HOME ELECTRICITY USAGE PREDICTION AND ANOMALY DETECTION

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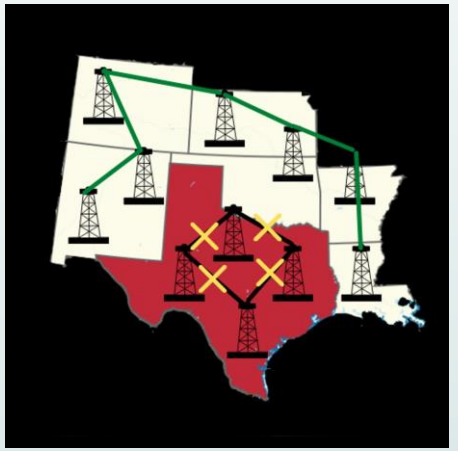
BACKGROUND

- Power production and consumption happens on a real time basis.
- When the power generation is high it leads to a energy wastage and if it is low then it leads to a overloading process.
- As simple when supply and demand imbalanced the grid become overload and the week entity gets failed quickly.
- This imbalance may occur due to the high demand or some natural disasters and bad weather conditions.
- Once this supply demand imbalance situation occurred the loads gets distributed among the other units of the grid. Then the other parts of the grid also become overload due to insufficient supply. Therefore one by one remaining working units of the grid fails. Finally this will lead to a blackout.
- This overloading would be disasters' to the system.
- In srilanka there is no such extra backup power generation source use in this kind of situations.

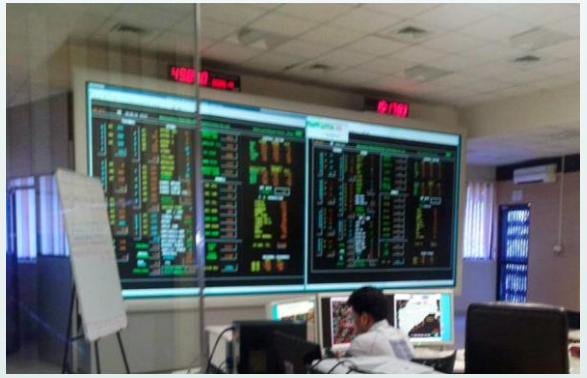


Texas power grid failure due to winter storms -February 10–27, 2021

India blackout due to high load demand One major transmission line overheated and damaged -2012

- Most of these power station built in Sri Lanka are 30 to 40 years ago.

  - **900 MW** Lakvijaya Thermal power station(2006) - Bituminous coal
  - **500 MW** Sampur Thermal power station(2006) - Coal
  - **300 MW** Yugadanavi Thermal Power Station(2007)-. Liquefied Natural Gas (LNG)
  - **360 MW** Kelanitissa Thermal Power Station(1964)- Diesel fuel
  - **172 MW** Sojitz Kelanitissa Thermal Power Station(2000) -Diesel fuel
  - **160 MW** Sapugaskanda Thermal Power Station(1984) - Heavy fuel oil
  - **210 MW** Victoria Hydro electric Power Station(1984)
  - **201 MW** Kotmale Hydro electric Power Station(1985)

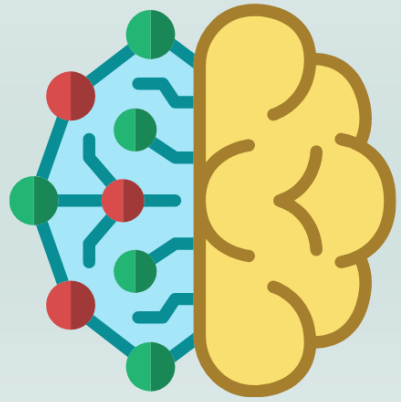


Load dispatch center

- To avoid load demand exceed the total capability of the system , **Load dispatch center** match the generation and consumption in the system by load scheduling.

- But monitoring the grid and balance the supply and demand is a difficult task. Therefore to avoid this there should be a proper load forecasting method and AI and advance technologies to face this situations.

- Most of countries use smart meters and smart grid technology to overcome from these issues.



Deep learning model to predict the energy consumption in the next period of time.

OBJECTIVES

- ❑ Building a deep learning model to predict the future energy consumption.
- ❑ Detect anomalies in electricity usage.
- ❑ Reduce energy wastage and cost
- ❑Mange demand

DATASET

- **Individual household electric power consumption Data Set**
- **Data Set Location:** Measurements gathered in a house located in Sceaux (7km of Paris, France) between December 2006 and November 2010 (47 months)
- **Number of Attributes:9**
- **Number of Instances:**2075259
- **Missing Values** :Yes(nearly 1.25% of the rows)

DATASET ATTRIBUTES

1. **date**: Date in format dd/mm/yyyy
2. **time**: time in format hh:mm:ss
3. **global_active_power**: household global minute-averaged active power (in kilowatt)
4. **global_reactive_power**: household global minute-averaged reactive power (in kilowatt)
5. **voltage**: minute-averaged voltage (in volt)
6. **global_intensity**: household global minute-averaged current intensity (in ampere)
7. **sub_metering_1**: energy sub-metering No. 1 (in watt-hour of active energy). It corresponds to the kitchen, containing mainly a dishwasher, an oven and a microwave (hot plates are not electric but gas powered).
8. **sub_metering_2**: energy sub-metering No. 2 (in watt-hour of active energy). It corresponds to the laundry room, containing a washing-machine, a tumble-drier, a refrigerator and a light.
9. **sub_metering_3**: energy sub-metering No. 3 (in watt-hour of active energy). It corresponds to an electric water-heater and an air-conditioner.

household_power_consumption - Notepad

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Date;Time;Global_active_power;Global_reactive_power;Voltage;Global_intensity;Sub_metering_1;Sub_metering_2;Sub_metering_3
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Available at:
https://archive.ics.uci.edu/ml/datasets/individual+household+electric+power+consumption

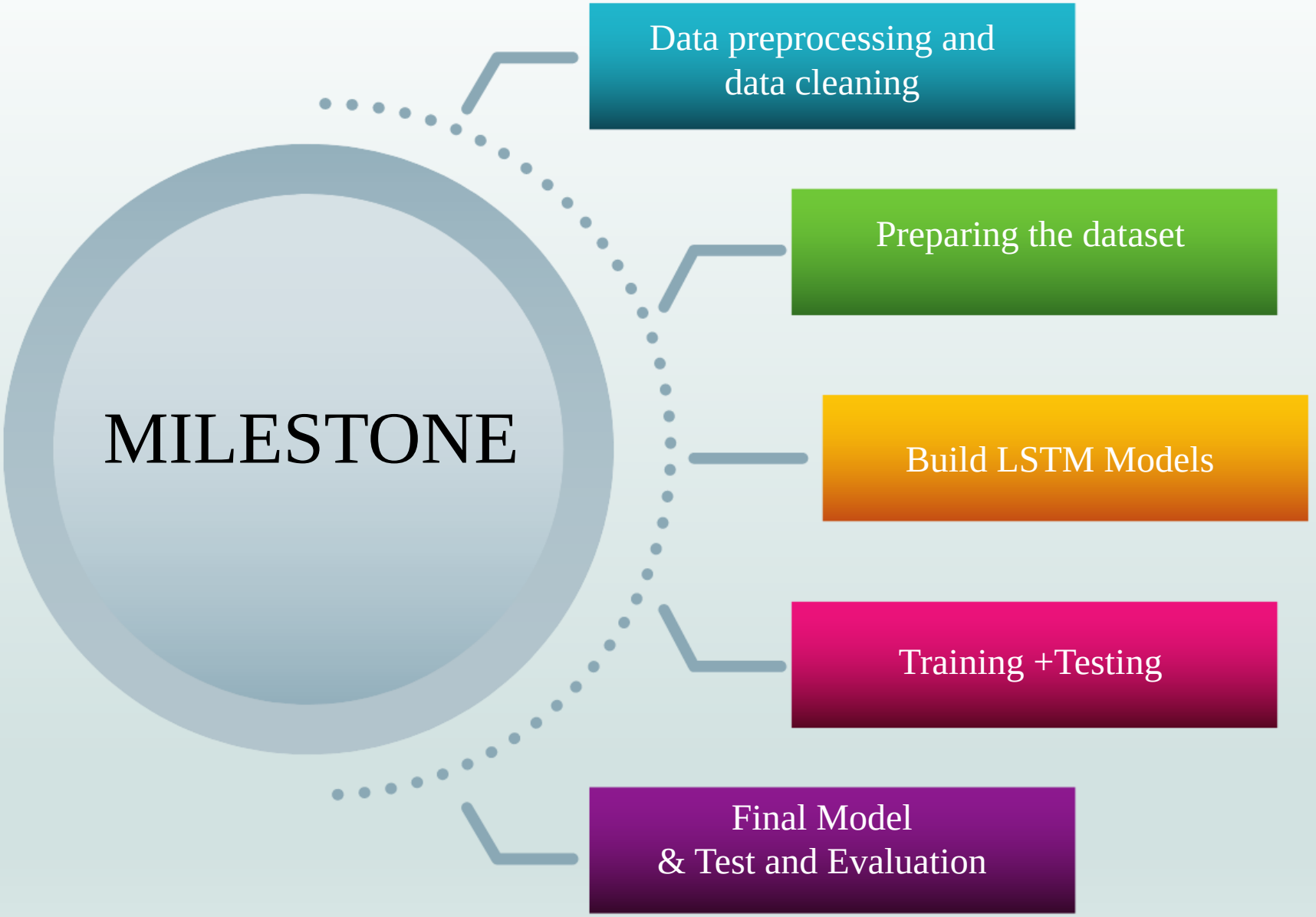
If Possible I hope to use my own dataset that generates from previous CO3302- computer engineering project. Because in this data set it didn't contains weather data. Weather data might be useful in analysis and evaluation stage. Available at-http://localhost/CEBFINAL2021/customer/dash/charts.php

ARCHITECTURE

Deep Learning models

- **Time series forecasting**
  Long Short-Term Memory(LSTM) –RNN architecture
- **Anomaly detection**
  LSTM Autoencoder architecture

Keras ,Tensorflow with python will be use to implementation mainly


MILESTONE
Data preprocessing and data cleaning
Preparing the dataset
Build LSTM Models
Training +Testing
Final Model & Test and Evaluation

BASIC TIMELINE

Activity	Week													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Selecting the dataset														
Data cleaning and preprocessing														
Preparing the Dataset														
LSTM time series prediction Model														
LSTM Autoencoder Model														
Final combination Model														
Testing and Evaluation														
Data Visualization														

Anything to clarify ?

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