Smart Meter Analytics for Optimizing the Utilization of Electricity using Arima, Navie & Holt Winter

P. Vidya Sagar, Nageswara Rao Moparthi, Mukesh Chinta

Abstract: — Smart Meter data is trending at present. The Smart Meter data means data generated for every second. This kind of data is produced by smart meters so we are working on smart meter data for analysis. Smart meters have smooth way to use electricity effectively to compare with the digital meters in nature. These types of meters have been arranged across few nations since from 2ks. The universal organizations would utilizing these meters on provide exact electric Vitality utilization information with their clients. Those enormous sum from claiming information created Eventually Tom's perusing keen meters each particular interim could be utilized to information analytics Furthermore furnish Different insights that camwood be determined for example, such that determining the electric demand, actualizing ToU Also duty costs and so on. Which will help both existing organizations What's more clients. In this article we are analyzing data using 3 methods. Namely ARIMA, NAVIE & HOLT WINTER. We compare these methods by AIC measurements of their MAPE values.

***Index Terms*: IOT, NAVIE, Smart Meters, ARIMA.**

I. INTRODUCTION

While access the smart meter data for analysis because smart meter is used not only used for accurate data. Enormous volumes from claiming genuine information created by keen meters [4] could make mined Eventually Tom's perusing vitality. Accepted organizations Furthermore new insights therefore processed could a chance to be drive business welfares. A number of the reasons for analysis are: to make efficient power buying selections based totally at the usage patterns, launching power performance[7], power fraud detection, evaluating and correcting metering service company performance, and detecting and decreasing unbilled power. As said SM data are time series [9] data that are series of capacities of the same variable gathered over time at ordinary intervals. SM data can be accessed for working out forecasting primarily based on the historic records. We enforce on few forecasting techniques, ARIMA [5] and Exponential Smoothing. Same time utilizing these models on perform time arrangement dissection and determining from claiming keen meter information Also with decide the a standout amongst the best model for foreseeing daily, weekly, month to month What's more quarterly aggravator information and additionally for picking suitableness time from claiming determining [1].

We integrate Apache Hadoop with statistic computing tool like R to solve the above mention forecasting. This integration can be done via hive. We utilized apache Hadoop, which is coordinated to RStudio [9] on perform time arrangement dissection What's more determining about time arrangement information transformed toward advanced mobile meter information. For comparison of two forecasting techniques we used the calculated MAPE values [11]..

II. LITERATURE REVIEW

In [8] Sentimental in Chandra Bhushan, V. V. Hara Gopal, and A. Vinay Babu investigates software of exponential smoothing and garch modelling techniques to match the historic statistics consisting day by day load of state AP in India, and estimation of coefficients for counting the earlier day power request. For this type of models R-Programming fits well[13]. By writing the code in R, the order of Exponential Smoothing model which is better for the data set can be raised out adopting the lower value of AIC .GARCH, which is a non-aligned model treats hetero elasticity in the form of variance which is to be modelled, for every inaccuracy phrase a prevision is anticipated to the variance other than modifying the insufficiencies of least squares.

Clinched alongside [10] Balaji k. Bodkhe and Dr. Sanjay P. Sood functioned by gaining entrance to advanced mobile meter information settling on utilization of An business discernment action apparatus with apache Hadoop. The technique included an orderly procedure custom-made on Indian states which At went with will bring about a totally compelling Furthermore appropriately figured out how advanced mobile power grid to 2024. Different functionalities are given for clients and also investigator clinched alongside GUI with visualize power utilization information Furthermore load profile dependent upon different parameters such as weekly, monthly[7] and so on.

To [6] Junwei Miaostudied the issue about power utilization china as a impact from claiming expanded population, and hence utilized ARIMA model to determining power interest from claiming china for the accompanying couple of a considerable length of time for making vitality What's more budgetary arrangements. The model indicated low lapse rate done prediction What's more will be more exact sufficient should conjecture power interest from 2013 to 2000.

Revised Manuscript Received on May 28, 2019.

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III. ARCHITECTURE DIAGRAM

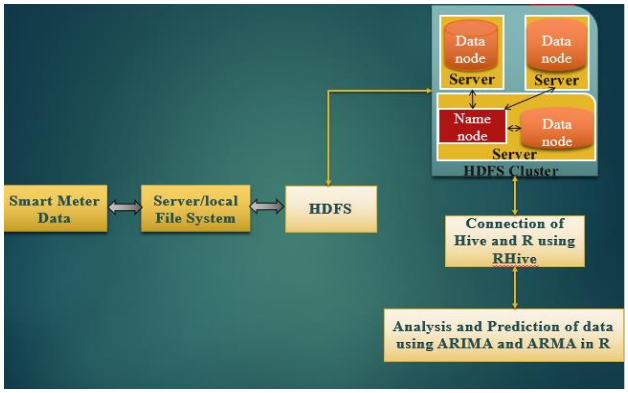


Fig.1 Architecture Diagram

IV. IMPLEMENTATION

The dataset contains time series of 100 consumers and theirs corresponding meta data. This enormous information comprise of the date Furthermore occasion when alongside the control used. Those colossal dataset will make stacking under HDFS starting with the typical neighborhood record framework. We utilize HDFS as the database with store the significant measure about information which must a chance to be exported under Rsystem for load profile examination and in addition those determining. Those tremendous information will make stacking under An hive information table alongside those timestamp provided for in the information. The HDFS could be accessed from those RStudio Eventually Tom's perusing interfacing those hive for Rsystem. R studio and Hadoop camwood a chance to be associated utilizing 3 bundles for example, Java, RJDBC, DBI to r. Those HDFS will a chance to be accessed from r framework support. Those sm electric utilization information will be Notwithstanding foreign starting with hive information table should Rstudio[9]. Those streaming information will make stacking under HDFS done An hive table, which may be further exported under r in place on perform predictive examination Furthermore load profile examination.

	timestamp	dttm_utc	value
2	1325376600	01-01-2012 00:10	52.1147
3	1325376900	01-01-2012 00:15	50.9517
4	1325377200	01-01-2012 00:20	49.8164
5	1325377500	01-01-2012 00:25	49.1795
6	1325377800	01-01-2012 00:30	47.6288
7	1325378100	01-01-2012 00:35	49.1241
8	1325378400	01-01-2012 00:40	50.3979
9	1325378700	01-01-2012 00:45	51.284
10	1325379000	01-01-2012 00:50	49.7056
11	1325379300	01-01-2012 00:55	51.6994
12	1325379600	01-01-2012 01:00	49.8441
13	1325379900	01-01-2012 01:05	47.075
14	1325380200	01-01-2012 01:10	46.8811
15	1325380500	01-01-2012 01:15	45.0812
16	1325380800	01-01-2012 01:20	48.3487
17	1325381100	01-01-2012 01:25	45.3581

Fig.2 Dataset

A. Integrating R and Hadoop via Hive

a) Create a Hive table over raw HDFS text data in a directory to make the HDFS data accessible from Hive. Load the dataset into hive table. Verify that the Hive table can be queried locally on the Hadoop [10] cluster before moving on to getting remote connectivity via R working. As we have created only for sample data now we to create for main variable which we have to be get accessed.

b) Check if the hive service is running, if not restart it in terminal. RStudio [9] can be accessed in centos 6.7 from the browser by typing localhost:8787.

B. Integrating R and Hadoop via Hive

Ploting graphs on monthly time seriesT What's more, the lion's share of Corps parts don't stay in their starting work areas once their comm information speaks to those qualities from claiming accurate variable gathered again a period period. Information of TS would mossycup oak suitableness will do determining. We utilize A percentage bundles over r in information. Table, ggplot, for determining monthly, weekly, What's more Every day. Those load profile chart indicates the load of power utilized again. An specific time of time for graphical design.

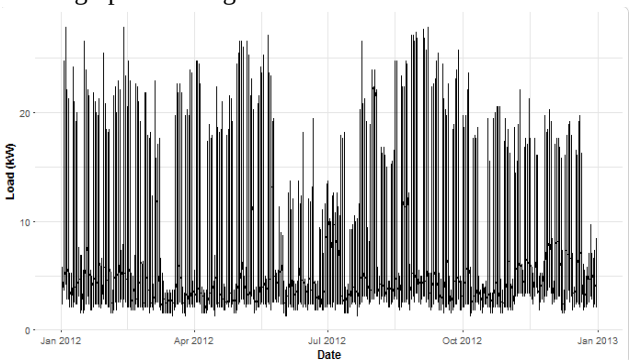


Fig. 3 Monthly Time Series

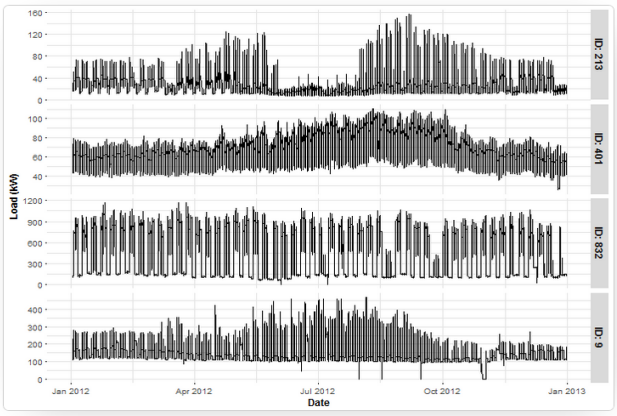


Fig. 4 Graph of a Particular Day in Monthly Time Series

C. Plotting graph on weekly time series

For utility (distribution) companies it is very helpful to create daily and weekly profiles of consumers for some area. It deals with characteristic behavior of consumer during the day. So, we create median daily profile of aggregate consumption with MAD (median absolute deviation). We use medians and MAD because of their robustness.

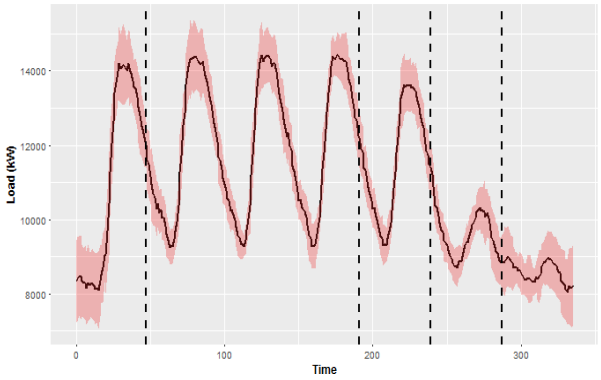
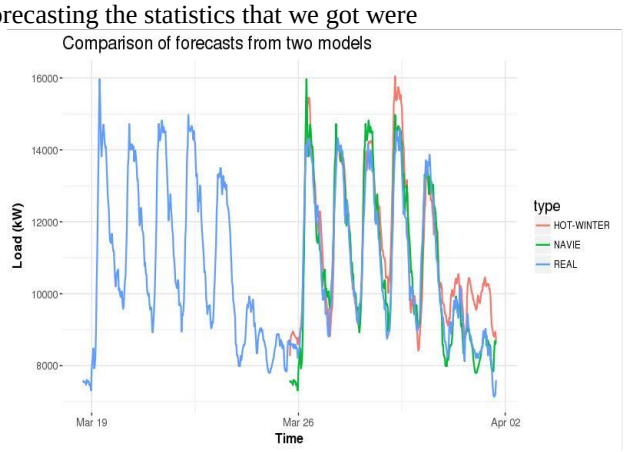


Fig. 5 Graph Load Vs Time Graph in Weekly Profile

On Comparison with the models Navie and Holt-winter forecasting the statistics that we got were



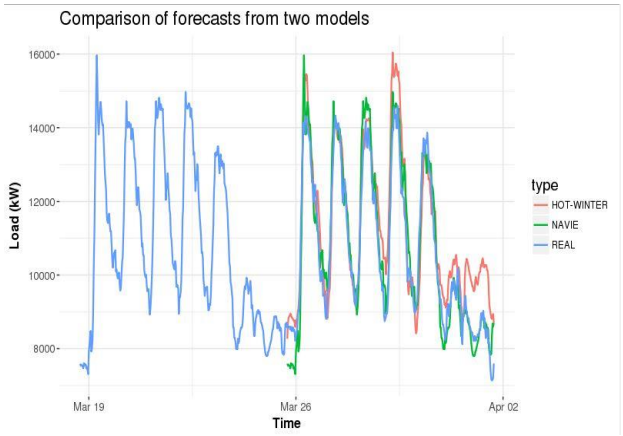


Fig 6. Comparison on Aggregated Load

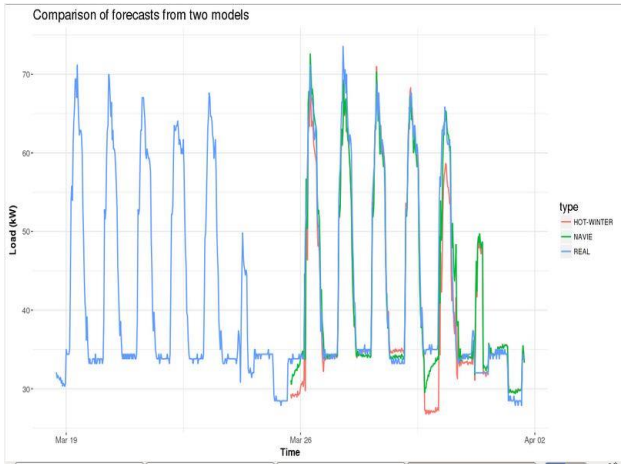


Fig 7 Comparison on Disaggregated Load

MAPE values for Aggregated Data:

SNO	Model	Values
1	Navie	4.3674
2	Holt-winter	7.3208

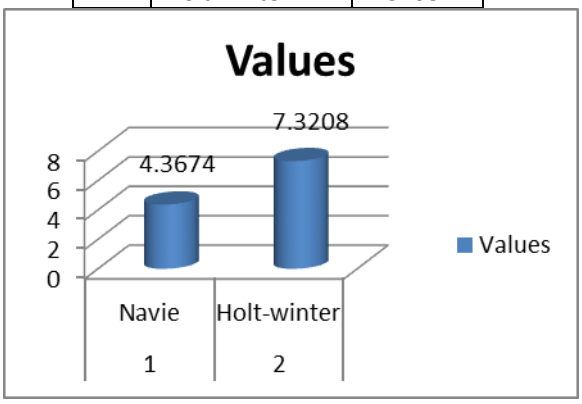


Fig 8. Comparison between Navie & Holt_Winter Models in Terms Of Mape Values

Disaggregated Data:

SNO	Model	Values
1	Navie	5.5166
2	Holt-winter	7.1316

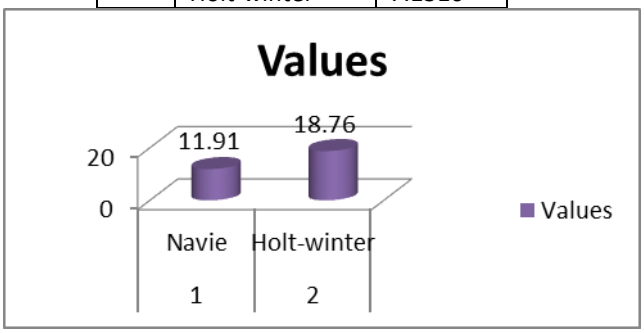


Fig 9 Comparison between Navie & Holt Winter Models in Terms Of Disaggregated Data

AIC VALUES For:
Daily:

SNO	Model	Values
1	Navie	550.36
2	Holt-winter	739.54

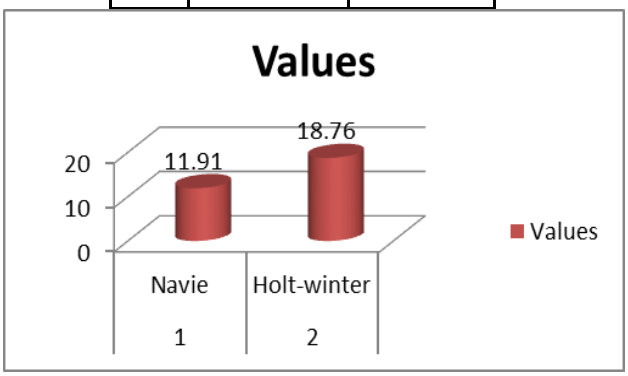


Fig 10 Comparison between Navie & Holt_Winter Models In Terms Of Aic Values Daily

Weekly:

SNO	Model	Values
1	Navie	11.91
2	Holt-winter	18.76

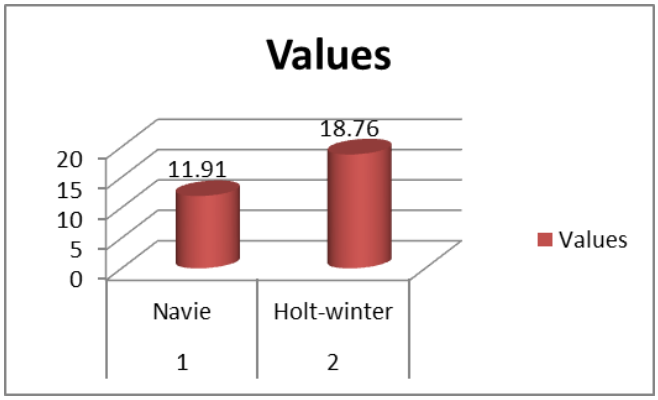


Fig 11 Comparison between Navie & Holt_Winter Models In Terms Of Aic Values Weekly

Monthly:

SNO	Model	Values
1	Navie	13.24
2	Holt-winter	20.43

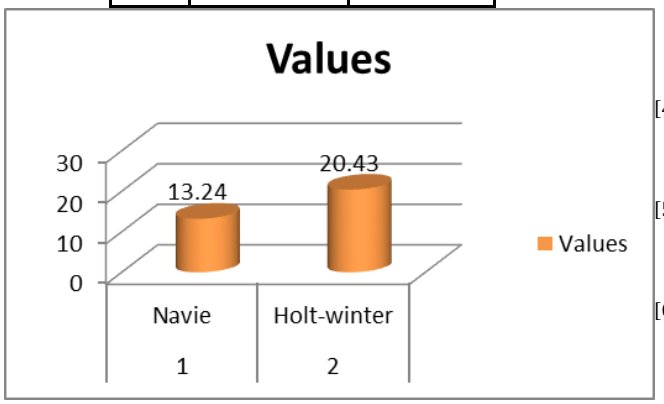


Fig 12 Comparison between Navie & Holt_Winter Models In Terms Of Aic Values Monthly

AIC Measurement Comparison:

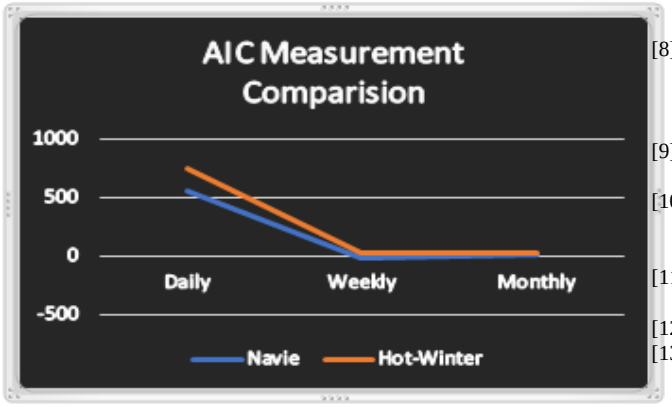


Fig 13 AIC Measurement Comparisons

V. CONCLUSION

In this article, we utilized information about time arrangement of keen meter at an inspecting rate about person moment. Those streaming information will be stacked under HDFS Previously, A hive table, which is further exported under r in place should perform predictive examination Furthermore load profile Investigation. We utilized exponential Smoothing Also ARIMA model should foresee what's to come power utilization. We likewise evaluated the correctness of the models toward utilizing those MAPE values [11]. AIC estimation examination for Navie & Holt winter models might have been carried out and the comes about were demonstrated as needs be. The Straightforwardness and adaptability of r modifying may be great used to would those determining Investigation.

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