

FY-24

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Exerciser and Pulse Rate Monitor

Contributor: Donald F. Hanson
Affiliation: Dept. of Electrical Engineering
University of Mississippi
University, MS 38677
Telephone: (601) 232-5389
FAX: (601) 232-7231
e-mail: eehanson@sunset.backbone.olemiss.edu

Type: Design Problem
Student time: 8 weeks
Location: Take home

Summary

It is often necessary to monitor a person's pulse rate when they are doing exercise. In this project, it is necessary to do research into human factors. There are often Physical Education Departments on campus that could help an engineering student determine the range of safe pulse rates. This varies with age, weight, body fat, and fitness level. Another measure might be to see how long it takes for the pulse rate to return to normal after exercise, or if a safe rate is exceeded.

The design problem is to design an exerciser that has several different exercise rates associated with it and then design a means by which the exercise rate can be varied while the pulse rate is monitored. Age, weight, peak safe heart rate, and exercise or workout rate desired should be variables. It would be best if the students contacted representatives for commercial devices, so that they could see what is already on the market and their features.

ABET Descriptors

Engr. Sci. Content: First Year Engineering
Type: Process, component, system
Elements: Establish requirements
Features: Open-ended, creativity, design methodology
Constraints: Economics, time
Effort: Team

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This is to be a group project with three or four members in each group.

Problem Statement:

A need has been identified to monitor a person's pulse rate when they are doing exercise. In this project, it is necessary to do research into human factors. The Physical Education Department on campus may be willing to help you determine the range of safe pulse rates. This varies with age, weight, body fat, and fitness level. Other variables that you discover should be taken into account. For example, another measure might be how long it takes for the pulse rate to return to normal after exercise. If safe rates are exceeded, an alarm must sound to alert the person exercising that he or she is in danger.

Design an exerciser or system that has several different exercise rates associated with it and a means by which the exercise rate can be varied while the pulse rate is monitored. At a minimum, age, weight, peak safe heart rate, and exercise or workout rate desired should be variables. These variables should be mathematically related with at least a linear multi-regression. This exerciser could be a static device, a mechanical device, or an electrical device.

Research a means by which pulse rate can be monitored effectively. *Cardiac Monitors* are very common devices in the medical community. The **Thomas Register**, the **Official Gazette** of the US Patent Office, and other sources can be used in doing research. One related example is that the astronauts' exercise system measures CO₂ in the exhaled breath to get the exercise rate. After your preliminary research, determine the fundamental principles used in the cardiac or pulse rate monitors and brainstorm to see if you can come up with more ideas. After considering all the alternatives, choose the one that you think is the best and explain why. Justify your decision. Then hypothesize a means for designing your pulse rate monitor and go through the process on paper in your report.

Aesthetics and ergonomics should be considered in the design.

Evaluation criteria:

Completeness of research, originality of design, project report, oral report.

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Engineering Notes:

Objectives/comments:

Examples of a static device: just a step or a series of steps, etc.

Examples of mechanical devices: treadmills, bicycles, roller skates, etc.

Example of electrical device: monitor pulse rate and output a "go faster" or "go slower" indication

A trivial case of varying exercise rate is walking faster or slower or skating faster or slower.

The astronauts exercise system measures CO₂ in the exhale to set rate. Some students might investigate this.

The students could contact representatives for commercial devices, so that they could see what is already on the market and their features. The **Thomas Register** and the library are good sources. The 800 Yellow pages may also provide information.

One pulse rate monitor is: insta - pulse model 105 heart rate monitor

Biosig Instruments
Montreal, Canada H4A 3R1

The housing is design patent D254569: March 25, 1980 edition of the Official Gazette of the US Patent Office, vol. 992, number 4.