FOSSEE Summer Fellowship Report

On

Creating Spoken Tutorials for PhET Simulations

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Acknowledgment

I would like to express immense happiness and gratitude for being part of this Fellowship presented by the FOSSEE Team, IIT BOMBAY. It was a great journey exploring new possibilities, knowledge and its practical uses. Being guided by some of the experts of the
country, I was given a great chance at acquiring new skills and further improvement.

I would like to thank Ms. Madhuri Ganapathi, Dr. Snehalatha Kaliappan Ms.Vineeta Ghavri, Ms.Rashmi Patankar for their support and guidance given throughout this internship. They helped me learn a lot of new concepts and improve professionally. The patience they showed while guiding me through this whole endeavor is truly exemplary.I would also like to express my profound gratitude to Prof. Kannan M Moudgalya for providing me with this opportunity.

I am forever grateful for this opportunity that has marked a milestone in my skill and career development and going forward will strive to learn more to make the best use of these skills throughout my life. I sincerely hope to work with FOSSEE and Spoken tutorial team again in the future.

Contents

Chapter 1

Overview

Spoken Tutorial and FOSSEE (Free/Libre and Open Source Software for Education) project at Indian Institute of Technology Bombay. They aim to promote the use of open source tools throughout India and reduce the use of proprietary software.

During the time of this internship we were tasked with creating Spoken tutorials for PhET for mathematics, chemistry and physics. I was able to contribute 5 tutorials to the chemistry PhET series.

In these, I performed various roles like exploring the PhET simulations, writing scripts and preparing slides, novice review, recording, etc for various spoken tutorials. The report talks about my work in detail.

Chapter 2

Spoken Tutorial

2.1 Spoken Tutorial Project

Spoken Tutorial is a multi-award winning educational content portal. It provides various resources on free and open source software so that anyone can learn them irrespective of place or time in a language of the learner's choosing. These courses range from Beginner to Advanced from which a learner can choose according to their knowledge or expertise. The content includes side by side practice which ensures the active participation of the learner.The Spoken Tutorial project is funded by the National Mission on Education through Information and Communication Technology (ICT), launched by the Ministry of Human Resources and Development, Government of India. In this day and age of digital learning, initiatives like the Spoken Tutorial Project are of vital importance.

2.1.1 Process of creating a Spoken tutorial

- Outline:
  An outline for the topic is created to help us get a basic understanding of the subject and to give some idea about the structure and sequence of the overall tutorial.

- Script:
  A script is the written form of the spoken tutorial. Each sentence said during the recording is according to the script. This is made according to the guidelines by the ST team. For a good spoken tutorial, the script needs to be clear and simple.

- Slides:
  Slides are made to help explain certain topics in the script. They are made corresponding to the script. LaTeX beamer environment is used to create the slides. For a specific FOSS, templates are used to make the slides. These slides should follow the guidelines given by the ST steam.

- Novice check:
  Novice check is done by a person who has very little knowledge about the ST

to make sure that the script and slides are easy to understand. The novice also points out mistakes made in the script and slides.

- Recording:
  The narrated video is made according to the guidelines. Extra care is taken to minimize mistakes and ensure the proper quality of recording.

- Review:
  After the above steps, the all related files are sent to the reviewer who verifies that the recording and files are done according to the spoken tutorial guidelines and checklist. This is to ensure a good quality of the content being uploaded. Once all issues are addressed, the reviewer publishes the tutorial on the spoken-tutorial website.

Chapter 3

PhET Simulations

3.1 PhET Simulations Project

The Physics Education Technology is a project at the `University of Colorado, Boulder` started in 2002. PhET simulations are interactive simulations covering topics in physics, chemistry, math, biology, environmental sciences etc., for elementary, middle and High School levels. The simulation makes the students understand the concept and explore the topic. PhET simulations provide fun, interactive research-based simulations for use in K-12 and college STEM education. To help students visually comprehend concepts, PhET simulations animate what is invisible to the eye through the use of graphics and intuitive controls such as click-and-drag manipulations, sliders and radio buttons. All of the simulations are extensively tested and evaluated. All of the simulations are freely available from the PhET website `https://phet.colorado.edu/` and are easy to use and incorporate into the classroom.

3.2 PhET Simulations for Chemistry

All of my contribution were to the Chemistry PhET series. The PhET simulation for chemistry aim at simplifying the complex topics through an interesting and animated interface. These animations include a lot of special tools and instruments such as including rulers, beakers, droppers, stop watches, voltmeters, and thermometers.

Chapter 4

Contributions

4.1 Creating Spoken tutorial for Chemistry PhET Series

In the Chemistry PhETs, I have worked on 5 tutorials:

- Salts and Solubility
- Sugar and Salt solutions
- Conductivity
- Diffusion
- Semiconductors

4.1.1 Salts and Solubility

To make the tutorial, I first explored the simulation. It is a Java simulation. It has one screen with three different tabs- Table Salt, Slightly Soluble Salts, and Design a Salt. We can choose anions and cations of different elements that make salts. Then we can choose their amount to add to water. The simulation displays the ions being dissolved and stops dissolving them at the saturation point.
The script is contributed by Dr. Snehalatha Kaliappan and slides for this tutorial are done by me. I have also done the recording for this tutorial which was then edited by the ST editing team. The tutorial is now ready for uploading on the ST website.

4.1.2 Sugar and Salt solutions

Sugar and salt solutions simulation is a Java based simulation. It has one screen with three different tabs- Macro, Micro and Water. It visualizes how ionic and covalent compounds dissolve in water. The simulation has tools such as shakers, faucets, evaporation box and concentration box. There is also a circuit with a bulb to check the conductivity of the solution.

I have made the script and slides for this tutorial after going through the simulation. I have also done the recording for this tutorial.

4.1.3 Conductivity

This simulation only has one screen and runs on Java. The interface has an electrical circuit and we can choose from three different materials- Metal, Plastic and Photoconductor to connect the circuit. It displays the energy level distribution for all of materials.
I have made the script and slides for this tutorial.

4.1.4 Diffusion

This simulation is HTML based simulation. It explains how two gases mix with each other and the factors that affect this diffusion. On the interface, we can select the number of particles, their mass, radius and initial temperature for both gases. There is a scale, stopwatch, center of mass and particle flow rate tools. We can view the diffusion in slow motion as well.
I have made the script and slides for this tutorial. I have also done the recording for this tutorial.

4.1.5 Semiconductors

The simulation runs on Java and it shows how the electron population created by doping results in the physical properties of different semiconductor devices. It has one screen with a circuit connected to p-type and n-type dopants. There is also an energy diagrams to display energy levels for both the dopants.
I have made the script and slides for this tutorial.

Chapter 5

Novice Check

Following novice checks were performed by me:

- Number Line: Operations
- Building Molecules and Molecule Shapes
- Concentration and Molarity
- Graphing Quadratics
- Geometric optics

Chapter 6

Professional outcomes

Professional skills developed during this internship are:

- Creating work reports and presentations
- Time management
- Workplace communication skills

Chapter 7

Challenges

Challenges that I faced during the fellowship:

- Following guidelines while making script and slides
- Deciding the flow and outline of the tutorial
- Understanding semiconductors concepts
- Pronunciation mistakes while recording the tutorial
- Time management

Chapter 8

Conclusion

In conclusion, I got the opportunity to work on 5 tutorials in PhET series in the FOSSEE Summer Fellowship 2022. Each of these tutorials imparted various new skills and concepts which I am sure would be of use in my professional career. I got a chance to learn about some new prospects of the open source software.

I feel a sense of happiness knowing that the work I've put into this fellowship would be of use to thousands of people via the Spoken Tutorial Website. I would like to thank all mentors and my fellow interns who turned this fellowship into such a wondrous experience.

Chapter 9

Useful Links

9.1 PhET Simulations for Chemistry

Salts and Solubility :
https://drive.google.com/drive/u/0/folders/1_K_L9H_U2sTLVKval5XeR0Junofy2mF-
Sugar and Salt solutions :
https://drive.google.com/drive/u/0/folders/1_K_L9H_U2sTLVKval5XeR0Junofy2mF-
Conductivity :
https://drive.google.com/drive/u/0/folders/1j3ORpx-OMm0FzZ_syLokFxL4sU15U4tb
Diffusion :
https://drive.google.com/drive/u/0/folders/1du0v2eo8_17Ted_Gb4KphEXTMOOCrkn5
Semiconductors :
https://drive.google.com/drive/u/0/folders/1zbyKTwZrV-I6E46Zjujd-IhGnkV5xUQg

9.2 Recordings

https://drive.google.com/drive/u/1/folders/1Is_ef0E1kxNj7v8IjS9BLrkGbsh6_
mll

9.3 Reference

- https://spoken-tutorial.org/about-us/
- https://spoken-tutorial.org/
- https://phet.colorado.edu/