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A Survey on Power Cut Reporting and Analysis using Data Mining

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ABSTRACT—*To realize the idea of Digital India, we aim to bring all the electricity consumers of India on an online platform where their concerns can be heard and proper action can be taken as soon as possible. In recent years a number of new procedures with that aim to digitize the consumer platform in the domain of electricity have come up. The purpose of survey paper is to survey a number of promising techniques and technologies. Our problem statement aims to solve the power cut reporting issue for household users without any bias of region and consumption capacity to provide an analysis and monitoring of power cuts, and in our paper we aim to find the soundest approaches and latest technologies available to achieve it.*

Keywords-- Power cut, android, global positioning system, data mining, cloud.

I. INTRODUCTION

The current system uses phone call and email as a platform for communication. Neither is the method effective nor does it leverage current technology to take advantage of the user data gathered. Our proposed system aims to bring the consumers and the system online to provide quick hassle free communi- cation.

Also, we use the data captured from users to derive meaningful insights about electricity cutoff behavior among household consumers and help the government to look into electricity prone areas and take necessary action.

II. LITERATURE SURVEY

In the prediction methods for consumer side in the upcom- ing developing nations, frequent power cuts are a common issue, which needs to be critically addressed by using con- sumer side prediction methods. Irregularity in scheduledpower cut causes loss of time and inefficient activity for consumers and therefore the consumers want to know about any elec- tricity cutoff occurrences well in advance. Three methods are discussed here which enable electricity consumers to get a reasonable idea regarding the beginning time of electricity cuts for the days ahead. SBP(Start time of electricity cut Based Pre- diction) utilizes recorded electricity cut begin time information for investigation and estimation, while FBP(Frequency Based Prediction) utilizes chronicled recurrence variance information and ADSP(Adaptive Data Selection Prediction) which is a half-breed of the above mentioned techniques and uses the benefits of both SBP/FBP.

(A) SBP: It predicts the beginning time of electricity cutoffs depending on the previously recorded data about start time gathered from consumers. A time series prediction method is used to predict the start time of further power cuts.

(B) Frequency Based Prediction: It predicts the beginning time of electricity shorts dependent on the authentic information about the frequency of the start time of power cut trends in the electricity framework of an area. The FBP depends on the speculation that a customer has a likelihood to confront power cuts at the time when power

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cut has happened most of the time in the past. The frequency based prediction is complementary to start time based prediction usually.

(C) Adaptive Data Selection Prediction: The method discussed is an amalgam of the above two methods and provides the most optimum results in terms of prediction. The method aim to retrieve relevant count of data from the dataset according to data similarity for betterment in the ratio of prediction success [1].

Ensemble learning is a method that generally provides high accuracy due to distributed predictions, is an ideal method for estimating weather related outages especially by using Adaboost. Estimation of power outage due to environmental factors like wind, lightning and rain is discussed here. The data of power outage is combined with the data of weather data and then it is analyzed.

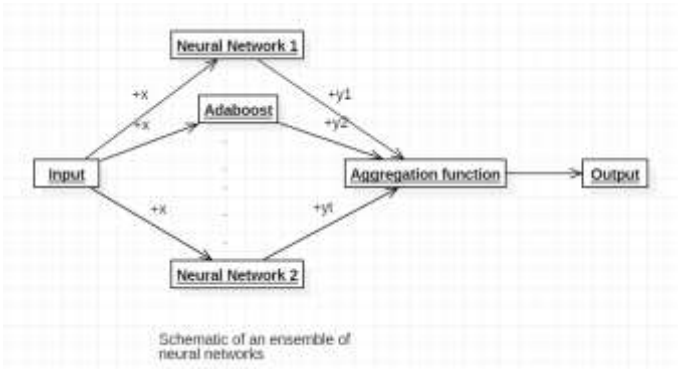


Fig. 1. Diagram of an ensemblelearning model [2]

Ensemble learning approach using a boosting algorithm (Adaboost) for estimation of weather related electricity out- ages is discussed here. The effectiveness of the Adaboost is evaluated using a dataset, which consists of weather status recording dataset and outages recordings for four cities. Ad- aboost which is an ensemble learning based approach is used here due to a variety of reasons, some being when input data is either extensive or spatially distributed or both, instead of transporting it to a single node for processing, the input data is distributed among various network nodes and processed at

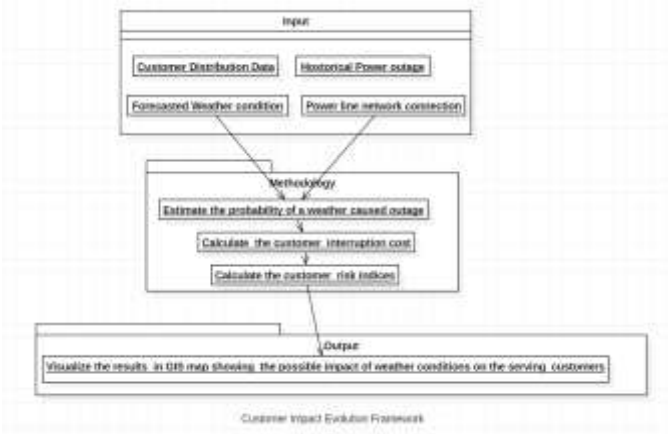
the respective nodes, before sending the cumulative result to the result node. Also, different nodes can consist of various prediction models which can process data simultaneously and give a varying result which will be rich in accuracy because of various predictions given by various models varying in their prediction accuracy, contributing towards a global optimum[2]. Based on a consumer's electricity consumption activity patterns forecasting can be made on the household level. A novel approach is discussed for short time interval electricity load prediction for one day in advance, not on a collective level but on an individual consumer level, for the forecasting, a domestic consumer specific data set of behavioral pattern was utilized that was dependent on the power utilization rate which was inferred by utilizing data mining algorithms and an investigation of power load expectation using different forecasting algorithms. One of the primary motivations be- hind the research is to limit the household electricity usage threshold by spreading awareness among the consumers about their electricity consumption pattern. To evaluate the model performance in forecasting, three parameters were utilized, precision, means absolute percentage error and accuracy. The methods for forecasting discussed in here are

Artificial Neural Networks, K-Nearest Neighbors, Regression Trees, Random regression forests, Support vector regression, Naive forecast,

Random forecast[3].

Weather plays an important role in the power cut and its prediction. Most of the time weather is the sole reason for frequent and unforeseeable power cuts. Thus incorporating them while studying the evaluation and prediction of inter- ruption due to power cuts can be useful. Real time weather related information is used for fitting in to models to evaluate customer interruption cost (CIC). It also assesses the risk associated with the customer impact from the weather-caused power cuts. Past weather data readings and weather forecast data are clubbed and used together for risk-evaluation of consumers if there should be an occurrence of particular climate conditions which are estimated to influence diverse territories in not so distant future.

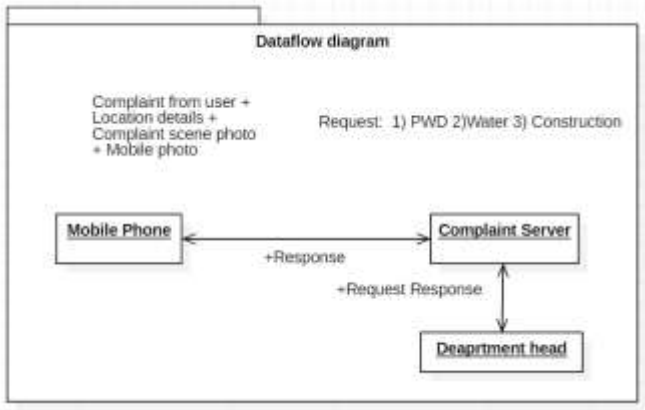
Fig. 2. Customer Impact Flow Framework [4]



The study encapsulates some modules namely, weather data: that is gathered from land-based stations, radar and satellites.GIS: Geological Information System is intended to empower capacity, control, representation and investigation of spatial information. Consumer information is converged with GIS and climate related information so as to build up a structure for the better estimation of the effect of various climate conditions on the customers. Predictions are made by a pre-trained model which is trained over the past power outage data that is related with climate parameters estimated at the time of blackout due to spatial factors.[4].

The mobile application has enabled a lot of potential in the hands of common man, which they can use to communicate and express their problems via the help of multi-media and internet.

Fig. 3. DataFlow diagram of proposed system [5]



The application discussed aims to provide a platform for common man to register their complaints to the municipal authority and let the authorities address the problem early as possible.

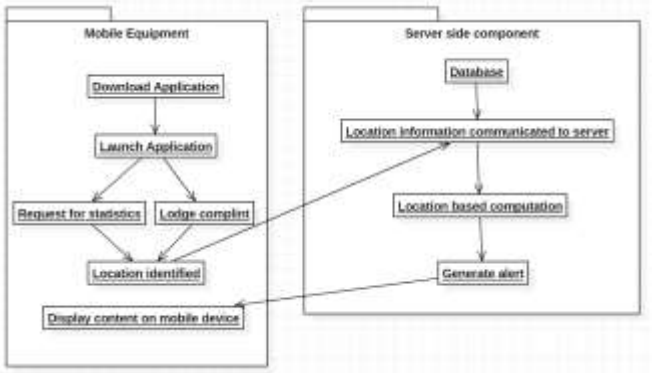


Fig. 4. Block diagram of proposed system [5]

The working of the solution are as follows, the user needs to download the application and launch it during need. The user needs to lodge a complaint and request for a statistical report of the problem being faced. Location of the user is identified and fetched by the application along with picture(s) of the issue being faced which are taken by the user. The complaint, location info and pictures are sent to the back end of the application where further processing takes place. All the data is stored in the database and location-based computation takes place according to which an alert is generated and a response is sent back on the application which is received by the user[5].

Each consumer can be given a unique identity based on their location and the kind of power consumption utilities they are using from the power distribution system. Power distribution system encounters a lot of potential problems such as non- availability of accurate location information and details about electricity supply utilities such as transformers, poles and transmission lines. The concept of consumer Indexing (CI) can be used to extract the exact location of the consumer through the power supply utilities such as poles, transmission lines and transformer number. The GIS and GPS (Global Positioning System) technologies provide a tool for assistance in the management, reporting and analysis of Power Distribution System related tasks. GIS plays a crucial role in indexing of consumer based on spatial information by handling the information about the distribution of power via power

distribution network to the consumers and information about the parameters associated with the characteristics of each consumer[6].

Every technology is some way or the other dependent on cloud computing for utilizing its full potential today, and so is Geospatial Information System. The Cloud Computing based approach is evaluated against Geographical Information Systems (GIS) and the result is discussed and a multi-level architecture for GIS Cloud System is extracted out of it. Geographical Information Systems or Geospatial Information Systems (GIS) is an accumulation of tools that manage, store, analyze, capture and represent data which are linked to geo-spatial locations on earth. GIS plays a crucial role in a varied range of fields and is extensively adopted at the present time for the development of solutions and products that leverage its potential. Simply put, GIS is the intersection of software, hardware, measurable examination and cartography. GIS is seen as a technological instrument for settling on the best choices through available geographical data and the non spatial and spatial data relations between them, processing and visualization. The full potential of GIS can be utilized when each and every individual can benefit from its application with minimal expenditure on technology and resources. Lately, efforts have been made to redesign the traditional last age GIS applications so as to make it available and accessible to as many individuals possible and offer a wide spectrum of services to the consumers around the globe. Cloud Computing services can turn out to be a stepping stone in the field of GIS applications and be used to find answers to push the potential of GIS technology and overcome the challenges faced in field of GIS applications [7].

III. PRESENT SYSTEM

The present system has two systems in place to address the issue of the power cut, first being a call center system where consumers can call and register their complaint to a representative who informs the concerned authority to take the necessary action. The above mentioned method has been utilized for a long time but it has not turned out to be an efficient approach as there is no proof of complaint and it is a time-consuming approach. Second is a ticket system where a user registers a complaint on a dedicated platform usually via email on the official id or on an online public portal and has to wait to get a response from the Electricity Board. The users need to keep checking their complaint request through the ticket assigned. Although the method provides proof of complaint it is still time-consuming and demands additional details from the consumer each time the consumer registers a complaint since it does not provide the consumers with any unique identity.

IV. PROPOSED SYSTEM

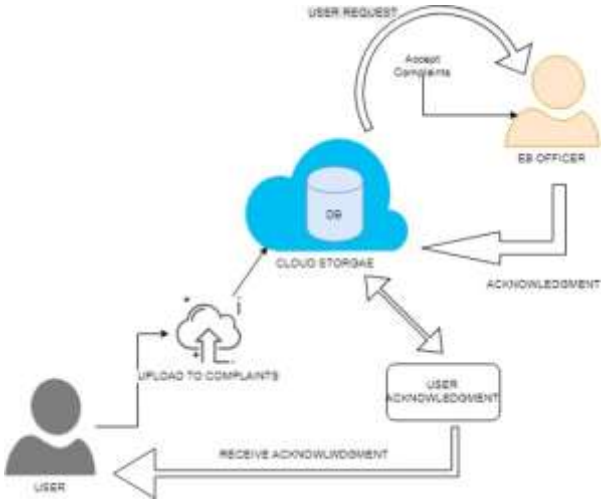


Fig. 5. Proposed system architecture

Our solution aims to collect user complaints without any bias of region and consumption capacity and provide a plat- form for consumers to register their complains on a mobile application. In a real world scenario concerned authorities can monitor user complaints and provide a proper response for the respective reason of power cutoff. The functionality of the proposed system involves two modules, android app and cloud storage. Once a complaint is registered by the consumer, the request is sent to the cloud hosting website where the data is stored in the database. The response for the request is entered from a back end web page, which is then sent on the client side android application and is retrieved by the consumer. The application will hence help in taking automated action and reducing problem of power cutoffs over a long duration. Data is also stored in a structured format and hence it can be further utilized for the research and analysis and to find various meaningful insights from data. The platform helps the users get proper response directly from the electricity department. All the data is stored in cloud and so it can be further used for analytics to derive meaningful insights. Our solution provides a platform for the individual electricity consumers to raise their concern which ensures that there problems are properly addressed by the concerned authority.

V. SCOPE

The scope of the project is nationwide, as the idea can be implemented in the electricity board throughout the country. The proposed solution can be merged with the back end system of the Electricity Board of India and can be used to serve millions of people. Our solution can act as an intermediate platform between government and consumers, enabling government to monitor, communicate, report and take action about the situations of power cuts region-wise.

VI. CONCLUSION

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A platform is build in which consumers facing power cut issue, login to the mobile application with the unique consumer id and reports the issue to the electricity department. The response is then generated to the consumer from the system, in case of a pre-planned event, response is pre-fed otherwise complain will be raised to EB department and once the response is fed to system the response/reason will be given to the consumer. The data hence collected from can also be used to analyze the power cuts and help government in taking proper action.

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