CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

J1401

Project Title

Low Cost Animated Teaching Tool for Study of Elements of the Periodic Table with an Interface for the Visually Impaired

Abstract

Objectives/Goals

Understanding elements and their atomic structure is a very interesting and important study. But, the logic involved is not straightforward. My goal is to come up with a solution that can help in teaching these complex concepts with visual effects that are easy to absorb. My goal is also to help visually impaired by adding sound. Finally I want my solution to be portable, extensible and low-cost and accessible to students with limited access to expensive resources or the Internet.

Methods/Materials

Materials: Raspberry Pi/Arduino, 2 Breadboards, 6V DC Motor, 8 LEDs, 8 resistors, Braille stickers.
Programming: Elements, Exception Elements, Electron Configuration, Speech, Drawing the atom, Lighting up LEDs and beeping for valence electrons, Turning spinner/beeping for radioactive elements.
Lewis Dot Notation: LEDs arranged in Lewis Dot Notation circuit on breadboard. Geiger Counter Simulation: Motor Circuit to simulate radioactivity level.

Results

The filling order of electrons is 1s2 2s2 2p6..
* Example: Oxygen: Atomic Number 8. Electron config: 1s2 2s2 2p4 with 6 electrons in valence shell. Lewis Dot Notation circuit: 6 LEDs light up (s1, s2, p1-1, p2-1, p3-1, p1-2) with 6 beeps.
Exception Elements (20 in all):
* The tool mentions #Exception#, so the student is aware
* Example: Copper: Atomic Number 29. Based on the filling order, the configuration should be: 1s2 2s2 2p6 3s2 3p6 4s2 3d9. But in reality, an electron is transferred from 4s to the inner 3d, resulting in: 1s2 2s2 2p6 3s2 3p6 4s1 3d10. Lewis Dot Notation: The max of 8 valence electrons: s - 1st (s1), s - 2nd (s2), p1 - 3rd (p1-1), p2 - 4th (p2-1), p3 - 5th (p3-1), p1 - 6th (p1-2), p2 - 7th (p2-2), p3 - 8th (p2-3). Radioactivite Elements: The Geiger counter is simulated

Conclusions/Discussion

My tool best serves the goal as: 1. It has both visual/audio capabilities, making learning fun and effective. 2. It is low cost, compact and portable as it uses Raspberry Pi, and a few simple components, and addresses those who do not have access to expensive resources or Internet. 3. It helps the visually impaired by SHOWING them with words and sounds.
Also as it is a programming project: 1. It shows it is much easier than a non-programming model to teach complicated concepts. 2. It, but for the breadboards part, can be put in a website and accessed from anywhere and free of cost, if Internet is available.

Summary Statement

Low-cost Animated Teaching Tool for Study of Elements of the Periodic Table with an Interface for the Visually Impaired

Help Received

Perkins.org and Kentucky school of the blind for feedback. My grandfather, Professor P S Sarma for teaching electronic circuits. School Science teacher, Mr Scharmen. Donumvisi.org for teaching me to help the blind. My weekly science and programming classes. Rishabh Bhasin for teaching Arduino.