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| FIXERS  CAPSTONE PROJECT |

**Description:**

The problem statement is regarding pharmaceutical companies. As we all know that during the manufacturing of tablets at company, the temperature of the tablets has to be maintained between some threshold values. But there are some cases where the temperature crosses its threshold values causing huge loss to the company. To overcome this huge loss we came up with a solution called Capstone project by using IOT. This project helps us in overcome the huge loss by sending the SMS or email when the temperature crosses the threshold limits, so that the company owner will get alert and set the temperature values back to its threshold limits, thereby reducing the loss.

**The contents of the Capstone project are as follows:**

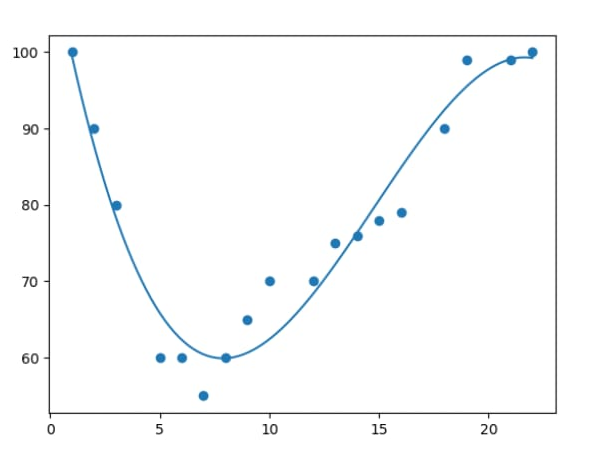
* Building the circuit for temperature monitoring system, using the Bolt and LM35 sensor.

LM35 Sensor: This sensor plays a crucial role in our project. The LM35 sensor is a temperature measuring device having an analog output voltage proportional to the temperature. It is a 3-terminal sensor used to measure surrounding temperature ranging from -55 to 150 degrees Celsius. The sensitivity of LM35 is 10mV/degree Celsius. As the atmospheric temperature increases, output voltage also increases.

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* Creating a product on the Bolt Cloud, to monitor the data from the LM35, and linking it to the Bolt.
* Writing the product code, required to run the polynomial regression algorithm on the data sent by the Bolt.

Polynomial regression: polynomial regression is a regression algorithm that models the relationship between a dependent(y) and independent variable(x) as nth degree polynomial. Here we are taking time on x-axis and temperature on y-axis. By this we can make a graph of time and temperature.



* Keeping the temperature monitoring circuit inside the fridge with the door of the fridge closed, and letting the system record the temperature readings for about 2 hours.
* Setting the boundaries for the temperature within the fridge using the reading received in the 3 hours.
* Writing a python code which will fetch the temperature data, every 10 seconds, and send out an SMS alert, if the temperature goes beyond the temperature thresholds.
* Modifying the python code, to also do a Z-score analysis and print the line “Someone has opened the fridge door” when an anomaly is detected.
* And also tuning the Z-score when someone opened the fridge door.

Z-Score analysis: The standard score (more commonly referred to as a z-score) is a very useful statistic because it allows us to calculate the probability of a score occurring within our normal distribution and enables us to compare two scores that are from different normal distributions. Here in our project we used it for detecting anomalous change in temperature.

Here in this project we used the fridge instead of the chamber (which company will use to store the tablets).

Hosting the project:

As this project works on real time implementation, we are implementing our project on cloud by using VMware to write the code by connecting the bolt to the cloud.