Natural Disaster Early Warning System

SENG 1210 - Programming For Engineers 2

By Group 3: Luka Aitken, Toma Aitken, Braden Wielgoz

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Introduction

- Natural disasters kill an average of over 60k people per year.
- When disasters hit, there is little to no time to prepare.
- After the disaster, many people:
  - Lose their homes.
  - Require food, water & medical supplies.
  - Lost loved ones.

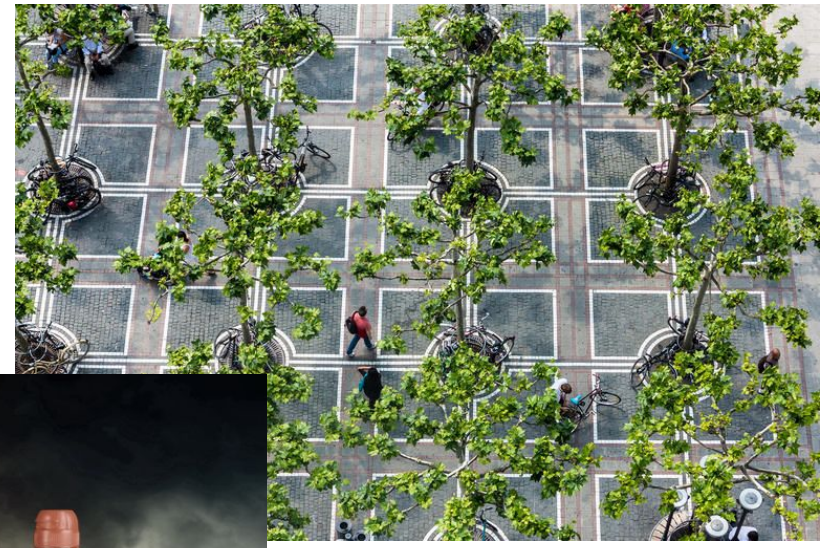
Problem Definition

Every year thousands of people die from natural disasters and even more experiences losses of their home and are forced to evacuate.

What we seek to do with this project is make a system to warn people of natural disasters so that they can use this advanced warning to save both lives and property.

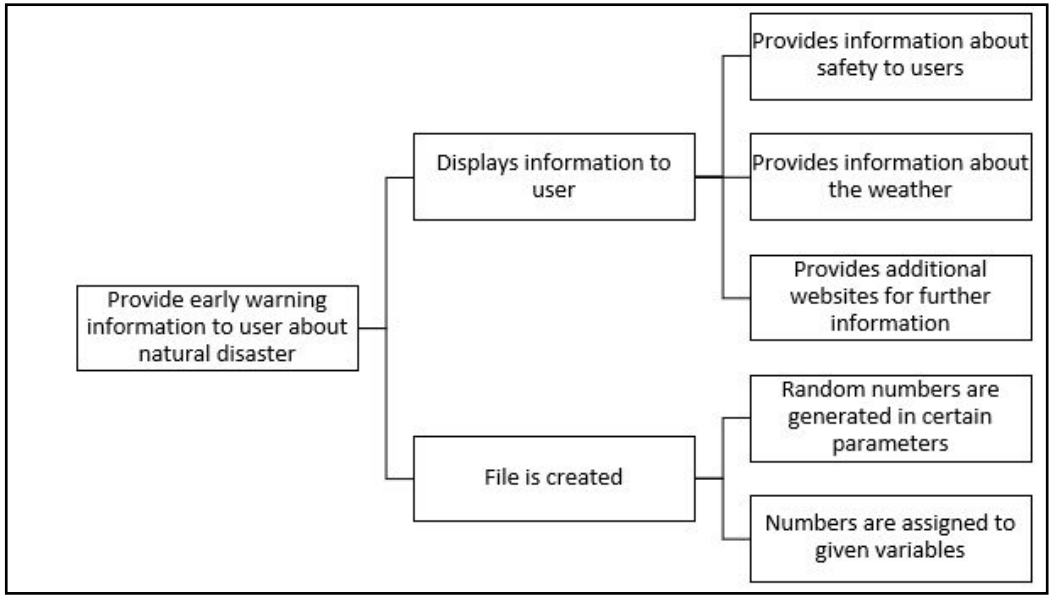
Functions

- Provide timely & meaningful information to:
  - People who are at risk.
  - Help save people:
    - Lives.
    - Jobs.
    - Land.
    - Infrastructures.



Functions CON'T

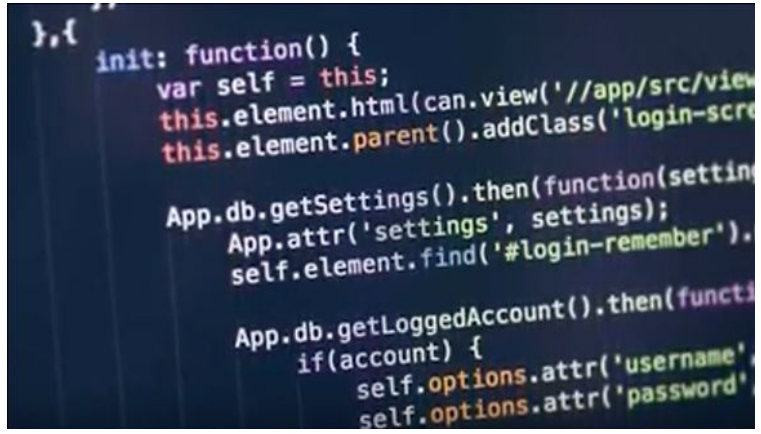
- Function Tree & Importance Chart of our EWS.



Safe	8
Reliability	8
Performance	6
Simplicity and Maintenance	7
Easy to control	7
Easy to access	6
Low maintenance cost	7
Low manufacturing cost	7

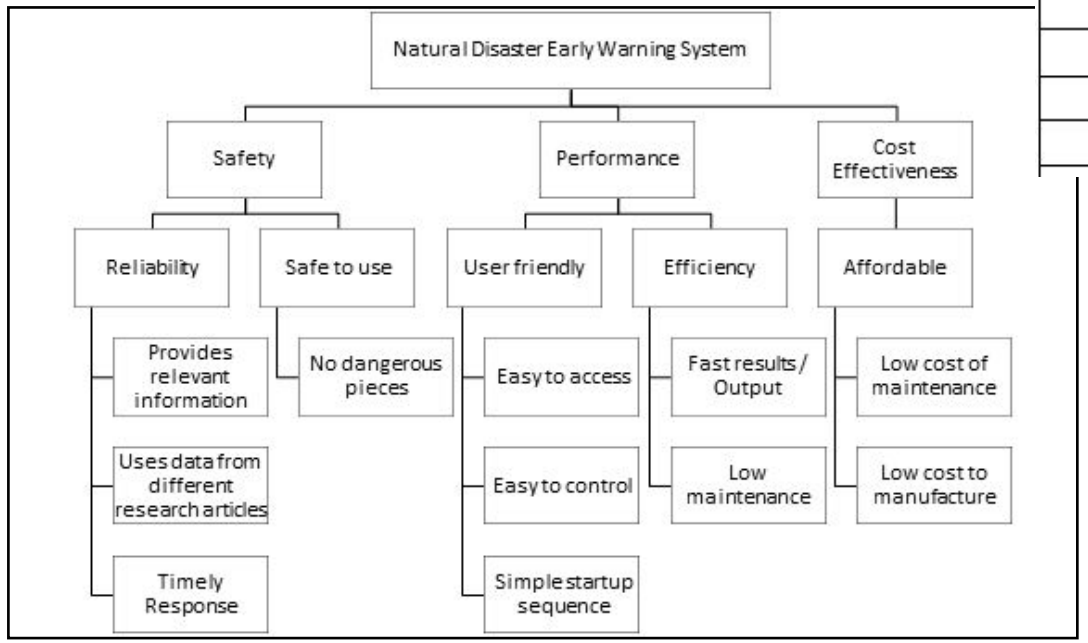
Objectives

- Create a Program that acts as an Early Warning System.
- Display relevant data in a timely response.
- Easy to:
  - Access.
  - Control.
  - Manufacture.
  - Repair.



Objectives CON'T

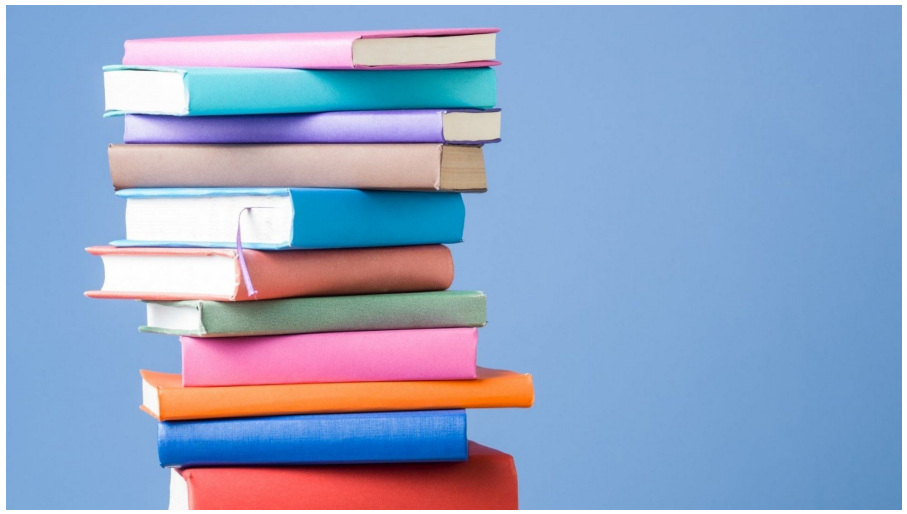
- Objective Tree & Requirement Table of our EWS.

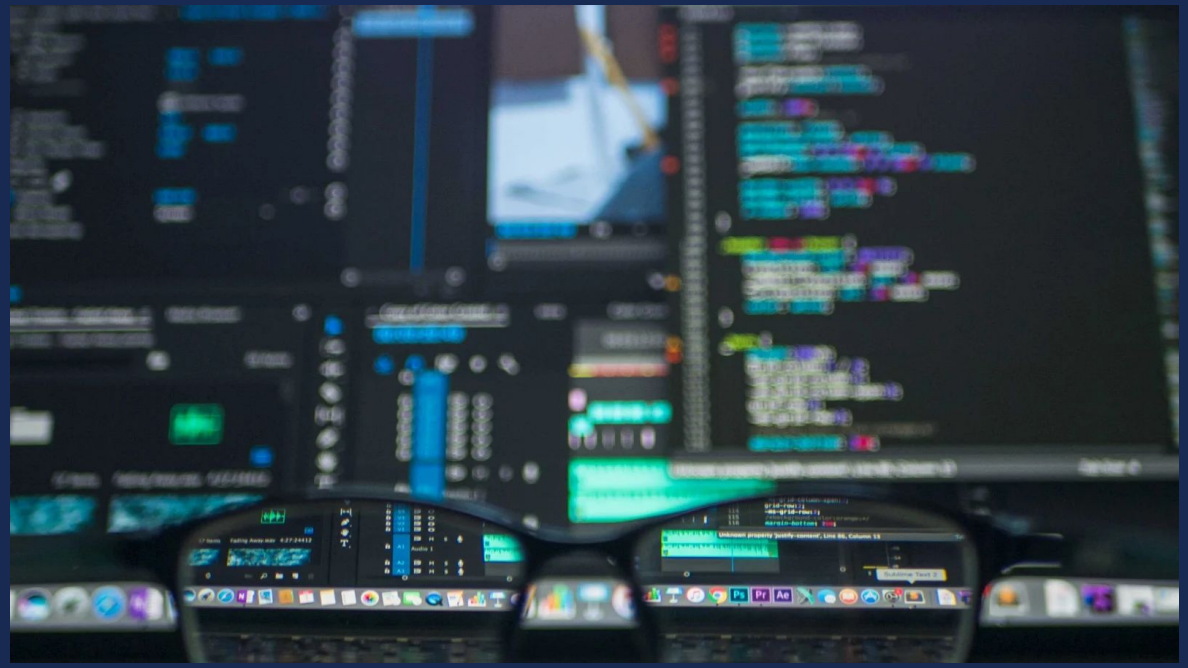


Requirement Table (Ranking)	
Rank	Requirement
1	Must be easily accessible to users before or during a natural disaster.
2	Provide ways for users to be safe.
3	Provide instructions to users to prepare for given natural disaster.
4	Use real data collected during different natural disasters.
5	Display information to users in a pleasing and formal way.
6	Provide reliable information
7	Must be easy to manufacture to create and be cost-effective

Constraints

- Must be in Project Format.
- Provide important information.
  - Environmental factors.
  - Social Impacts.
  - Health & Safety.
- Must be:
  - Reliable.
  - Aesthetic.
  - Sustainable.





Our Solutions

Solution 1

Our first solution was a very simple design where the program would ask questions to the user and use the responses to figure out if a natural disaster was coming.

We didn’t use this solution for two reasons.

1. It wouldn’t be very useful because somebody would have to already know that something was wrong in order to think to use it.
2. It would be annoying and more difficult to use.

Solution 2

The second solution was based around a singular piece of source code that had a lot of if and else statements. It would take data from a file and output the results.

The reason we didn’t use this system was because it would require the file be kept up to date and it would be less efficient time wise which is very important when lives are on the line.

Final Solution

The final solution is somewhat similar to the last solution but is improved in multiple ways to create a reliable, easy-to-use early warning system program.

Natural Disasters in Program

- Blizzards, Forest Fires, Tornados, Hurricanes.

Reasons Why We Choose This Solution.

1. It uses classes and functions to make the program more efficient and easier to modify.
2. It would constantly take information from sensors allowing it to constantly update. (In the real world)

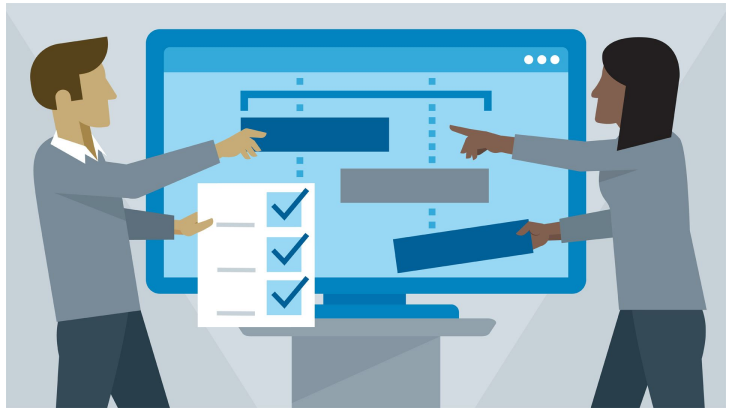
Components

- Thermometers: senses temperature
- Hygrometers: senses humidity
- Anemometers: senses wind speed

- Main.cpp: links program together
- Ews.h: header file for detection system
- EWS.cpp: detection system
- Details.h: header file for printing details
- Details.cpp: prints details

Features

- Uses multiple files with different information.
- Collects data from the input file.
  - Creates the file with random numbers.
  - Extracts the numbers from the file.
  - Assigns each number with a variable.
- Displays:
  - What disaster.
  - What to expect.
  - How to prepare.
- Displays information aesthetically.



Video Demo

Environmental, Societal, Safety, and Economic Considerations

Environmental:

- Acts as a safeguard for users to:
  - Be safe.
  - Indicate information about the environment.

Societal:

- Helps prepare users with warnings and instructions for:
  - Communities.
  - Cities.
  - Others nearby.
- Of the potential dangers that could occur.

Environmental, Societal, Safety, and Economic Considerations CON'T

Safety:

- Provides accurate & reliable Information.
- Easy to use.
  - Does not waste time.
- Give instructions on what to prepare.

Economic:

- Cost effective.
  - Cheap & inexpensive to run.
- Doesn't require any subscriptions.

Limitations

- Couldn’t use disaster that:
  - Cannot be predicted.
- Example of this are:
  - Earthquakes & Tsunamis.
- Only way to tell is when its about to occur.

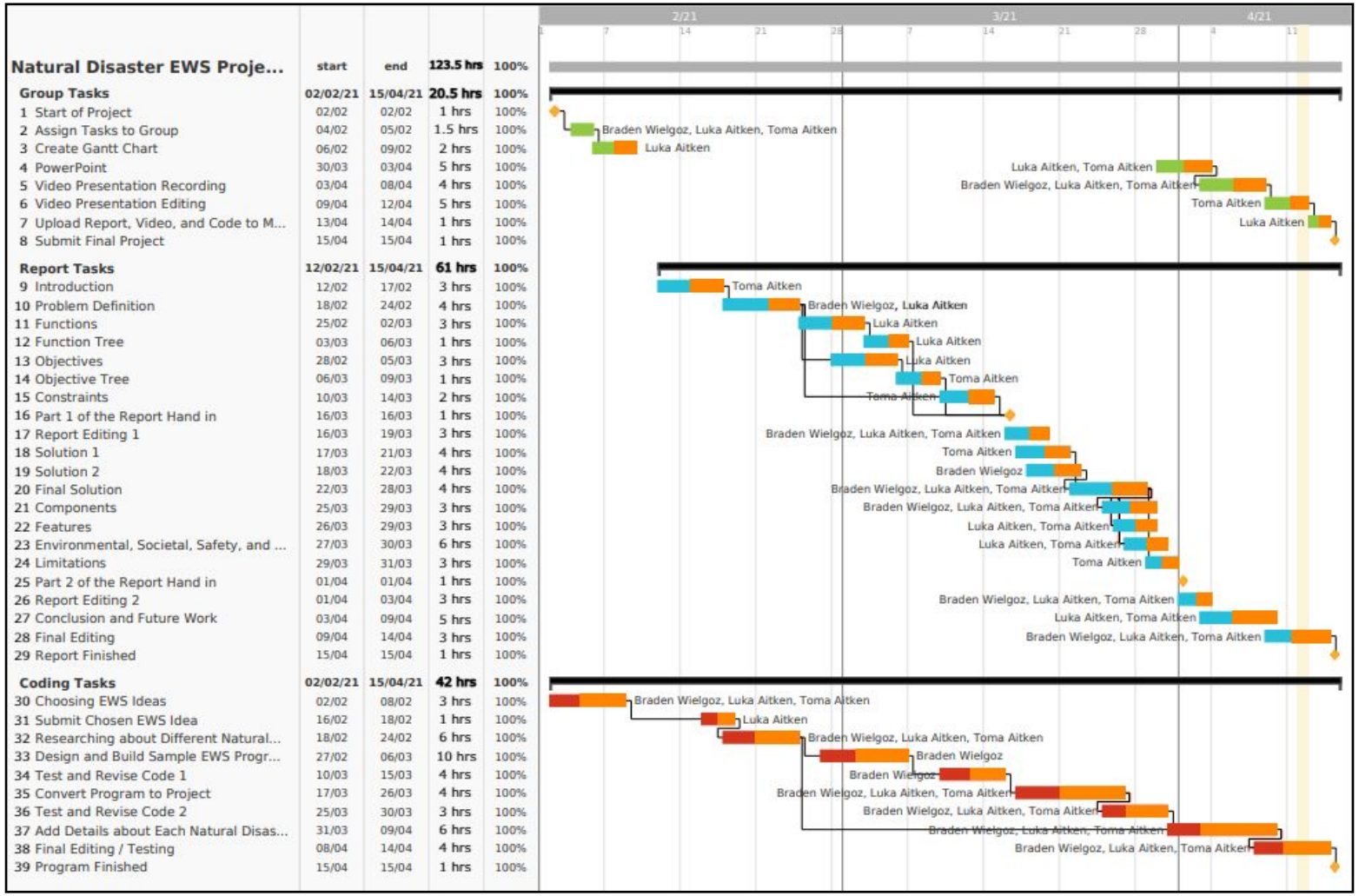
Conclusion & Future Work

We achieved plenty of considerable designs on how to create an early warning system for natural disasters. First off, we came with a couple of solutions that could be used to make the best possible early warning system for natural disasters, while following all the constraints. Our objective was to code and create a prototype of an early warning system for natural disasters while making it cheap and accessible for users who believe that a natural disaster will occur.

In the final design, we achieved all of our functions, objectives and constraints. Our design used multiple files to make the program fast and helpful for people who could be in danger. With each disaster, we made sure to use reliable information to check if the disasters could occur, as well as giving reliable information to better prepare if the disasters does occur.

For future improvements, we would add more class files, to help organize the program and make it alot faster. Also, we would include more disasters that are able to be predict and use more c++ feature that we learned over this course.

Project Management



Natural Disaster EWS Proje...	start	end	123.5 hrs	100%
Group Tasks	02/02/21	15/04/21	**20.5 hrs**	100%
1 Start of Project	02/02	02/02	1 hrs	100%
2 Assign Tasks to Group	04/02	05/02	1.5 hrs	100%
3 Create Gantt Chart	06/02	09/02	2 hrs	100%
4 PowerPoint	30/03	03/04	5 hrs	100%
5 Video Presentation Recording	03/04	08/04	4 hrs	100%
6 Video Presentation Editing	09/04	12/04	5 hrs	100%
7 Upload Report, Video, and Code to M...	13/04	14/04	1 hrs	100%
8 Submit Final Project	15/04	15/04	1 hrs	100%
Report Tasks	12/02/21	15/04/21	**61 hrs**	100%
9 Introduction	12/02	17/02	3 hrs	100%
10 Problem Definition	18/02	24/02	4 hrs	100%
11 Functions	25/02	02/03	3 hrs	100%
12 Function Tree	03/03	06/03	1 hrs	100%
13 Objectives	28/02	05/03	3 hrs	100%
14 Objective Tree	06/03	09/03	1 hrs	100%
15 Constraints	10/03	14/03	2 hrs	100%
16 Part 1 of the Report Hand in	16/03	16/03	1 hrs	100%
17 Report Editing 1	16/03	19/03	3 hrs	100%
18 Solution 1	17/03	21/03	4 hrs	100%
19 Solution 2	18/03	22/03	4 hrs	100%
20 Final Solution	22/03	28/03	4 hrs	100%
21 Components	25/03	29/03	3 hrs	100%
22 Features	26/03	29/03	3 hrs	100%
23 Environmental, Societal, Safety, and ...	27/03	30/03	6 hrs	100%
24 Limitations	29/03	31/03	3 hrs	100%
25 Part 2 of the Report Hand in	01/04	01/04	1 hrs	100%
26 Report Editing 2	01/04	03/04	3 hrs	100%
27 Conclusion and Future Work	03/04	09/04	5 hrs	100%
28 Final Editing	09/04	14/04	3 hrs	100%
29 Report Finished	15/04	15/04	1 hrs	100%
Coding Tasks	02/02/21	15/04/21	**42 hrs**	100%
30 Choosing EWS Ideas	02/02	08/02	3 hrs	100%
31 Submit Chosen EWS Idea	16/02	18/02	1 hrs	100%
32 Researching about Different Natural...	18/02	24/02	6 hrs	100%
33 Design and Build Sample EWS Progr...	27/02	06/03	10 hrs	100%
34 Test and Revise Code 1	10/03	15/03	4 hrs	100%
35 Convert Program to Project	17/03	26/03	4 hrs	100%
36 Test and Revise Code 2	25/03	30/03	3 hrs	100%
37 Add Details about Each Natural Disas...	31/03	09/04	6 hrs	100%
38 Final Editing / Testing	08/04	14/04	4 hrs	100%
39 Program Finished	15/04	15/04	1 hrs	100%

References

- https://offgridsurvival.com/wp-content/themes/church_10/images/2016/04/aftermathdisaster.jpg
- https://static01.nyt.com/images/2011/03/19/weekinreview/CAREYalt/CAREYalt-articleLarge.jpg?quality=75&auto=webp&disable=upscale
- https://i2.wp.com/movingtips.wpengine.com/wp-content/uploads/2019/06/hurricane-house.jpg?fit=1024%2C684&ssl=1
- https://static.scientificamerican.com/sciam/cache/file/E1B8E863-08BA-4137-AEF10324AF7D47F0_source.jpg
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