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Information visualization approaches for Green House Gas Emission

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Chapter 1

Introduction

1.1 Project overview

For the 2019-20 academic year there are two different themes you can choose from:

- **Theme 1 (environmental data: GHG)**: visualization of environmental data collected through a network of stations located on the territory
- **Theme 2 (cultural heritage)**: visualization of data collected from a relevant database related to the collection of an important museum of art, artworks of a well-known artist (an agreement with the teacher is needed for the selection of the theme)

Project Goal

The goal of the project is to provide a design solution for the visualization of data at different levels of granularity**,** to provide insights given by the exam of the representations and to initiate a discussion on how to perform scientific evaluations of climate visualization tools originating from the field of information visualization.

Requirements

The Environmental Data (GHG) theme has been chosen. the maximum level of granularity is given by the records of the dataset. For this theme, it is required to design:

- an app for smartphone/smartwatch for letting the user to access the environmental data and to offer some kind of comparison.
- an information visualization tool, designed as an application for large tablets or desktop/laptop computers for letting scientists to access data at different levels of granularity for monitoring the status of GHG, identifying patterns related to the relation between GHG and the other available variables.

- an information visualization tool for the end-users, designed as an ambient display to be delivered in a public space.

For what concerns the design solution, the project work should give an appropriate answer to three main questions, corresponding to the three main arguments of the Information Visualization book by Robert Spence:

- *how data are represented?*

The choice of representation should take into account the different representations taken from the Robert Spence's book and described in the classroom, but also alternative interesting solutions derived from the analysis of the literature (two initial starting points for crawling the available literature are scholar.google.com and acm.org/dl; the access to the latter repository is free when made from the department LAN or even from home using the Unive VPN services).

- *how data are presented?*

Presentation should take into account the specific features of the device you're designing for, such as the screen size or the multimodal features (e.g. the availability of audio or haptic eco-feedback).

- *how the user interacts with data?*

Interaction should take into account the potentialities and the limits of the human being, considered in the specific context (e.g. the access to a small screen in mobility would take into account the fact that the user's attention is probably limited).

Project's phases

The project is articulated in the following main phases:

Phase 1:

- Analysis of the state of art of information visualization tools for the theme selected.
- Design of a first draft of the proposal focused on representation and presentation.

- Discussion of the project draft with the teachers and the peers.

Phase 2:

- Design of an advanced draft.
- Discussion of the advanced draft with the teachers and the peers.
- Delivery of the final project proposal for the final exam.

1.2 Project requirements

In this section, project requirements previously introduced are better explored. For each tool, two main categories of users are analyzed:

Common users are interested in to see a different level of GHG emission in different countries to improve their knowledge about it and also understand some general information about the meaning of what is a greenhouse gas.

Expert users aim to compare the different circumstances in a different year or a different country.

1.2.1 Smartphone requirements

Common user the smartphone application allows the exploration and visualization of GHG emission in different countries. According to similar smartphone applications, several features must be available to the user:

- The emission of CO2 in your location right now.
- The last news about all countries surrounds the world.
- Search about specific subjects which user want to read.
- Register and log in for users who want to explore.
- Follow the app on social networks like Instagram, etc.
- Give users some general information about GHG.
- Show geographical location and a raw dataset which use for visualization in different attributes.

- Select the countries we need to compare and watch the visualization.

Smartphone displays are not suitable for precise tactile exploration.

Expert user: Expert users do not need additional requirements when using smartphone.

1.2.2 Desktop or tablets requirements

Common user: The Desktop application allows the exploration and visualization of GHG emission in different countries. According to similar Desktop applications, several features must be available to the user:

- The last news about all countries surrounds the world.
- Register and log in for users who want to explore.
- Follow the app on social networks like Instagram, etc.
- Give users some general information about GHG.
- Subscribe button for the users who want to get news on their emails.

Expert user: The desktop application allows expert users to see and analyze visualization and data more precisely. Several features must be available to the user:

- Show geographical location and a raw dataset which use for visualization in different attributes.
- Select the countries we need to compare and watch the visualization.
- Expert users can choose a different type of GHG like CO2, CH4, etc.;
- Select the first year and end year of the period they want to see.
- Type of graph they want to visualize and survey.

1.2.3 Ambient display requirements

- Analyze and receive bad situations data from the air by devices located in the weather stations.
- Satellites for send and receive the data from different stations to have up to date information about the whole area.
- Massive 3D holographic display projectors to show environmental conditions in the landmarks or the famous buildings.

1.3 Document Structure

In this project we have 4 main parts which the two first of them we explain some introduction and one paper about evaluating climate visualization. And after that, describe prototyping as our project on 3 parts smartphone, desktop and ambient display. At last, we have a conclusion for sum up.

Chapter 2

State of environmental analysis

This chapter is dedicated for analyzing a description of the sources that inspired this project. The two main papers that lead to the final implementation are “Evaluating Climate Visualization: An Information Visualization Approach” [1] .

2.1 Evaluating Climate Visualization: An Information Visualization Approach

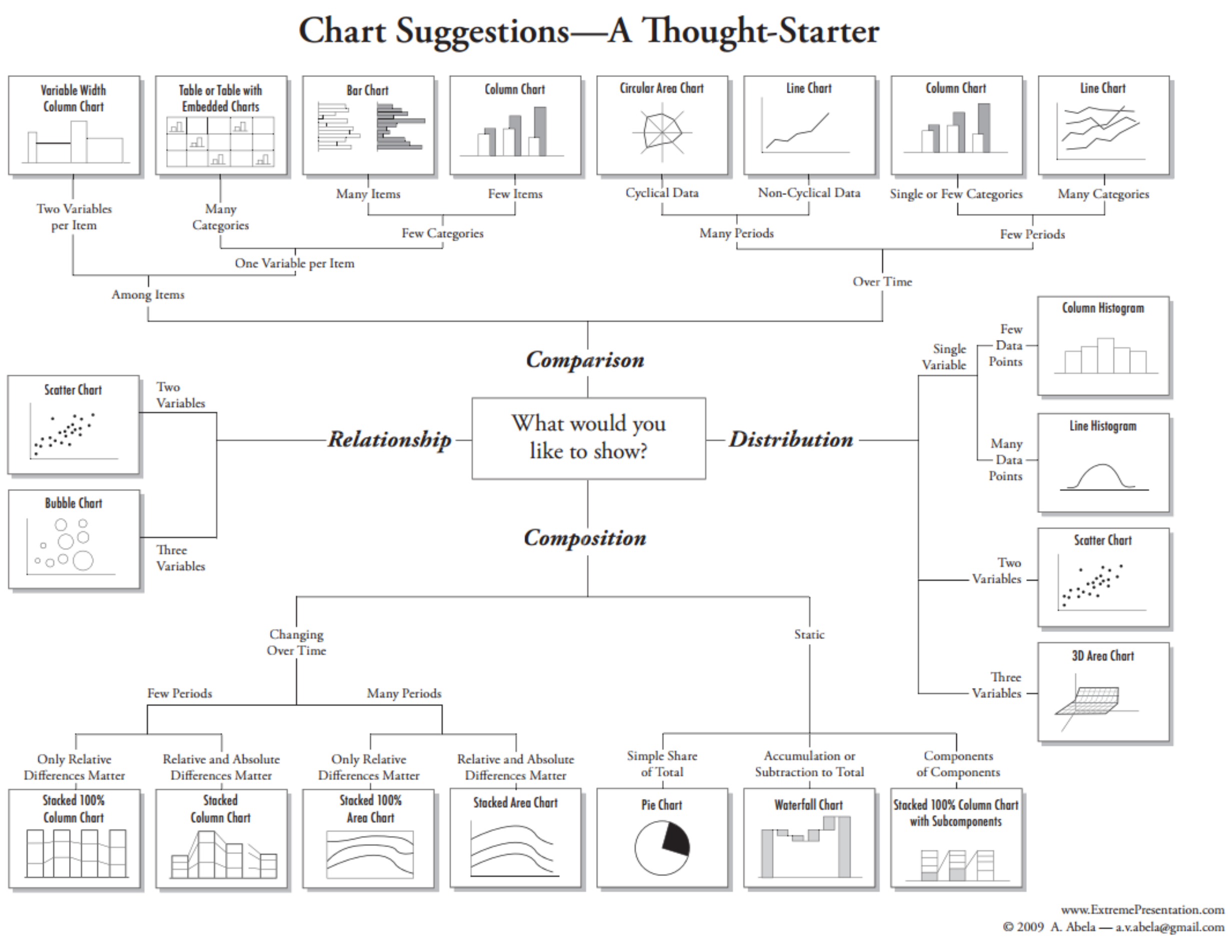
In the last years Greenhouse gas emissions` effect on the climate change has been broadly discussed in a large variety of media and thus there is an evident need for communicating scientific data to all the social, environmental, cultural and educational groups of life. For this, the implementation of the process developed in the modern century called visualization is crucial which we can achieve by computer technologies and special information visualization applications.

Visualization is a powerful tool, as it is persuasive and can provide intuitive understanding of complex data. Climate visualization refers to tools for analysis and communication of climate change issues and research results, and provides decision making support for planners and policy makers [1].

According to Jimmy Johansson, Tina-Simone Schmid Neset and Bjorn-Ola Linner, due to the power of visualization, all choices related to data selection, transformation and representation should be carefully reflected upon. Also, their effectiveness and efficiency should be evaluated. And this calls for a close collaboration between climate, visualization and human-computer interaction researchers to define key communication challenges and to design appropriate evaluation tools for different groups of audiences such as common, professional and expert users.

As data visualisation is the process of representing data graphically in order to identify trends and patterns, it serves two purposes of bringing clarity during analysis and communicating. The choice of the type of graph or visualisation must be used depends greatly on the nature of the variables one has. They can be relational, comparative, time-based and so on.

Sometimes graphing climate data with an inappropriate visualisation during analysis can lead to the problem that some correct information of the environmental changes carefully gathered time by time would have remained hidden or it can lead to confusion, errors, and abandonment among viewers. It can not be so trouble in the case of experimentation with visualisations during analysis, but during the level of communicating a visualisation, it is appropriate to use the graph types listed in the picture 1 below.



Picture 1 [2]

So, climate visualization as a general concept of interdisciplinary research over the fields of visualization and climate research ‘refers to interactive research platforms, which use computer graphics to create visual images of causes and effects of climate change as well as mitigation and adaptation options' [1]. The visualization techniques which are considered standard in computer knowledge sphere are being used for making results both between scientists themselves as well as to a broader public within the climate system and impact research communities. However, as it is mentioned in this work, in the last decades, the rapid development of computational power and computer graphics have created a broad spectrum of opportunities to visually represent massive amounts of data on processes of climate and its effects like the associated complexities and uncertainties interactively, using consumer computer hardware.

Until this day, within climate communication, several challenges have been identified. This is a responsible approach that has to be taken by climate scientists regarding the selection of data and their visual representations. Information about climate change is a part of a, particularly complex nature. So one of the main challenges within climate visualization is certainly the creation of nuanced representations of climate change related issues. For this reason, climate visualization is defined as the visual representation of data that effectively communicates an existent dataset. The best data visualizations rely on less text and are intuitively designed. Acceptable submission formats include interactive data visuals, posters, apps, and videos and those submissions can be interactive, dynamic or static. The best key solution for this challenge is an evaluation.

In this paper used, four different categories of evaluation obtained from a survey of literature of about fifty different user studies conducted within the area of information visualization are shown:

1) controlled experiments comparing design elements;

2) usability (qualitative) evaluation of a tool;

3) controlled experiments comparing several tools;

4) Tools of these studies in a realistic setting.

Among these categories, the most frequently reported evaluations concern controlled experiments and comparisons between different tools (1 and 3). Controlled experiments are typically used to test the effectiveness or efficiency of an isolated feature. To meet the specific requirements of climate visualization tools originating from information visualization, evaluation techniques already used within this community can be applied and adopted [1].

Among these categories, the most frequently reported evaluations concern controlled experiments and comparisons between different tools (1 and 3). Controlled experiments are typically used to test the effectiveness or efficiency of an isolated feature. To meet the specific requirements of climate visualization tools originating from information visualization, evaluation techniques already used within this community can be applied and adopted [1].

Actually, the character of climate change information poses a particularly difficult problem to convey it to public and decision makers. However, in order to understand and perceive easily information of visual representations it is not necessary they are to be evaluated beyond the realms of a general audience survey. In this regard, since climate visualization covers three distinct but overlapping areas as science communication, data analysis and decision making support, evaluation of visualization tools and visual representations need to focus on features relevant to one or more of these three dimension. Below, the authors of the paper used, identified the areas which are set for capturing in depth knowledge on the effectiveness and efficiency of climate visualization following the categorization of C. Plaisant who is a research associate at the University of Maryland.

For the evaluation category “Controlled experiments comparing elements” they refer testing the usability of small, individual features as colour, graphical primitives, assessment of interaction techniques, conveyance of uncertainties and variations in research data by the visual representations, using linear and non-linear transfer functions for mapping of data values to opacity, advanced illumination models, etc [1].

For the evaluation category “(Qualitative) usability evaluation of a tool” specific application areas for climate visualization tools might range from web-based platforms and their applicability for uploading, displaying and sharing various data sets for a number of research areas to the tools for dome presentations, their interactivity and compatibility for different data formats [1].

The evaluation category “Controlled experiments comparing two or more tools” is vital for comparing visualization tools currently under development with what is state of the art to advance the insights on user perspectives [1].

The process of the evaluation category “Case studies of tools in realistic settings” should involve new applications functioning as visualization platforms, that include the development, storage and possibility to display and share relevant data sets in an interactive session with for instance regional decision makers [1].

2.2 paper conclusion

To conclude, this paper is written to develop a framework for analyzing the content, form, context and relevance of climate or environmental change visualization, based on insights from literature on evaluating the climate change visualization for better communication in society. Climate visualization is a almost new field in the communication of sustainability. However, work on science communication including satellite data, field data, and climate modelling results has been ongoing in recent decades and is opening up new perspectives for a larger public.

Climate visualization concerns the relation of information of climate and data via the use of different information technologies and different visual representation modes. In the context of climate change communication, visualization of climate is highlighted as a strong way of increasing public engagement with climate change. In spite of that, there is a lack of research searching climate visualization from a user perspective. And to solve this issue, evaluation methods commonly used in information visualization can be applied to develop and improve existing tools as well as gain a better understanding of the consequence and capability of developed visual representations of climate change-related issues. These evaluation methods need to be further embraced and designed towards a large diversity of audiences and groups of users.

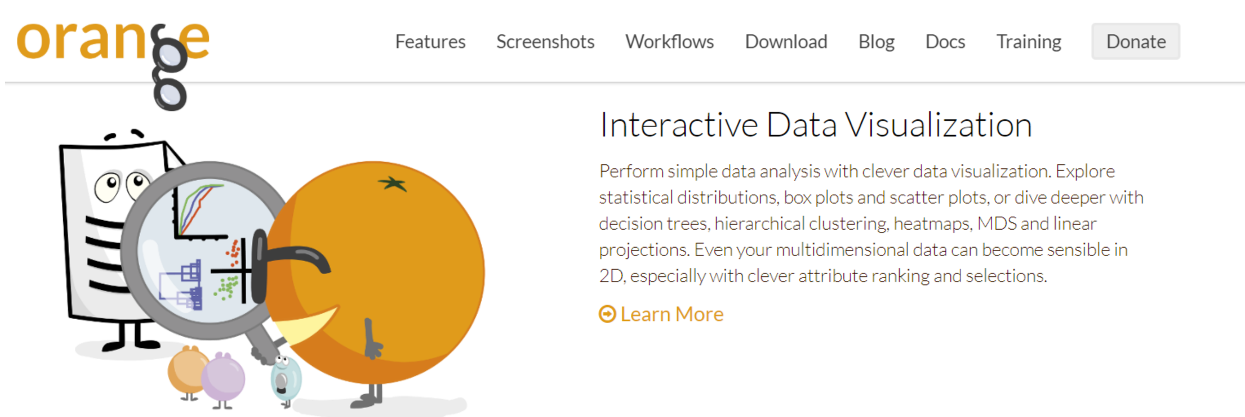
Chapter 3

Existing tools analysis

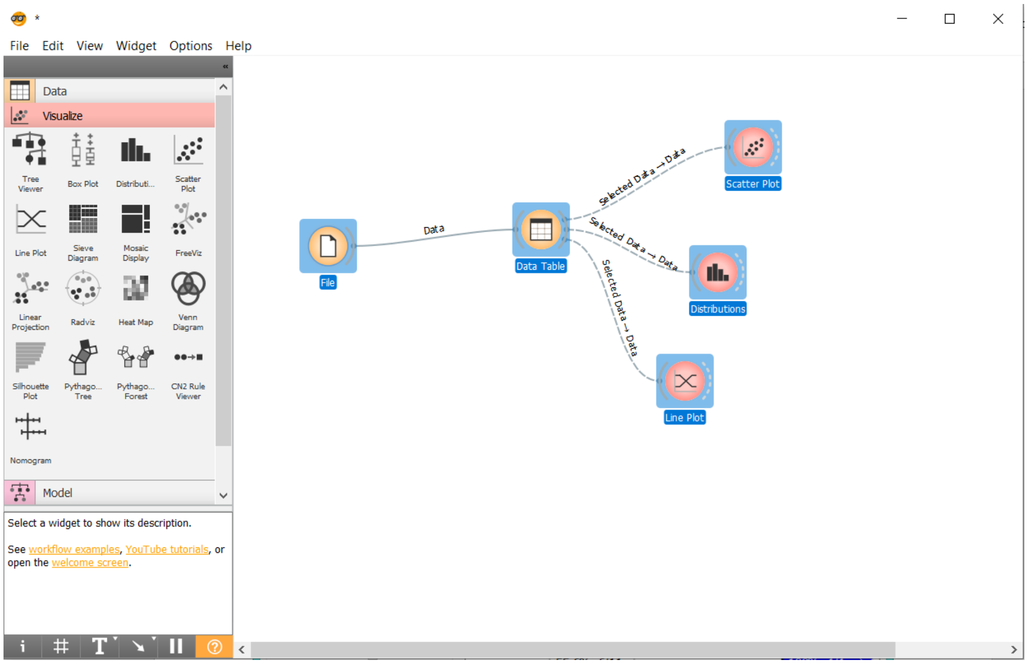
In this chapter, explain some tools, which use for making some visualization for our project, between many existing tools we have in the world. All these tools apply information visualization techniques to better represent the datasets we got from the environment.

3.1 Orange Software

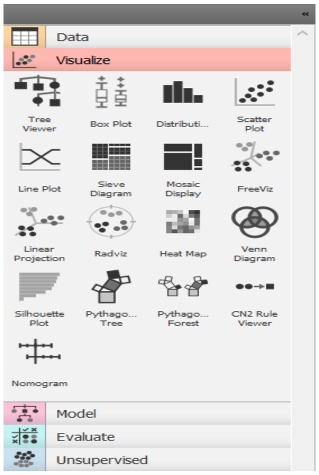
Orange is an open source data visualization, machine learning and data mining tool. It has some visual programming front-end features for searching and exploring data analysis and interface visualization. It is a software that everyone can download for free and use it for research on datasets.[3]



This software is a component based visual programming for visualization, machine learning and data mining and analysis. Orange components are called widgets and it has from some simple data visualization to evaluating of learning algorithm.[4]



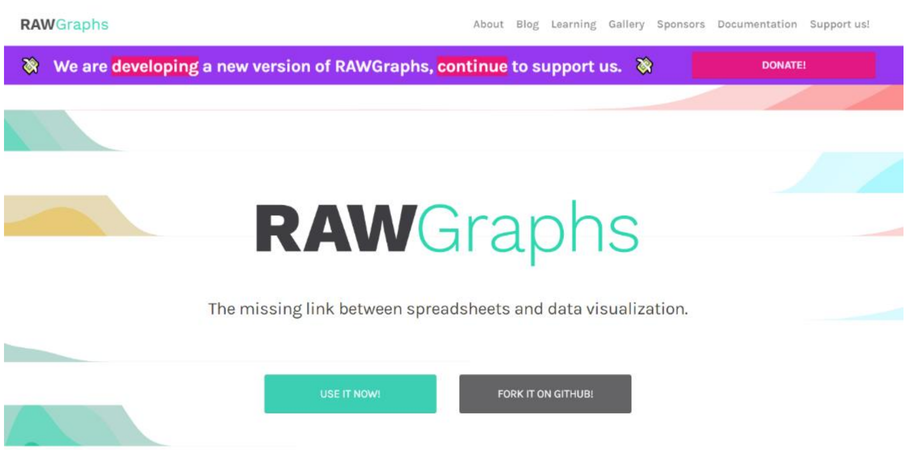
Here is the main page of using the software. On the left side, it has five main widgets (Data, Visualize, Model, Evaluate, and Supervised), which is a collection of many types of visualizations, data that is usable.



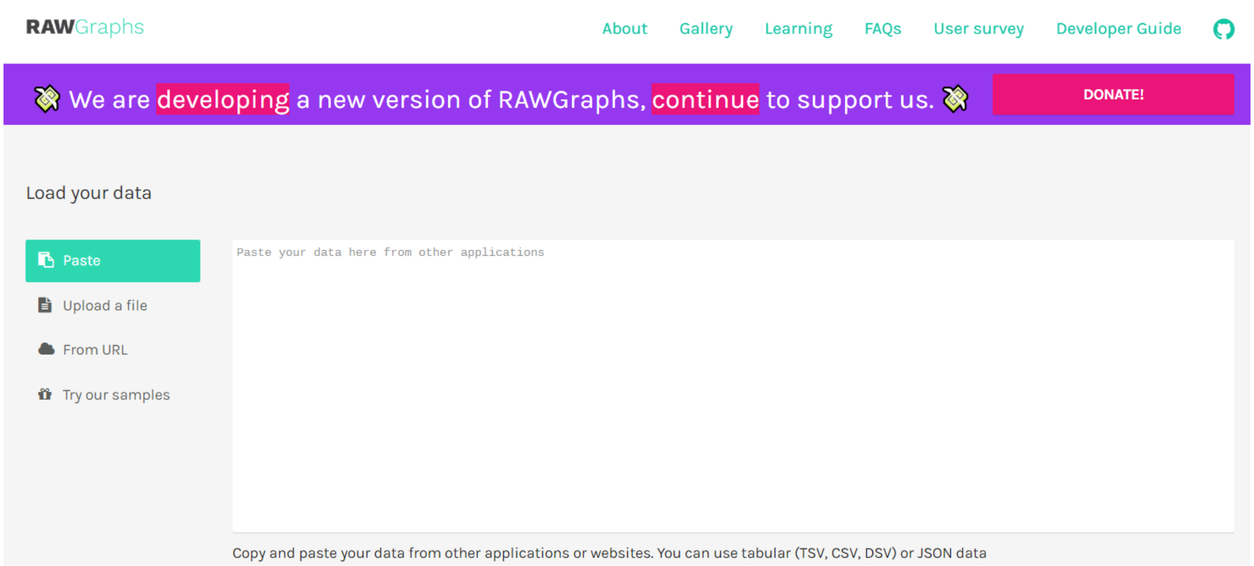
Orange composed of a canvas interface inside which the user places widgets and creates a data analysis workflow. Widgets offer basic functions such as read the data, show a data table, select features, train predictors, compare learning algorithms, visualize data elements, etc. The user can interactively search visualizations or feed the chosen subset inside other widgets.

3.2 Raw Graph

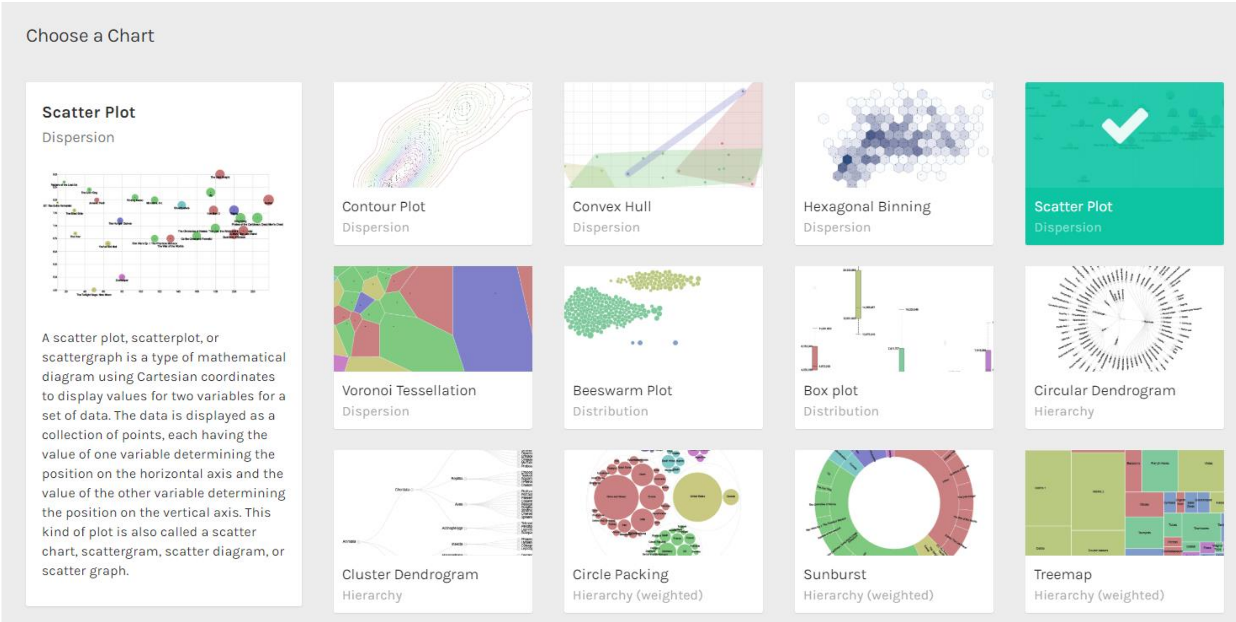
RAW Graphs is an open source data visualization framework built with the goal of making the visual representation of complex data easy for everyone.[5]



Once your data is uploaded, you can play with various charts and graphs to convey your information. A helpful feature of RAW Graphs is the descriptions under charts you select. Not every chart or graph is suitable for your data set, you should find the best one for your data.



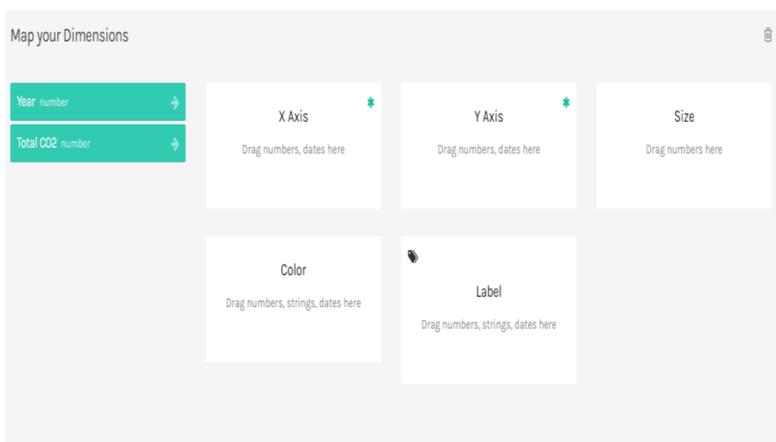
After upload or paste your data, you have to choose one of the charts which exist on the website for your data collection and be careful to choose the right one to doesn't have the problem for yours.



Choose a chart you need for your dataset

Unfortunately, some errors are encountered as shown if you use wrong chart.

After choosing your chart, you should define, for example, your x-axis or y-axis, etc. to show the exact thing you want.



3.3 Tableau

Tableau Software is an American interactive data visualization software company founded in January 2003 by Christian Chabot, Pat Hanrahan and Chris Stolte, in Mountain View, California.

Tableau products query relational databases, online analytical processing cubes, cloud databases, and spreadsheets to generate graph-type data visualizations. The products can also extract, store, and retrieve data from an in-memory data engine.[6]

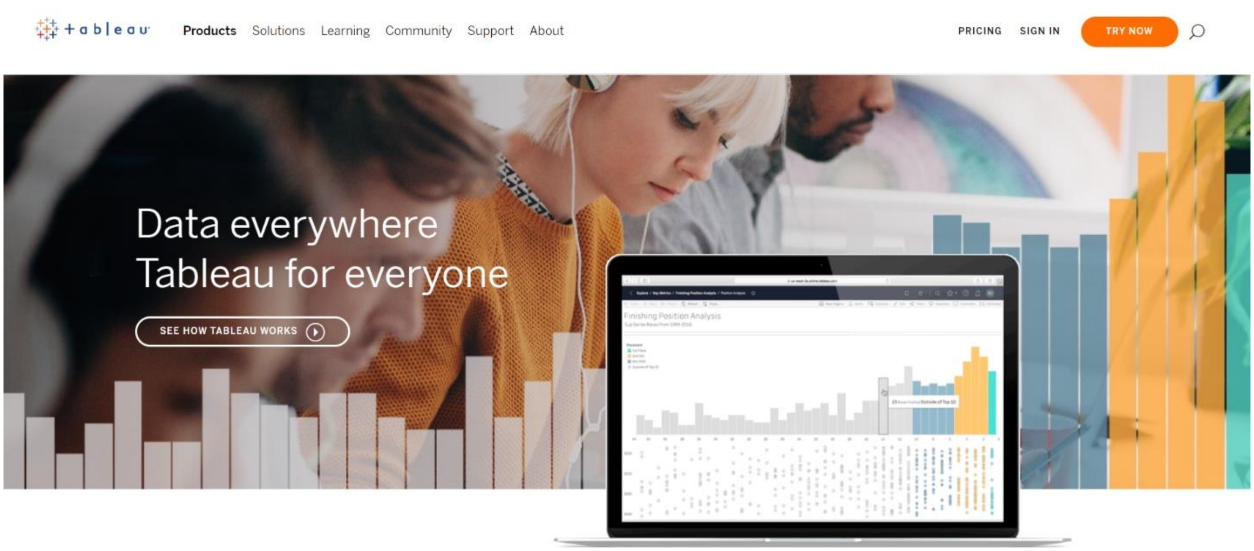


Tableau products are including:

- Tableau Desktop
- Tableau Server
- Tableau Online
- Tableau Prep Builder
- Tableau Vizable
- Tableau Public (free)
- Tableau Reader (free)

Visualization created by Tableau Software

Tableau's products are Unicode enabled and suitable with data stored in all languages. The user interface and supporting documentation are in English, French, German, Italian, Spanish, and many other languages.[7]

Tableau Desktop and Tableau Prep are supported in Windows and macOS environments. Moreover, Tableau's products operate in virtualized environments when they are configured with the proper underlying Windows operating system and minimum hardware requirements.

Chapter 4

Prototyping

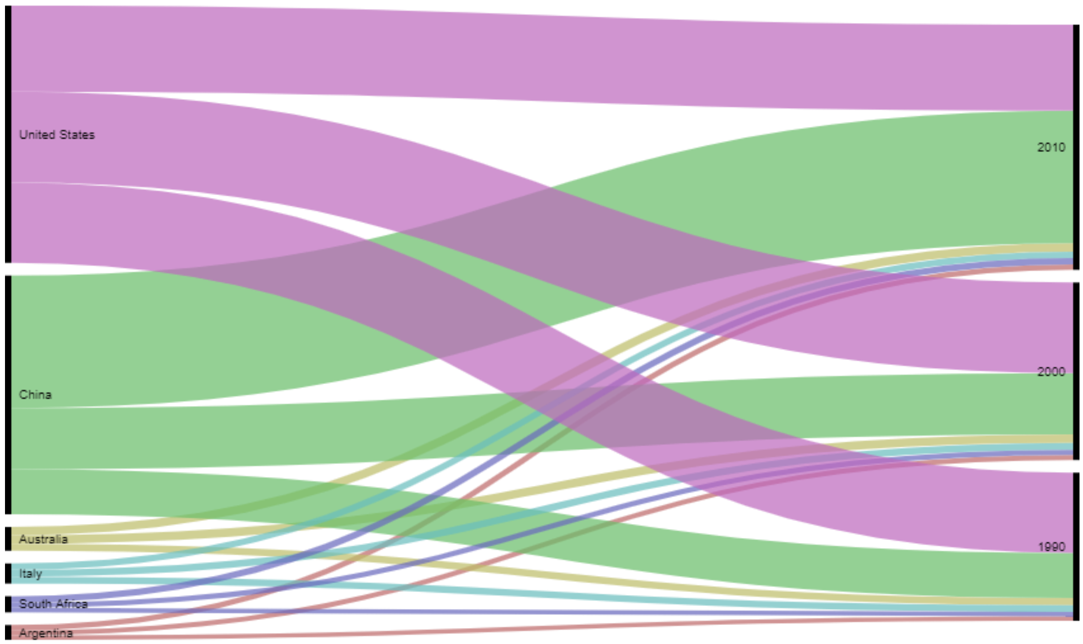
In this chapter, Prototyping describes it very well. At first, we survey the dataset and the graphs that used in the project and after that explain smartphone, Desktop, and ambient display, respectively.

4.1 Data analysis

In this section, analyzed data studied to classify and detect particular relations between variables. The first analysis concerns the different part of the raw dataset which used.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	Country	Year	Total GHG	Total GHG	Total CO2	Total CH4	Total N2O	Total F-Ga	Total CO2	Total CH4	Total N2O	Energy (Mt	Industrial I	Agriculture	Waste (Mt	Land-Use (	Bunker Fue	Electricity/	Manufactu	Transporta	Other Fuel	Fugitive Emissions	
117	Argentina	1990	233.7956	312.9334	106.357	88.9618	36.8158	1.6609	182.1927	91.2474	37.83232	114.2173	3.6067	106.5919	9.3898	79.1378	2.22	34.09	15.77	28.16	22.995	13.2024	
118	Argentina	1991	238.4044	306.0991	111.6405	88.8113	36.4912	1.4614	176.0332	91.09687	37.50776	120.1478	3.3029	105.2886	9.6552	67.6947	1.5	38.06	15.73	29.67	23.2547	13.4331	
119	Argentina	1992	242.951	311.3852	113.9208	90.4035	37.3649	1.2618	179.0529	92.6891	38.38137	122.1744	3.9299	106.9261	9.9206	68.4341	1.52	37.57	15.97	31.8	23.5344	13.3	
120	Argentina	1993	243.312	312.4856	115.3229	90.0386	36.8884	1.0622	181.1943	92.32413	37.90487	123.8304	4.0292	105.2564	10.186	69.1736	1.2	34.01	16.11	35.39	24.4341	13.8863	
121	Argentina	1994	253.6927	323.6057	123.4174	91.3201	38.0926	0.8626	190.0283	93.60561	39.1091	132.1806	4.1468	106.9139	10.4515	69.913	2.12	32.32	23.2	36.78	25.6838	14.1968	
122	Argentina	1995	256.5896	327.242	126.5423	91.4991	37.8852	0.6631	193.8926	93.78461	38.90166	136.2802	3.5353	106.0572	10.7169	70.6524	3.29	34.02	23.34	37.93	26.4835	14.5067	
123	Argentina	1996	265.2518	336.1749	135.907	89.9937	38.6102	0.7408	203.9642	91.96839	39.50153	146.0278	3.4512	104.3967	11.3761	70.9231	3.8	37.61	25.3	39.07	27.1496	16.8982	
124	Argentina	1997	268.8841	341.0274	139.6335	90.0885	38.3435	0.8186	208.3666	92.44613	39.3961	149.104	4.4003	103.3446	12.0352	72.1433	4.36	37.29	30.62	40.21	26.7457	14.2382	
125	Argentina	1998	270.8315	343.6716	143.3634	88.6594	37.9124	0.8963	212.995	90.88315	38.89716	152.9383	4.5947	100.6041	12.6944	72.8402	4.29	39.35	31.53	42.08	26.8919	13.0864	
126	Argentina	1999	277.5198	352.2505	146.645	91.2537	38.6471	0.9741	216.9359	94.32452	40.01601	156.3803	4.7231	103.0529	13.3536	74.7306	4.28	44.32	30.27	40.71	28.528	12.5524	
127	Argentina	2000	280.0677	353.1693	146.025	92.2773	40.7137	1.0518	216.9687	93.75851	41.39025	156.5196	4.2726	105.2629	14.0127	73.1015	4.31	44.92	30.26	39.87	29.3241	12.1455	
128	Argentina	2001	274.1757	345.0856	135.5755	94.121	43.2063	1.2728	205.0101	95.16398	43.63872	146.5455	4.2144	109.2745	14.1513	70.9099	4.14	38.95	30.97	36.22	28.1053	12.3001	
129	Argentina	2002	266.7804	338.9397	127.8437	95.6652	41.7776	1.4938	198.0511	97.04911	42.34561	139.8066	3.6286	109.0654	14.2898	72.1593	3.69	36.62	29.43	33.75	27.2066	12.8	
130	Argentina	2003	287.5601	361.0857	138.7102	101.1144	46.0208	1.7148	209.2109	103.2435	46.91648	150.1904	4.5084	118.433	14.4283	73.5256	3.73	40.38	32.31	34.65	29.4779	13.3726	
131	Argentina	2004	302.206	377.3669	154.2489	101.2619	44.7594	1.9359	225.9008	103.6985	45.8317	165.3821	5.2526	116.9945	14.5669	75.1608	3.83	46.69	36	37.54	32.0791	13.073	
132	Argentina	2005	305.8821	379.6889	157.6305	101.8193	44.2755	2.1569	229.207	103.4	44.92497	168.2764	6.147	116.7432	14.7054	73.8068	4.33	47.37	34.95	39.27	33.8404	12.846	
133	Argentina	2006	319.7875	384.452	167.9118	103.6229	45.8576	2.3951	229.4071	105.817	46.83277	178.0935	7.0647	119.7616	14.8677	64.6645	3.91	50.17	38.06	41.41	35.4471	13.0064	
134	Argentina	2007	330.0338	394.9095	174.9396	104.3088	48.152	2.6333	235.988	106.9891	49.29908	184.9832	7.6562	122.3744	15.03	64.8757	4.51	55.82	37.8	42.08	35.8438	13.4394	
135	Argentina	2008	338.3464	407.1063	185.8391	103.5993	46.0364	2.8715	247.9795	107.9129	48.3423	196.0103	7.9619	119.1819	15.1923	68.7599	4.66	60.68	36.98	44.69	40.0605	13.5998	
136	Argentina	2009	322.7855	389.4891	178.1424	100.0881	41.4452	3.1098	240.8902	102.8728	42.61626	188.6538	8.0552	110.7121	15.3545	66.7036	4.69	60.95	34.5	40.19	39.2173	13.7965	
137	Argentina	2010	323.5705	389.3786	183.1064	93.5252	43.591	3.348	245.3779	95.99346	44.6593	193.2963	8.8299	105.9274	15.5168	65.8082	5.6	61.97	35.15	43	39.274	13.9024	
138	Argentina	2011	328.183	394.6995	191.0226	90.5894	42.9664	3.6047	253.9585	93.08921	44.04716	200.7002	9.6718	102.1374	15.6736	66.5165	6.44	66.38	35.06	48.79	36.5967	13.8734	
139	Argentina	2012	338.0027	405.0348	195.7599	94.9191	43.4623	3.8615	259.6194	97.15121	44.40265	205.7339	9.695	106.7335	15.8304	67.032	7.53	71.04	33.91	48.32	38.4195	14.0444	
140	Armenia	1990			20.7013			0.0148				22.2612	0.2561		0.6165		0.59	6.05	4.57	2.93	7.041	1.6702	
141	Armenia	1991			21.6437			0.016				23.0803	0.2397		0.6105		0.66	7.73	4.87	2.87	6.0598	1.5505	
142	Armenia	1992	14.4095	14.4099	10.8779	2.8837	0.6307	0.0172	10.87786	2.883937	0.630905	12.2094	0.2151	1.3806	0.6044	0.0004	0.46	4.82	1.49	1.81	2.6586	1.4308	
143	Armenia	1993	8.3512	9.1936	5.0989	2.666	0.5678	0.0184	5.940938	2.666271	0.567964	6.3985	0.1173	1.237	0.5984	0.8424	0.2	0.81	2.1	1.18	0.9974	1.3111	

It is a raw dataset about the Greenhouse gas in all the countries between the year 1990 and 2012 which considered by many sections, for example, Total greenhouse gas emission include and exclude the land-use change and forestry, total CO2, CH4, etc. by the way, because of the massive collection of data, our project focus on six countries from different continents and compare them to each other.



Total Greenhouse gas emission in 6 six countries in the years 1990,2000, and 2010.

The collection can be seen as composed of six countries that are chosen from 6 continents and compare the emission of greenhouse gas with a ten years delay in this period. It is clear that the United States and China are the biggest making greenhouse gas countries in the world by far. The United States has spread the emission with a constant situation, but China increases its emission almost double.

It is a sunburst chart that shows us the different GHG emissions in selected countries, which show us better about the spread of emission in countries every five years distance. It is much clear here that the USA has almost equal emissions in all the years, but China has increased its emission by using many factors to made greenhouse gas.

4.1.1 Data Variables

The used CAIT Country GHG Emissions dataset is composed of the following variables:

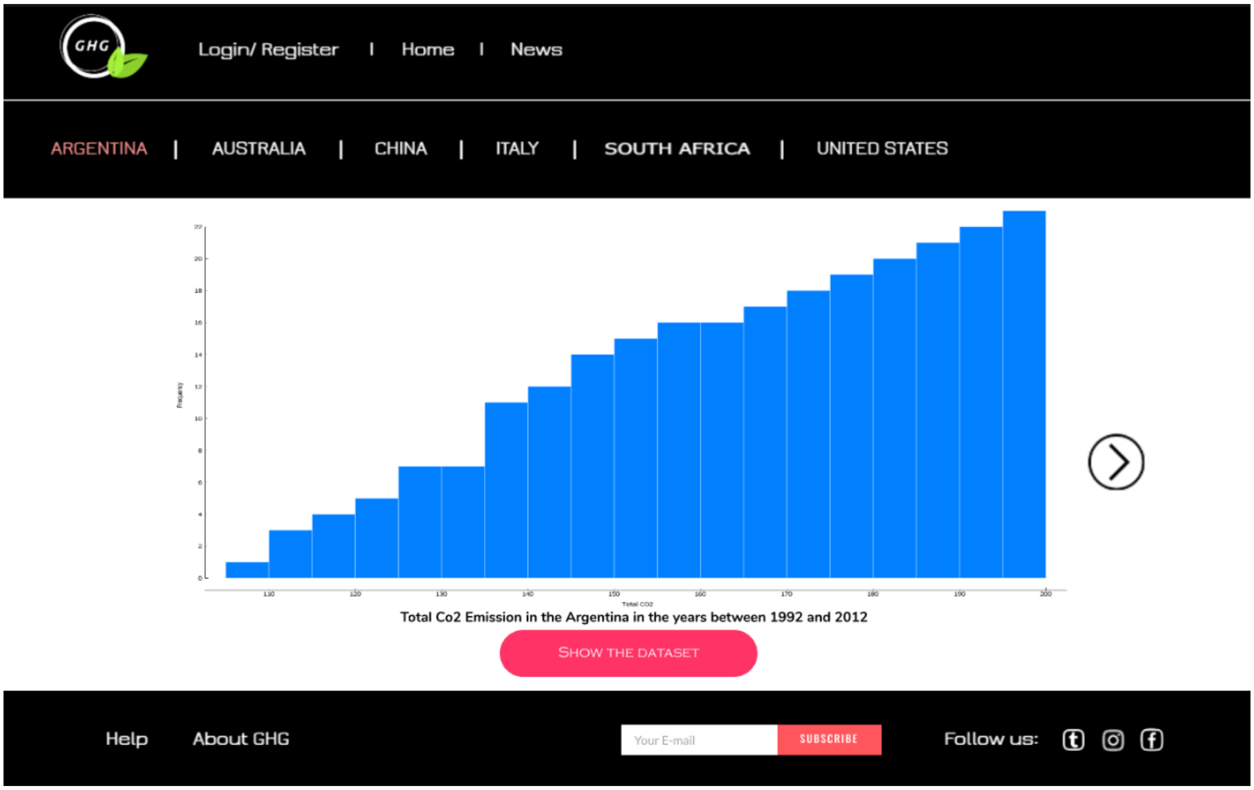
- Country(s)
- Year(s)
- Total GHG emission excluding land-use change and forestry
- Total GHG emission including land-use change and forestry
- Total CO2
- Total CH4
- Total N20

4.2 Expert Tool

The desktop application has two row menus on the top that the first one is considered by logo, Login/welcome, the home page, and news page about the last news about the all the countries. The second menu is regarded by the name of the countries that we are chosen from different continents. In the bottom, it has a place for help to users to know better about the application and also one tab for understanding better about GHG, also a part for subscribing to users insert its email to get a new notification on their email. It also has some icons for social networks like Twitter or Instagram to follow the application on social networks.

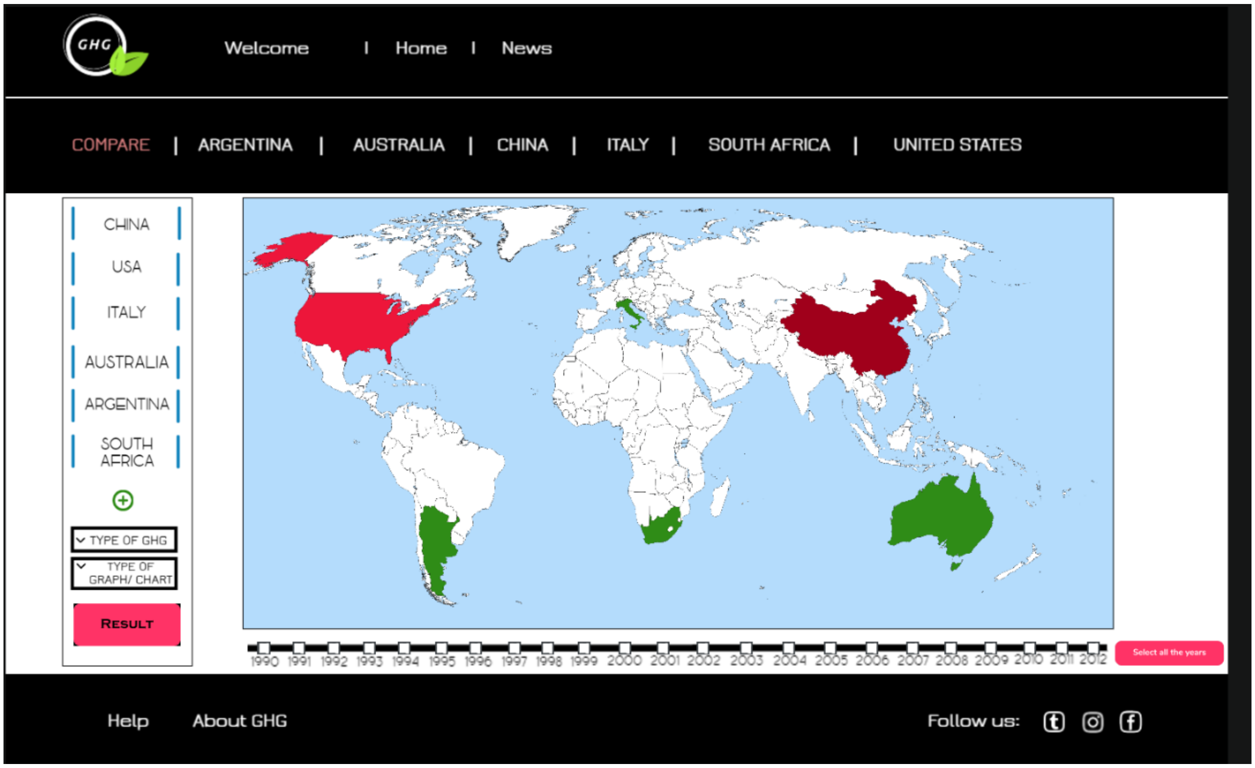
The expert tool is composed of two parts:

- The people are common users
- The expert users



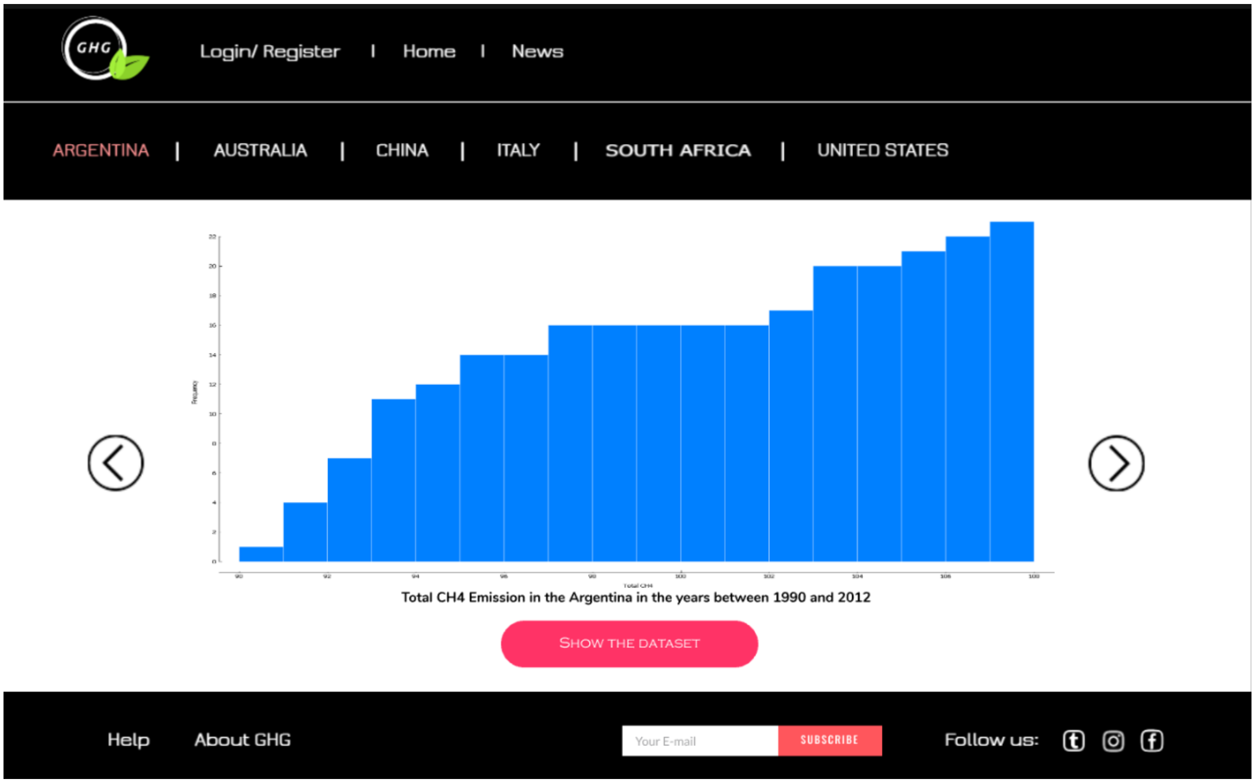
The desktop application composed of two parts; the common user wants to increase their information about the different countries and the experts that they want to compare and analyze the data.

For the first group, common users could be open the application, and they observe the information about the individual country. For example, if someone wants to know about Argentina, he/she should click on the Argentina tab or click on Argentina on the map to see the graphs about the selected country.

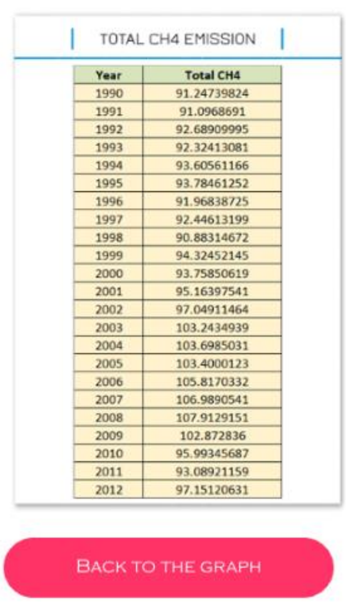


For the second group, everything is different. Experts after login in the application are facing with a map that they can select countries they want for comparing. Each country experts decide to add on the left side, and also when experts want to choose a country, the color of the country change to its situation now. For example, China, which has made much greenhouse gas, is colored to dark red.

Also, on the left side, experts can choose the type of gas that affects greenhouse gas like Co2, etc. Also, they can select the type of graph they need, for instance, if experts want to see the data on bar chart, experts should choose bar chart on the left side and also in the bottom of the map they can select the years to need, after selecting the years, it should click on result to see the effect they make.



After observing the graph by clicking on the "SHOW THE DATASET," researchers can see the dataset related to the chart.



TOTAL CH4 EMISSION

Year	Total CH4
1990	91.24739824
1991	91.0968691
1992	92.68909995
1993	92.32413081
1994	93.60561166
1995	93.78461252
1996	91.96838725
1997	92.44613199
1998	90.88314672
1999	94.32452145
2000	93.75850619
2001	95.16397541
2002	97.04911464
2003	103.2434939
2004	103.6985031
2005	103.4000123
2006	105.8170332
2007	106.9890541
2008	107.9129151
2009	102.872836
2010	95.99345687
2011	93.08921159
2012	97.15120631

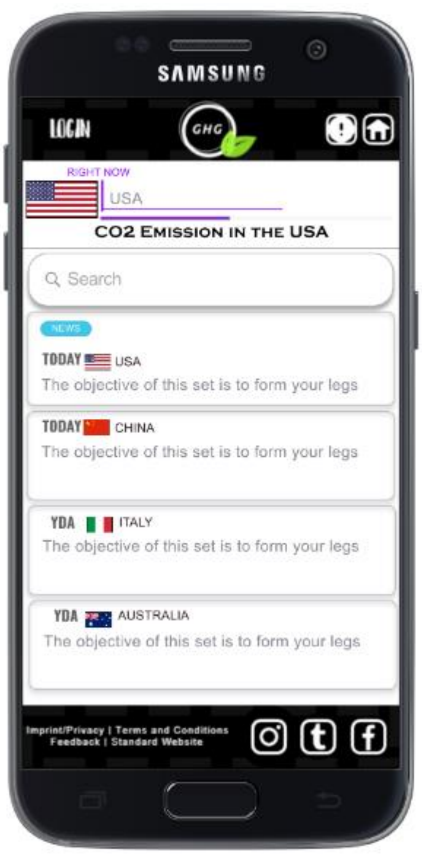
BACK TO THE GRAPH

4.3 Smart phone app

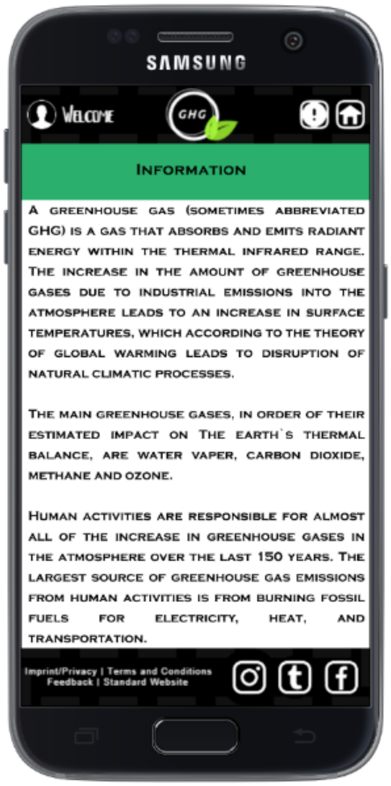
The Smart Phone app considered by three parts; main page when the users open, it has three sections, at the top section the users can log in, or if they do not register , it is icon that can register also has a logo for application which is the same in the desktop application and also has two buttons; one for about information about greenhouse gas and one for going back to first page if you are in the other pages.

In the body, it is CO2 emission about the country you live there now; for instance, if you are an Italian, it should be shown the CO2 radiation in Italy with setting your IP.

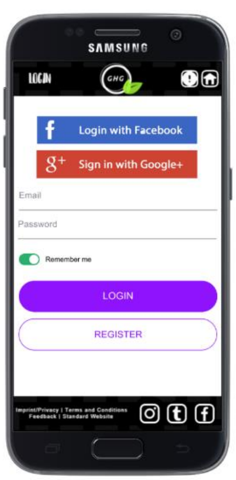
The central part of the first page is related to the last news about all countries but, if you are looking for specific news, there is a search on the top of the news; users can search the report they want on them using keywords.

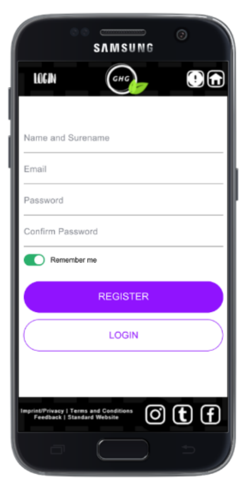


And in the bottom, some icons prepared for access to the social networks and also feedback and some terms and conditions about the application.



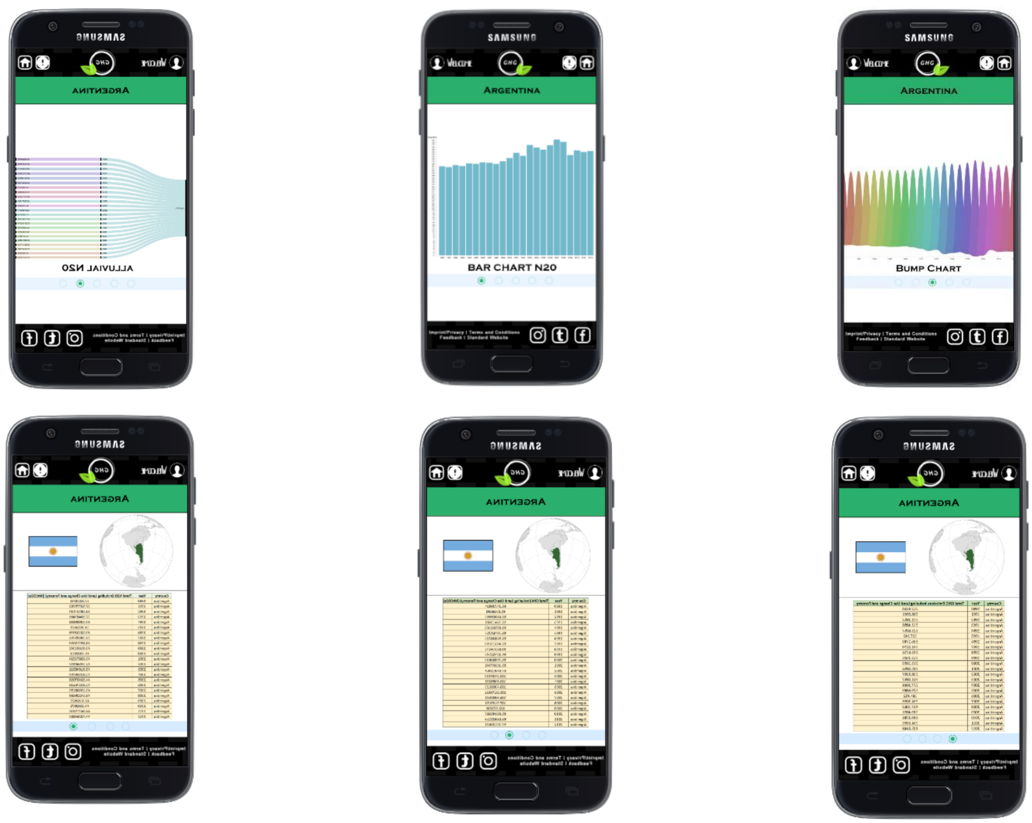
Users have to login before using the application; it has two pages for login or register, users could also log in with google plus account or Facebook, or if they do not have an account they have to create one. Also, it has a button “Remember me” to save the Username and password in the application for the next login.





After Log in, a page appear that users should select the country want to observe its information. Users should check the countries and press the result to see the charts about the related country and also, it’s dataset.

In the next page which is prepared for the related country, users see these charts and also dataset.



After the charts, users could survey its dataset in the next pages.

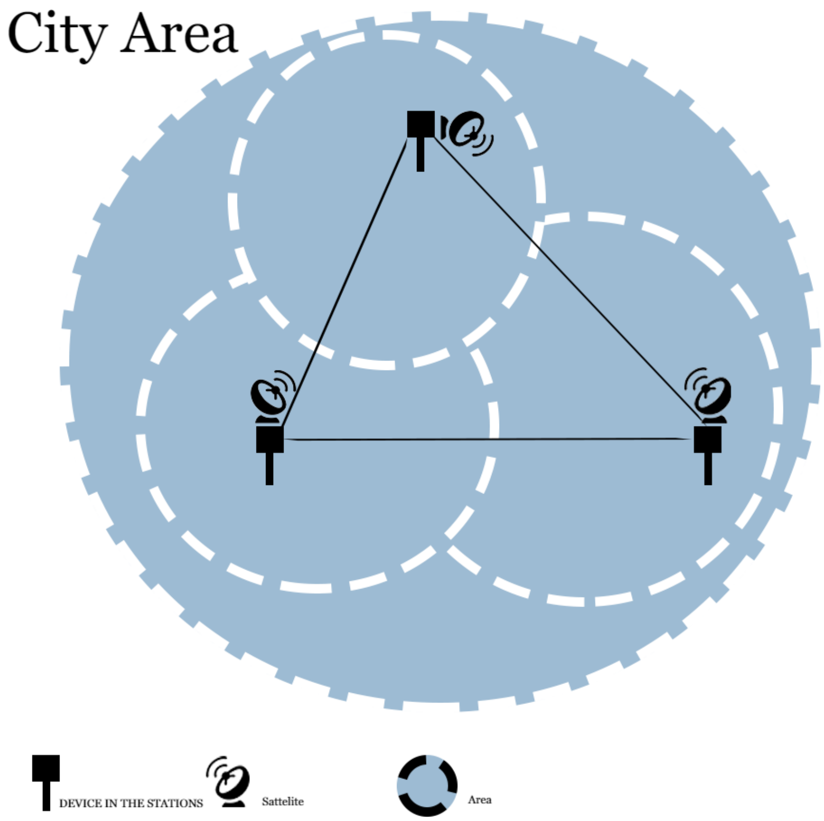
4.4 Ambient Display

These days with increasing the population around the world, countries note that they need to use more from the vehicles which make greenhouse gas. So, for this reason, and many other reasons like forestry, human spread more harmful gases in the air that effects on our planet. Some of these gases are directly affecting health like CO_2, and some of the damage to the environment. So, we should find a way to tell people to be careful when they come out.

In our project, we decide to describe using the 3D holographic display to show the unfortunate situation to the people around us, which tell you how we should do that in the following pages:

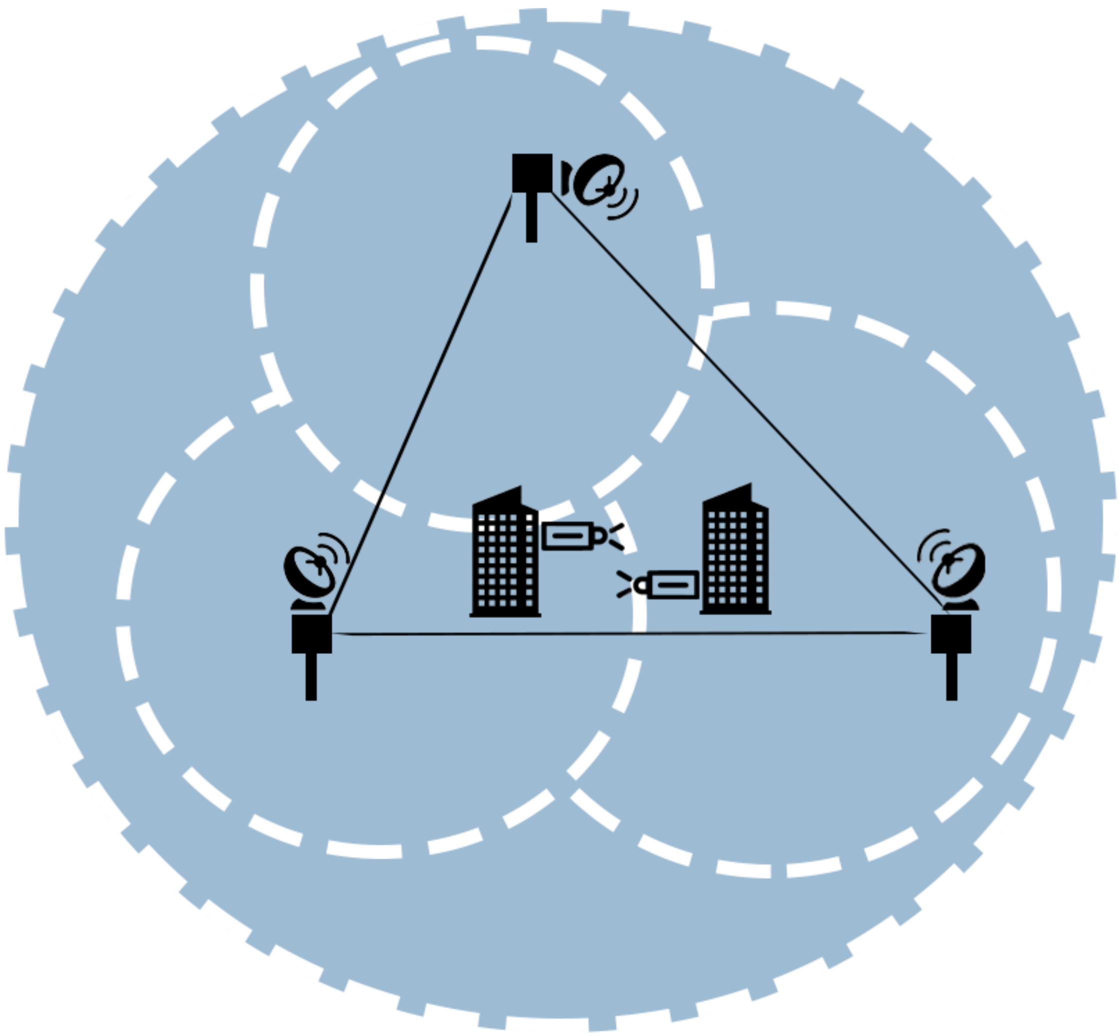
Requirements:

- Analyze and receive bad situations data from the air by devices located in the weather stations.
- Satellites for send and receive the data from different stations to have up to date information about the whole area.
- Massive 3D holographic display projectors to show environmental conditions in the landmarks or the famous buildings.



How it works:

1. Devices in the weather stations in the different area receive the weather conditions from the air and exchange the data to each other by network to all the stations have up to date information about the circumstance.
2. Each station has a satellite to send urgent situations to the projectors, which prepared in the landmarks and famous places. Also, all the satellites should be connected to be up to date and have the same information at the time.
3. When the sensors in the station get the unfortunate circumstance from the air, it sends the information to projectors to display on the buildings to people who outside understand the situation.
4. Each projector has a receiver to get the data from satellites.
5. All the satellites installed before on the good places.



Chapter 5

Conclusion

In conclusion, the project goal tries to provide an application to make a practical and straightforward interface for experts and common users to access new information about greenhouse gas.

The project made base on 3 main part:

- Smartphone app
- Desktop/Expert application
- Ambient display

For first glance, the project made with different interface but, after review and after getting advice from the professor and the type of information users need, we change whole the interface.

Each part needs the specific information for work better and give us good result.

For implementation, it needs some Infrastructure that they should installed in the environment specially for ambient display but, it should be powerful and practical project If implemented.

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