Next Gen Snowflake Camera and SSS

Team Members: Lindsay Carver, Giuliana Seretti, and Will Vikse
Project Advisor: Branislav Notaros

Introduction:

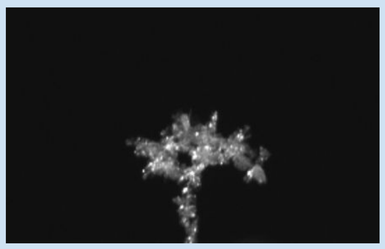
The Snowflake Sensing System (SSS) has been a continuous senior design project, this year being its 6th. The SSS has come a long way since its first year, it now has the capability to take three dimensional images of snowflakes with more than one method. It also is capable of measuring the speed at which the snowflakes fall, which is critical for determining snow storm severity.

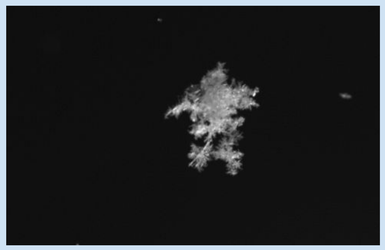
Importance:

With the data produced from the SSS, weather forecasters can better determine what type of snowfall to expect. Being able to classify images through machine learning will produce immediate results of the snowflakes. By classifying the storm we can obtain more accurate information about the severity, leading to increased safety of citizens.

SSS and Monitor System Mounted on Transportation Cart

Snowflake Images Captured by the SSS





Previous Teams Work:

Over the past 6 years teams have been able to produce a mobile snowflake camera capable of take a 3D image of snowflakes and the fall speed using two different methods. Since the first team there have been many additions over the years. For example, new hardware components, SSS hood design, and an easier way for transporting and deploying the SSS.

Fall Semester:

In order to compare and verify the data produced and the methods used to create the data a commercial used version of the SSS was introduced. A Multi-Angle System Camera (MASC) from a previous research project was used to compare/verify the SSS's results. Most of the semester was used getting the MASC running again in order for it to be shipped out to a NASA center in Virginia.

Spring Semester:

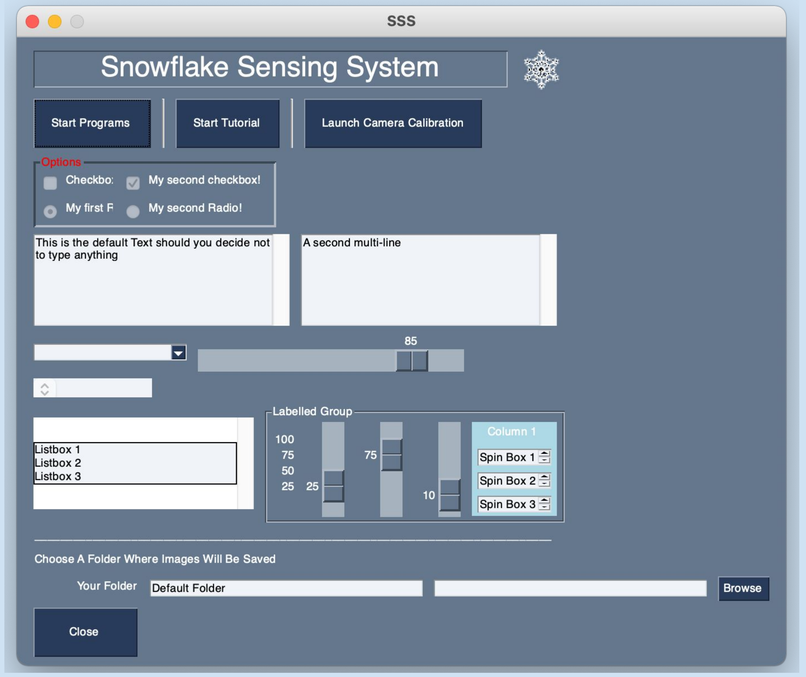
Going into the spring semester our task initially was to start up the SSS and take some snowflake pictures. Next was to implement the strobe speed method for taking pictures and ensure that it was working correctly. The code for the strobe method needed to be transferred over to the SSS computer and tested. After testing strobe and confirming that it worked properly next steps were to analyze and improve the strobe method code.

Completed Tasks:

- Research MASC commercial instrument
- Attend and contribute to meetings with Dr. Huang to explore MASC and the physics of snowfall
- Diagnose and solve software and hardware concerns with MASC
- Learn the ins and outs of the SSS
- Debug connection concerns with USB cables to Cameras
- Update software (programs, IDEs, Operating System, Drivers)
- Re-mount laser component for more accurate projection
- Test the SSS in real storms and ensure reliability
- Put previous fall speed and machine learning code into effect on the SSS itself
- Debug code related to fall speed, SSS operation, and snowflake classification
- Design and implement a Graphical User Interface

Graphical User Interface (GUI):

This semester we started the implementation of a GUI to ensure operating the SSS was more user friendly. The GUI was created using Python and the PySimpleGui package. The most important functions are completed within the GUI. The image below shows the current status of the GUI, with additional options available for future implementations.



Current SSS GUI

Future Work:

After the snowflake pictures are stored in a folder they need to be sorted into snowflake shape categories. This can be done with a machine learning model, able to recognize and classify what certain snowflake shapes are and then put them in their respective folders. This can be done using Jupyter notebooks with some Python code.

Once the above is completed, the GUI can be updated as needed to add more options and improve the user friendliness.

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