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Measurement Technology

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Type: Design Problem
Student time: 3 weeks
Location: Take home

Summary

This is intended to be used in the first year engineering class as an introduction to design. Each student is to locate and investigate as many different length measurement technologies, such as rulers and tape measures, as they can find. They are to list the different technologies that they find and compare their usefulness and limitations in different situations. Recent electronic measures should not be overlooked. The primary purpose of this exercise is to see how linear or other measurements can be made and the different technologies that one finds in use.

The students must pick one measurement technology for design or re-design to measure the distance in kilometers between two cities. A *decimal* display meter must read the running distance in kilometers as the device is moved between the two cities. It is not necessary for the student to construct the device, but he/she should show their idea for designing such a device.

ABET Descriptors

Engr Sci Content: First Year Engineering
Type: Process, component
Elements: Evaluation of existing products, measurement design
Features: Problem formulation, open-ended, creativity, design methodology, alternatives
Constraints: Economics, time, size
Effort: Individual

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Measurement Technology

This is to be an individual project.

Problem Statement:

A. Market study: You are to locate and investigate as many different length measurement technologies, such as rulers and tape measures, as you can find. You are to list the different technologies that you find and compare the usefulness and limitations of each technology in different situations. For each technology found, keep a chart or spreadsheet of at least the following properties:

1. Photograph, xerox, or sketch of unit.
2. Catalog reference where unit is found or literature reference where application is made of unit.
3. Maximum carrying size of unit. (will it fit in a pocket or tool kit?)
4. Cost of unit.
5. Availability of unit.
6. Ease of use.
7. Maximum measurement length.
8. Accuracy.
9. Typical application or typical situation where the unit is used.
10. Constraints in application of unit, such as straight shot only, or circular measurements only.
11. Mechanical or electrical principles used for length measurement.

B. Design or re-design: Pick one researched measurement technology or design one of your own for *one* of the two following specific applications:

1) Measure the distance in kilometers between two cities on a map. For calibration purposes, the miles *(kilometers)* per inch *(centimeter)* scale off of the map must give the unit or device proper scale information.

2) Measure the driving distance in kilometers between two cities as you drive the route in your car. The unit or device must be calibrated to ensure that it reads properly before beginning the trip.

For your chosen case, a visual display meter must give the kilometer reading as the device is traces the route between two cities. It is not necessary for you to construct the device, but you must show your idea for designing such a device.

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Evaluation criteria:

Number of different technologies found, uniqueness and originality of design, written report.

Discussion/follow on activities:

Take measurements of a parking lot or baseball field using several different measurement technologies and compare the measurements by finding their mean and standard deviation.

How can other measurements be made; for instance, pressure, temperature, etc.

If the device is later constructed, different units can be compared to each other, or to a standard known length.

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Engineering notes:

This will be a good place to introduce spreadsheets and word processing.

Some electronic technologies are:

Infrared scanner with optical densitometer trace

Sonic with electronic integrations (summation)

Laser with prism like surveying

This might be a good place to introduce the students to the **Thomas Register**.