

Advances in Intelligent Systems and Computing 1057

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# Soft Computing for Problem Solving

SocProS 2018, Volume 2

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# Advances in Intelligent Systems and Computing

Volume 1057

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# Preface

SocProS stands for *Soft Computing for Problem Solving*. It is an Eight years old series of International Conferences held annually under the joint collaboration among a group of faculty members from the institutes of repute like NIT Silchar, IIT Roorkee, South Asian University Delhi, Liverpool Hope University, UK and VIT Vellore.

For the first time, SocProS was held at IE(I), RLC, Roorkee, India during Dec 20-22, 2011, with General Chairs as Prof Kusum Deep, Indian Institute of Technology Roorkee and Prof Atulya K. Nagar, Liverpool Hope University, UK. The second SocProS was held at JKLU, Jaipur, India during Dec 28–20, 2012. Similarly, the third SocProS was held at the Greater Noida Extension Centre of IIT Roorkee during December 26–28, 2013, fourth SocProS was held at NIT Silchar, Assam during December 27–29, 2014, Fifth SocProS was held at Saharanpur Campus of IIT Roorkee, during December 18–20, 2015, Sixth SocProS was held at Thapar University, Patiala, Punjab, during December 23–24, 2016, Seventh SocProS was held at IIT Bhubaneswar, Odisha, During December 23–24, 2017, Now the name ‘SocProS’ became a brand name which has already established its benchmark in last eight years through its successful milestones every time in attracting many participants from all over the world like UK, US, Korea, France, Dubai, South Africa etc.

This time, the Eighth SocProS has been held at VIT Vellore, India during Dec 17–19, 2018. Like earlier SocProS conferences, the focus of SocProS 2018 lies in Soft Computing and its applications to solve real life problems occurring in different domains in the field of medical and health care, supply chain management, signal processing and multimedia, industrial optimization, image processing, cryptanalysis etc. SocProS 2018 attracted a wide spectrum of thought-provoking research papers on various aspects of Soft Computing with umpteen applications, theories and techniques. A total 176 quality research papers are selected for publication in the form of proceedings in its Volume 1 and Volume 2.

We are sure that the research findings in the novel papers contained in this proceeding will be much fruitful and may inspire more and more researchers to work in the field of *soft computing*. The topics that are presented in this proceedings

are Fuzzy logic & Fuzzy controller, Artificial Neural Network, Face Recognition & Classification, Feature Extraction, Machine learning, Reinforcement learning, Deep learning, Supervised learning, Different optimization techniques like Spider-Monkey Optimization, Particle Swarm Optimization, Meta heuristic Optimization, Artificial Bee Colony Optimization, Walk Grey Wolf Optimization, Algorithms like Flower Pollination Algorithm, Parallel Random Forest Algorithm, C-mode Clustering Algorithm, Crow Search Algorithm, Genetic Algorithm, Artificial Bee Colony Algorithm, Adaptive Multi-Swarm Bat Algorithm etc. Therefore this proceeding must provide an excellent platform to explore the assorted soft computing techniques to the readers.

The editors would like to express their sincere gratitude to its Patron, Plenary Speakers, Invited Speakers, Reviewers, Programme Committee Members, International Advisory Committee, and Local Organizing Committee; without whose support the quality and standards of the Conference could not be maintained. Special thanks to Springer and its team for this valuable publication.

Over and above, we would like to express our deepest sense of gratitude to 'VIT Vellore' for hosting this conference. Also, sincere thanks to all sponsors of SocProS' 2018.

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New Delhi, India  
Roorkee, India  
Liverpool, UK  
Vellore, India  
Vellore, India

Kedar Nath Das  
Jagdish Chand Bansal  
Kusum Deep  
Atulya K. Nagar  
Ponnambalam Pathipooranam  
Rani Chinnappa Naidu

# About This Book

The proceedings of SocProS 2018 will serve as an academic bonanza for scientists and researchers working in the field of Soft Computing. This book contains theoretical as well as practical aspects using fuzzy logic, neural networks, evolutionary algorithms, swarm intelligence algorithms, etc. with many applications under the umbrella of 'Soft Computing'. This book is beneficial for the young as well as experienced researchers dealing across complex and intricate real world problems for which finding a solution by traditional methods is a difficult task.

The different application areas covered in the proceedings are: Image Processing, Cryptanalysis, Industrial Optimization, Supply Chain Management, Newly Proposed Nature Inspired Algorithms, Signal Processing, Problems related to Medical and Health Care, Networking Optimization Problems etc. This will surely helpfully for the researchers/scientists working in similar fields of optimization.

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**Prof. Rani Chinnappa Naidu** received the B.Eng. and M.Tech. degrees from VIT University, Vellore, India, and Ph.D. degree from Northumbria University, Newcastle upon Tyne, UK., all in Electrical Engineering. After that, she joined as a Postdoctoral Researcher in Northumbria Photovoltaic Applications Centre, Northumbria University, UK. She is currently an Associate Professor at VIT University. She is an Senior member in IEEE. She leads an appreciable number of research groups and projects in the areas such as solar photovoltaic, wind energy, power generation dispatch, power system optimization, and artificial intelligence techniques.

# Artificial Neural Network-Based Smart Energy Meter Monitoring and Control Using Global System for Mobile Communication Module



P. Ashwini Kumari and P. Geethanjali

**Abstract** This paper presents smart and optimal way of allocating power to the utility using global system for mobile communication module-based remote automatic energy meter reading system. The designed device is installed with the energy meter at consumer premises. A smart communication is established between service provider and consumer using GSM module which is capable of calculating the energy consumed at different tariff and time. An artificial neural network using back-propagation approach is employed to obtain optimal allocation of service provider to meet the objective function. The novel idea of smart energy metering not only reduces the cost of energy consumption but also helps in proper repayments, optimal usage of power based on time of day tariff, and theft control with higher reliability and greater flexibility. A smart real-time prototype of the automatic energy reading system was built to demonstrate the effectiveness and efficiency of automatic meter reading, billing, and notification through the use of global system for mobile communication network.

**Keywords** Arduino microcontroller · Artificial intelligence (AI) · Global system for mobile communication (GSM) · GSM modem · Current transformer · Artificial neural network (ANN) · Back-propagation algorithm (BPA) · Independent power producer (IPP)

## 1 Introduction

Energy, being a strategic commodity, plays a significant role in economic development of a country. Energy consumption in efficient way has become a major issue

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in current scenario. Consumer electricity usage has been increased without actual knowledge of his requirement which sometimes increases the risk of power theft. The service provider could not predict his own power consumption of particular location at any given time. The usage pattern of the consumer effectively judges the load changes. There is need for accurate measurement of energy consumption by using smart techniques [1]. An automated energy metering system reduces the human intervention and avoids the error produced due to manual billing. Advances in soft computing gives significant thrust to automatize smart cities. It also paves the way for increasing the operating efficiency by resolving issues with respect to wrong meter readings and theft which is auto self-corrected by adopting AI techniques. To combat power theft and fraud which represent economic losses, researchers are focusing on IoT, big data, and machine learning. The learning algorithms can not only learn and anticipate large amount of data but also diagnose unusual behavior in big data sets. Intelligent metering includes progressed metering innovation, which includes setting clever meters that measure vitality utilization, remotely switch on the supply to clients and even control the most extreme power utilization conceivable, in this manner perusing, preparing, and sending messages to clients [2]. An automatic remote meter reading system based on GSM is presented in this paper. This paper is useful to obtain meter reading when desired, so meter readers do not need to visit each customer for the consumed energy data collection and to distribute the bills [3]. Microcontroller can be used to monitor and record the meter readings. In case of a customer defaulter, no need to send a person of utility to cut-off the customer connection. Service provider can continue or stop the supply of power by sending the Short Message Service (SMS). GSM is employed for transferring the readings recorded by the energy meter. An IoT-enabled measurement of power line metrics and power consumption for monitoring is proposed as per IoT protocols. Android-based Web service feature is used to extract and respond to the messages which are sent through server [4]. Need-based energy consumption with suitable decision criteria to incorporate the shortest transmission path as per IEEE 21451 standard is presented in [5]. The measurements were made with the help of current and voltage transducers by considering the effect of harmonics using FFT to enhance the quality of power. Power theft being a major issue could be classified into two ways as mentioned in [6, 7]. By comparing energy usage with substation loads and by incorporating prediction based on machine learning anomalies present in the grid could be easily detected. The success rate of Advanced Energy Metering Infrastructure (AEMI) is determined by data analytics.

The key challenges in smart metering include:

- Ability to work with large data
- Privacy and security constraints
- Adoption of unsupervised learning techniques
- Effective control strategies and optimized latency.

## 2 Description

The block diagram of proposed work and its hardware implementation is shown in Fig. 1.

### 2.1 Independent Power Producers

These are the service providers who generate the power and sell it to utility with different tariff schemes. The service provider bids the cost as per the time of the day.

Data acquisition system receives the information from IPP and the large data will be dumped to cloud. Whenever required, the data can be retrieved for the processing. A wired or wireless secure cryptographic standard is employed in [8] for secured communication. In this paper, the communication between the energy meter and the user is established through microcontroller. GSM module consists of modem

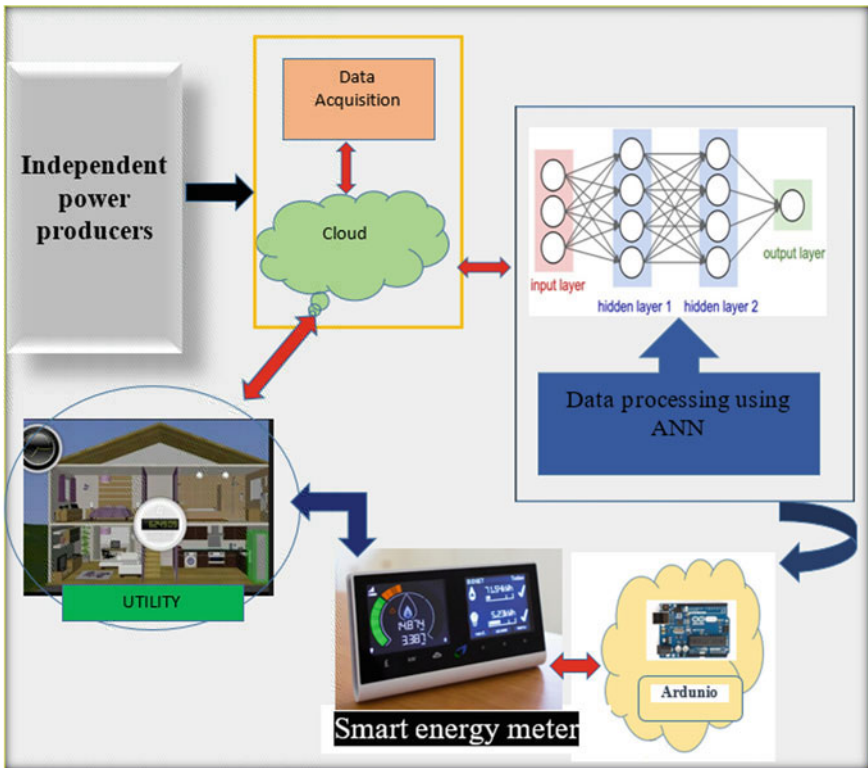


Fig. 1 Block diagram of complete automatic energy metering

assembly, interfacing units like USB and RS-232 and power supply circuits. GPRS is a communication protocol used in GSM technology [9]. IPP should provide SIM card with an IMEI number for ease of identification.

### 3 Artificial Neural Network

There are various intelligent techniques available in the literature which proposes a feasible solution to deal with nonlinear and unpredictable problems. One of such framework is artificial neural network which mimics the behavior of human brain. It has neurons, synapse, and dendrites. The neural network architecture includes perceptron, convolutional neural networks (CNNs) [10], which uses back-propagation with many layers incorporating feed-forward network, recurrent neural networks (RNNs) [11] that work by predicting the next term of the input data in a sequential manner, which are basically suited for supervised learning framework long-/short-term memory, gated recurrent units (GRUs) [12], Hopfield networks [13], deep belief networks (DBNs) [14], auto-encoders, and generative adversarial network (GAN). In this paper, multi-layer back-propagation algorithm is used to obtain the optimal solution which aims at minimizing the cost function. In order to make the learning fast, the bias  $\alpha$  is chosen to be between  $-1$  and  $1$ .

The net output is given by Eq. 1

$$Y_{\text{net}} = \alpha + \sum_{i=1}^n (x_i w_i) \quad (1)$$

where  $Y_{\text{net}}$  is the optimal net output of the output layer,  $\alpha$  is the bias function,  $X_i$  is the input vector, and  $W_i$  is synaptic weight connected to hidden layer.

There are two types of constraints which can be imposed to achieve minimum cost function which are defined over the range of minimum to maximum limits:

1. Equality constraints
2. Inequality constraints.

### 4 Methodology

In this paper, ANN-based automatic energy monitoring and control using GSM module is proposed with objective of optimally allocating the best service provider, thereby reducing the cost per unit consumption. Back-propagation framework serves as an effective way of altering the weights in feed-forward network.

Steps to compute optimum cost by lambda iteration method:

- Step: 1 Read the data from all the service providers, and store it in cloud.
- Step: 2 Feed the input to ANN framework.
- Step: 3 Set learning with weighing factor and bias.
- Step: 4 Check for the convergence; if not converged, change and update the bias with previous values.
- Step: 5 Run various iterations until optimal cost function is achieved.
- Step: 6 Stop.

These optimum values of cost function are fed to Arduino which sends SMS to utility using GSM about the best service provider, and it also informs the account balance along with next recharging period. If the customer fails to pay the amount on due date, the power will be disconnected automatically by controller. There are two modes of operation, namely postpaid mode and prepaid mode. In first mode, when the supply is given to microcontroller and if postpaid mode is selected, the customer after every 30 days receives a SMS from electricity board with the details of energy consumed and its tariff. If payment is not done within the stipulated time, the controller is enabled to automatically turn off the supply without visiting the consumer premises.

## 5 Hardware Implementation and Flowchart

The complete flowchart depicting the flow of the process is given in Fig. 2, and the complete hardware implementation with load and energy meter is as shown in Fig. 3.

The messages received by the user indicate the amount payable and the due date before which the bill has to be paid. The customer also receives the intimation of power supply connection and disconnection due to low balance.

## 6 Conclusion and Future Work

This paper presents the design of ANN-based, simple, low-cost, GSM-based automated energy monitoring system for automating billing and managing the collected data globally. The proposed system overcomes the drawbacks associated with traditional way of reading data. The service provider would be able to track and monitor the energy usage at faster rate and can optimally plan the load schedule with optimal cost.

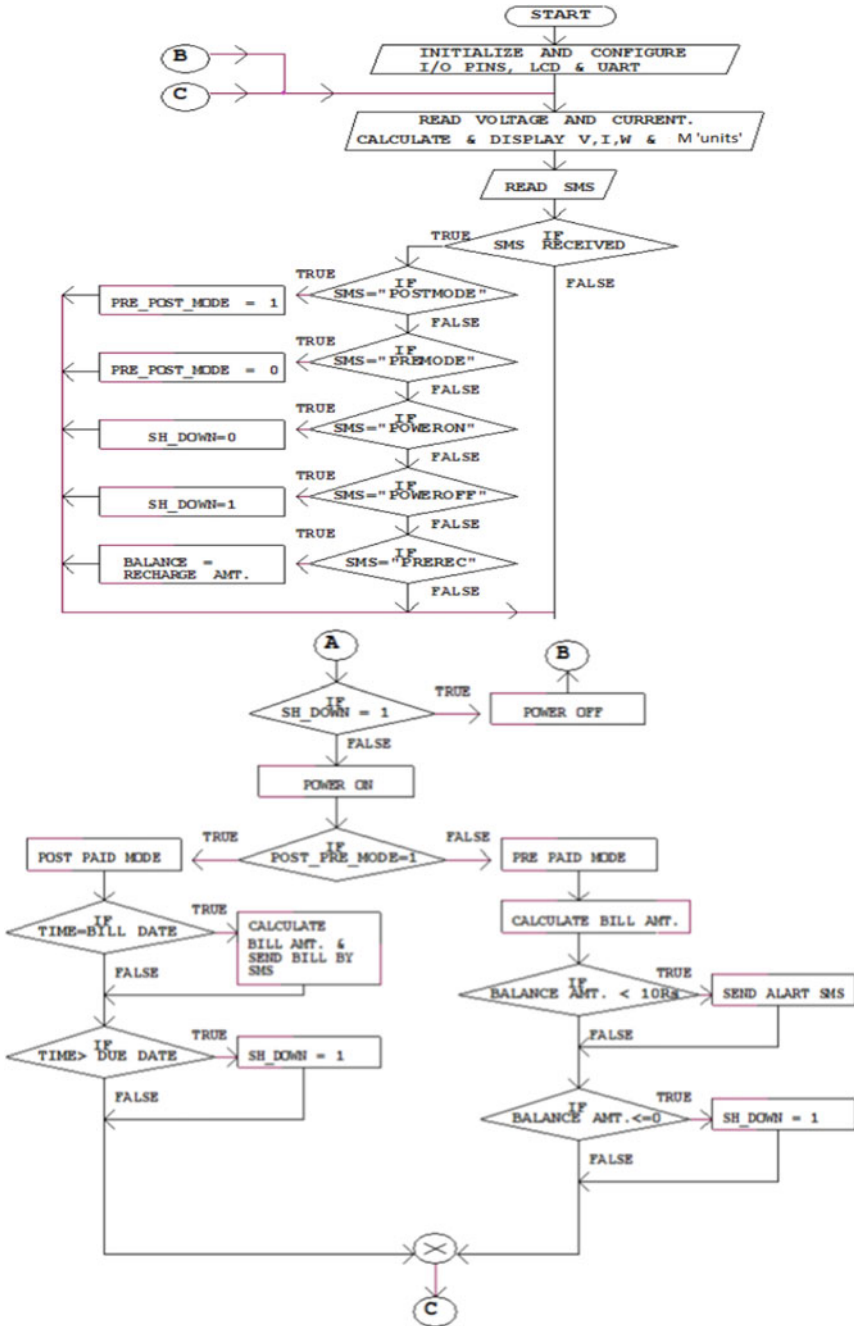


Fig. 2 Flowchart depicting the logic of the program



**Fig. 3** Complete hardware implementation

The proposed work eases the process of accessing information, reducing power thefts, flexible online payments, and bill generation via SMS and reduction of manpower intervention. The work can further be taken a head by incorporating evolutionary computing techniques to check the best solution at reduced cost infrastructure. The overall paper aims at achieving optimal demand side management so that economic load dispatching is accompanied with ANN algorithm with its smart features.

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# Efficient Analysis of User Reviews and Community-Contributed Photographs for Reputation Generation



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**Abstract** People can share their thoughts and opinions on any entities through the Internet. Normally, the attitude of the preferences of human can be predicted which are expressed in natural languages. Using sentimental mining method, the readership predictions are made on online reviews of locations. The reviews have been useful for the travelers to gain knowledge about the information of various locations and shortlist the best that is needed for them. In this paper, we categorize the locations based on the reviews and community-contributed photographs with the help of yelp and Tripadvisor datasets. In the proposed approach, opinions are filtered to eliminate unrelated ones through opinion pertinence calculation, and later grouped into a number of fused principal opinion sets. Based on the experiments conducted on large-scale datasets, the proposed approach is found to be useful for the user to make a decision.

**Keywords** Sentiment analysis · Prediction · Decision making · Opinion mining · Reputation generation · Data mining

## 1 Introduction

The recent developments in web technologies have generated massive user data in the form of reviews and comments. Users tend to share their opinions on the items in the websites [9]. The user-generated comments and reviews are more helpful to customers and merchants and the opinion mining enhances the sales and user satisfaction [8]. Customers can make purchase decisions, and the merchants can

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make use of the reviews to improve their products [2–4]. The processing of the reviews is more complicated and understanding the meaning in the users' context. Similar to digital items, locations and tourist spots can also have reviews. People around the world may visit different places on vacations to begin a new life, to start a business, on a pilgrimage, and so on [6]. The people will get the information about the location using social media. A traveler who wishes to travel around the world heavily depends upon these reviews to select the places he has to visit. Different people have different tastes, and their preferences about a place can differ. To suit everyone's needs, in this paper, we suggest a system which using the datasets taken from online travel websites, displays information about a location.

The main challenge faced is deciding upon the places to visit, trying to gain knowledge about the place and coming to a conclusion. Here, we accumulate the information and identify the appropriate pieces of data that cohesively form a part of the larger whole. Given any input of data, we satisfy them giving them all the appropriate information about the places so that they could find one of their comforts. We take the user preference into account and also find out the common shared interests to travel their plans that satisfy the users.

The major contributions of this paper can be summarized as:

- We propose a system that incorporates datasets taken from travel websites.
- We demonstrate techniques used to group those data.
- We develop a system that analyzes and displays information based on user queries.
- We display the location and Google map and present the Wikipedia article about the location.

This paper is structured as follows. The next section presents an outline of related works. In Sect. 3, we specify the research challenges and we explain about our proposed approach. In Sect. 4, we present our experimental results and discussions. Finally, Sect. 5 concludes the article with summary of work with future work directions.

## 2 Related Works

An important problem with reviews is their degree of relevance to our current scenario. Just because the forum is open, anyone can write anything. The less relevant and irrelevant reviews can be labeled as noisy. They can also be called as review-spam. Such reviews have to be removed before considering them for our project. The degree of relevance of a review to the relevant forum is called review pertinence [9]. Extraction of opinion target experimented on open-domain contents like news. Reviews were also helpful in prediction of political events based on people's opinion. Kim and Hovy [5] used a designed approach to name the one who holds the opinion and the target. They developed an election prediction system for this purpose.

Shapiro [7] stated that in calculation of reputed scores, time is the main constraint. Reputation systems are becoming popular among internet users, nowadays, because

we can measure the quality of a product using metrics provided by these systems. These systems play a vital role in e-commerce and review websites. Abdel-Hafez. et al. [1] introduced a function that generates scores for item reputation. Micro-blogs are used by various people ranging from normal people to popular persons. They contain many opinions which are helpful and can be processed. To summarize opinions, Zhou et al. [11] adapted the traditional aspect-based summarization framework to manipulate opinions contained in micro-blogs.

One of the important media to express opinion is blogs. People write blogs about anything and everything. This information can also be processed based on our needs. By extracting the bloggers' information, we can also group people based on their interests. To improve the ability to retrieve, Weng and Zhao [10] determine the relations between a blogger and another and give information about the interfaces of query. Unlike ratings and scores, natural texts contained in reviews are complex to analyze [8]. Processing texts such as reviews help the system at intelligent by evaluating the current sentimental context of the user by making better predictions.

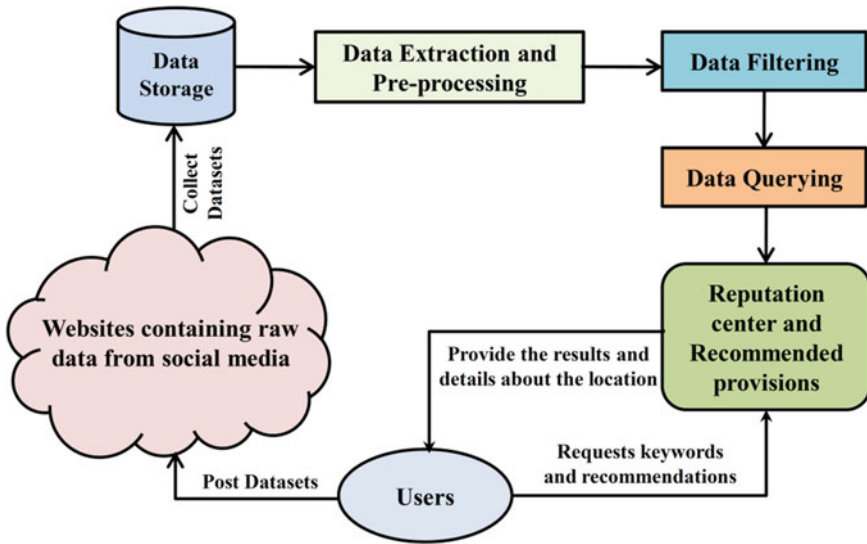
### 3 Proposed Methodology

In this section, we present the case scenario to understand the research problem and describe the proposed approach. Mr. Shiva is on an executive visit in Dubai. He is extremely preoccupied and can devote a weekend for visiting nearby places. Dubai is a place known for its buildings and hangout places. Shiva wants to roam around Dubai and makes some beautiful memories. Being new to the place, he does not know anything about tourist locations. He wants to know about famous spots to visit and also some additional information about the location. To save time, he also wants to locate the place in map so that he can travel without any chaos.

In order to suggest these, we allow him to explore his affinities based on his own choice and point of interest. We suggest the places which match his points of interests. For example, he could see the places which are all nearer to him and also he could explore the details and make up his mind whether to visit the place or not.

#### 3.1 System Architecture

The descriptions about a place given by the user with or without ratings on the target item as a dataset help us to recommend places on their point of interest. Information collection and preprocessing is done in order to avoid raw datasets. Raw datasets will not account into efficiency. The overall efficiency will be let down if we have data taken from the raw datasets. Filtering of the data collected is done in order to increase the efficiency and also gather only related data. Thus, this will reduce the possibilities of the irrelevant data being present in the system. Filtering is a must because having the data which are not needed not only results in time lag but also the



**Fig. 1** Proposed system architecture

inconsistency of the system as it might wrongly retrieve the data which are similar. The data are grouped after the filtering based on the user's request and given back. Reputations are generated based on the popularity of the locations. This is executed to increase the user's trust toward the software. The user should find the software to be useful and easy so that it would be a great reach. Other locations related to the keyword are also recommended based on their point of interest. The detailed architecture is shown in Fig. 1.

### 3.2 Proposed Architecture

We collect the dynamic data from the website with the help of crawler. The HTML parser is exploited to analyze the dataset. The preprocessing of data is helpful in achieving effective results. The first step in preprocessing is tokenization, where all the words in the dataset are divided into tokens. The preprocessed dataset is used for further calculations. An important step in mining approach is data preprocessing. If there are so many irrelevancy and redundancy present along with dirty data, then gaining sufficient information about that is a tedious task. Preparation of data and filtering of data will take a decent time of processing. Hence data cleansing is done.

It is the method of detection, removal and correction of the misread, not precise, or damaged records and so on from an entity, datasets, or database center, and this refers to the identification of the incomplete, imperfect, and unmatched data and