











LEWIS on the Train University of New Mexico SMILab, UNM SOE, Rail Runner











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Overview

Traditional education results in little hands-on learning in the real world, because it takes place within a secluded building. To mitigate this effect, education modules should incorporate research applicable STEM activities. Therefore, the pedagogy in these activities should utilize the students gross and fine motor skills. This will allow children to use a multitude of learning mechanisms. Although integration of complex STEM ideas can be difficult, a cost effective, simple device can make incorporating STEM in education attainable. One device that fits these parameters is the Low-cost Efficient Wireless Intelligent Sensor (LEWIS). LEWIS sensors do the same calculations as any other state-of-the-art sensor, but with a fraction of the cost. LEWIS sensors can be easily made and disposed of as needed, making them an excellent education option. This is vital as students tend to use their gross motor skills for destructive means. In this education module, we will be focusing on using a LEWIS-1 sensor in the state of New Mexico (NM). It is also particularly fitting since New Mexico notoriously struggles with academic excellence at the K-8 level (figure 1), and at the 9-12 level (figure 2) of education. While the LEWIS project is based out of University of New Mexico's Civil Engineering Lab in collaboration with SMI Labs, these modules are applicable to any school system that has the required prerequisites (materials, etc.).

Introduction

LEWIS sensors have a multitude of engineering applications, however, for this module, LEWIS-1 sensors will be used in a civil engineering setting. LEWIS-1 sensors calculate the acceleration of the X/Y/Z axes of any object over time. For example, a LEWIS-1 sensor could calculate the acceleration of an airplane's takeoff, ride, and landing. Although the applications of a LEWIS sensor are numerous, it is easiest to demonstrate LEWIS capabilities on a form of transportation like a train due to the abundance of transportation systems in the US. This module will help guide educators through the creation and use of a sensor while on a train.

Objective

Getting students interested in sensors/sensor technology by demonstrating potential applications of the technology in a fun and interactive way. Sensors can be lackluster, and so it is our objective to keep children engaged throughout the field trip. Ideally, students will see a broader view of STEM applications and pursue a career in STEM.







Activity Summary

Table 2. Activity chart

Location	RailRunner
Duration	1 day – 9:00-4:00
Number of students	10-25
Number of educators (UNM mentors,	5-10
volunteers)	
Stakeholders' involvement	Rail Runner
Preplanning required (Y/N)	Y

Timeline

Table 2. Schedule		
Task	Time	
Train Aboard	9:00 – 9:15	
Introduction to Smart Sensors/uses of		
sensors	9:15-9:30	
Building LEWIS sensor	9:30-11:30	
Lunch	11:30-12:30	
Talks about STEM careers	12:30-1:00	
Break/Games on the ride back	1:00-2:30	
Analyzing data	2:30-3:30	
Answering questions/closing remarks	3:30-4:00	

Procedure

First, students will be introduced to LEWIS1. They'll learn about the parts and how they work together. A live demonstration will be given where they'll get to see how movement affects the graph and test it for themselves. Mentors for this class should have a basic understanding of engineering and have attended a previous LEWIS training or be trained by someone who has. After being introduced to the equipment, the children will start to build the LEWIS's while they are taking the train with the instructions provided. Instructors will supervise to ensure that the students are fabricating the LEWIS's properly. After the LEWIS's are created, students will then graph the Rail-Runner ride using a LEWIS sensor and a Chromebook.

- Introduce LEWIS1 with demonstration
- Build LEWIS1 with groups
- Plotting data
- Regroup and analyze the graphs







Materials

- 4-5 hotspots
- 5-10 LEWIS 1 packets
- 5-10 Laptops with USB adapter
- Instructions for LEWIS fabrication and software installation
- Rail-Runner ticket for each student

Contact Information

If you are interested in one of the most diverse, collaborative, and inspiring programs to help build up the future of the young generation and encourage them to be engineers and railroaders of the future, please contact us!

Contact information:

Website: Tramway website: Mahsa Sanei: Fernando Moreu: SMILab: UNM School of Engineering: https://smartrailroads.org/ https://sandiapeak.com/ msanei@unm.edu fmoreu@unm.edu http://smilab.unm.edu/ https://engineering.unm.e









References



New Mexico Voices for Children. (2020, February 14). Retrieved August 5, 2022, from https://www.nmvoices.org/