Project Design Specifications
#44- Step rate monitor for treadmill
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Function:
Our proposed design project is to create a device that will identify a runner's step rate as they are running on a treadmill. The step rate monitor will be mounted on the treadmill and a step will be identified from a biologically relevant signal. Step rate feedback will be provided to the patient and the clinician in real time to assist in the running analysis. An additional application for this device includes identification of the relative magnitude of the ground reaction forces. It is intended that this device will be used in clinical settings, such as the UW Runners' Clinic. Future adaptations of our design will allow for portability and versatility for implementation in other clinics.

Client Requirements:
- Real time identification of runner's step rate while running on a treadmill
- Quantify relative magnitude of ground reaction forces while running on treadmill
- Must not interfere with patient's running mechanics
- Securely mounted to treadmill
- Visually appealing
    - Device should be hidden from view on the internal structure of the treadmill
    - Simple, easily understood display of step rate
- User friendly software that can be used by multiple clinicians

Design Requirements:
1) Physical and Operational Characteristics
    a) *Performance requirements*
        i. Accurately measure step rate
        ii. Display real-time visual feedback
        iii. Easily operated by multiple clinicians
    b) *Safety*
        i. Non-distracting visual display
        ii. Components should not detract from the safety features of the treadmill
        iii. Device attachment should not comprise the durability of the treadmill
        iv. Should not interfere with patient's running mechanics
    c) *Accuracy and Reliability*
        i. Must accurately measure step rate within 2 steps
        ii. Accurately relate resultant vibration magnitudes in the treadmill to ground reaction forces
    d) *Life in Service*

i. Match or exceed the life of a treadmill
ii. 10 years

e) *Shelf Life*
i. Not applicable

f) *Operating Environment*
i. Clinical gait analysis setting
ii. Biomechanics research lab
ii. Dry environment

g) *Ergonomics*
i. Easily maintained
ii. Device must not interfere with runner
iii. Display must not interfere with safety of the runner or cause the runner to alter his/her mechanics to view

h) *Size*
i. Contained within treadmill cover
ii. 3 x 3 x 3 in

i) *Weight*
i. Testing must be performed to determine if weight will affect vibrations

j) *Materials*
i. Computer
ii. Display screen
iii. Treadmill
iv. Accelerometer
v. Power supply for accelerometer
vi. Data acquisition system

k) *Aesthetics*
i. Accelerometers hidden from view
ii. Visually pleasing display

2) Production Characteristics

a) *Quantity*
i. One complete system

b) *Target Product Cost*
i. $200

3) Miscellaneous

a) *Customer*
i. Runner's Clinics
ii. Home users
iii. Fitness centers

b) *Patient-related concerns*
i. Must not interfere with patients running mechanics

c) *Competition*
i. Pedometers
a) Garmin systems, Olympus

ii. Force-plate instrumented treadmill