodermis (subcutaneous adipose layer).

1.3MUSCLE:

Muscle is the contractile tissue of animals and is derived from the mesodermal layer of embryonic germ cells. Muscle cells contain contractile filaments that move past each other and change the size of the cell. They are classified as skeletal, cardiac, or smooth muscles. Their function is to produce force and cause motion. Muscles can cause either locomotion of the organism itself or movement of internal organs. Cardiac and smooth muscle contraction occurs without conscious thought and is necessary for survival.

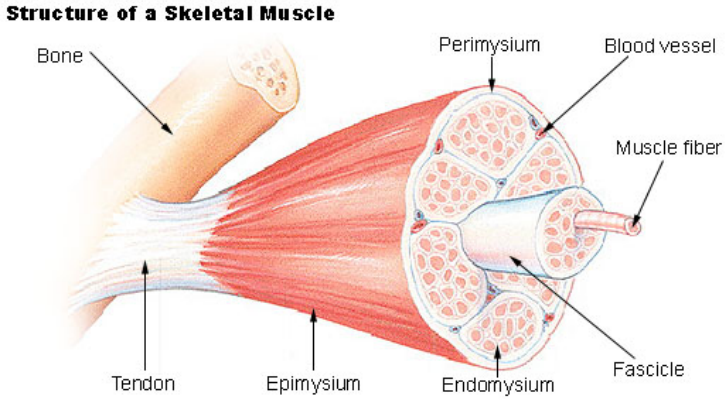


Fig. 1.2 Skeletal Muscle

1.4MUSCLE STRUCTURE:

Skeletal muscles consist of 100,000s of muscle cells that are also known as "muscle fibers".These cells act together to perform the functions

of the specific muscle of which they are a part.

1.5MUSCLE STRENGTH:

Muscle strength is what happens when the nervous system communicates a message to the muscle fibers to contract so as to produce force. Often the force produced by a muscle contraction is against resistance. This is possible due to the integration of the muscle with the other tissues and structures of other associated body systems - especially the bones (skeletal system) or, in the cases of facial muscles, the skin (integumentary system), and also the nerves (nervous system).

1.6STRESS:

Researchers define stress as a physical, mental, or emotional response to events that causes bodily or mental tension. Simply put, stress is any outside force or event that has an effect on our body or mind.

1.7TYPES OF STRESS:

Depending on the stressors and the types of changes or events we are dealing with, stress can manifest itself physically, emotionally and/or mentally.
Physical – this occurs when the body as a whole starts to suffer as a result of a stressful situation. Symptoms can manifest in a variety of ways and vary in their seriousness.The most common physical symptom is headaches because

stress causes people to unconsciously tense their neck, forehead and shoulder muscles.

2.COMPONENTS

2.1RESISTOR:

A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current passing through it in accordance with Ohm's law:

$$V = IR$$

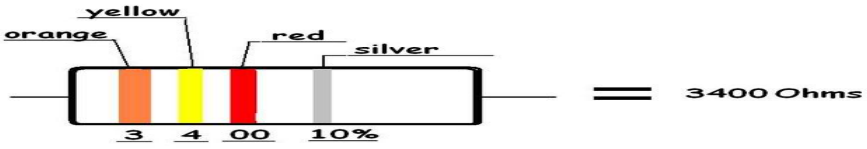


Fig2.1Resistor

FUNCTION:

Resistors are elements of electrical networks and electronic circuits andare ubiquitous in most electronic equipment. Practical resistors can be made of various compounds and films, as well as resistance wire (wire made of a high-resistivity alloy, such as nickel/chrome).

SPECIFICATIONS:

1K- 1 No., 1.2K- 2 No.

2.2CAPACITOR:

A capacitor (formerly known as condenser) is a passive electronic component consisting of a pair of conductors separated by a dielectric (insulator).

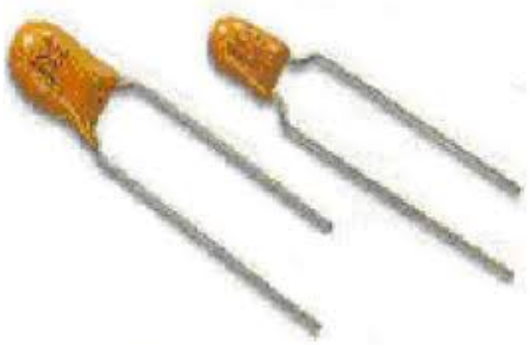


Fig.2.2Capacitor

FUNCTION:

When there is a potential difference (voltage) across the conductors a static electric field develops in the dielectric that stores energy and produces a mechanical force between the conductors.Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass, in filter networks, for smoothing the output of power supplies, in the resonant circuits that tune radios to particular frequencies and for many other purposes.

SPECIFICATIONS:

1UF/10V Tantalum -1No.

2.3LIGHT EMITTING DIODE (LED):

A light-emitting diode (LED) is a semiconductor light source. LEDs are

used as indicator lamps in many devices, and are increasingly used for lighting.

Fig.2.3Light emitting diode.

FUNCTION:

The LED is based on the semiconductor diode. When a diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor.

SPECIFICATIONS:

- L1 greenLED
- L2 TO L10-red LED

2.4DIODE:

A diode is a two-terminal electronic component that conducts electric current in only one direction.

Fig.2.4Diode.

FUNCTION:

The diode can be thought of as an electronic version of a check valve. This unidirectional behavior is called rectification, and is used to convert alternating current to direct current, and to extract modulation from radio signals in radio receivers.

SPECIFICATIONS:

IN4007-1No.

2.5POTENTIOMETER:

A potentiometer is a three-terminal resistor with a sliding contact that forms an adjustable voltage divider.If only two terminals are used (one side and the wiper), it acts as a variable resistor or rheostat.

Fig.2.5Potentiometer

FUNCTION:

Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers.

SPECIFICATIONS:

VR1-1Meg-1No.

VR2-220K-1No.

2.6PROBES:

A device used to measure electron temperatures, electron and ion densities, space and wall potentials, and random electron currents in a plasma; consists substantially of one or two small collecting electrodes to which various potentials are applied, with the corresponding collection currents being measured. Also known as electrostatic probe.

Fig.2.6Probes

2.7DC SOURCE:

DRY CELL:

An electrical battery, is a combination of two or more electrochemical cells used to convert stored chemical energy into electrical energy.A common dry cell battery is the zinc-carbon battery, using a cell sometimes called the dry Leclanché cell, with a nominal voltage of 1.5 volts, the same nominal voltage as the alkaline battery(since both use the same zinc-manganese

dioxide combination).

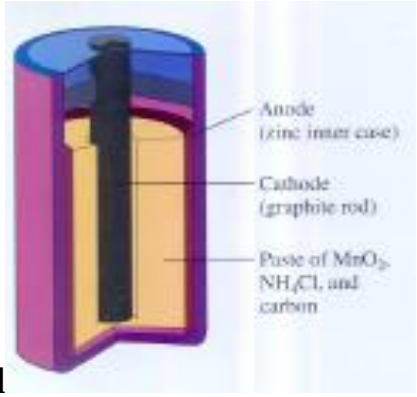


Fig.2.7Drycell

SPECIFICATIONS:

DRY CELL -1.5V-1No.

2.8IC-LM3914:

The LM3914 is a monolithic integrated circuit that senses analog voltage levels and drives 10 LEDs, providing a linear analog display. A single pin changes the display from a moving dot to a bar graph. Current drive to the LEDs is regulated and programmable, eliminating the need for resistors. This feature is one that allows operation of the whole system from less than 3V.

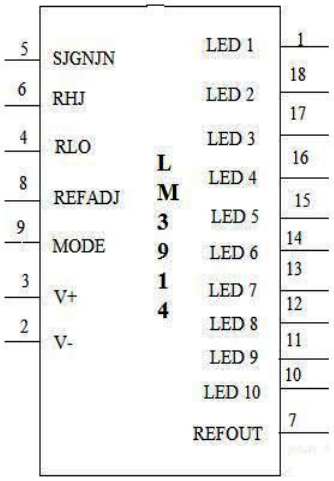


Fig.2.8LM3914

FEATURES OF LM3914:

Features Drives LEDs, LCDs or vacuum fluorescents.

Bar or dot display mode externally selectable by user.

Expandable to displays of 100 steps.

Internal voltage reference from 1.2V to 12V.

Operates with single supply of less than 3V.

Inputs operate down to ground.

Output current programmable from 2 mA to 30 ma.

No multiplex switching or interaction between outputs.

Input withstands ±35V without damage or false outputs.

LED driver outputs are current regulated, open-collectors.

Outputs can interface with TTL or CMOS logic.

The internal 10-step divider is floating and can be referenced to a wide range of voltages.

3.STRESS METER USING SKIN RESISANCE AND MUSCLE STRENGTH:

3.1INTRODUCTION:

Stress meter using skin resistanceis generally used to determine the stress felt by a person. This equipment consists of sensors or two probes made of conducting materials into the fabric that register the mechanical excitation of the muscle fibers that pass the signals to an electronic analysis system. People's muscle tension changes with their stress level – the greater the stress, the more likely the muscles are to produce a synchronous twitching effect. At the same time, skin offers some resistance to current and voltage. At relaxed state they offer more resistance and at higher stress they offer less resistance. This resistance changes with the emotional state of the body. Thus determining the person's stress.

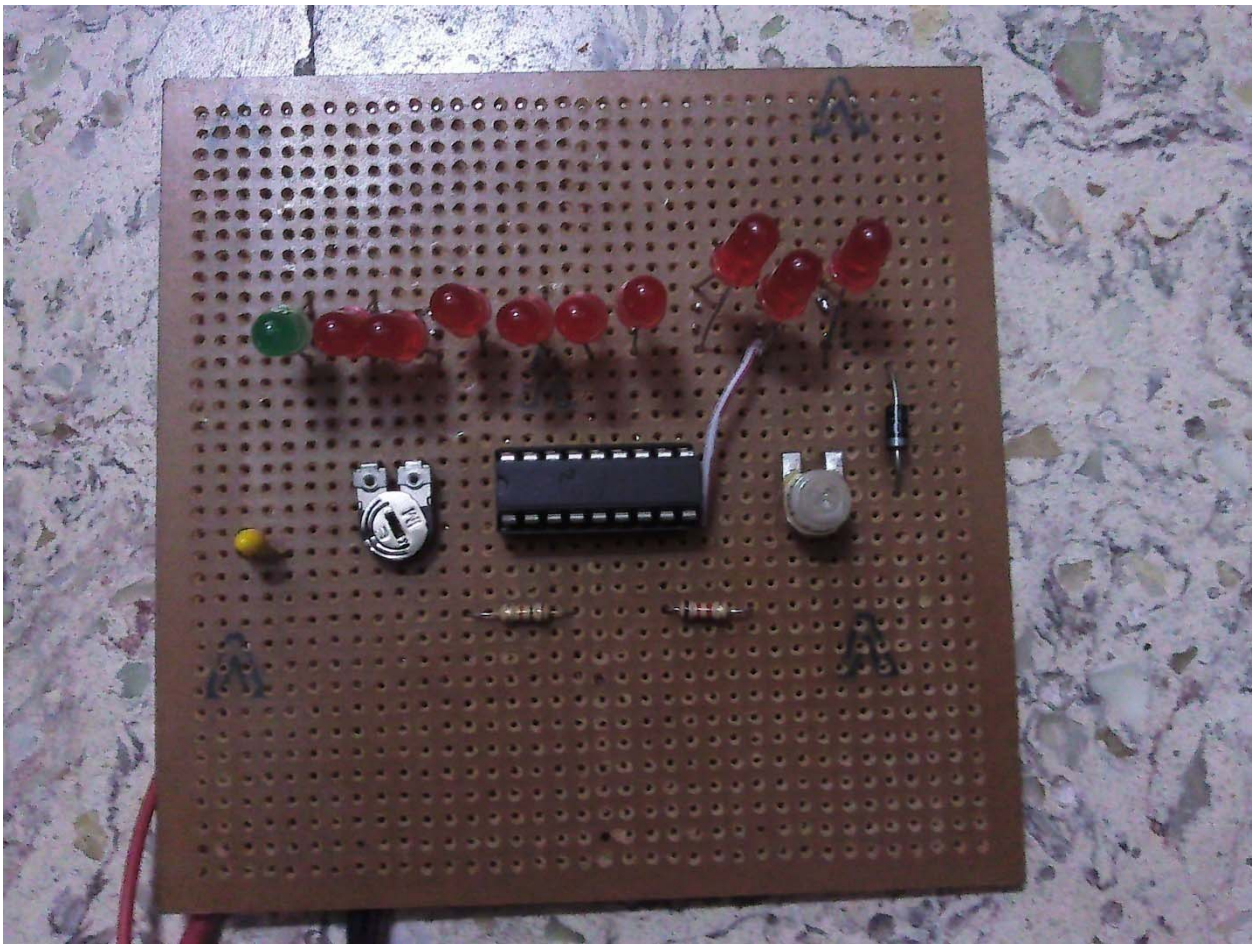


Fig.3.1Stress meter using skin resistance and muscle strength.

3.1.1PRINCIPLE:

Muscle tension changes with individual persons stress level – the greater the stress, the more likely the muscles are to produce a synchronous twitching effect. At the same time, skin offers some resistance to current and voltage. At relaxed state they offer more resistance and at higher stress they offer less resistance. This resistance changes with the emotional state of the body. Though this is barely perceptible, the electrodes register the change that is detected by LM3914 for which the LED dot oscillates up and down in this way the

stress meter detects the stress.

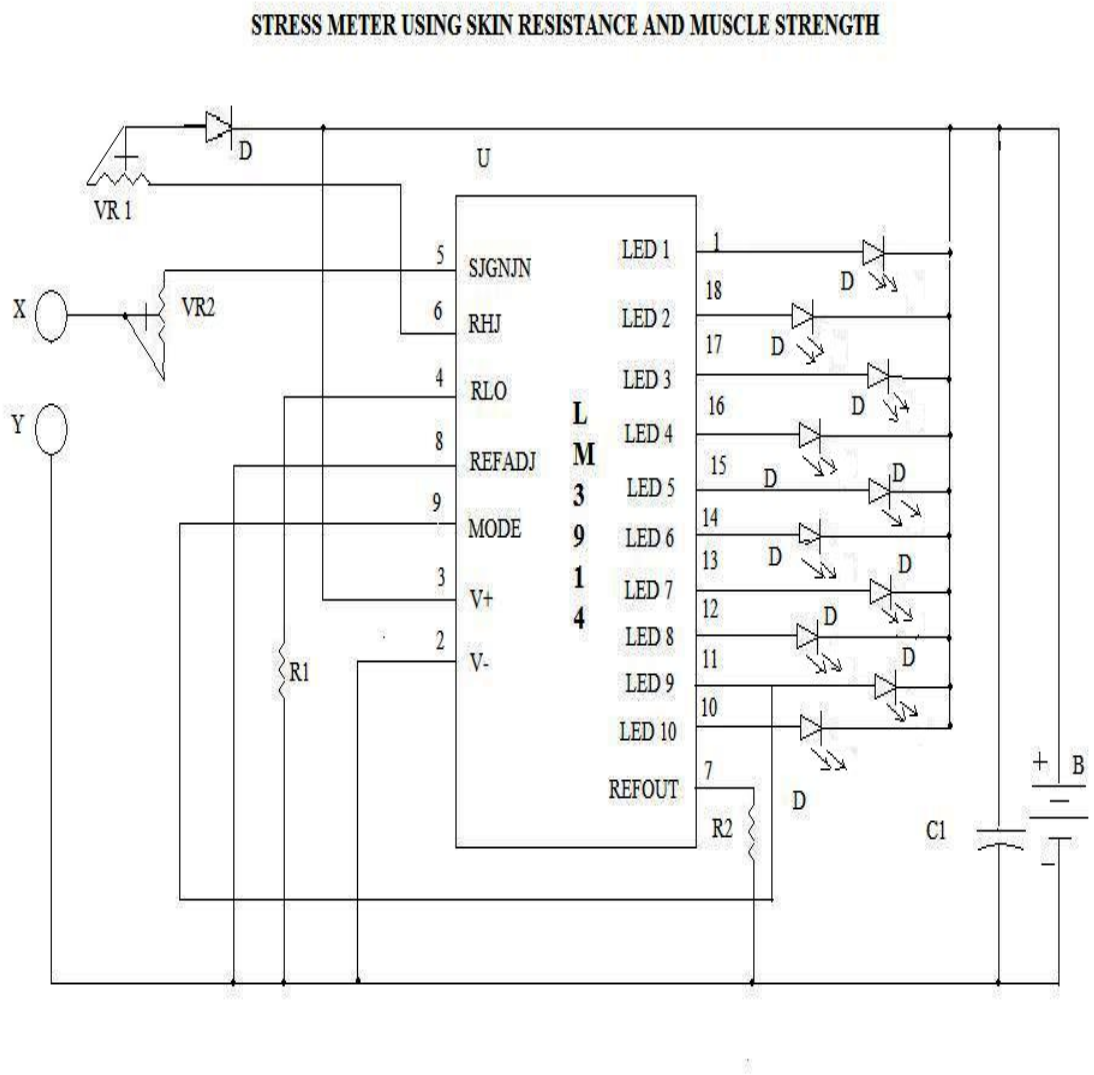


Fig.3.2.

3.1.2WORKING:

This circuit is useful to monitor the muscle strength and skin's response through relaxation techniques. It is very sensitive and shows response

during a sudden moment of stress. Even a deep sigh will give response in the circuit. The input power supply is a DC voltage source of 1.2V(B), that is connected in parallel with a capacitor of capacitance (C1)1uf that will provide a capacitance voltage of 10V whose positive end is grounded.

The negative end of C1 is connected to the diode IN4007(D) preventing high voltage through the IC LM3914(U). The resistors R2 and R1 are connected to the pins REFOUT and RLO accordingly to adjust the voltage throughout the IC. The potentiometer VR2 is connected through one of the probe (X)and it varies the input resistance based upon the muscle strength and skin resistance and it is connected to the pin5(SIGNJN), that provides load voltage to the IC for about 10-15V.

The potentiometer VR1 is connected to the positive terminal of the diode D, to change the resistance for variable voltage through the IC and the other end of the VR1 is connected to the IC LM3914 at RHJ. The LM3914 is a monolithic integrated circuit that senses analog voltage levels and drives 10 LEDs, providing a linear analog. A 1.2V full-scale meter requires only 1 resistor and a single 1.2V to 15V supply in addition to the 10 display LEDs from the range +V to -V. If the 1 resistor is a pot, it becomes the LED brightness control.

Current flows through the reference adjust pin when the reference amplifier is in the linear region, that is fed from one of the probes through muscle force on the probe(Y), hence when force is constant the current flows through REFADJ.

Pin 9, the Mode Select input controls bar or dot mode operation, where the LED dot oscillates up and down. As the LM3914 has a linear response, the stress that we apply on the probe leads the LEDs to glow accordingly from pin1 to pin10. Where the green LED isconnected to the pin1 and the rest of the LEDs in red.

4.APPLICATIONS:

The application of this project can be in various aspects, such as:

1. Person's muscle tension changes can be seen (with their stress level applied by the muscle).

2. The mental state of a person can be known (based upon the changes in skin resistance).

3. It can be used as a lie detector.

4. It can be used in physical fitness programs.

ADVANTAGES:

1. Simple circuitry.
2. Easy to use.
3. Easy to transport.
4. Less power consumption.
5. Desired output.

DISADVANTAGES:

1. Output is not measurable.
2. Output depends upon the grip of the person.

5.CONCLUSION:

In this project the stress of a person can be determined by sensing the skin resistance and muscle strength of that person. Two probes are used to sense the grip of that person. Skin resistance changes the emotional state of the body. The grip of the person that is applied on the probe leads the LEDs to glow accordingly from pin1to pin10 .Hence the stress levels of that person can be determined by the oscillations of the LED dot up and down. .It is a very simple process and can be used as a lie detector ,skin response meter etc.

6.FUTURE SCOPE:

Stress meter using skin resistance and muscle strength is a basic model to determine the stress of a person. This device can be further developed to design equipment like lie detectors; skin response meters; skin resistance meters; fitness meters; griposcopes etc. there fore this model, if further developed can be used in medical field, forensic department and it even helps in improving the body fitness .

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