Requirements for Grades 6-8 Project Submission

PART 1 SLIDES

Summary

Your project will contain the following:

- Maximum of 12 8.5x11 slides (plus possible appendix slides noted below) in PDF Form. No images of trifold boards.
- A separate one page Quad chart in PDF form (details below).

Optional: A maximum 2 minute video but only if you need to demonstrate a moving object in your project.

You may prepare your Project Presentation using any software tools that you desire, but the final document submitted for display to the judges and the public must satisfy the following requirements.

1. Project Slides Format Requirements

1. Your project must be a single PDF document. (Quad chart is a separate pdf document. See part 2)
2. You must use a page size no larger than 8½"X11"
3. The Project Presentation must be a **single PDF** document limited to **no more than 12 pages plus a possible safety slide.** Your PDF document must be without animation or active hyperlinks. The document must not have instructions to open in "full screen mode." Eliminating this mode automatically precludes page transitions and embedded videos or animations, so do not attempt to include these in your presentation. (There is provision below in your submission for an optional video if you need something to move in order to illustrate your project.)
4. The page background color must be a light color and not affect readability. Text color must be predominantly dark to support readability.
5. The smallest allowable font size of body text is 14 pt. and an 18 pt. font is recommended. *Exception:* You may use a smaller font size, down to 10 pt., for figure captions or photo credits.

2. Format Guidelines:

1. Do not use non-standard fonts or colors to "stand out from the crowd" or to be entertaining. Use Arial, Calibri, Helvetica or Century Gothic. If you cannot use these fonts, please contact us at scifairdir@plu.edu. All body text should adopt a common font style and size. Similarly, all heading text should adopt a common font style and size.
2. Avoid long expository paragraphs and sentences. State your points succinctly.
3. Use bullets to set out individual points of interest.

Project (Science or Engineering)

These slides are required. The additional 5 slides are up to the student.

1. **Project ID and Title**
    a. The following should be included:
        i. Project ID. This ID will be provided by South Sound.
        ii. Project Title
        iii. Finalist Name(s)
        iv. School(s)
2. **INTRODUCTION - What is your research question? What problem are you trying to solve?**
    a. Explain what is known or has already been done in your research area.
    b. What were you trying to find out? Include a description of your purpose, your research question, and/or your hypothesis.

3. **METHODS - Explain your methodology and procedures for carrying out your project in detail.**
    a. What did you do? What data did you collect and how did you collect that data? Discuss your control group and the variables you tested.
    b. DO NOT include a list of materials.
    c. If there is a physical prototype, you may want to include pictures or designs of the prototype.
    d. If you tested the prototype, what were your testing procedures? What data did you collect and how did you collect that data?
    e. Did you do a redesign of a prototype after first testing it?

4. **RESULTS - What were the result(s) of your project?**
    a. Include tables and figures which illustrate your data.
    b. Include relevant statistical analysis of the data.
    c. If you tested the prototype, provide a summary of testing data tables and figures that illustrate your results.

5. **DISCUSSION - What is your interpretation of these results?**
    a. What do these results mean?
    b. Discuss possible errors. Did any questions or problems arise that you were not expecting? How were results affected by uncontrolled events?

6. **CONCLUSIONS - What conclusions did you reach?**
    a. What do these results mean in the context of the literature review and other work being done in your research area?
    b. What application(s) do you see for your work?

7. **SAFETY – Does your project involve safety issues?**
    a. If so, please tell us what they are and what you did to avoid problems.
    b. If you do not have room in your 12 slides, you may put safety on an additional slide.

8. **REFERENCES**
    This section should not exceed one page. Limit your list to the most important references.

JOURNALS - Please see journal submission requirements.

Follow the Journal button at the bottom of our website home page.
https://www.plu.edu/scifair/

PART 2 QUAD CHART

QUAD Chart 6-8

Your QUAD chart is a summary of your project. Before reviewing detailed slides the QUAD chart allows judges and others to quickly see a summary of your project. A "quad chart" is a single page divided into four quadrants providing a high-level summary of the project. It is intended to be more visual than detailed to quickly introduce your judges to what is important about your project. Follow the model below that corresponds to the Project Presentation template you selected.

1. In order to provide sufficient space, please use 8½"X11" and arranged in Landscape orientation.
2. The page background color must be a light color and text color must be predominantly dark to support readability.
3. The minimum allowable font size is 13 pt. *Exception*: You may use a smaller font size, down to 9 pt., for figure captions or photo credits.
4. All four quadrants of your Quad Chart should each be the same size with a single border line delimiting each, as in the examples below. The Title section should be only as tall as necessary to include your project title and other identifying information (see section on Quad Chart Title).
5. The Quad Chart should not include a bibliography, references, or acknowledgments.

Quad Chart Title:

- In the upper right-hand corner, list the Project ID (You will receive this after registering.)
- Line one is the title of your project

Quadrant 1: Research Question/Engineering Objectives

- This should reflect material in #2 of the Slide Requirements.
- Please state the research question or engineering problem being addressed
- A leading core graphic or visual is encouraged, but not required.

Quadrant 2: Methodology/Project Design

- This should reflect material in #3 of the Slide Requirements.
- Please provide a succinct, bulleted summary of the methodology/project design

Quadrant 3: Data Analysis & Results

- This should reflect material in #4 and 5 of the Slide Requirements.
- It is advised that this quadrant should primarily be a graphic representation of relevant data and results.
- Text should be kept to a minimum.

Quadrant 4: Interpretation & Conclusions

- This should reflect material in #5 and # 6 of the Slide Requirements

Science Project Quad Chart

Q1: Research Question	Q3: Data Analysis & Results
Q2: Methodology	Q4: Interpretation & Conclusions

Engineering Project Quad Chart

Q1: Engineering Problem & Objectives	Q3: Data Analysis & Results
Q2: Project Design	Q4: Interpretation & Conclusions

Example Below

11-23-2021

Project ID: ROBO057

Phytoplankton detection using machine learning and a mobile application

Q1: Problem

Plankton are the world's largest oxygen producers and first level of all marine food chains, making quantification a measurement for Earth's health. Currently, manual microscopic plankton analysis is a laborious process, but with the rise of artificial intelligence and its implementations in the past decade, automated data collection for plankton has been attempted.

This study set out to create a neural network, programmed in Python, to identify phytoplankton on the characteristics of shape.

Q2: Framework

Plankton collection required to create the dataset.

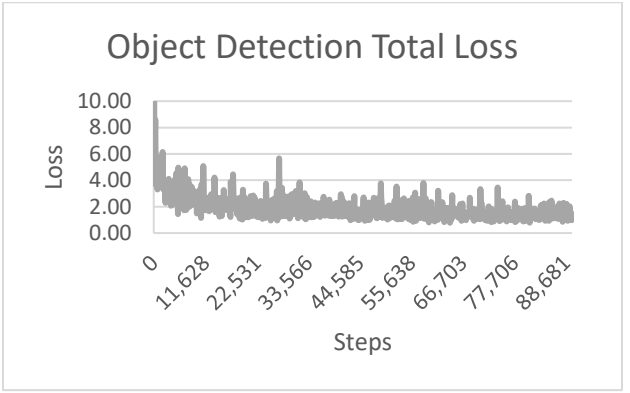
Data augmentation was used to increase the dataset by a factor of 3.

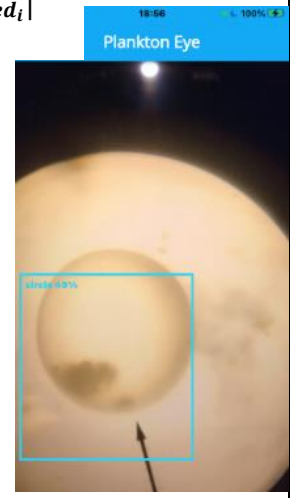
Two models were developed: image classification and object detection.

```
model = Sequential()

model.add(Conv2D(8, (3,3), input_shape = X.shape[1:]))
model.add(Activation("relu"))
model.add(MaxPooling2D(pool_size = (2,2)))

model.add(Conv2D(16, (3,3)))
model.add(Activation("relu"))
model.add(MaxPooling2D(pool_size = (2,2)))

model.add(Conv2D(32, (3,3)))
model.add(Activation("relu"))
model.add(MaxPooling2D(pool_size = (2,2)))

model.add(Dropout(.2))
model.add(Flatten())
model.add(Dense(32))
model.add(Activation("relu"))

model.add(Dense(3))
model.add(Activation('sigmoid'))
```

Q3: Findings

$$Loss = \sum_{i=1}^{n} |y_{actual_i} - y_{predicted_i}|$$





Q4: Interpretations and Conclusions

The machine learning model worked as expected, producing the correct outputs for each shape. Object detection proved to be a more valuable format as having multiple plankton in the frame is quite common allowing for more than one output.

There were limitations caused by the size of the dataset/training data, reduction of image pixel ratio, and training hardware.

Continued research could include expanding the dataset to train a higher caliber model, species-specific classification, and developing an automated quantification feature for the application.

11-23-2021