MEMS Applications Overview: Research Activity

Participant Guide

Description and Estimated Time to Complete

This provides you the opportunity to explore a specific application of MEMS. You may research one of the applications discussed in the Primary Knowledge unit (MEMS Applications Overview) or you may find another application or potential application for MEMS in an area of interest.

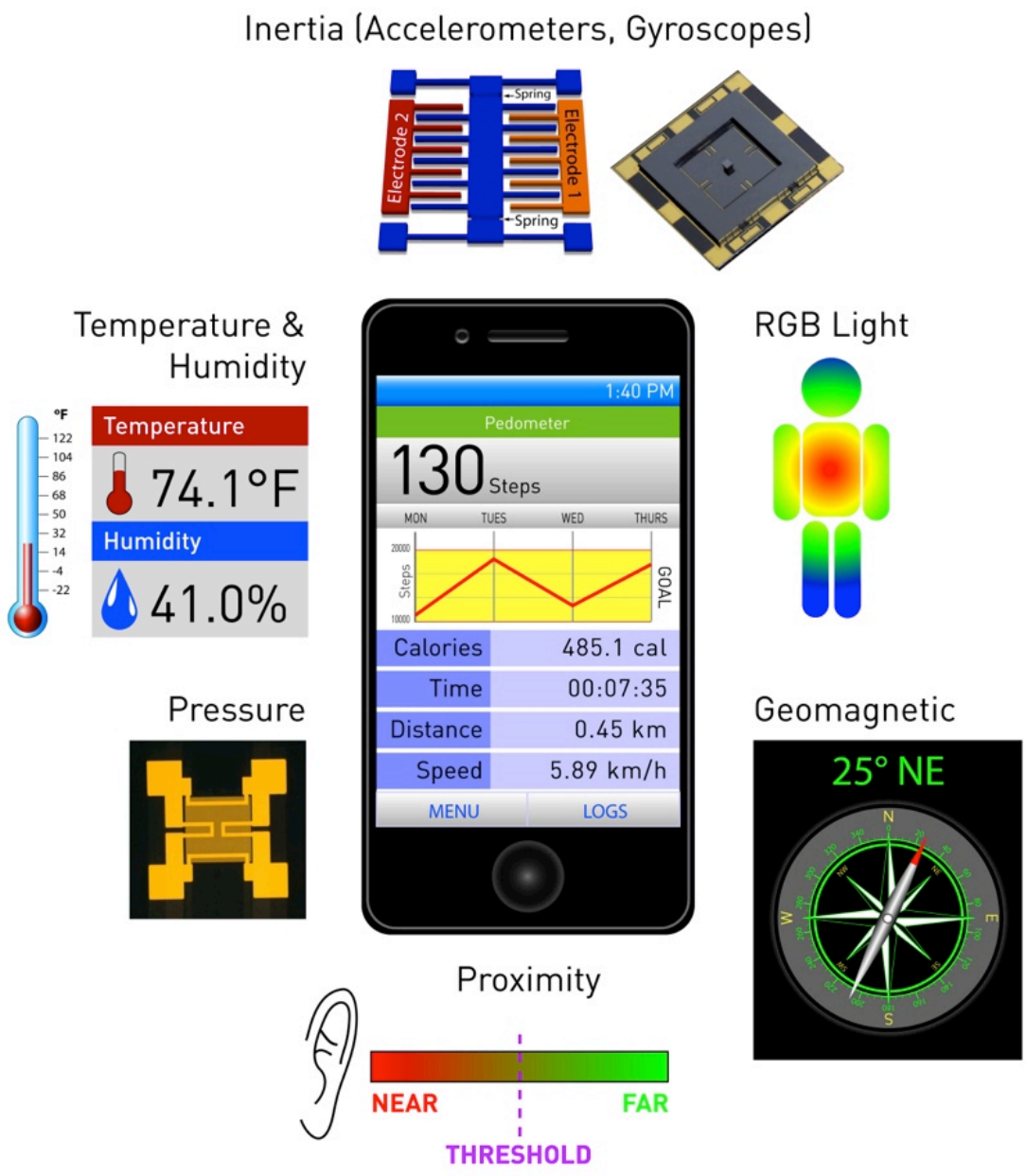
Estimated Time to Complete
Allow 4 hours for research and documentation

Introduction

Microelectromechanical systems (MEMS) are very small devices or groups of devices that can integrate both mechanical and electrical components. MEMS can be constructed on one chip that contains one or more micro-components and the electrical circuitry for inputs and outputs of the components. The components include different types of sensors, transducers, actuators, electronics and structures (e.g. gears, sliding mirrors, diaphragms). Each type of components is designed to interface with an input such as light, gas molecules, a specific type of radiation, pressure, temperature, or biomolecules.

Applications for MEMS are being realized every day. MEMS are built as submillimeter devices as needed for medical applications and in the millimeter range for miniature robots. A single MEMS can consist of a few components to millions of components ranging in size from the nanoscale to the milli-scale. One to 100 MEMS can be found in many devices. For example, today's cars have over 100 MEMS while the number of MEMS in smartphones is increasing every year. Because of this versatility, MEMS applications are practically unlimited. The following graphic illustrates MEMS found in most smartphones.

Smartphone and MEMS Sensors



Activity Objectives and Outcomes

Activity Objectives

- Describe the operation of a MEMS or MEMS device within a specific application.
- Discuss the effectiveness of the MEMS or MEMS device within this application as compared to previous methods.

Activity Outcomes

Upon completion of this activity you should have a more in-depth understanding of the working of a MEMS or MEMS device within a specific application.

Documentation

The documentation for this activity consists of a written report on the chosen MEMS application. The report must include, but is not limited to the following:

- A discussion of a specific MEMS application: General information on the application (who uses it and how), what type of MEMS device is used, how the MEMS device works and how the MEMS device works within the application.
- A discussion on the use of MEMS in this application compared to previous methods.
- Graphics (if available)
- References for information, materials, and graphics
- Answers to the Post-Activity Questions

Procedure: A MEMS Application

Description

Study a specific application for a MEMS or MEMS device and explore how the MEMS device is used in the application.

1. Choose a specific application for a MEMS or MEMS device in any field of interest. (To see examples of MEMS, review the Primary Knowledge unit for this activity or Google MEMS applications.)
2. Research your topic.
3. Complete the requirements of "Documentation". Your discussion should include the following (but is not limited to):
   - General information on the application (who uses it and how)
   - Type of MEMS or MEMS device used
   - How the MEMS device works
   - How the MEMS device works within the application
   - How the MEMS device compares to previous methods used in this application
4. Answer the Post- Activity Questions.

Post- Activity Questions / Answers

1. What, if any, are the limitations to using a MEMS or MEMS device in the application you researched?

2. In your chosen application, what are the advantages of using a MEMS device over previous methods?

3. Describe a potential or existing application of MEMS in agriculture.

4. What do you see as the limitations of MEMS and MEMS devices in replacing existing macroelectromechanical devices?

Support for this work was provided by the National Science Foundation's Advanced Technological Education (ATE) Program.