

Cardiac Rehabilitation Gesture Gaming System

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ABSTRACT: Post cardiac treatments certain rehabilitation like respiratory therapy, physiological ailments are mandatory. System which focuses mainly on respiratory therapy using spirometric analysis is what this cardiac rehabilitation system emphasis on. Further as a enjoyable way of treatment airflow gesture gaming makes this system more advantageous. For a person who has already suffered a surgery a system which makes mind relaxed will always find its importance among communities .Gamification in rehabilitation will purposefully be an advantage for the physicians and the patients. Labview is also included as a way of integrated monitoring system controlled by myDAQ.

I. INTRODUCTION

Need for rehabilitation:

Current techno world needs a system that responds with accuracy, less time drag and efficiency. In medical world time delays would risk a patient's life after any sort of internal treatments. In the field of rehabilitation bringing back a patient to normalcy makes a difference in a individual's life. Cardiac rehabilitation is available to anyone who has had a heart attack, a coronary angioplasty, heart surgery, some people who have angina or heart failure and some people who have an ICD implanted. Cardiac rehabilitation programmes will help an individual to understand the condition, to recover post surgery, procedure or heart attack, make changes to your lifestyle that will help improve your heart health and reduce the risk of further heart problems.

II. EXISTING METHODS

Respirometer:

Innovative system to exercise respiration through inspiration. Specially designed with 3 stage chambers to provide more efficient exercise to patient at a step up basis.

PROPOSED METHOD:

An CRGGS is a device that encourages, through visual and or audio feedback, the performance of reproducible, sustained maximal inspiration. CRGGS is the treatment technique utilizing incentive spirometers. Bartlett et al developed an incentive spirometer that both provided visual feedback to the patient and recorded the number of successful breathing maneuvers. This unit, the Bartlett-Edwards incentive spirometer, remained the standard for many years, although it has since been replaced by less expensive, single-use units. Jenkins and Soutar reported a usage rate of 44% in hospitals in Which coronary artery bypass graft (CABG) surgery Was carried out in the United Kingdom. More recently, Wattie repeated this survey and found that the usage rate had increased to 71%, despite recent publications that have cast doubt on both the need for Incentive Spirometry in patients undergoing CABG surgery and the effectiveness of Incentive Spirometry in this population."The CGGS is designed to be utilized in the following settings: Critical care , Acute care inpatient Extended care and skilled nursing facility Home care The small size makes the described invention easy to utilize in any of these settings. A person could easily implement an effective CGGS in the comfort of their own home just as easily as if they were in a hospital or extended care facility.

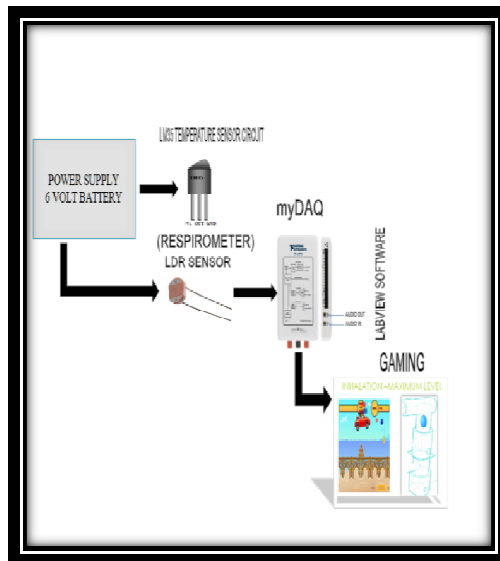
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III. PROJECT DESCRIPTION

BLOCK DIAGRAM :



TEMPERATURE SENSOR

LM35 sensor:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

RESPIROMETER SENSOR

LIGHT DEPENDENT RESISTOR:

A **Light Dependent Resistor** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices.

PRINCIPLE OF WORKING:

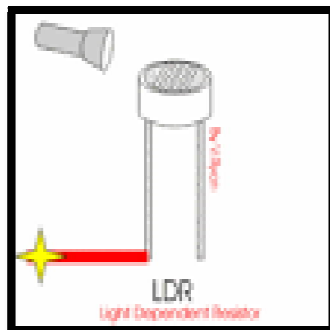
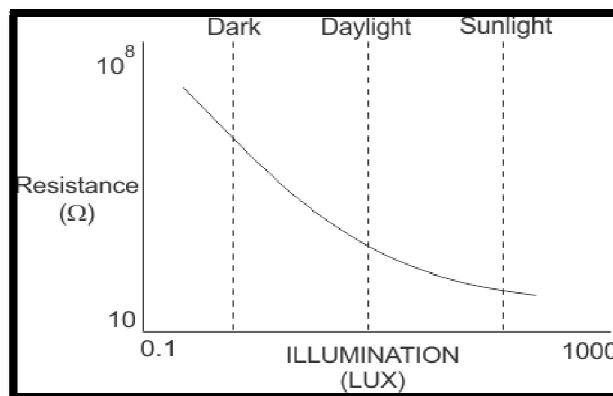


Fig 2.4

A **light dependent resistor** works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band.



Resistance Vs. Illumination Curve
Fig 2.5

RESPIROMETER DESIGN:

In advance to the existing system CRGG system employs a different way of respirometric approach. Normally the 3 chambered tubes are arranged in parallel. Here 3 chambers are arranged in a floor wise manner. Different coloured balls are placed inside the tubes which are of specific diameters. The inner diameter of the tube should be in precision with the ball size. The bottom of each chamber design is made in such a way that balls get lifted up as the air is sucked in through the mouth piece. This gives the overall design of a respirometer. This difference in design makes a change from the existing methods.

Specification:

The size of 3 balls is as follows

Blue-1.7cm

Yellow-2.1cm

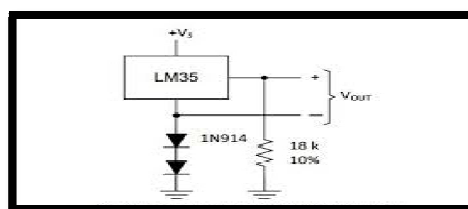
Red-2.3

sThe diameter of the tube is 2.5 cm.

The length of the tube is 12cm.

Respirometerworking:When normal inhalation is given to the input of the respirometer the position of the ball remains unchanged. This indicates that patient who is undergoing crggs rehabilitation process makes a normal breathing. Once the air is sucked in through the mouth piece there in the chamber vaccum is created and the ball raises up. When more pressure is given for sucking the air the second also starts raising. On increasing the pressure the third ball in the upper chamber also goes up where the air capacity in that chamber is 1600cc. The capacity of the second chamber is 1200cc and finally the first chamber has its capacity as 900cc.

Sensor circuitry:



TEMPERATURE SENSOR:

Fig 2.10

Lm35 temperature sensor has 3 pins. The required voltage for sensing the temperature for lm35 sensor is 5v. Therefore 7805 voltage regulator is connected to the lm35 sensor in order to maintain the input of lm35 sensor's voltage at 5v. In

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the above circuitry 9v voltage input is given and regulated using a 7805 regulator. The LM35 is a low voltage IC which uses approximately +5VDC of power. This is ideal because the voltage regulator gives out 5V of power. The IC has just 3 pins, 2 for the power supply and one for the analog output. The output pin provides an analog voltage output that is linearly proportional to the Celsius (centigrade) temperature. Pin 2 gives an output of 1 millivolt per 0.1°C (10mV per degree). So to get the degree value in Celsius, all that must be done is to take the voltage output and divide it by 10- this gives out the value degrees in Celsius. So, for example, if the output pin, pin 2, gives out a value of 315mV (0.315V), this is equivalent to a temperature of 31.5°C.

Respirometer circuitry:

LDR is connected to the resistor. Normally LDR detects the light from the light source. Here the resistance of the LDR changes when there is a change in the light falling on the LDR. This change in the resistance will be taken as the output. Here the ball that moves up due to air suction interrupts the light falling on the LDR. The bottom of the 3 chambers is where the sensor is placed. When the first ball is raised up the indication is taken to the controller. Similar to this the rest of the balls pass the control information to the controller. This gives a clear picture of the condition of the patient.

Simulated circuit :

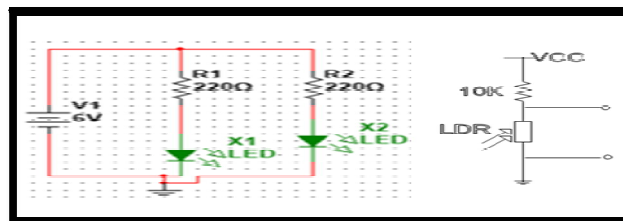


Fig 2.12

An LDR is made of a high-resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance. This sort of action takes place in the circuit.

IV. SOFTWARE IMPLEMENTATION

LAB VIEW: The output from the circuitry of the respirometer is given as the input to myDAQ. MyDAQ is a controller which is controlled using LabVIEW software. In LabVIEW software the control is given to the game. Patient on making use of this system gets a recreation.

GAMING: Game is designed using MIT SCRATCH application software. Snippet of the code for the game design is given below.

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when space key pressed
point towards Baseball
point in direction 90
play sound dog1
switch costume to dog1-b
glide 1 secs to x: 90 y: 100
point in direction 120
play sound dog1
glide 1 secs to x: 100 y: -145
switch costume to dog1-a
say Hello! for 2 secs
go to front
switch backdrop to next backdrop
    
```

Fig 4.2

Where as the air is sucked in a acceleration is given to the respective game control and the movement of the game is controlled. When the ball is in the rest position the car or dog in the game keeps moving. Once the ball goes up the object raises up and this process is repeated as the respirometer exercise is being done.

CONTROL 1:



Fig 4.4

CONTROL 2:

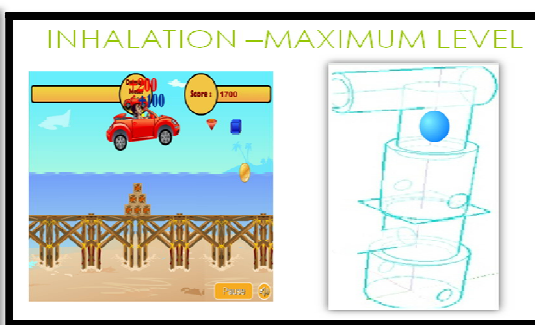


Fig 4.5

SOFTWARE RESULT(LABVIEW):

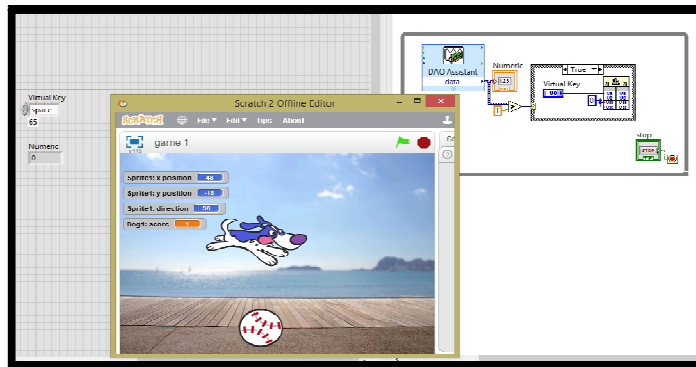


Fig 4.7

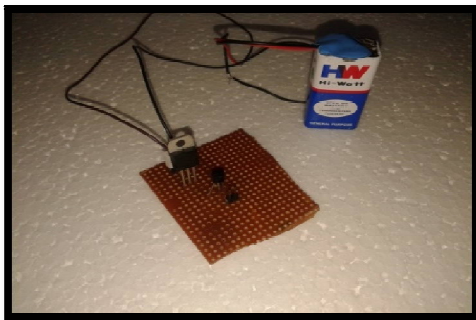
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V. HARDWARE RESULTS

TEMPERATURE UNIT: Spirometer:



VI. CONCLUSION

A personal computer utilized is where a proprietary program is run that produces a visual representation of a movable flying object, such as a spaceship, airplane, super hero, bird, balloon, or some other flying object, upon a moving background that is controlled by the inhaled or exhaled air flow of the user. With the objective being to inhale or exhale at a great enough rate to hold the flying object within a designated minimum and maximum to allow for accelerated rehabilitation of a user. The personal computer will also store user data and allow for a doctor to analyze the information to determine if any progress is being made, and allow for an updated or modified program parameters to be sent to the personal computer via a direct download through a CD (compact disk), DVD (Digital Video Disk), USB Thumb drive, or by a Wired or Wireless connection through the Internet or World Wide Web (WWW).

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