Ethics and Creativity come first.

ALEX STEM SCHOOL

جمهورية مصر العربية

وزارة التربية والتعليم

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DESCEON

Capstone Portfolio 2017/2018 Semester 2

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Introduction:

The Egyptian industrial base problem is the starting point for a complex chain of other issues. It has exhausted everything including health, money and the limited resources of power. We have found that the majority of Egyptians doesn't rely on, nowadays, technology or the alternative materials for the industries which may have some defects. In fact, Egypt industrial base in nonetheless still a key driver of the economy. So, we are working for the improving of the industrial base.

se by reducing the cost of manufacturing the product itself.

Thus, we focused on the air conditioning industry as it has a lot of defects and a lot of fields that we could work on. We tried to reduce the cost of the products in the industrialization using microcontrollers such as Arduino and silica gel indicator (SiO_2) that reduces the humidity. We replaced the system by the heater in the air conditioner to reduce the disputed power and the cost.

And we named our group "Desceon". It is combination between Desiccant and Freon as our solution is focusing on replacing Freon by the desiccant as it is relatively very low and has same efficient.

Egypt Grand Challenges:

Our beloved Egypt is suffering from many problems and challenges that obstacle her progress and affect badly our economy and all other fields.
Since we are her sons, then we have to overcome these challenges and put an end of these problems.

These Challenges and Problems represent in:

- ►Recycling
- ►Urban Congestion
- ►Water Pollution
- ►Public Health Issues
- ►Pollution
- ►The deficiency of the Industrial and Agricultural Base
- ►The Lack of Use of Scientific and Technological Methods
- ►Population Growth
- ► Arid areas
- ► Alternative Energy

Recycling

Recycling is the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products. Recycling can benefit your community and the environment. It is an alternative to "conventional" waste disposal that can save material and help lower greenhouse gas emissions (compared to plastic production, for example. Recycling can prevent the waste of potentially useful materials and reduce the consumption of fresh raw materials, thereby reducing: energy usage, air pollution (from incineration), and water pollution.

Figure (1)

Walking along the streets of Cairo and Alexandria, one can hardly miss the piles of trash on almost every street corner, even in upscale districts. There seems to be no solution to the garbage problem, which has become a normal part of Egyptian daily life. Environmentalists say that the problem goes further than just garbage collection and includes poor social behavior and a lack of environmental awareness. Physicians warn of the possible health hazards.

In old films portraying the streets of Cairo in the 1930s and 1940s, men in tailored suits and women wearing fashionable dresses stroll along city streets. Although the films are in black-and-white, the cleanliness of the streets cannot be missed.

In these scenes, captured more than half a century ago in places like Tahrir Square, Sayeda Zeinab, the Citadel, one hardly sees any garbage on the ground, making one wonder just what has led to the enormous contrast with the situation today.

According to research conducted by the American University in Cairo in 2009, the estimated population of the Zabaleen district is between 50,000 and 80,000 people, with some 30,000 working in the garbage village located in Mokattam (see figure (2)). Several generations of the village's residents have worked in recycling waste collected from Cairo neighborhoods.

Figure (2)

Urban Congestion

The Greater Cairo Metropolitan Area (GCMA), with more than 19 million inhabitants, is host to more than one-fifth of Egypt's population. The GCMA is also an important contributor to the Egyptian economy in terms of GDP and jobs. The population of the GCMA is expected to further increase to 24 million by 2027, and correspondingly its importance to the economy will also increase.

Traffic congestion is a serious problem in the GCMA with large and adverse effects on both the quality of life and the economy. In addition to the time wasted standing still in traffic, time that could be put to more productive uses, congestion results in unnecessary fuel consumption, causes additional wear and tear on vehicles, increases harmful emissions lowering air quality, increases the costs of transport for business, and makes the GCMA an unattractive location for businesses and industry.

In recognition of the seriousness of the problem of traffic congestion (see figure (3)), and upon the request of Government,

Figure (3)

The World Bank funded an investigation into its magnitude, causes, and potential solutions in the GCMA. The objective of the study was intended to conduct a macro-level investigation of congestion in the GCMA: its magnitude, causes, associated economic costs, and potential solutions.

This report documents the results of the study. The results of this study should be of interest to policy-makers and practitioners in the GCMA, the Egyptian Government, other cities facing similar problems, and international financial institutions.

Traffic congestion in Egypt has many causes: fuel subsidies result in cheap petrol and diesel, which in turn result in more private cars on the streets, meanwhile the lack of parking areas results in cars having to turn back or park incorrectly on the streets prompting further traffic jams. Although the number of metro commuters is high, the metro only reaches a limited number of places in the city. Also, public transport buses are few in number and outdated, thus prompting people to use other buses and taxis to get by. However, the latter generally need to be cleaner, safer and be able to better load and unload passengers. There are also few areas for pedestrians to cross the streets and street peddlers often occupy these areas and the sidewalks, making things worse. Moreover, there are many problems related to the construction of roads where there are few street lights, stop signs and crossroads; people also find

awful corners and U-turns that are either very sharp turns or are very narrow thus not allowing drivers to make smooth U-turns. Drivers also behave badly and irresponsibly added to the poor implementation of traffic laws, which causes
the public to undermine traffic regulations. Economic costs incurred due to traffic congestion in Cairo may reach almost a 4% loss from the Egypt's annual gross domestic product (GDP). Not only are these economic costs limited to an increase in the amount of time taken to get from one place to another, but also include a rise in costs due to excessive fuel consumption as well as having negative effects on people's health due to air pollution, accidents and economic production effects. Combined, the economic cost resulting from traffic congestion reaches about 4% of Egypt's GDP; in other words, Egypt suffers a loss of nearly EGP 50 billion every year due to traffic congestion.

Water Pollution

Water pollution is defined as the presence in groundwater of toxic chemicals and biological agents that exceed what is naturally found in the water and may pose a threat to human health and/or the environment. Additionally, water pollution may consist of chemicals introduced into the water bodies as a result of various human activities. Any amount of those chemicals pollutes the

Figure (4)

water, regardless of the harm they may pose to human health and the environment (see figure (5)).
Not only does this spell disaster for aquatic ecosystems, the pollutants also seep through and reach the groundwater, which might end up in our households as contaminated water we use in our daily activities, including drinking.

Figure (5)

There are various types of water pollution based on the various causes of water pollution. Various classifications can be made, based on various water pollution causes:
The type of the water pollutants – based on this classification criteria, water pollution can be:
1) Chemical – when various chemicals are the water pollution causes.

2) Radiological – when radioactive materials are the water pollutant causes.

3) Biological – when various microorganisms (e.g., bacterial species and viruses), worms, and/or algae occurring in a large number are the water pollution causes. This type of pollution is caused by decaying organic material in water, animal wastes, as well as improper disposal of human wastes.

Sources of Water Pollution:
The main sources of pollution are all resulted from the disposal of chemical substances coming from medical, industrial and household waste, chaotic agricultural fertilizers disposal and accidental oil spills that pollute the water to a large extent.
Examples of major water pollutants that affect the health of humans are:
_The numerous infectious agents (bacteria, viruses, and parasites) that contaminate the water through sewage, human waste, and animal excreta

_Radioactive waste that contains highly toxic materials such as uranium, thorium, and radon. This waste is a major water pollutant resulted from mining activities, power plants or natural sources

_The chemical substances that contaminate the water (see figure (6)).

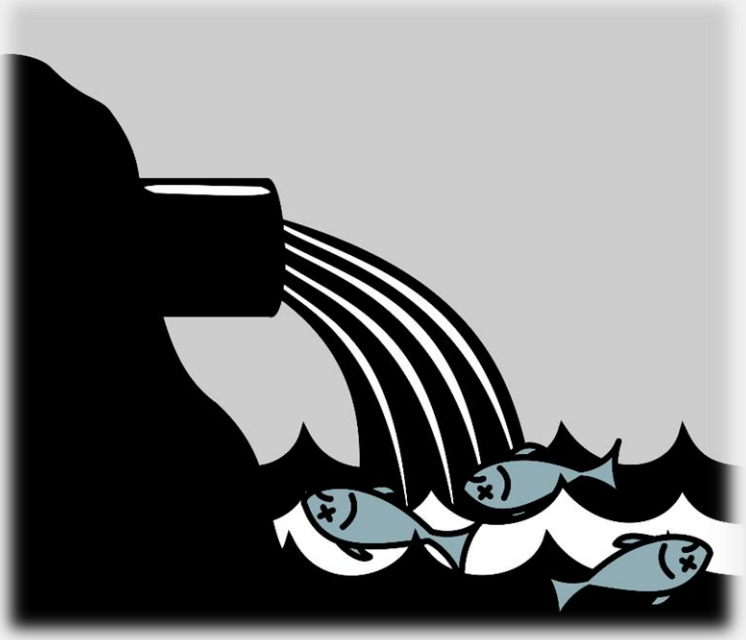


Figure (6)

Public Health Issues

Egypt's health challenges disproportionately affect the rural poor and have the potential to impact the country's economic prosperity more broadly over the long term. Poor women are 20 percent less likely to receive regular antenatal care than wealthy women, and under-five mortality for children born in the wealthiest quintile is 19 deaths per 1,000 live births versus 42 deaths for the poorest. Current threats include high rates of childhood stunting and the highest rate of Hepatitis C in the world; seven percent of Egyptians between the ages of 15 and 59 suffer from chronic Hepatitis C.

Egypt's 2014 Demographic and Health Survey (DHS) recorded a globally unprecedented 17 percent increase in the country's total fertility rate in the past six years, as well as a reduction in key best practices related to good maternal and child health such as early breastfeeding. Some of these trends can be linked to low-quality health care services, poor health behaviors, and weak management of health systems in the public sector.

USAID's programs improve health behaviors, enhance the quality of health services, and help the Government of Egypt to guide

policy and program design by supporting research and monitoring in key areas such as nutrition and infectious disease. USAID programs in Egypt place particular emphasis on poor and underserved populations, including women and youth; geographical areas where there are health disparities; and addressing gender inequalities in the health sector.

Figure (7)

To improve health and promote a stronger workforce, key areas of intervention include maternal, neonatal, and child health and nutrition; emerging and infectious disease detection and response; health communication; and support for research to improve information on key health topics

•Infection rates dropped 20% one month after healthcare acquired infection surveillance began

•Support to helped vaccinate over 35 million children and more than 95% of the population; DPT3 immunization reached 95% of the population

•3963 Egyptian nationals and 2273 regional staff were trained in surveillance and laboratory diagnostics since 2009.

The Pollution

Egypt is suffering from several kinds of pollution. One certain pollution is not really being reaching any awareness at all from both the official authorities as well as the citizens, which suffer from it but also create it to a certain extend: The Noise Pollution!
From loud and blaring car horns and horn symphonies of most taxi- and micro-bus drivers to wedding parties with drifting cars and motor-cycle donuts on public roads and right in the middle of other cars, rising noise pollution in the already much-polluted 24-hour metropolis of Cairo has reached disturbing and alarming levels, leading to hearing problems, irritability and even death. Not to mention the loss of concentration which often leads to minor accidents and sometimes even to major and severe crashes.

That? ½s probably one of the many reasons why cars in Egyptian have scratches and bends everywhere. Not only cars are polluting Cairo, but also the old Jawa and Cezet motorcycles Living in the city Centre, where noise levels reach an average of 90 decibels (dB) and never drop below 70 dB, is like spending all day inside a factory, a 2007 study by the Egyptian National Research Centre (NRC) unveiled. According to the WHO (World Health Organization), which considers noise pollution to be the world's third worst after polluted air and water, exposure for more than eight hours a day to sound in excess of 85 dB is potentially hazardous and can lead to serious illness. The Egyptian ministries of health and environment announced plans to establish a national network for monitoring noise levels in Egypt, but no date has yet been fixed for it to begin gathering data. In the coming weeks we will publish several studies about the harmful results of being exposed to such pollution as well as to the air pollution in Cairo.

Figure (8)

Figure (9)

The deficiency of the Industrial and Agricultural Base

Future industrial policies in Egypt will be focused on enabling the industrial sector to be the engine of growth through the expansion of exports and job opportunities. At present, the industrial sector in Egypt is a major contributor to economic growth, employment generation, and export proceeds. Roughly accounting for 20 percent of GDP (excluding informal industrial activities), there are

around 26,000 formally registered industrial establishments employing nearly 2.4 million workers and around 1.5 million workers in informal industrial establishments which represents around 20% of the labor force. In addition, manufactured exports account for nearly 3% of GDP, 40% non-oil export proceeds and 11% total current account receipts.

The industrial sector is a major growth driver having strong backward and forward linkages with both the agriculture and services sectors. It is expected to play an instrumental role in reinvigorating economic growth in the Egyptian economy over the medium and long terms.

Figure (10)

Learning from the successful experience of other developing countries, the industrial sector is bound to become the driver for increasing growth rates, generation of sufficient employment opportunities, and fostering Egypt's integration into the global economy.

The industrial sector is best-positioned as a potential growth driver because:

- It enjoys strong forward and backward linkages with other important economic; sectors such as agriculture and services.
- It offers high prospects for employment creation especially in labor-intensive industries
- It acts as a catalyst for technology transfer and attraction of FDI
- It offers high prospects for deepening Egypt's drive to integrate further into the global economy (see figure (10)).

Comparative performance indicators suggest that there is a large room for improving the competitiveness of Egypt's industrial sector. The legacy of state intervention in the industrial sector coupled with absence of a clear vision and strong commitment to enhancing industrial competitiveness are seen as primary reasons for the current state of affairs. The time is ripe for envisaging a national strategy for improving industrial performance.

It has to be emphasized from the outset that implementing the Industrial Development Strategy has to be phased. Three phases are envisaged, each of which leads to, and paves

the way for the next. The first phase to be carried out in the short term should have as its objective the increase in exports and employment.

Agricultural land

Egypt is in the north-eastern corner of Africa between latitudes 21^{o} and 31^{o} North and longitudes 25^{o} and 35^{o} East with a total area of 1 001 450 km^2; the country stretches 1 105 km from north to south and up to 1 129 km from east to west. It is bordered in the north by the Mediterranean Sea, in the east by the Gaza Strip, Palestine and the Red Sea, in the south by Sudan and in the west by Libya.

Egypt is divided into twenty-six governorates, which include four city governorates (Alexandria, Cairo, Port Said and Suez), nine in Lower Egypt (in the Nile Delta region), eight in Upper Egypt along the Nile River from Cairo to Aswan, and the five frontier governorates covering Sinai and the deserts that lie west and east of the Nile.

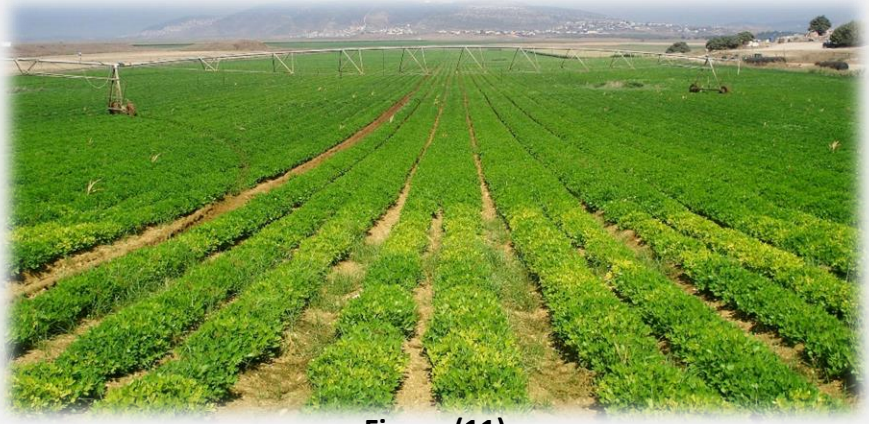


Figure (11)

Egypt is known as one of the oldest agricultural civilizations; the River Nile allowed a sedentary agricultural society to develop thousands of years ago. It has a predominantly rural population (the percentage of rural inhabitants is estimated at about 58%) and according to World Factbook the July 2011 population was estimated at 82 079 636 with a growth rate of 1.96%. The capital city is Cairo with an estimated population of 10.902 million, while Alexandria has 4.387 million persons (2009 estimates).

The Lack of Use of Scientific and Technological Methods

This is from the most challenges that faces Egypt.
The influence of science on people's lives is growing. While recent benefits to humanity are unparalleled in the history of the human species, in some instances the impact has been harmful or the long-term effects give causes for serious concerns.

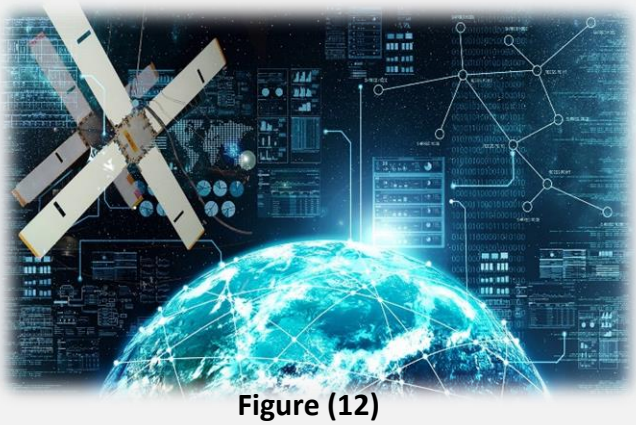
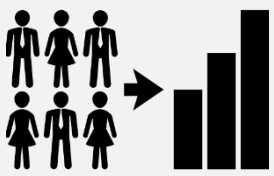


Figure (12)

A considerable measure of public mistrust of science and fear of technology exists today. In part, this stems from the belief by some individuals and communities that they will be the ones to suffer the indirect negative consequences of technical innovations introduced to benefit only a privileged minority. The power of science to bring about change places a duty on scientists to proceed with great caution both in what they do and what they say. Scientists should reflect on the social consequences of the technological applications or dissemination of partial information of their work and explain to the public and policy makers alike the degree of scientific uncertainty or incompleteness in their findings. At the same time, though, they should not hesitate to fully exploit the predictive power of science, duly qualified, to help people cope with environmental change, especially in cases of direct threats like natural disasters or water shortages.

Population Growth

95.7 million persons live in Egypt with an annual growth rate 2.0 %. By this rate we will reach in 2050 we will reach 136.9 million people. This will have a bad consequence on the life in Egypt as the urban congestion will increase in the Delta region that led to the desertification (when building over agriculture



lands), Depletion of Natural Resources which will cause increase in the demand on the food and water and will cause also High Cost of Living and the spread of poverty as the prices of various commodities including food, shelter and healthcare will increase.
So, we have to work from now on solutions that can help us in the future like reclaiming the desert that will help a lot in this problem as it will provide the food and shelter in the future and the destination of sea water to help us after reclaiming the desert for irrigating lands and provide the water for domestic and industrial uses.
By following these steps from now we will manage the population growth consequences.

Figure (13)

Arid areas

If we want to talk about Egypt we've to talk about the ignored lands the lands that cover more than 95 percent of its total area, the lands that have no agriculture, the lands that have no people, the lands that can change Egypt if used.

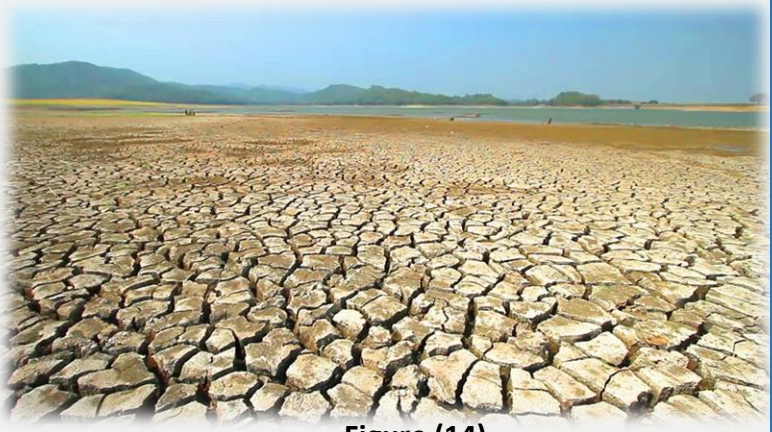


Figure (14)

It's the arid-areas that found in the dessert in three areas as shown in the image: the western desert that covers an area of 680 billion square meters, the Eastern desert that covers 221 billion square meters and Sinai that covers 60 billion square meters. The arid-areas increased by climate variations: like the draught, Climate change (that happened due to the excess of combustion of greenhouse gases) or human activates like deforestation for building in the Delta religion (by considering it

the region that contain the population). It was 2 years ago when Egypt began the reclamation project to reclaim the Giza lands in Egypt and in May,2017 the Government finished from reclaiming 1.7 million acres from 229 million acres. The process of reclamation needs a soil and a water after that. The amount of water in pure Egypt isn't enough for the 229 million acres if reclaimed so we've to decrease our consumption of water and look for other sources of water like desalination of sea-water. Also, by solving the problem of the arid areas, other related problems will be solved like the urban congestion, poverty and other economic problems.

Alternative Energy

Energy is considered to be life line of any economy and most vital instrument of socioeconomic development of a country. Energy is pivotal in running machinery in factories and industrial units, for lighting our cities and powering our vehicles etc.

There has been an enormous increase in the demand of energy as a result of industrial development and population growth, in comparison to enhancement in energy production. Supply of energy is, therefore, far less than the actual demand crisis has emerged. An energy crisis can be defined as any great bottleneck (or price rise) in the supply of energy resources to an economy.

Figure (15)

The energy crisis is a growing problem for everyone in the world. It affects and will continue to affect all people, and it is a major issue. This problem has persisted throughout the ages and into the twenty first century. The energy crisis can be defined as the profound, negative effects that the energy industry has placed upon the global society. The energy crisis affects everyone on the planet through all layers of society, and it will continue to affect people into the near future.

Problem to be Solved:

Going into 2018, most of us are reflecting on the year gone by and looking forward to the year ahead. Many in the Egyptian industry, however, may be less than optimistic about 2018. The past year has been difficult for Egyptian industry, which has been consistently inhibited by dollar and energy shortages. Despite efforts to alleviate these challenges, these problems are not likely to be fully resolved any time soon. Looking to the year ahead, it may be helpful to recap the roots of these problems, how they affected Egyptian industry in 2017 and their possible outlook for 2018.

Energy

Egypt's energy challenges will not be news to Egypt Oil and Gas readers. Since 2011, the Egyptian government has had a strained relationship with many international energy firms – failing to pay bills or diverting natural gas to the domestic market that it had previously agreed to export. As a result, production declined for much of the past five years, while domestic energy demand has been increasing. In 2015, production of both petroleum and natural gas fell, despite generally good news in oil and gas exploration and electricity production. Further, Egypt's antiquated electricity infrastructure, pushed past its capacity, urgently needs investment.

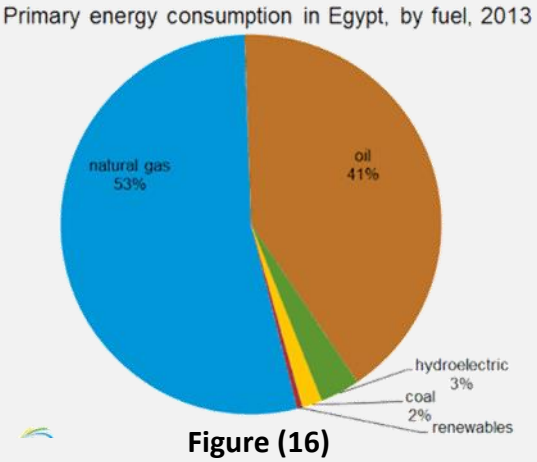


Figure (16)

The good news is that industrial gas supplies have increased during lower-demand winter months, which factories hope continues. In late December, an official with EGAS stated that due to decreased winter demand, Egypt has been able to decrease gas imports and meet the full needs of high-consumption industries such as steel, cement and fertilizers. Still, there are some troubling signs. Despite lower energy prices and numerous public commitments to repay debts to international energy companies, which will hopefully catalyze exploration and production,

government arrears owed to energy firms actually increased to $3b at the end of 2015, up from $2.7b in October.

Dollars and Depreciation

The other major challenge facing the Egyptian industry is monetary – a lack of dollars in the Egyptian monetary system, and a deflating Egyptian pound. Since 2011, political instability has led to a serious decline in tourism revenue and foreign investment – major sources of dollars for Egyptian banks. Currently, Egypt's foreign reserves are around $16.5b, around half of 2011 levels. Declining foreign reserves and other economic struggles have led to devaluations of the Egyptian pound (three times in 2015 and more expected for 2016) and have led to inflation of nearly 12%. The result of decreasing dollars and an inflating pound is more expensive imports for Egyptian industry, which is already feeling the crunch of decreased production capacity due to diminished energy supplies. As inputs, imported and domestic, have become more expensive, and as production has slowed due to decreased energy, companies are able to produce and export less, further adding to Egypt's foreign currency shortage. Egypt's energy and currency issues are in an almost self-perpetuating slide.

Figure (17)

As a result of declining foreign reserves and to slow the flow of dollars leaving the country, the Egyptian government has implemented currency and import restrictions. Interest rates of 10%-15% make credit expensive to businesses and importers, who also object to restrictions on foreign currency deposits – which put daily caps on deposits and withdrawals of $10,000 per day. On December 21, the Central Bank of Egypt announced new regulations which require importers to provide a 100% cash deposit on new letters of credit, rather than the 50% previously required. Importers must also obtain documentation directly from foreign banks, rather than from clients, and imports of luxury goods and "unnecessary imports" have been more heavily regulated. In some industries, including the energy industry, government policies preventing banks from offering dollar loans for projects

which will be paid in Egyptian pounds further complicates industry growth and investment – preventing firms from obtaining the inputs and equipment they need.

Indicators that show the severity of situation:

- Poverty rates currently stand at 70%
- Economic growth has dropped to between 1% and 2%
- Hard currency reserves have declined from $36 billion to $28 billion
- The flow of foreign investments is down to zero;
- Budget deficit has reached EGP1290 billion
- The general debt is calculated at EGP1080 billion, i.e. 90% of GDP
- The proceeds from tourism are down by 40%
- The Stock Exchange has lost more than EGP20 billion

◆ What if the problem is solved?

Future industrial policies in Egypt will be focused on enabling the industrial sector to be the engine of growth through the expansion of exports and job opportunities. At present, the industrial sector in Egypt is a major contributor to economic growth, employment generation, and export proceeds. Roughly accounting for 20 percent of GDP (excluding informal industrial activities), there are around 26,000 formally registered industrial establishments employing nearly 2.4 million workers and around 1.5 million workers in informal industrial establishments which represents around 20% of the labour force. In addition, manufactured exports account for nearly 3% of GDP, 40% non-oil export proceeds and 11% total current account receipts. So, Solving the industrials problems will let the government to improve it by using strategy that will lead to the progress of Egypt.

◆ What if the problem is not solved?

Egypt's economy is battling a number of structural problems, mainly low growth rates, high deficit and all forms of industrial problems. The country's external debt reached $60 billion in the first quarter of 2016/2017. This debt is increasing and going to increase more and more if the problem doesn't be solved. As part of the IMF bailout plan, the country agreed to implement a series of sensitive reforms. Egypt's central bank allowed the currency to float freely, leading to a sharp devaluation of the pound and soaring food and fuel prices. The last months of 2016 were marked by public loss of confidence in the government and regular protests over its inability to control inflation. On the political front, the threat of terrorism continues to harm Egypt's reputation as a safe place for foreign investments.
So, Solving the problem of industry will help to increase Egypt economy and decrease its debt then solve all these former problems.

Researches:

Topics that we searched about for the problem:

- The Problems of industry
- The Reason behind the weakness of Egypt Industry
- The Budget of different industries
- Egypt Industrial issues
- The Effect of industry on other fields

❖The Pollution of the Industry and its By-products.

Topics that we searched about for the solution:

❖ The Components of the air conditioner

❖The Mechanism of working air conditioner

❖The Manufacturing air conditioner

❖The Pollution of Air conditioner

❖ The Cost of air conditioner

❖ The Silica gel (desiccant) composition

APA Links:

☒ Industrial Problems. (n.d.). Retrieved March 10, 2018, from https://www.aem.umn.edu/Solid-Liquid_Flows/industry.html

☒ Dollar and Industrial Crisis. (n.d.). Retrieved March 13, 2018, from http://www.ega.org.eg/egyptian-industries-between-the-dollar-crisis-and-the-energy-challenges/

☒ Solutions for Industrial Problem. (n.d.). Retrieved March 13, 2018, from http://weekly.ahram.org.eg/News/10361.aspx

☒ Prior Solution. (n.d.). Retrieved March 18, 2018, from http://www.aluminum.org/industries/production/primary-production
☒ Bagasse. (n.d.). Retrieved March 18, 2018, from https://www.feedipedia.org/node/559

☒ Desiccant enhanced evaporative air-conditioning. (n.d.). Retrieved March 22, 2018, from https://www.nrel.gov/docs/fy11osti/49722.pdf

☒ Air conditioner changing industry. (n.d.). Retrieved March 25, 2018, from https://www.nrel.gov/continuum/spectrum/air_conditioner.html

☒ Air Conditioner Manufacture. (n.d.). Retrieved March 25, 2018, from http://www.cccme.org.cn/shop/cn1231533465/index.aspx

☒ Principle of refrigeration. (n.d.). Retrieved March 28, 2018, from https://www.swtc.edu/Ag_Power/air_conditioning/lecture/basic cycle.html

◆ What did our research teach us about the problem we are addressing?

- The problem of Industry has many effects on all fields.
- 30% of the external debt of Egypt is due to industrial problems.

- Air Conditioner Manufacture is one of the most expensive industries that needs huge amount of energy.

- The cost of the products has a vast influence on the marketing base.

Other Solutions Already Tried:

• Solution (1):

Aluminum Production

Aluminum is a very active metal, it is found in nature as its oxide in an ore called bauxite. In 1782 Lavoisier recognized aluminum to be a metal "whose affinity for oxygen is so strong that it cannot be overcome by any known reducing agent." As a result, pure aluminum metal remained unknown. Finally, in 1854 a process was found for producing metallic aluminum using sodium, but aluminum remained a very expensive rarity. Both the limestone formation and the corrosion had to be dealt with. Since CaCO3 contains the basic anion CO32-, acid dissolves limestone:

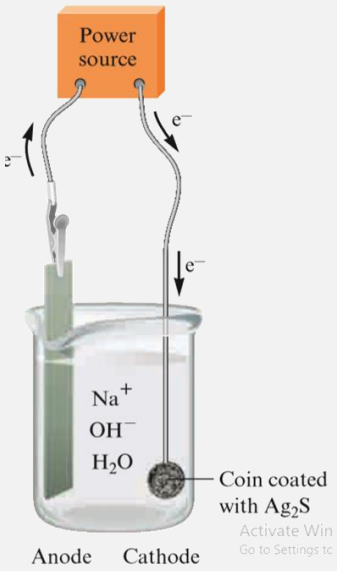


Figure (18)

$$2H^+_{(} + CaCO_3 \rightarrow Ca^{2+} + CO_2 + H_2O$$

Soaking the mass of coins in a buffered acidic bath for several hours allowed the individual pieces to be separated, and the black Ag2S on the surfaces was revealed. An abrasive could not be used to remove this corrosion; it would have destroyed the details of the engraving and it would have washed away some of the silver. Instead, the corrosion reaction was reversed through electrolytic reduction. The coins were connected to the cathode of an electrolytic cell in a dilute sodium hydroxide solution.

Ion mobility also can be produced by melting the salt. But the melting point of solid Al2O3 is much too high (2050oC) to allow practical electrolysis of the molten oxide.

A mixture of Al2O3 and Na3AlF6, however, has a melting point of (1000oC), and the resulting molten mixture can be used to obtain aluminum metal electrolytically. Because of this discovery by Hall and Heroult, the price of aluminum plunged, and its use became economically feasible. Bauxite is not pure aluminum oxide (called alumina); it also contains the oxides of iron, silicon, and titanium, and various silicate materials. To obtain the pure hydrated alumina, the crude bauxite is treated with aqueous sodium hydroxide. Being, alumina dissolves in the basic solution:

$$Al_2O_3 + 2OH^- \rightarrow 2AlO_2^- + H_2O$$

The other metal oxides, which are basic, remain as solids. The solution containing the aluminate ion (AlO2–)is separated from the sludge of the other oxides and is acidified with carbon dioxide gas, causing the hydrated alumina to reprecipitate:

$$2CO_2 + 2AlO_2^- + (n + 1)\ H2O_{(l)} \rightarrow 2HCO_3^- + Al_2O_3.\ nH_2O_{(s)}$$

The purified alumina is then mixed with cryolite and melted, and the aluminum ion is reduced to aluminum metal in electrolytic cell. Because the electrolyte solution contains a large number of aluminum-containing ions, the chemistry is not completely clear. However, the alumina probably reacts with the cryolite anion as follows:

$$Al_2O_3 + 4AlF_6^{3-} \rightarrow 3Al_2OF_6^{2-} + 6F$$

◆The reason behind this solution being poor is its high cost. Although it reduces the cost, Its cost still too high.
In fact, some countries like America uses 5% of its electricity in this industry.

• Solution (2):

Bagasse (sugarcane)

Bagasse is the name for the residual fibers that remain after the squeezing of sugarcanes at the sugar production. Usually, they consist of 40 – 60% cellulose, 20 – 30% hemicellulose, and about 20% lignin. They are the most important raw-material supplier for the production of (retail) sugar. For this purpose, the sugarcanes

are harvested, collected, and squeezed in order to produce sucrose or sugarcane juice. 100 tons of sugarcanes generate about 10 tons of sugar and 34 tons of valuable bagasse.
Instead of burning this “waste product”, our manufacturers increase the material’s value and produce eco-friendly disposable products. In the following, we explain the necessary steps to convert bagasse into sustainable green box products.

<u>Production steps of bagasse products:</u>

1_The residual sugarcane fibers are stored wet in order to remove short fibers and residual sugar because they may hinder the further processing.

2_The bagasse is blended with water until the compounds have developed into a pulp.

3_Biodegradable bleachers are added. In this step, it is also possible to add further additives.

4_The pulp is poured into a form and pressed into the desired shape by the aid of high temperatures and pressure.

5_The green box bagasse plates, bowls, and containers are ready for transport and shipping and cannot wait for their application in your company.

Sugarcane is a very fast renewable resource for which no trees have to be cut down. As a by-product of the sugar production, bagasse does not require additional cultivation areas and has no impact on the area of forests. On the contrary: It is actually a sustainable and eco-friendly alternative to conventional paper production because the bagasse paper production wastes much less energy than the wood paper production.
After their usage, products that are made of sugarcane end up in the trash bin, sometimes eve in open nature. But thanks to their biodegradability (certified according to US ASTM),

Figure (19)

the products decompose relatively fast and turn into soil. This soil may be used as breeding ground or fertilizer for new plants and the cycle is closed.
Since already mentioned, bagasse is not only used to produce tableware. The factories often use it as fuel. However, this process is significantly more environmentally friendly than the incineration of fossil fuel because the incineration of fossil fuels does not only release CO_2 but also hazardous substances such as carbon monoxide and particulate matter.

◆ The reasons behind this solution being poor are:
_It isn't ecofriendly as it has little harms on the environment.
_It has a lot of byproducts.

- **Solution (3):**

Antifoam

Unwanted foam happens in an endless variety of products and industries it can happen just about anywhere, from manufacturing, processing and packaging to distribution and end use. No matter where it occurs, foam can cause big problems for companies and customers. It can limit your formulation options.
Wreak havoc with product quality and performance. Reduce manufacturing capacity cause overflows and spills. And raise environmental concerns.
That's why it's so important to take control of unwanted foam whenever and wherever you find it. A job made easier and less costly with silicone antifoams from Dow Corning.
Although they are called "antifoams," they are used.to help control foam in your system. When used as "antifoams," they help prevent foam from developing. When used as "defoamers," they help destroy or knock down foam after it has occurred.
"Knockdown" refers to the reduction in foam height that occurs when the antifoam is added. Speed of knockdown is also important. So is persistency, the length of time the antifoam continues to

perform. Different foaming situations require different degrees of knockdown, speed of knockdown and persistency.
Silicone has low surface and interfacial tensions, this enables it to flow easily over the foam wall. It seeks out openings and occupies them, causing the wall to thin and collapse.
Silicone antifoams perform so well, that in a head-to-head battle with organic antifoams silicones almost always win. Because, Silicones have much lower surface tensions, which means they tend to spread through the foam more quickly. They remain stable over a wide range of temperatures and pH levels.
They also tend to be less reactive than organics, leading to fewer compatibility problems. Silicone antifoams also tend to be more persistent, longer-lasting, than organic antifoams.

And if that isn't enough, they are effective at much lower dosages which adds up to lower cost-in-use. Silicone antifoams from Dow Corning come in a variety of product forms to meet the needs of a wide range of systems and applications. Silicone fluids are designed for use in non-aqueous systems. They are inert, are not conducive to bacterial growth, and are available in a wide range of viscosities. Silicone compounds are silicone fluids that contain a suspension of finely powdered silica to enhance their defoaming efficiency. They also are designed primarily for non-aqueous systems. Silicone antifoam emulsions are ideal for controlling foam in aqueous systems.

Silicone dispersions silicone fluids dispersed in aliphatic solvents are used primarily in oil and gas applications. And powdered silicone antifoam compounds are often used in dry products to help prevent foaming when liquids are added. Silicone antifoams have proven their performance for decades in a host of industries and applications.

◆The reason behind this solution being poor is:
_It has a lot of byproducts.

◆What lessons can we learn from their attempts to solve this problem?

- Our solution mustn't depend on variable factors like the weather and the amount of resources.
- Our solution must be ecofriendly not to harm the nature.
- Our solution should use cheap and common materials to decrease the cost.

Design Requirements:

Our design is based on decreasing the cost of production of air conditioner by replacing a part of its system with desiccant.

The solution should have some characteristics such as:

- It should ecofriendly and clean not to pollute the environment.
- The system we will choose to work on should conserve the energy and works to makes it more sustainable.
- Our design should be strong and durable that it could last for a longer time without being destroyed or damaged.
- It also should be at low cost and save money.

- It also should meet safety rules or instructions to avoid bad accidents.

- It should be reconstructed easily when there is no source of materials.

The Testable Design Requirements:

1_ The first one is the same efficiency of the real air conditioner by reducing the humidity to 40%.

2_ The second one is the rotation of motor quarter cycle in the specific time related to the changing in the humidity.

3_ The third one is the reduction of the cost of the production of air conditioner.

Selection of Solution:

◆ How did we select our solution?

As we are targeting to reduce the cost of a specific industry, we choose the air conditioner industry as it has a lot of impacts on the environment. Also, it has been considered to be from the main industry as the air conditioners demand from 4,246,000 in 2001 to 5,264,000 in 2016. It works on replacing the coil inside the air conditioner with desiccant (silica gel) in order to absorb the water vapor from the air. So, this will improve a lot in this industry.

◆ How does it work?

The system consists of three main parts, the heater, the coil and the cooler. What happens that the desiccant absorbs the water vapor in the air and store it inside its capacity. The heater takes its role after that by heating this desiccant in order to condense the water vapor inside it and change it into water. The desiccant will be put inside a hollow bar, and the quarter of the bar is facing the heater. The output air with reduced humidity transfers to the cooler which contains a refrigerated gas (Freon) to adjust its temperature according to the user's desired temperature.
The device is ECO-FRIENDLY and AVAILABLE ANYWHERE, or ANYTIME.

Motor Shield and Arduino Actuators:

Our solution counts on Arduino to send instructions to actuators and get information from the motor shield and the sensor.

This is achieved through coding using Arduino C language on Arduino IDE. During the operating of the system, the sensor read the percentage of the humidity in the air and according to this, it identifies the rotation rate of the D.C. motor and speed of rotation. The last thing that the motor stop making the charged part face the heater in order to condense and discharge it.

What is the importance of each part:

H-bridge

It makes much easier to interface with other components like motors, simplifying the wiring (and allowing features like motor direction reversal), also the code that control the motor is included within the shield.

Arduino Uno

It is the software device wherein you can test various circuits. It is based on the microcontroller Atmel series. It has its own CPU along with a control unit and arithmetic and logic unit and memory. It has software called IDE where we work on and type the code and instructions but all of this is written in Arduino C language and we used Arduino to control on the temperature sensor, H-bridge and consequently the motor.

Humidity temperature sensor

Used to provide the actual humidity condition within the air at any given point or place. This is used widely in the air conditioning industry as we mentioned before that the rotation and the movement of the motor depend on the reading of the sensor and consequently the percentage of humidity in the air.

The design of the air conditioner

As shown it will be the compressor then followed by our device. The compressor will direct the hot air towards the desiccant then, the desiccant eliminates the humidity and this makes air easy to be cooled and this let us go to the next step, the cooling. This makes the user adjust the temperature of the room by the Freon which is the refrigerated gas.

Figure (20)

It lowers the temperature of the air in order to condense the water vapor into liquid, and that's why water is getting out a hose from the air conditioner.

◆ How will our solution meet the design requirements?

1• Its materials are available and very cheap.

2• It decreases the humidity of the atmospheric air by 40% and discharge it in a specific time.

3• The D.C motor responds concurrently with the change of the percentage of humidity in the air and follows the readings of the sensor in rate of rotation, speed, time of discharging of the desiccant.

4• It does not pollute the environment.

5• It's more efficient than the normal air conditioners and has lower cost, as this is the main challenge that we target this semester.

6• It's eco-friendly and comfortable for the body and the skin.

Selection Prototype:

At the beginning, we had decided on the desired requirements depending on the changing circumstances near the user. The first one is get the same efficiency of the real air conditioner by reducing the humidity to 40%. Thus, we used a silica gel to achieve the least humidity. Also, we divided the bar into for parts to spare a corner for the discharging of the desiccant. We fixed a humidity temperature sensor to measure the output air humidity before and after the exposure to the desiccant.
The Second one is the rotation of motor quarter cycle in the specific time related to the changing in the humidity. In order to actualize that we fixed the gear around the center of the bar, to

give the motor ability to rotate the bar more sufficiently. We fixed an axis to work on. We calculated the length of the arc relatively to the axis, synchronistically, we calculated the time demanded to rotate a quarter cycle. In addition, we fixed a potentiometer to adjust the period according to the quantity of the input air humidity. The third one is the reduction of the cost of the production of air conditioner. Therefore, we replaced the heater of the real conditioner with our device. Also, the silica gel that we used is everlasting, economical and eco-friendly. Then, we compared the cost of the real device before and after the changes. We found that the cost of the real air conditioner before our changes is 6750 PE and after is 5980 PE.

Our Prototype is divided into four parts:

1 • The Mechanical Parts

We used a rolling bearing to achieve the least coefficient of friction, in other word, more efficiency.
We fixed the center of gravity of the bar on the rolling bearing to have a perfect stability.
We fixed a motor touching a gear which is fixed around the bar to rotate the bar freely.
We got advantage of the ratio between the sprockets of the gear and the motor to achieve the maximum angular momentum by increasing the velocity.

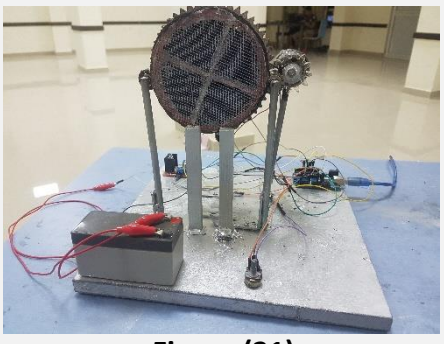
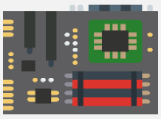


Figure (21)

We found that every 3 rotations of the motor, the bar will rotate 13 rotations. We fixed the hair dryer at one corner of the bar to discharge the desiccant.

2 • Electronics Parts and its Connections



We used a 12-volt battery to support the demanded power of the motor. The electricity of the Arduino is fed from a USB data cable connected to the lab.
The sensor and the H-bridge gets their electricity from the Arduino and the battery.
The humidity sensor is connected to the Arduino to send the reading to the Arduino which will presented on a serial monitor.
The motor is connected to the H-bridge in which it gets the instructions from the Arduino and sends it to the motor.

The H-bridge controls the power of the motor hence, it's considered as a medium between the Arduino and the motor.

3 • The Coding Section

We used Arduino 1.8 program and C-programming language to put into our code.
We sit pin numbers in variables and we defined them each one with an abbreviation to ease the process of writing.
We appointed the variables to their functions.
We set the potentiometer in a range of 0 to 1023 and changes its value from to 3 hours.
We took the value of the time that stored in variable and made the Arduino wait this time before sending the next command.
We set the humidity sensor to print the readings on the serial monitor. **See figure (22)**
We used some functions to make us achieve our requirements like.
•pinMode (determines the state of the connected pin)
•digitalWrite (rotates the motor in periods by giving high or low values to the digital pins).
•delay (determines time of the periods)
•Serial.Print (prints data to the serial port as human-readable text).
•Analog read (defines analog value to the specified port on the device).
•Loop (Rotates the process of rotation).
•map (applies a given function to each element of a list).

Therefore, these functions gave us the ability to produce a prefect and accurate device which exactly meets our design requirements.

```
#include <dht.h>
dht DHT;
#define DHT11_PIN 13

int in1 = 6;
int in2 = 7;
int ena = 11;
int pot = 0;
int t = 0;
int k = 0;
void setup() {pinMode(A0, INPUT);pinMode(in1, OUTPUT);pinMode(in2, OUTPUT);
pinMode(ena, OUTPUT);pinMode(2, OUTPUT);digitalWrite(2, HIGH);Serial.begin(9600);}
void Move_right(int spd) {digitalWrite(in1, LOW);
digitalWrite(in2, HIGH);analogWrite(ena, spd);}
void Move_left(int spd) {digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);analogWrite(ena, spd);}
void Stop() {digitalWrite(in1, LOW);digitalWrite(in2, LOW);digitalWrite(ena, 0);}
void check() {pot = analogRead(A0);t = map(pot, 0, 1023, 0, 5000);}
void print_humidity() {int chk = DHT.read11(DHT11_PIN);Serial.print("Temperature = ");
Serial.println(DHT.temperature);Serial.print("Humidity = ");Serial.println(DHT.humidity);}
void loop() {print_humidity();//  Serial.println(t);if (k == 0) {Move_right(255);
delay(500);k = !k;}else if (k == 1){Move_left(255);delay(500);k = !k;}
  Stop();check(); int i_temp = 0;for (int i = 0; i < t; i++) {if (i - i_temp > 1000)
  {print_humidity();i_temp = i;}check();delay(1);}}
```

Figure (22)

4• The Flow of air and the Rotation

While a flow of air with air humidity of 70% percent enters the device from the hollow bar within only 3 parts, as the other part will be discharging, the desiccant absorbs the water in air. Then, it reduces its humidity by 40%. When the part which is discharging finishes the process, the Arduino gives instructions to the H-bridge which sends it to the motor.
The motor will rotate a quarter cycle and, the other part which is filled with water will face the hair dryer and begin the process of discharging. By the changing in humidity, the sensor reads the changes and sends them the Arduino which will be presented on the serial monitor. When we see the change, we will adjust the potentiometer to be adaptable with the input humidity.

◆ How Will We Test It?

1• We will measure the humidity of the output air to be assured that it is reduced by 40%.

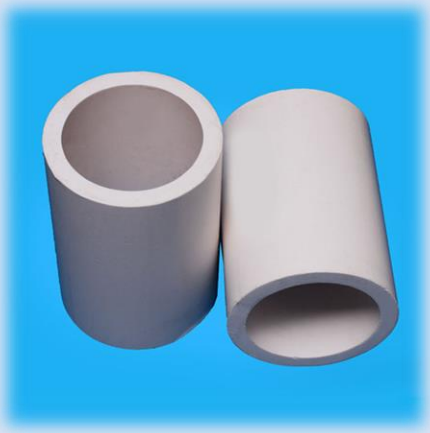
2• We will calculate the period demanded for the desiccant to reduce the humidity till 40%.

3• We will calculate the least amount of desiccant to reduce the humidity in a certain time.

Materials and Methods:

Materials:

Humidity and Temperature Sensor (DHT22) 35 L. E	

Arduino Uno 130 L. E	
A hollow bar of aluminum 20 L. E	
Jumpers wires 10 L. E	
0.5 K. G Desiccant 110 L. E	

Hair Dryer	
Gear **5 L. E**	
Motor **35 L. E**	

Figure (00)

Total Cost = 345 L. E

Methods:

_We designed our prototype using sketch up. see figure (23)

_We divided the hollow bar to 4 parts hence, there will be a spare part for the discharging.

_We filled the bar with the desiccant and fixed it on the wood plate for stability.

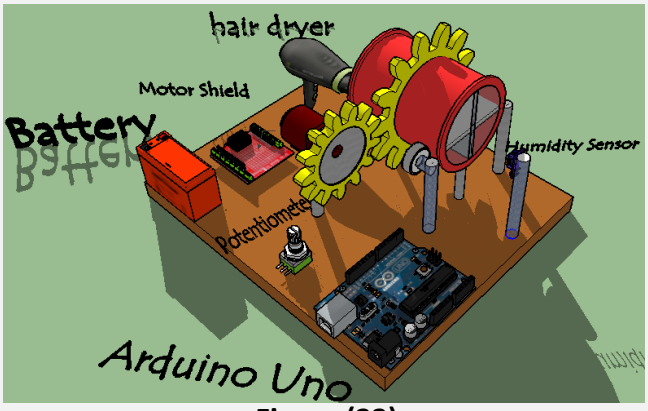


Figure (23)

_We fixed the hair dryer on one part of the bar, and, the gear at the middle of the bar.

_We fixed the motor gear the gear that is taped of the bar to give the access for the motor to rotate the bar.

_We fixed the humidity and temperature sensor at the output of the bar to measure the humidity.

_We wrote the code on Arduino 1.8 program.

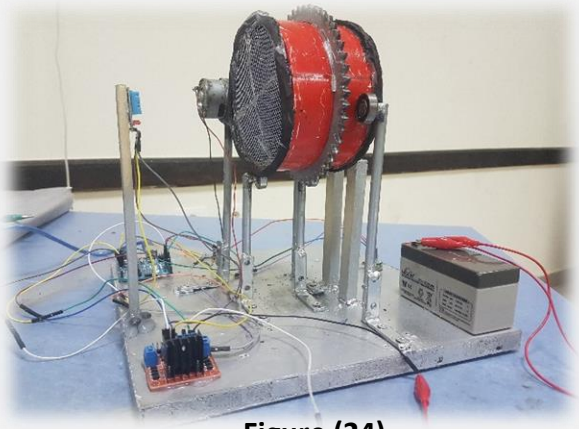


Figure (24)

_We executed the code on the Arduino board then, we connected it to the sensor.

_We adjusted the motor to rotate depending on:

The humidity in the air.
A certain time, if the humidity is constant.
The soaking of the desiccant.

_We calculated the data from the serial monitor and superposed the result to our predictions.

_We changed the humidity and measured the time taken for the motor to rotate.

_The results met our predictions in two design requirements:

The rotation of the wheel with the changing in the humidity in the accurate time.
The humidity by the effect of the desiccant decreased by more than 50%

Safety Precautions:

• Checking all connections of the jumpers to obviate any mistake.

• Using gloves to be isolated from electrical shocks.

- Using laser cutter to cut the hollow bar to be more accurate and more safety.
- Using heat shrinks to avoid any electric short.
- Using insulated tools during working.

Test Plan:

➢ Humidity:

Objective:

Lowering the humidity after the exposure to desiccant by 40%.

Procedures:

_We placed a humidity temperature sensor at the end of the aluminum bar.
_We executed the code on the Arduino UNO then, we measured the temperature before the exposure.
_We found that the humidity was 75% at 25°C.
_We placed source of air and the hair dryer to the bar and we switched up the device.

Observation:

After switching, the humidity was reduced by 40.2% which means 30% at the same temperature.

➢ Rotation of the motor:

Objective:

Making the rotation of the bar is adjustable with the amount of humidity and time.

Procedures:

_We placed the source of air and the hair dryer to the bar and we switched up the device.
_We fixed the humidity and observed if the rotation was compatible with the time that we executed.
_We measured the time taken for the motor to rotate with the change in humidity.

Observation:

The time was consistent with the motor to rotate within every 0.45 sec at 75% humidity and took about 0.45 sec to rotate the bar, however, a potentiometer is used to make the motor adaptable to the change of the humidity.

➢ Cost

We compared the real devices before and after the changes.

♦Is this test plan written in a way that supports repetition and testing by others?

yes, because we maintain accuracy and precision in our measurements as in the reading of the humidity has an error of (± 0.04%) so we applied the rule of systematic errors also the materials are common so the experiment can be conveyed at any time.

Data Collection:

First Test Results

We Fixed the humidity of the input air to have an access to measure accurately the output humidity. We got the following results as shown in the figure (25).

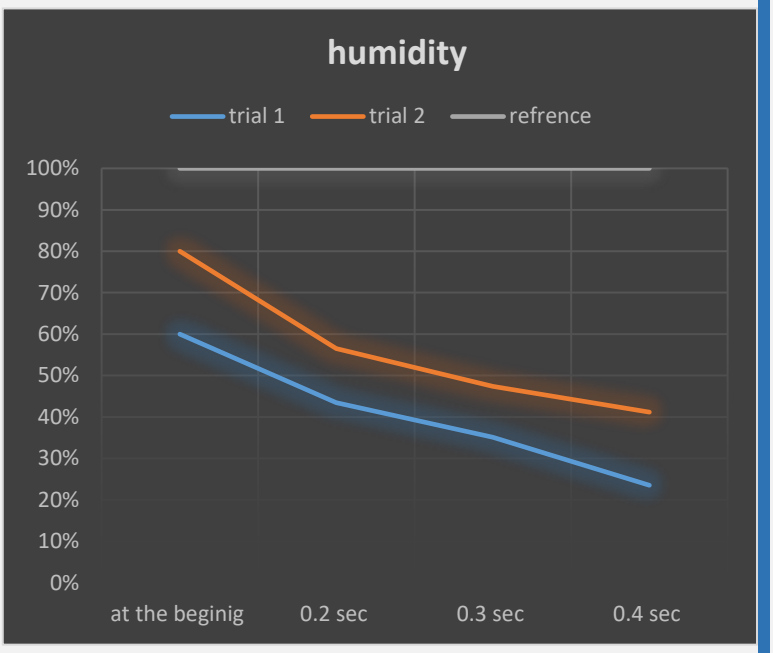


Figure (25)

Trials	Humidity efficiency
1	39%
2	40.5%
3	42%

The Average of the three trials = 40.5% which is approximately 40%
As we use humidity sensor with uncertainty (±1%)
So, we observed that the humidity of the air is at the desired humidity and the test was successful.

Second Test Results

We measured the time taken for the motor to reached the desired arc length and the period between every rotation with the changing in the humidity then, we gathered the data.

Humidity	Time	Period	Arc length
60%	0.45 sec	8 sec	8.365
68%	0.46 sec	6.9 sec	8.4
70%	0.43 sec	6.5 sec	8.275

Third Test Results

We found that the cost of the real air conditioner before our changes is 6750 PE and after is 5980 PE.

◆What measurement tool did we use?

We used humidity sensor as a measurement tool.
We used timer to calculate the time between each rotation.

Discussion:

◆What did the results find after our data collection?

We deduced that our project has a great implementation as it saves effort and time. The device isn't affected by the weather conditions as the desiccant have the ability to absorb the humidity during any season. Our device is eco-friendly as it prevents the formation of bacteria that is produced in the ordinary air conditioner.
Also, our device has achieved the desirable design requirements with an error in a range of ± 0.04 % in the humidity. Our prototype meets the design requirements and reaches to a humidity removal efficiency of 40%. Our prototype is applicable, has a relatively low cost and has a great effect on the air conditioner industry.

◆Were our conclusions accurate enough?

In usual, any project has its defects and inaccurate results which will let the user know the precise output. Although, our device has a very little error rang whereby it will not affect the purposes that we had early determined. Our solution was more accurate than we had ever expected whereas it produced results that gave an extreme satisfaction of our goals. However, our solution has achieved the pervious determined design requirements with an error in range of ± 0.04 % in the humidity calculations.

Also, there is an error in range of ± 0.003% in the rotation of the motor calculations and ± 0.01% in the period calculation.

♦ Did the data demonstrate whether the prototype met the identified design requirements?

Our conclusions and results have extremely met our design requirements. Since, in case of a flow air of humidity 75 % percent, the sensor sends the readings to the Arduino. Then, the Arduino sends back instructions to the H-bridge which forwards the commands to the motor to be adaptable with the input humidity.
The other great accomplishment of our solution is the reduction of the input humidity by 40% in only a period of time in range of 0.5 to 2 seconds depending on the input air velocity.
It demonstrates that our solution is more efficient than the other air conditioners.

Recommendations:

What recommendations do we have for future work in this area?

1• We recommend the other groups to make the rolling bearings built-in to make it more accurate and efficient.

2• Making mobile phone application that controls the percentage of humidity required with respect to the temperature ordered.

3• Replacing the desiccant with new material which is fast charging and is efficient to reduce the humidity by 80%.

4• Using alternative sources of heat like the sun heat which will be concentrated to have more heat. Or, using solar cells to operate the heater to discharge the desiccant.

5• Using a more accurate sensor that reads the Humidity in decimals.

◆ What would we tell another team who wanted to start where we stopped on our solution to help them?

•►First learning how to deal with Arduino components then learning how to cod with Arduino C language.

•►Applying more developed integrated IOT environments than Making an android application like getting data from internet.

Learning Outcomes:

Learning Outcome	Subject	More about it	Relation to the Capstone
2.05	**Mechanics**	It identifies and explain the concept of power, what are the appropriate measuring unit for it and how we could	We could calculate the efficiency of our prototype in terms of watt and comparing it to the previous

		calculate it mathematically.	solutions. So, this outcome helped us a lot in the test plan, results and conducting the conclusions.
2.06	**Mechanics**	It identifies the meaning of the center of gravity, the importance of identifying it in any system and how to calculate it.	We identify the location of the center of gravity to make the forces in our prototype exert the force on it to conserve energy and use smaller amount of energy to rotate the gears.
2.10	**Biology**	It gets deep inside the reasons of the evolution, means of it and the natural selection and how the environmental changes affect on the organisms	We take in consideration the environmental changes that our prototype could do and it effect on the organisms and trying to reduce or omitting any side effects that our prototype could do to be

			an eco-friendly one.
2.12	**English**	It explains how to get audiences' attention, how to be more active with them and explain more about the presentation and communication skills.	It helps us a lot in preparing for our project presentation and how to present our content our project in a creative way and show it in a logical sequence with connecting the ideas together.
2.15	**English**	It explains how to collaborate our ideas and how to criticize and reflect it.	It helps us to organize our ideas, collaborate in order to reach to the appropriate idea.
2.17	**English**	It explains the types of writing and ow to choose the right one according to the topic that I write about it.	This helps us a lot in identifying the way of writing the poster and the portfolio and make it wrote in a creative way to make it more interesting.
2.08	**Chemistry**	It makes us able to calculate oxidation	It helps us to get to our first prior solution

		numbers of elements in compounds and ions, describe and explain redox processes in terms of electron transfer and changes in oxidation number (oxidation state); use changes in oxidation numbers to help balance chemical equations; explain, including the electrode reactions, industrial processes and applications.	that is related to extraction of aluminum for the bauxite and aluminum oxides by electrolysis and this outcome helps us a lot in understanding the mechanism of its working and its idea.

2.10	**Chemistry**	This outcome gets deep into the organic chemistry, how the structure and bonding of carbon lead to the diversity and number of organic compounds. - Compare the use of molecular and structural formulas to represent organic compounds. Distinguish among the structures of alkanes, alkenes, alkynes, and aromatic hydrocarbons.	This helps us a lot in understanding the IUPAC names of the hydrocarbons and the function of each functional group and side chains and how does each reaction affect on the compound even by combustion or halogenation or Free-radical reactions.
1.01	**Physics**	It makes us able to measure precisely and accurately using a variety of measurement tools and make more than one trail in aim to reach high level of accuracy. Also, it helps to calculate the	we learned how to avoid measurement errors by using appropriate measuring tools which helped us a lot in constructing accurate results from the test plan.

		zero error of the readings.	
2.13	**Physics**	It makes us able to analyze production and transmission of electrical energy via electromagnetic induction and learn more about: AC generator Effective value of EMF D.C. Generator Motor Transformer Eddy currents Faraday's law	As we are using a D.C. motor know by learning this outcome the mechanism of its working as it applies Faraday's law which states that if a wire rotates between two poles of a magnet, an electric current is generated. This current is generated due to the change in the magnetic flux.