GRADE 12

SHANGHAI TOWER

portfolio

Semester 1

MENOFIA

STEM SCHOOL

20327

2022/2023

"If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions."
— Albert Einstein

Contents:

Present and justify the problem

Menofia STEM school 20327 Grade XII

Egypt's Grand Challenges

FIG1

Improve the scientific and technological environment for all

Advances in science and technology over the last 10 years have drastically changed the capabilities of the three sectors as well as the expectations of their respective users. Barriers to entry have been lowered, eroding previously exclusive roles. For example, data collection and modeling are no longer exclusively the role of the federal government, and visualization techniques are no longer used exclusively by the private and academic sectors. Modeling and forecasts have improved, and new methods of communicating weather and climate information have emerged, creating opportunities for providing new products and serving new user communities. Major shifts include the use of wireless technologies and long-range (climate) forecasts by the private sector and the implementation of Internet search tools and the National Digital Forecast Database by the NWS.

Impacts on the environment

humans are looking for ways to save the environment with technology. So, be it generating renewable, green energy or using sensors to monitor endangered species, technologies like AI and IoT are helping create a sustainable future for us.

1. **Developing renewable energy technology**
   - Efficient energy storage and smart grids.
   - Renewable and rechargeable batteries and fuel cells.
2. **Saving endangered wildlife**
   - Smart collars for endangered species and reducing human-animal conflict.
   - Gene sequencing for detecting and researching the deadly animal disease.
3. **Adopting a smarter lifestyle in smart homes**
   - that promotes energy saving and green living.
     electric cars which are three times more efficient than conventional vehicles.

Reduce and adapt to the climatic change

Egypt is expected to suffer from many emphasizes of climate change in the recent century; The average Temperature in Egypt will increase by 4OC in Cairo and by 3.1 to 4.7OC in the rest of Egypt by 2060, The annual precipitation may drop by 10 to 40% over most of Egypt by 2100, raising the Mediterranean Sea level by 0.5m by 2050 which will lead to flooding the coastal areas along the Nile Delta. The government of Egypt tries to confront the 7problem by building concrete sea walls to protect the beaches along The Mediterranean reducing the population growth rate to the replacement level of 2.1 by 2019 are applied. Increasing the inhabited area of Egypt by establishing new cities in the desert with a comprehensive.

FIG2

Causes of climate change

- **Generating power**
- **Manufacturing goods**
- **Cutting down forests**
- **Using transportation**
- **Producing food**
- **Powering buildings**
- **Consuming too much**

Effects of climate change

Hotter temperatures
More severe storms
Increased drought
Warming, rising ocean
Loss of species
Not enough food
More health risks
Poverty and displacement

Problem to be Solved

Definition:


FIG3

Climate Change refers to long-time period shifts in temperatures and climate patterns. These shifts can be natural, inclusive of via versions within side the sun cycle. But for the reason that 1800s, human sports had been the primary driving force of weather extrude, often because of burning fossil fuels like coal, oil, and fuel line. Burning fossil fuels generates greenhouse fuel line emissions that act like a blanket wrapped across the Earth, trapping the sun's warmth and elevating temperatures. Examples of greenhouse fuel line emissions that are inflicting weather extrude encompass carbon dioxide and methane. These come from the usage of gas for using an automobile or coal for heating a building, for example. Clearing land and forests also can launch carbon dioxide. Landfills for rubbish are a primary supply of methane emissions. Energy, industry, transport, buildings, agriculture, and land use are most of the essential emitters. And emissions keep to an upward thrust. As a result, the Earth is now approximately 1.1°C hotter than it became within side the overdue 1800s. The final decade became the warmest on record. Many humans suppose weather extrude particularly method hotter temperatures. But temperature upward thrust is most effective at the start of the story. Because the Earth is a system, in which the whole lot is connected, modifications in a single region can impact modifications in all others. The outcomes of weather extrude now encompass, amongst others, severe droughts, water scarcity, intense fires, growing sea levels, flooding, melting polar ice, catastrophic storms, and declining biodiversity. Climate extrude can have an effect on our health, and cap the potential to develop food, housing, protection, and work. Some people are already extra prone to weather influences, including humans dwelling in small island countries and different growing international locations. Conditions like sea-degree upward thrust and saltwater intrusion have superior to the factor in which complete groups have needed to relocate, and persistent droughts are placing humans susceptible to famine. In the future, the variety of "weather refugees" is predicted to upward thrust. In a chain of UN reports, heaps of scientists and authorities' reviewers agreed that restricting international temperature upward thrust to no extra than 1.5°C could assist us to keep away from the worst weather influences and preserve livable weather. Yet primarily based totally on modern-day country-wide weather plans, international warming is projected to attain around three.2°C with the aid of using the quilt of the century.

Causes:

Human causes of climate change

Humans cause climate change by releasing carbon dioxide and other greenhouse gases into the air. Today, there is more carbon dioxide in the atmosphere than there ever has been in at least the past 2 million years. During the 20th and 21st centuries, the level of carbon dioxide rose by 40%. We produce greenhouse gases in lots of different ways:

Burning fossil fuels – Fossil fuels such as oil, gas, and coal contain carbon dioxide that has been 'locked away in the ground for thousands of years. When we take these out of the land and burn them, we release the stored carbon dioxide into the air.

Deforestation – Forests remove and store carbon dioxide from the atmosphere. Cutting them down means that carbon dioxide builds up quicker since there are no trees to absorb it. Not only that, trees release the carbon they stored when we burn them.

Agriculture – Planting crops and rearing animals releases many different types of greenhouse gases into the air. For example, animals produce methane, which is 30 times more powerful than carbon dioxide as a greenhouse gas. The nitrous oxide used for fertilizers is ten times worse and is nearly 300 times more potent than carbon dioxide!

Cement – Producing cement is another contributor to climate change, causing 2% of our entire carbon dioxide emissions.

Natural changes to the climate - The leading cause of climate change is human activity and the release of greenhouse gases. However, there are lots of natural causes that also lead to changes in the climate system. Natural cycles can cause the climate to alternate between warming and cooling. There are also natural factors that force the climate to change, known as 'forcings'. Even though these natural causes contribute to climate change, we know that they are not the primary cause, based on scientific evidence. Some of these natural cycles include:

- **Solar irradiance – Changing energy from the sun has affected the temperature of Earth in the past. However, we have not seen anything strong enough to change our climate. Any increase in solar energy would make the entire atmosphere of Earth warm, but we can only see warming in the bottom layer.**

- **Volcanic eruptions – Volcanoes have a mixed effect on our climate. Eruptions produce aerosol particles that cool Earth, but they also release carbon dioxide, which warms it. Volcanoes produce 50 times less carbon dioxide than humans do, so we know they are not the leading cause of global warming. On top of this, cooling is the dominant effect of volcanic eruptions, not warming.**


FIG4

Consequences:

Positive effects on Climate Change:

Natural consequences:

Temperatures: The temperature will stay constant. May will be some changes but this is by natural effects. This will be normal. This will not be the effect of some human disses.

Drought and wildfires: They will not reduce water levels in rivers and groundwater, stunt tree and crop growth. The wildfires will not affect pests.

Availability of freshwater: The constant rate of cloudburst events (sudden extreme rainfall) is also likely to influence the quality and quantity of fresh water available, as stormwater can't cause uncleaned sewage to enter surface water.

Floods: There will not be an increased value or rate of rainfalls to cause floods. This will remain in the form of normal nature.

Sea level rise and coastal areas: The melting ice from glaciers and the Antarctic ice sheet will stop consequently.

Biodiversity: Climate change is happening so fast that many plants and animal species are struggling to cope. This evidence will decrease consequently, and plants and animal species will not struggle.

Soils **The effect of climate change on soil carbon storage will not be related to changing**

- **atmospheric CO2 concentrations.**

Inland Water: **Water temperatures of rivers and lakes will be at a natural rate, thereby affecting water quality and freshwater ecosystems will disappear. Marine Environment: Changes in temperatures and ocean circulation have the potential to change the geographical fish distribution. So, fish will state in normal and natural life.**

Social Threats:

- **Health: Climate state constant is a significant safe not only for human health but also for animal and plant health.**
- **Employment: climate change will not be an effect on employment. This will depend only on the people who are recruited.**
- **Education: Education will state like it in a normal time. The routine will not change.**

Threats to business:

- **Infrastructure and buildings: The impacts of climate change are particularly pertinent to infrastructure and buildings are given their long lifespan and their high initial cost, as well as their essential role in the functioning of our societies and economies.**
- **Energy: More intense and frequent heatwaves will shift energy supply and demand patterns, often in opposite directions. Further increases in temperature and droughts may limit the availability of cooling water for thermal power generation in summer (lowering energy supply), whereas demand for air conditioning will increase.**

Agriculture and forestry: **Climate change and climate variability are projected to have a substantial effect on agricultural production, both regarding crop yields and the locations where different crops can be grown. The crop season has lengthened and is projected to increase further due to an earlier onset of growth in spring, and a longer growing season in autumn. This would allow a northward expansion of warm-season crops to areas that were not previously suitable.**

Insurance: **The frequency and intensity of most types of extreme events is expected to change sig.**

FIG5

Research

Technology and climate change:

climate technologies that help us reduce greenhouse gas emissions include renewable energies such as wind energy, solar power, and hydropower. To adapt to the adverse effects of climate change, we use climate technologies to make climate change analyses or solve its problems.

Smog consequences

Smog is a serious problem in most big urban areas. The emissions from vehicles and industries, as well as the combustion of wood and coal together with the buildup of certain weather conditions, are the main causal agents of smog.

The terminology refers to a mixture of liquid and solid fog and smoke particles. It is usually seen as yellowish or blackish fog, which remains suspended in the atmosphere or forms a ceiling in the air. It happens when fume, emissions, and particulates (nitrogen and sulfur oxides and volatile organic compounds) react in the presence of sunlight to form ground-level ozone.

PCB board

A printed circuit board (PCB; also printed wiring board or PWB) is a medium used in electrical and electronic engineering to connect electronic components to one another in a controlled manner. It takes the form of a laminated sandwich structure of conductive and insulating layers: each of the conductive layers is designed with an artwork pattern of traces, planes, and other features (similar to wires on a flat surface) etched from one or more sheets layers of copper laminated onto and/or between sheet layers of a non-conductive substrate.

MQ135

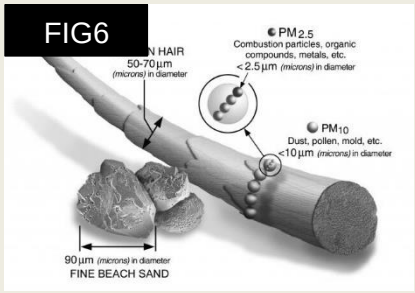
The MQ-135 gas sensor senses gases like ammonia nitrogen, oxygen, alcohols, aromatic compounds, sulfide, and smoke.

ESP 32

ESP32 can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor

Particulate matter

FIG6



PM stands for particulate matter (also called particle pollution): the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen by the naked eye. Others are so small they

Increased temperatures can only be detected using an electron microscope.

Climate change impacts

drought and water stress, diseases, and weather extremes create challenges for the farmers and ranchers who put food on our tables. Human farm workers can suffer from heat-related health issues, like exhaustion, heatstroke, and heart attacks.

Climate analysis

climate analysis is the process used to describe the state of the climate system and its evolution over some period in order to identify and understand systematic patterns of climate variability and the character of climate change.

Prior solutions

1.5°C national pathways

FIG7

The Paris Agreement commits all countries to take ambitious steps to guarantee a low carbon future. This requires individual national governments to submit more ambitious emission reduction targets. In support of this urgent need to translate global trajectories to be in line with the Paris Agreement, this project, funded by the IKEA Foundation shows how a group of countries, across all regions and development spectrum can update its NDCs to be in line with the Paris climate goals. Leaders of 197 countries recognized that climate change poses an ever-greater threat to their people, ecosystems, and economies, and in 2015 at the United Nations climate summit in Paris, committed to addressing this threat through the Paris Agreement. The Agreement aims to keep global temperature rise below 2ºC above pre-industrial levels and to try and limit it even further to 1.5ºC by the end of the 21st century in order to prevent the worst of climate impacts

PROS

THE AGREEMENT AIMS TO MITIGATE AND ADAPT TO CLIMATE CHANGE

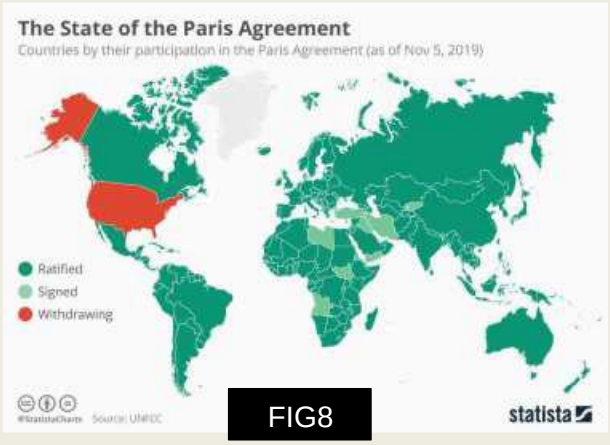


FIG8

The Paris Climate Agreement serves a wildly essential purpose: asking countries to mitigate climate change as much as possible and put measures in place to adapt to climate change. Global warming is threatening our food and water supplies, lives, livelihoods, homes, wildlife, natural wonders, ecosystems and more. If we ignore this issue, more people will suffer and more lives will be lost.

Although the Paris Climate Agreement has its fair share of problems, it addresses this global crisis in a the way that no other current agreement does.

IT HAS INTERNATIONAL SUPPORT

The Paris Agreement has received overwhelming international support. As I mentioned above, only one country globally (*cough* United States *cough*) is not signed onto the Agreement, while only seven have not formally ratified it. This unity demonstrates that all countries are aware of climate change and, in theory, take it seriously. With an issue as global and potentially catastrophic as climate change, every nation must formally recognize its role in the problem before committing to meaningful mitigation efforts. At future conferences, this formal recognition can serve as the starting point for more substantial (and hopefully legally binding) changes.

CONS

THE AGREEMENT IS NOT LEGALLY BINDING

The Paris Climate Agreement has no legal component. It merely states that countries should follow their mitigation plans. If countries do not follow their Paris Pledge, they do not face any punishment. International judgment is one risk of non-compliance, but because the vast majority of countries are currently not meeting their promises, few are judging. Without legal ramifications, and with little international pressure, some view this treaty as meaningless. With an issue as life-threatening as climate change, we need to hold ourselves to a higher legal standard.

CURRENT PLEDGES WON'T KEEP US UNDER 1.5 DEGREES CELSIUS

The Agreement's goal is to keep warming "well below" 2 degrees Celsius and "pursue efforts" to keep warming below 1.5 degrees Celsius above pre-industrial global average temperatures. This is a noble goal, but it is far from realistic. If all nations follow current policies and pledges, we will be lucky to stay below 3 degrees Celsius of warming. This discrepancy between the Agreement and reality makes the Paris Agreement seem less legitimate. Instead of painting an accurate picture of the millions of people who will experience extreme heatwaves, drought, flooding, and food scarcity, it fantasizes that we will remain within a comfortable degree of warming. This language waters down the urgency of the situation and calls the rest of the agreement's logic into question.

#2 prior solution

The United Nations Intergovernmental Panel on Climate Change (IPCC) describes an aggressive approach to reducing carbon emissions, which is being imposed by various government-led initiatives around the world. It can be difficult for organizations and households alike to get a grasp on how they can turn around their carbon footprint, as there are so many variables at play. By working with a carbon-certified engineer or agency, you can measure your organization's greenhouse gas emissions to ensure you know where to cut down on emissions. This in itself can be a difficult process, because once the high pollutants are assessed, you must then track them back to the processes that cause them in the first place. That's a lot of assessing and analyzing. All new buildings must now meet a zero-carbon footprint, as statistics show even if all greenhouse gases were to stop today, the world's temperature would still increase by 2 degrees. This shows a lot of damage has already been done, and we still have a long way to go to eradicate these pitfalls. To ensure buildings stay at net zero carbon, they must be equipped with IoT sensors that can easily track energy consumption, and lighting, generate renewable energy on-site, and eliminate waste sustainably.

PROS

- **A report carried out also shows how IoT can bring about positive change within n industry. It**
- **states that IoT use could reduce carbon emissions by up to 15% by 2030, and at the rate, IoT adoption is heading, this could well increase.**
- **Reducing traffic congestion and unnecessary government spending can also have a positive impact on environmental issues. As governments will have more capital to plug back into the economy. This traffic reduction will be greatly helped by various smart city initiatives all over the world.**
- **Smart traffic management and improving both road and rail networks for more**
- **efficient services will vastly improve greenhouse gas pollutants in urban environments. Electric**
- **vehicle usage is also on the increase, coupled with these smart traffic systems ensuring cars are on the road for the minimum amount of time.**

CONS

sensors Surely can't be 100% renewable or long-lasting? Work is now being carried out in various research centers such as Trinity College Dublin to find a solution to sensor life. One such solution is to develop sensors that, when they reach their end of life, can simply dissolve into the ground or whatever they are held in, as it's nearly impossible to collect all sensors once they've run out.

#3 prior solution

carbon offsetting

All carbon offset projects are based on international standards, such as the Verified Carbon Standard (VCS), and the Gold Standard, and regularly audited by independent third parties. The standards set out the rules and requirements that all carbon offset projects must meet in order to be recognized as a proven method of avoiding, reducing, or removing carbon emissions from the atmosphere.

Impact beyond CO2

The transition to a low-carbon, more resource-efficient, and sustainable world, needs to be fair, and it is crucial to provide support to the communities that are suffering the most from the impact of climate change. Sustainability is about more than just climate action and it is important that all strategies, initiatives, and investments are considered with this holistic impact in mind.

This is why carbon offset projects often support multiple UN Sustainable Development Goals (SDG) beyond climate action (SDG #13). For example, clean cookstoves projects also have a positive impact on health and well-being (SDG #3) by reducing diseases linked to indoor smoke inhalation. Many afforestation projects empower women (SDG #5) in the local community they are situated in by providing decent work (SDG #8) throughout the project lifecycle, and they improve biodiversity (SDG #15).

Many of the standards (e.g. Gold Standard or VCS CCBS) require another impact categories to be monitored as well to receive certification, meaning the purchase of a carbon, credit can entail multiple verified co-benefits. This can be a powerful way of driving sustainable development while tackling the urgent issue of climate changes.

PROS

When "done right", carbon offsetting could "inject huge sums into underfunded climate solutions", said the Financial Times. These examples included a scheme that reduced reforestation in an area of the Peruvian Amazon by 75%, resulting in the equivalent carbon emission avoidance of "taking more than one million cars off the road each year".

The Costa Rican government also generates $30m a year for forest conservation through carbon credit sales, which has helped to conserve millions of acres of forests.

CONS

flawed' estimations

Calculating emissions and carbon footprints is "a complex and flawed process", said The New York Times. "At best it provides an estimate, usually reported as kilograms of carbon dioxide equivalents." Even if these estimates are accurate, offsets are "a super-murky world without a whole lot of oversight", according to Jamie Alexander, director of Drawdown Labs, a nonprofit that works with tech companies on climate solutions.

Greenpeace concluded that "the big problem with offsets isn't that what they offer is bad – tree planting or renewable energy and efficiency for poor communities are all good things – but rather that they don't do what they say on the tin.

#4 prior solution

IoT Based Air Pollution Monitoring System monitors the Air Quality over a web server using the internet and will trigger an alarm when the air quality goes down beyond a certain level, which means when there are amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, NOx, and LPG.

The system will show the air quality in PPM on the LCD and as well as on the webpage so that it can be monitored very easily. Temperature and Humidity are detected and monitored in the system.

FIG9

LPG gas is detected using the MQ

6 sensor and the MQ135 sensor is used for monitoring Air Quality as it detects the most harmful gases and can measure their amount accurately. This IoT project can monitor the pollution level from anywhere using your computer or mobile. This system can be installed anywhere and can also trigger some devices when pollution goes beyond some level like we can send alert SMS to the user.

Working

The proposed Air Pollution Monitoring System is based on the block diagram as shown in Fig.1. The data of air is recognized by the MQ135 gas sensor and MQ6 LPG gas sensor. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, and CO2. So, it is a dynamic gas sensor for our Air pollution Monitoring system. When it will be connected to Arduino then it will sense all gases, and it will give the Pollution level in PPM (parts per million). MQ135 gas sensor will give the output in form of voltage levels and we have to convert it into PPM. So, for converting the output in PPM, we have used a library for the MQ135 gas sensor and MQ6 sensor.

Advantages:

1) Easy to Install
2) Updates On mobile phones directly
3) Accurate Pollution monitoring
4) Remote location monitoring

Disadvantages:

As these devices are interconnected via the internet there are possibilities that they can get hacked or monitored by malicious users or can be tracked by other systems as well. So, the security of the recorded data can be an issue using this type of device

#5 prior solution

Weather Reporting System is mostly used to monitor the continuously changing temperature,

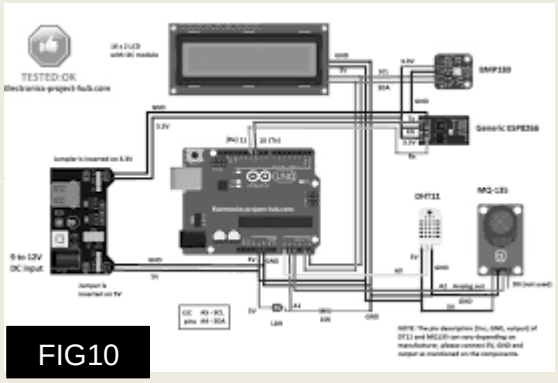


FIG10

Weather Reporting System is mostly used to monitor the continuously changing climatic and weather conditions over controlled areas like houses, industry, agriculture, etc. This project will focus on the development of ThingSpeak an IoT platform that shows the data of the sensor. The method is divided into two parts which are the hardware and software development parts. The hardware development involves the circuit construction and develops the prototype. Meanwhile, the software part involves the IoT coding, circuit schematic diagram, circuit simulation, and data acquisition.

By using three (3) types of sensors to monitor the weather par parameter which are temperature, humidity, rain, and air quality the system will be able to display the weather condition by an analysis of the current weather with the sensor value data. All the data will be controlled by a microcontroller ESP32 and Wemos as the client will receive the sensor data from ESP32 and display it on OLED.

Working

1) the circuit of the control unit system has been made so that the ESP32 microcontroller control all weather parameters sensor, that is the BME280 (Temperature, Humidity, and Pressure) sensor, MQ135 (Air quality sensor), Rain sensor, LDR sensor.

2)Then it is powered by a USB cable also to upload the sketch of coding in the ESP32 microcontroller.

The sensor data can be displayed serial monitor in Arduino IDE software. ESP32 will connect with the Wi-Fi hotspot that is applied to this system. Data received by weather the station

will be displayed on OLED. demonstrate the communication of both the sensor station and weather station by using a Wi-Fi hotspot.
3)The web server contains HTML that can display the sensor data by simple coding and connection where the IP address of the ESP32 is needed to complete this action.
4) It will read all the sensor values and then send them to the cloud data where ThingSpeak has been used for this. Thing Speak will store the sensor value and display that data to the channel create there. The user can check the weather parameter via the thing speak website.

Advantages

- **1) Easy to Install** **2) Saves time and effort**
- **3) it provides information on the variations in humidity, temperature, and CO levels in the exact region where the embedded monitoring device is installed.**

Disadvantages

1) It is complicated due to a large amount of code and the machine's communication
2) Without a stable internet connection, the IoT devices fail to work and the tasks are incomplete.
3) the user data is now available on the internet and hackers can hack this private and sensitive information.

#6 prior solution

As a renewable source of power, solar energy has an important role in reducing greenhouse gas emissions and mitigating climate change, which is critical to protecting humans, wildlife, and ecosystems. Solar energy can also improve air quality and reduce water use from energy production. Because ground-mounted photovoltaic (PV) and concentrating solar-thermal power installations require the use of land, sites need to be selected, designed and managed to minimize impacts on local wildlife, wildlife habitat, and soil and water resources. The amount of sunlight that strikes the earth's surface in an hour and a half is enough to handle the entire world's energy consumption for a full year. Solar technologies convert sunlight into electrical energy either through photovoltaic (PV) panels or through mirrors that concentrate solar radiation. This energy can be used to generate electricity or be stored in batteries or thermal storage.

PROS

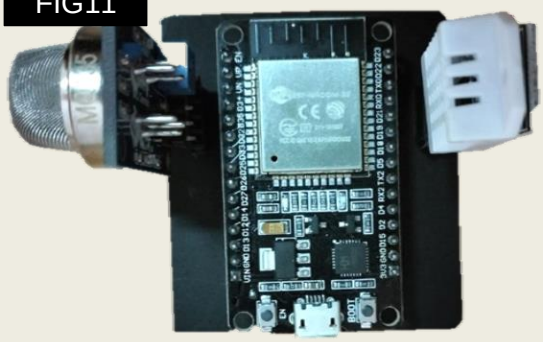
- **Renewable Energy Sources**
- **Reduces Electricity Bills:**
- **Diverse Applications**

CONS

- **Cost:**
- **Uses a Lot of Space**
- **Associated with Pollution**

Design Requirements

FIG11



In our project, we will work on the smoke so it has a lot of particulate matter that will affect the temperature We used specific design requirements that make the project successful and detect the problems that we must detect. Also, we should take into consideration the accuracy of these sensors to get accurate values.

1-temperature: we use the sensor "DHT22" to measure the temperature and we use It because it is a minimum value equal to (-40) and a maximum value equal to (+125) so also it will achieve accuracy in measurements

2- Particulate matter: like (CO, CO2, Alcohol, Acetone, Toluene, and NH4) we want to detect the minimum value of these gases (=10 ppm) and also the maximum value (=1000 pm) so we use the sensor "MQ135" that achieves these requirements.

3-Accuracy: we use sensors with small error values to make the results more accurate so we use a DHT22 temperature sensor ±0.5. we make a glass box 15cm(height)*15cm(width)*15cm(length) to control well in the environment and make sure that we have values of the particulate matter that approach the proportions of gases in the smoke.

4- dynamic range is the minimum value and the maximum value that the sensors can detect. So, the minimum value that we want the sensors (MQ135, DHT22) to detect is the temperature and the concentration of the particulate matter in the surrounding room environment, and the maximum value that we want the sensors to detect is the particulate matter that we will add and the temperature that will change according to the change in the particulate matter.

Generating and defining a solution

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Selection of solution

Wildfires produce particulate count which can purpose critical fitness problems. A great frame of clinical proof shows that inhaling the best debris over the direction of hours to days (short-time period exposure) and months to years (lengthy-time period exposure) can purpose critical public fitness results that encompass untimely loss of life and negative cardiovascular results. Particulate count emitted thru human sports now no longer handiest pollutes the air, however, additionally cools the Earth via way of means of scattering shortwave sun radiation. However, coarser dirt debris had been determined to exert a warming impact that could, to a degree make amends for the cooling impact of best dirt. Here we look into the radiative results of sulfate-containing aerosols of diverse sizes and core/shell systems the usage of Mie scattering and three-D finite distinction time area simulations of the electromagnetic fields' inner and round particulate count debris. We locate that now no longer the handiest coarse dirt, however additionally best non-light-soaking up inorganic aerosols including sulfate could have a warming impact. Specifically, despite the fact that the opacity of best debris decreases at longer wavelengths, they are able to strongly take in and re-emit thermal radiation below resonance situations at lengthy wavelengths. We advocate that those results want to be taken under consideration whilst assessing the contribution of aerosols to weather change. The PM within side the atmospheric window might have an effect on the absorption and scattering results of thermal radiation. Measuring PM can assist decide the air pollutants coming from mining sports. The particulate count is launched for the duration of floor mining, in addition, whilst soil and flora are removed, exposing the soil to the climate that may purpose debris to emerge as airborne. PM-size gadgets can assist quantify the influences that mining has on general air pleasant. PM is likewise the dominant pollutant accounting for the hazard of wildfire smoke to human fitness, so measuring the extent of particulate count launched via way of means of wildfires can assist each categorizing the wildfire's influences on air pleasant and assist tell people of the hazard that the air poses at a given moment. The result will be better availability of high spatiotemporal resolution air quality data in near-real time for air quality managers, researchers, and the general public.

The availability of this data will help governments and communities to better understand — and act to reduce — air pollution around the world. In addition to causing smoggy skies and chronic coughs, soot – or black carbon – turns out to be the number two contributor to global warming. It's second only to carbon dioxide, according to a four-year assessment by an international panel. Climate change creates conditions, including heat and stagnant air, which increase the risk of unhealthful ozone levels. Ground-level ozone often called smog,

forms in the atmosphere when gases emitted from smokestacks and tailpipes mix in the air. Hotter weather and stagnant air create conditions that make ozone more likely to form. Even with current measures to reduce ozone, evidence warns that climate change likely will increase ozone levels. To protect human health, the nation needs strong measures to reduce climate change and ozone. Hotter temperatures and lack of rainfall increase the risk of drought and wildfires, both of which create particle pollution. Wildfires have become a major source of extremely high particle levels in places hundreds of miles from the fire itself. Dust storms may increase as the soil dries out and the water table drops. Even with current measures to reduce particle pollution, these changes have led to increased high particle pollution days with worse levels of pollution. Scientists warn that climate change impacts the air we breathe, making it harder to clean up ozone pollution and increasing the risk of particle pollution. Air pollution is causing the climate to change, and climate change is also causing air quality to change. Because of climate warming, the Earth experiences more extreme weather, such as heat waves and drought, which can negatively impact air quality. Heat waves cause an increase in ground-level ozone pollution because the chemical reactions that create ozone in the atmosphere occur more often in hot temperatures.

Selection of the prototype

our lives. communication, the internet of things (IoT), mobile devices, the development of new better sensing technologies, and hardware interfaces have great potential in reducing the negative impacts of climate change.

To address discovering the climate actions that negatively affect the earth generally and Egypt specifically. We decided to harness our effort by working on smog actions in Egypt and measuring its factors and consequences accurately and precisely.

Our prototype has been distributed into three parts (the closed environment, the PCB board, and the GUI)

Closed environment:

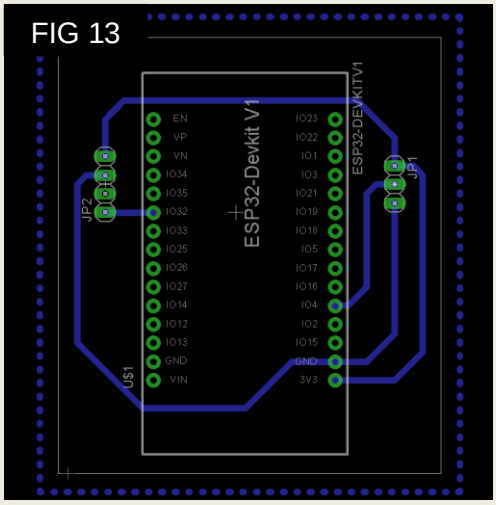
We made the required environment to highlight smog as climate action. We designed a glass box with dimensions of 15*15*15, we specified those dimensions to control the availability of smog inside the box. We chose the glass material as

FIG 12

it is fairly priced compared to other materials such as acrylic. Also, it is suitable for the temperature that will be exposed to during the smog simulation.
We glued five faces of glass sheets with silicon glue and left the box without a lid. As shown in FIG., smog artificially can be prepared by using a foil sheet as a lid for the box. The box implicitly contained folded paper which has been fired. Consequently, smog started to form grey clouds on the box's lateral surface area.

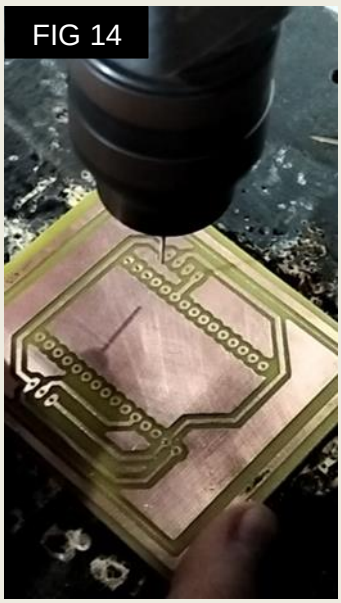
PCB board:

FIG 13



Instead of using complicated jumpers and breadboards, we decided to substitute them by creating a PCB board with an internal circuit. Firstly, we drew our circuit by putting our components – two sensors and ESP-. Secondly, we printed our circuit on glossy paper. Also, we get a thermal paper transfer that dimensionally satisfied the circuit; we cleaned it to check its smoothness. After that, we used iron to make to press our draw into the thermal transfer paper. Consequently, we left it in an acidic medium for a few seconds, and then we left it in a water bowl. After a few minutes, we started to remove the glossy paper from the thermal transfer paper carefully. We sprayed it with a color to give it a more expert appearance. After a while, we started to use a presser to perforate the PCB board to make a stable space for the components to be fixed in. By finishing the previous step, we have finished the PCB board and it has been ready to carry MQ 135 sensor, DHT 22 sensor, and ESP 32.

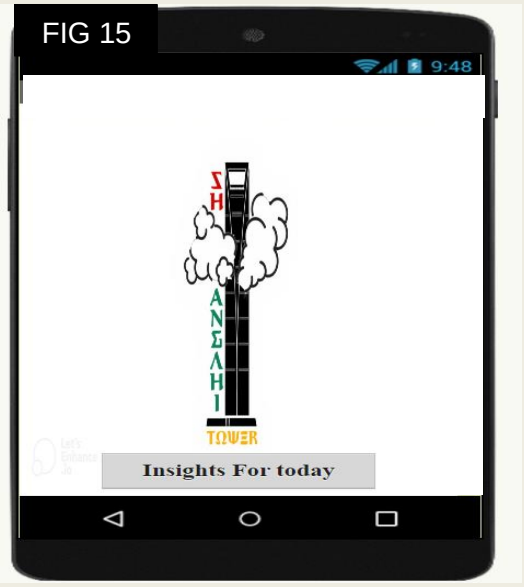
FIG 14



GUI:

We created a mobile application with GUI to connect the user with the server or the user can see the analysis directly. The website has been connected by WIFI through the WIFI module in ESP 32.

FIG 15



Constructing and testing the prototype

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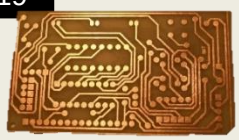
Materials & Methods

MQ-135	45 EGP	1	Makers online store	Air quality sensor used to measure Pm and other gases	 FIG16
DHT-22	120 EGP	1	Makers online store	A Temperature sensor used to measure variability in temperature	 FIG17
Glass Box	50EGP	1	Local workshop	Used as a closed system to make artificial smog	
ESP 32	175EGP	1	3Duino online store	Controller to our sensors and includes Wi-Fi module	FIG18 
PCB board	75EGP	1	I-Engineer	Used to connect all the components on the same circuit	FIG 19 
Foil Roll	10EGP	1	-	Used as a lid for the closed environment	FIG20  FIG21
Paper	-	-	-	Have been flamed inside the glass box to produce the smog	 FIG22

Test plan

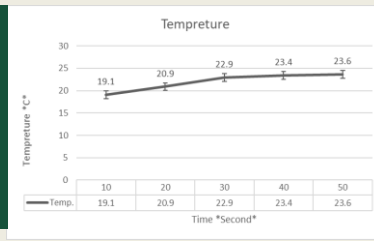
- **Measure the temperature of the smog :**
  we use a sensor (DHT22) to measure the temperature of the smog, so when we make the smog we put the sensor in it, and the temperature is increasing.
- **Detect the particulate matter and measure them:**
  We use a sensor (MQ135) to detect particulate matter and determine its proportions. so when we make the smog in the box and put sensors in it, we detect CO, Alcohol, CO2, NH4, Toluene, and Acetone. They all were increasing.
- **Accuracy of the measurements:**
  We use a (DHT22) temperature sensor with an accuracy of ±0.5 to make sure that we will have accurate and right results. And we heat afire in a large piece of paper instead of a small wrapped paper to have the accurate results that we want.
- **Dynamic Range:**
  We want to detect the minimum and the maximum values that the sensors (DHT22), and(MQ135) can detect. So before putting the sensor inside the box, the sensors detect the surrounding environment and the result values are the minimum values and equals (19 C), then we put the sensors inside the box that is filled with smog and the values measured by the sensors are the maximum values and it is equal (23.9 C).

Data Collection

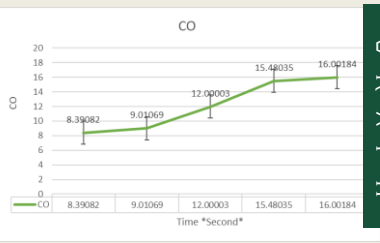
When we started to test our prototype according to the plan that we set. Also, calculate the results and measures that are required to prove to design requirements to measure the success of the prototype in four different trials to check the precision and accuracy.

After following some steps from flaming the folded paper in the wet surface glass box and using foil paper as a lid; putting ice cubes on it. After almost 20 seconds we started to make
the sensors detect temperature and other three gases which are alcohol, carbon monoxide, and carbon dioxide. We measured it with
a rate of one trial every ten seconds. DHT 22 sensor with error ±0.5. Additionally, our MQ135 sensor detected successfully NH4, acetone, and toluene–benzene derivatives-. We observed that our test is done as it was expected. The temperature has been increased as long as
it is kept in a smog environment. Also, PMs have been raised with various ratios.

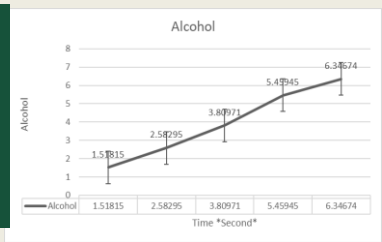
GRAPH



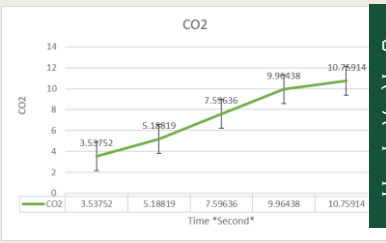
GRAPH



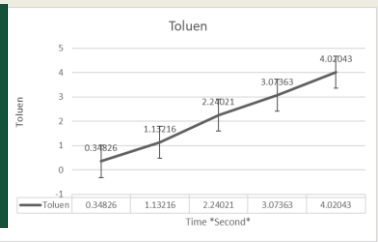
GRAPH



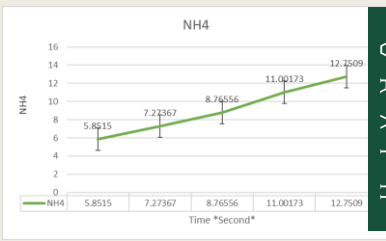
GRAPH



GRAPH



GRAPH



GRAPH 7

Evaluation, reflection, and recommendations

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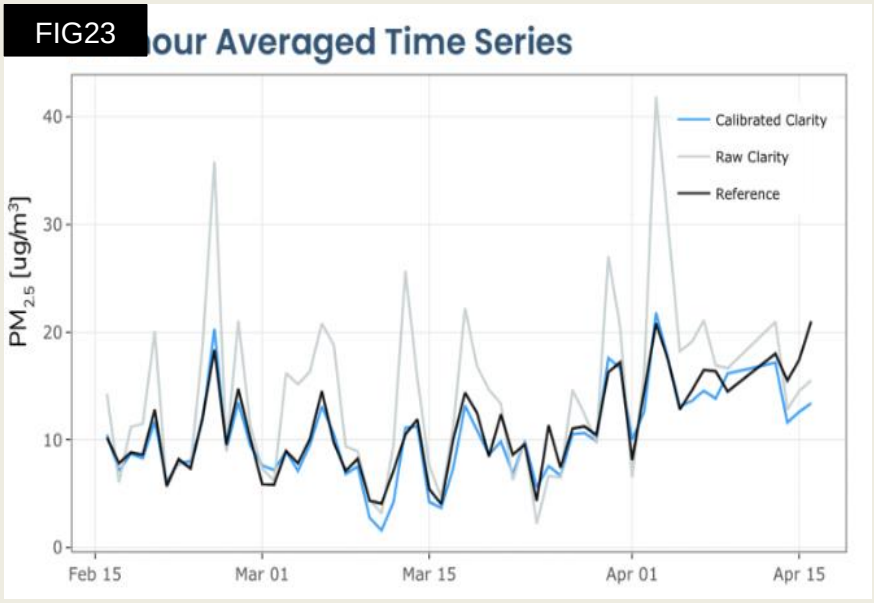
Discussion

Climate Change refers to long-time period shifts in temperatures And climate patterns. These shifts can be natural, inclusive of via versions withinside the sun cycle. Burning fossil fuels generates greenhouse fueloline emissions that act like a blanket wrapped across the Earth, trapping the sun's warmth and elevating temperatures. As a result, the Earth is now approximately 1.1°C hotter than it became withinside the overdue 1800s. The final decade became the warmest on record. Many humans suppose the weather extrude particularly method hotter temperatures. But temperature upward thrust is most effective the start of the story. Because the Earth is a system, in which the whole lot is connected, modifications in a single region can impact modifications in all others. PM size gadgets can assist quantify the influences that mining has on general air pleasant. So, we made the required environment to highlight smog as climate action.

FIG23



Come from each a part of the sector and have an effect on everyone, however a few international locations produce an awful lot extra than others. The a hundred least-emitting international locations generate three according to cent of overall emissions. With respect to the results, the project was successful. The grand challenge was solved in deft form.

Moreover, the solution was proved that match the design requirements of:

Temperature:

The temperature had measured to determine how the temperature rise in the smog. To know what the ratio between every trail is.

Particulate matter:

The particulate matter had measured, especially (CO, CO2) had measured in the smog.

Accuracy:

We used a DHT22 temperature sensor ±0.5. To make sure that we have values of the particulate matter that approach the proportions of gases in the smoke.

Dynamic range:

It's the minimum value and the maximum value the sensors (MQ135, DHT22) can detect.

The Equation:

r=correlation coefficient, x=values of the x-variable in a sample, y=values of the y-variable in a sample, n=number of pairs of data Consequently, with table 3, we got the value of r, which has been found to be r=0.9168345623. The value indicates that is a directly strong, also called significant, between the CO and temperature. Hence, after verifying that the linear correlation is significant, we determined the equation of the line that can be used to predict the temperature for a given value percent of CO.

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2]\,[n\Sigma y^2 - (\Sigma y)^2]}}$$

FIG24

x	y	xy	x^2	y^2
8.39082	19.1	160.26	70.405	364.81
9.01069	20.9	188.309	81.192	436.81
12.00003	22.9	274.800	144.00	524.41
15.48035	23.4	362.240	239.641	547.56
16.00184	23.6	377.643	256.05	556.96
$\sum x$=60.883	$\sum y$=109.9	$\sum xy$=1363.252	$\sum x^2$=791.288	$\sum y^2$=2430.55

The equation formula of a regression line is: ŷ=ax+b a= 15.87162755, b=0.5016441602. Where ŷ is the predicted y value for a given x-value, m is the slope, and b is the y-intersect. To the end, the equation of regression line is: ŷ=15.87X+0.5016441602.

$$m = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2} \qquad b = \frac{\Sigma y - m(\Sigma x)}{n}$$

Coding:

The technology part was applied depending on collect data of each element in this system by the following code: We connect the Wi-Fi with including Wi-Fi library and Thing-Speak library. By putting our channel key in the code to define it. Then we put the timer variables. This is shown through Figure (25).

FIG25

```
#include <WiFi.h>
#include "ThingSpeak.h"

const char* ssid = "Mayar";
const char* password = "AA854620";

WiFiClient  client;

unsigned long myChannelNumber = 1;
const char * myWriteAPIKey = "UJXFN75QAVDJ
```

We included the DHT library to define the pin of DHT22. Shown in figure (26).

FIG26

```
de "DHT.h"
#define DHTPIN 4
#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);
```

By including MQ library and defining the type of MQ which is MQ-135 then determine the voltage resolution of ESP32. Figure (27).

FIG27

```
<MQUnifiedsensor.h>
placa "ESP32"
#define Voltage_Resolution 3.3
#define pin A4
#define type "MQ-135"
#define ADC_Bit_Resolution 12
#define RatioMQ135CleanAir 3.6
```

We set every element that we can to measure in MQ-135 with their A and B points with respect that A and B in every element are different. Shown in figure (28).

FIG28

```
e();
(605.18); MQ135.setB(-3.937);
MQ135.readSensor();

MQ135.setA(77.255); MQ135.setB(-3.18);
float Alcohol = MQ135.readSensor();

MQ135.setA(110.47); MQ135.setB(-2.862);
float CO2 = MQ135.readSensor();

MQ135.setA(44.947); MQ135.setB(-3.445);
float Toluen = MQ135.readSensor();

MQ135.setA(102.2 ); MQ135.setB(-2.473);
float NH4 = MQ135.readSensor();

MQ135.setA(34.668); MQ135.setB(-3.369);
float Aceton = MQ135.readSensor();
```

With this we defined the (x, y) points of each element. Which the X is the number of fields on the website, and Y represented by name of element measured in this field. Shown in figure (29).

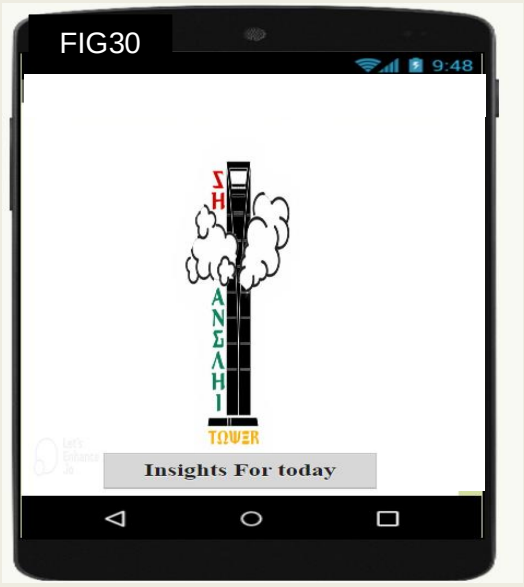
FIG29

```
etField(1, t);
stField(2, CO);
ThingSpeak.setField(3, Alcohol);
ThingSpeak.setField(4, CO2);
ThingSpeak.setField(5, Toluen);
ThingSpeak.setField(6, NH4);
ThingSpeak.setField(7, Aceton);

ThingSpeak.writeFields(myChannelNumber, myWri

lastTime = millis();
```

FIG30



We created a mobile application with GUI to connect the user with the server or the user can see the analysis directly. The website has been connected by WIFI through the WIFI module in ESP 32. Shown in Figure (30).

conclusion:

The way of climate change problem is one of Egypt's grand challenges. As a result, we believe that the first step in solving the problem is detecting its size to search for how can we control it. After simulating smog successfully, we connected the WIFI module which is in ESP 32. We started to write down the readings of six gases and temperatures. We observed a gradually increasing in temperature; as long as the sensors in the box, read numbers more in values. Those observations met our design requirements. We concluded that most of the reasons behind smog are human-made. Consequently, the country must enact strict rules to reduce smog and its consequences; reduce the number of car trips, eliminate fireplaces and avoid burning leaves, trash, and other materials, in addition, avoid using gas-powered lawn and garden equipment.

Recommendations

After making our prototype we recommended points for the new researchers who would work on developing our project to put them into consideration:

- **We recommend using an Ozone sensor to be more specific in its reading, in addition, reach a more advanced level of precision and accuracy.**
- **We recommend using larger spaces to make a higher percentage of smog; as more, we put more variety and specificity in the results we get.**
- **We recommend to other researchers to make their trials in a natural environment instead of a closed one. They can find smog mostly located in basins surrounded by mountains because the smog is trapped in the valley and cannot be carried away by the wind.**

Learning Outcomes

MA.3.01	We learned about parametric differentiation in this learning transfer, which allows us to obtain a relationship between the rate of change of one variable and that of another variable when both of those variables share a parameter. As in our project, we can determine the relationship between the rate of change in soil acidity and carbon dioxide gas as they have time as a parameter.
MA.3.02	In this learning outcome, we learned about the critical points where the function's rate of change altered, either increasing or decreasing, and the derivative was zero or undefined. Knowing these critical points would help us examine the graph and its rate of change as well as its maximum and minimum points-more closely.
MA.3.04	This learning result taught us about sequences, which made it easier for us to determine the order in which the variables moved on and to analyze and make conclusions about them.
CH.3.01	In this learning outcome, we learned about scientific methodology where we can objectively establish facts through testing and experimentation by using its seven steps.
CH.3.03	We learned how to build a balanced chemical equation and the chemical compound formulas used in the chemical laboratory to prepare carbon dioxide gas
ENW.3.1.2	Using this learning outcome, we were able to develop our ability to compose well-developed essays in a variety of genres, such as expository persuasive, and argumentative essays that would be useful for our poster and portfolio submissions.
ENR.3.3.5&ENR.3.2.3	In this learning outcome, we discovered how to read for gist, read to find out specifics Make of graphic organizers
PH.3.4&5	Throughout these two learning outcomes, we Throughout these two learning outcomes, we learned about the fundamentals of communication and wireless technology, such as WI modules that are used in our project. Since our project is about to, these learning outcomes particularly useful

ES.3.06	**We learned about Resonance which is a phenomenon that occurs when the matching vibrations of another object increase the amplitude of an object's oscillations. consequently, happening very strong winds (storms) that cause a lot of destructive events including resonance and you won't be prepared for it.**
BI.3.04:	**We learned about the different sensory receptors in our body and their pathways. In our project, the temperature sensor represents a Thermo receptor as its responsible for detecting changes happening in the temperature of our environment simulation. This sensor then sends the information as electric pulses to the WI-FI module in ESP32 (interneurons are WI-FI, and ESP32 is the motor neurons)) to integrate it and create the command with respect to it in the ESP32 which then carries it to the website (effector or target) to form a suitable response.**

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