DESCEON

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Key Words: Arduino - Desiccant - Humidity - Rolling Bearing - Motor Shield

Alex Stem . Grade 11 . Semester 2 . 2017/2018 . Group 18

ABSTRACT

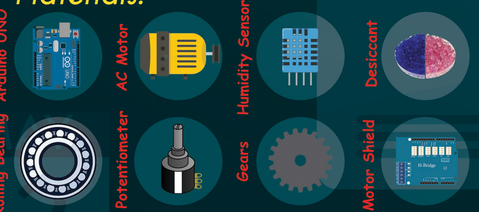
The Egyptian industrial base problem is the starting point for a complex chain of other issues. It has exhausted everything including health, money and the limited resources of power.
We have found that the majority of Egyptians doesn't rely on, nowadays, technology or the alternative materials for the industries which may have some defects. For instance, cost of medicines has been raised a lot affecting public health. This is because of the expensive materials that are used in making medicines. Because there are alternatives that could be indemnified with the same quality. Thus, 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. Then, we filled a hollow bar with desiccant (silica gel). Rolling bearings are used to rotate the bar freely around its horizontal axis as it decreases the friction.
We fixed a hair dryer at one corner to heat the desiccant till it completes the discharging by evaporation. We fixed a motor that touching a gear at the middle of the bar for the rotation. We fixed humidity sensor at the end of the bar that is facing the output air to measure the humidity. Our design requirements were the reduction of Humidity by more than 40%, the rotation of motor quarter cycle in the specific time related to the changing in the humidity and the reduction of the cost of the production of air conditioner. Our project aims to decrease the cost of the manufacturing of air conditioners. Hence, the results of the test plan prove that the solution is applicable and successful.

INTRODUCTION

Industry plays a significant role in the economy besides its crucial contributor to the country's growth. The value-added contribution of the manufacturing sector to GDP (Gross Domestic Product) stood at 16% in 2014, down by one percent point from levels prior to the Arab spring, according to the world bank. We are working for the improving of the industrial base by reducing the cost of manufacturing the product itself. We've searched for some prior solutions that helped us sufficiently in constructing our solution. One of them was "Hall and Heroult Method", it's used in the production of pure alumina by electrolysis. The energy needed in the industry is to achieve ion mobility. Ion mobility can be produced by melting the salt. But the melting point of solid Al2O3 is much too high (2050 °C) to allow practical electrolysis of the molten oxide. They found that the mixture of Al2O3 and Na3AlF6, however, they have a melting point of (1000 °C), and the resulting molten mixture could be used to obtain aluminum metal electrolytically. Up to that point, in spite of, it has reduced the cost, the electricity used by the industry disputes a lot of power. In fact, some countries like America uses 5% of its electricity in this industry. Hence, we focused on the air conditioning industry as it has a lot of defects and a lot of fields that we could work on. Our solution is focusing on replacing Freon by the desiccant as it is relatively very low and has same efficient. To make sure that our hypothesis is true, we identified two design requirements that we will test in the test plan. The first one is the same efficiency of the real air conditioner by reducing the humidity to 40%. The second one is the rotation of motor quarter cycle in the specific time related to the changing in the humidity. The third one is the reduction of the cost of the production of air conditioner. Our idea is supported by scientific laws as we used L.O (IT.2.01) that helped us in the coding of the project. The L.O (PH.2.12) helped us understanding faraday's law and how to apply it in the solution. The L.O (ME.2.05) that helped us in calculating the power of the prototype and its efficiency.

MATERIALS & METHODS

Materials:



Methods:

_We designed our prototype using sketch up program.
_We began to divide the hollow bar into 4 parts then, we filled the bar with the desiccant and fixed it on the wood plate.
_We fixed the gear around the center of the bar, to give the motor ability to rotate the bar more sufficiently then, We fixed the humidity sensor at the output of the bar facing the air.
_We wrote the code on Arduino 1.8 program then, executed the code on the Arduino board after that, we connected it to the sensor.
_We adjusted the motor to rotate depending on the humidity in the air and the soaking of the desiccant.

Test Plan:

Test (1): Humidity.
_We executed the code then, we calculated the ratio between the humidity before and after.

Test (2): Rotation & time.
_We calculated the length of the arc relatively to the axis, synchronistically, we calculated the time demanded to rotate a quarter.

Test (3): Cost. We compared the cost of the real device before and after.

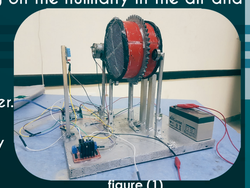


figure (1)

RESULTS

First Test Results: We Fixed the humidity of the input air to measure accurately the output humidity. We got the following results as shown in the figure (2) & table(1).

Second Test Results: We measured the time taken for the motor to reach the desired arc length and the period between every rotation with the changing in the humidity then, we gathered the data as shown in the table(2).

Third Test Results: We found that the cost of the real device with the heater is 6750 PE and without the heater is 5980 PE.
We found that the increase in humidity by 10% leads to decrease the period between the rotations by 1.5 sec which meet our design requirements.

Trial	Humidity Effeciency
1	×39
2	×40.5
3	×42

table (1)

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

table (2)

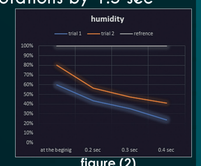


figure (2)

ANALYSIS

Our Solution Has a Great Effect

Our solution reduces the high cost of the air conditioners especially the heater and the Freon.

Electronics

Our solution has a controlling system relies on the Arduino that controls the rotation of the motor and the period between every rotation by giving instructions to the Motor Shield. The Motor shield controls the input power to rotate the motor by converting volts into signals and sending them to the Arduino. The Arduino sends back instructions to the motor shield in order to switch on or off in a certain time. A (DHT22) humidity sensor detects the changes in the humidity and sends the readings to be represented on a serial monitor. By the changing in the humidity, the potentiometer makes the period between the rotations adaptable with the humidity with a range from 1 hour to 3 hours.

Mechanism Of Working

While a flow of air with humidity 60% gets into 3 quarters of the bar, the desiccant absorbs it and reduces its humidity by 40%.the output air humidity is be measured by the humidity sensor. Within 3 hours, the desiccant will be charged, glowing in pink, and the bar will be rotated by motor a quarter of cycle. The hair dryer will discharge the charged quarter of desiccant while the other three are charging.

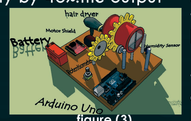


figure (3)

Function Of Air Conditioner

Our solution will be the first step in the air conditioner in which it will decrease the humidity. The output air will move to the coil to decrease its temperature to the user's desired then, it will get out from the device by a fan to push the air away.

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. We followed a sequence of steps in writing the code which is illustrated in the following diagram.


figure (4)

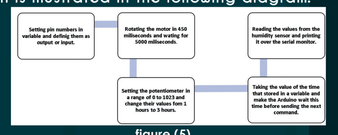


figure (5)

Interfering with scientific laws

How does A.C. motor work?
A.C. motor applies Faraday's law which states that if a wire rotates between two poles of a magnet, an electric current is generated.

Why did we use rolling bearings?
To have a perfect rotation and less power, we used rolling bearings to reduce the friction between the bar and the holders. This happens because of the friction coefficient which depends on the softness of the iron.

How did we fix the rolling bearings?
To get a stable bar, we calculated the center of gravity of the bar to fix the lower rolling bearings. Also, we calculated the lateral center of gravity of the bar in order to not deviate from the path.

Why did we make the radius more than the length?
To achieve the maximum angular momentum, it depends on the moment of inertia (I) –K.M.R^2 - which depends on the radius squared.

Learning transfer
(PH.2.13) in electrical energy via electromagnetic induction.
(ME.2.06) in the center of gravity of a system of particles.

CONCLUSION

1-Our project has a great implementation on as it saves effort and time.
2-The device isn't affected by the weather conditions as the desiccant have the ability to absorb the humidity during any season.
3-Our device is ecofriendly as it prevents the formation of bacteria that is produced in the ordinary air conditioner.

Test results proved different aspects for our solution

1-Our device has achieved the desirable design requirements with an error in a range of ± 0.04 % in the humidity.

2-Our prototype meets the design requirements and reaches to a humidity removal efficiency of 40%. 3-Our prototype is applicable, has a relatively low cost and has a great effect on the air conditioner industry.

RECOMMENDATION

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.

LITERATURE CITED

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