

Verification and Authentication of Electrical Meter Reading

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Abstract: - The existing energy metering and billing systems in India uses electromechanical and somewhere digital energy meter. It slow expensive an consumes more time and labor. One of the prime reasons is the custom billing system is incorrect d lack of flexibility over and above reliability. So there is a need to develop an efficient and accurate reading of the digital electricity meters by extracting and recognizing the meter reading digits from electric meters. The user can be able to track about the energy Consumption on daily basis. This paper provides a survey of different existing automated metering systems and gives an abstract view of developing the most optimal automated meter reading system.

Keywords: *Electrical Meter Reading, Otsu's Thresholding Techniques, Row Segmentation, Character Segmentation, Number Recognition, Monthly Electricity Charges.*

1. INTRODUCTION

Electricity plays a major role in our lives. The use of electricity is increasing every day. It is used the world over with different purposes that we can't even imagine our lives without it. The device accustomed to calculating the electricity consumption is Electric Meters. So forgetting proficient and accurate reading of the digital electricity meters an efficient and accurate reading system is needed. Electricity meters are used in terms of the size of loads and therefore can be classified as follows:

- Single phase meter – 1 ϕ
- Three phases Meter – 3 ϕ
- CT Meter - 1 ϕ

Single phase meter – 1 ϕ Single phase meter having two wires (phase + neutral) used for homes with loads ranging between (0-20 kW), 20-100 Amp.

Three phase Meter - 3 ϕ Three phase Meter consists of four wires (3phase + neutral) used for homes with loads ranging between (20-60 kW), 50-100 Amp. Three phase CT meter

Three phase CT meter - consists of four wires (3phase + neutral), and three AC Adapter to be installed on the three wires.

In these days in every sector, there is the number of customers who use the electricity but they are not satisfied with the services provided by power distribution companies. Also, electricity authority and the government realizes problems occurring in the existing transmission network, such as increasing cost due to poor operational efficiency, environmental impacts and ongoing demand for energy.

This conventional energy meter billing techniques make use of a huge number of readers and also long working hours to collect complete data and to prepare the bill. Sometimes the energy meter is placed, which cannot easily accessible, also if the door is closed reading can't be taken in the first visit and the reader have to revisit that house. Manual billing is limited and is decelerate by bad weather condition.

Printed bill may get lost in the mailbox. In developing countries similar to India rising in population and industrialization for reading meters, the huge number of human operators and long working hours are mandatory. Because of this cost of energy provider for meter reading enlarged, hence Automatic Meter Reading (AMR) [7][8][9] concept is used where automatic collection of meter reading is possible also it decreases meter reading, has more data correctness, and allows regular reading, accurate billing, and real-time customer service. AMR technique is to automatically gather the consumption of energy from energy meter devices and transferring that information to a central database server for billing purpose.

In recent years, with the growing requirements of intelligent life, the automatic meter reading system is becoming more and more popular. The meter can be a gas meter, a water meter or an electric meter. The traditional way to get a meter's data is to send a man read meters house by house. It is inefficient and errors will easily occur if a careless man was sent to read meters. So the concept of automatic meter reading was proposed to develop a new way to read meters

2. LITERATURE SURVEY

Cephas Paul et al. [1] proposed a method to recognize the digits where a camera is composed to capture an image with an interval of time. Here, SVM classifier is used to classify the digits. Finally, the output is transmitted to the remote server with other necessary information. The system can and generalize over the large degree of variation between styles and recognition rules. This classifier is used for both detection and recognition of these digits.

K. Parthiban et al. [2] gives the method for meter reading using image processing by extracting the serial numbers in the electrical meter. The image of the meter is captured during the sequence of the time interval. The input image is preprocessed, and then by using Adaptive Thresholding (AT), for the grayscale image binarization is done. The Morphological operation on a binary image is carried out to create an enhanced binary image. The image is scanned horizontally until the white pixel is encountered and the resultant image is stored in an array matrix. The segmentation is done by Vertical Edge Detection Algorithm and each segmented image is stored in an individual array matrix. Each image is compared with the actual template and the result is stored in the text file.

Lamiaa A. et al.[3] introduces a system based on image processing to obtain efficiently and accurately reading of the electricity digital meter. The captured image goes through three main stages i.e. preprocessing where, cropping the numeric reading area is done, segmentation of individual digits with horizontal and vertical scanning of the cropped numeric area, and detection of the reading by comparing every segmented digit with the digits templates. The system is executing during Android Studio software with open CV library. The results show the accuracy rate of 96,49 %.

Tanmoy Maity et al. [6] proposed an energy meter calculates the total average active power mainly for

industrial and commercial applications. The hardware circuit gets three phase voltages and currents as its inputs and provides the output in the form of serial interfaced data equivalent to the average real power. Data is fed to a remote personal computer through using wireless ZigBee [7]

[8] [9] network metering. ZigBee is used for presenting the remote wireless Electric Meter Reading System to analyze the use cases for Electric Meter.

Tariq Jamil et al.[9] introduced a model of Wireless Automatic Meter Reading System (WAMRS). The system is based on IEEE 802.15.4 (ZigBee) standard and security are implemented by the Direct Sequence Spread Spectrum (DSSS) protocol

3. EXISTING SYSTEM

Various systems are developed so as to lessen the problems faced by user regarding the inaccurate and time consuming meter reading process. Given below are a few of the many systems that are developed for Automatic Meter Reading

a. Computer Vision Techniques Remote Meter Automatic Reading

Shutao Zha et al.[10] introduced remote automatic reading where local meter reading information of distributed substation can be transmitted to center by the computer network. The pretreatment, segmentation and pattern matching, can be done in meter image recognition process. Computer vision techniques mean the course that turning image signal of the substation meters to digital signal and processing the discrete digital signal used the computer. Figure 1 gives the meter recognition process.

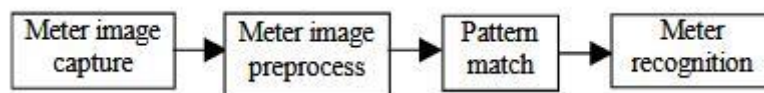


Figure 1 : Meter Recognition Process

After getting the elements of the meter image the exact position of the digits is determined by constructing two histograms. Knowing the position of each digit the patterns match algorithm can determine their value.

The goal of the project is to generate a graph that gives a sensible analysis of the detailed aspects of the user's comments and an emotional analysis of the comment using the supervised learning algorithm. • The goal of the project is to minimize the reading time for users to read all comments and to provide an efficient and simple way to generate graphs of product rankings.

a. ZigBee Based Electric Meter Reading System [7]

S. Arun [7] gives an Electric Meter reading system. The data acquired by the electric meter is transmitted to the Data Acquisition Device through a ZigBee network. In the meantime display the energy and system time on the Electric Meter for a customer. The latter functioned as a coordinator in the whole ZigBee network. Its purpose is to get all the information of the Electric Meters. And then convey them to the energy management center with the help of the parallel port.

b. Electrical Meter Using Image Processing Techniques [2]

Meter Reading Recognition based on image processing is given in [2]. Here VEDA is proposed and used for detecting vertical edges. Adaptive thresholding (AT) is applied to the image for binarization. ULEA is used to eliminate noise and to improve the binarized image. The flow of the meter reading system using image processing is given in figure

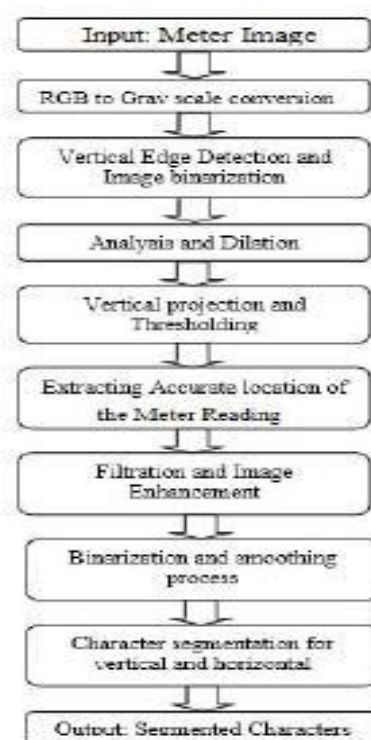


Figure 2: Electrical Meter Using Image Processing

4. Application:

- It is confusing to user to note down reading so our system provides correct reading to user.
- It improves the electricity usage by user on daily basis. with the help of these system which provides an information about meter reading and can avoid the unwanted use of electrical appliances.
- These project can be used in fields where electric meter is used. such as home, companies, hospitals.

5. ARCHITECTURAL DESIGN

The contribution of this work is extracting and recognizing the meter reading digits from electric meters. User can be able to track about the energy Consumption on daily basis, Weekly as well as monthly and can also track the charges to be paid by user to the electricity board from the android Application.

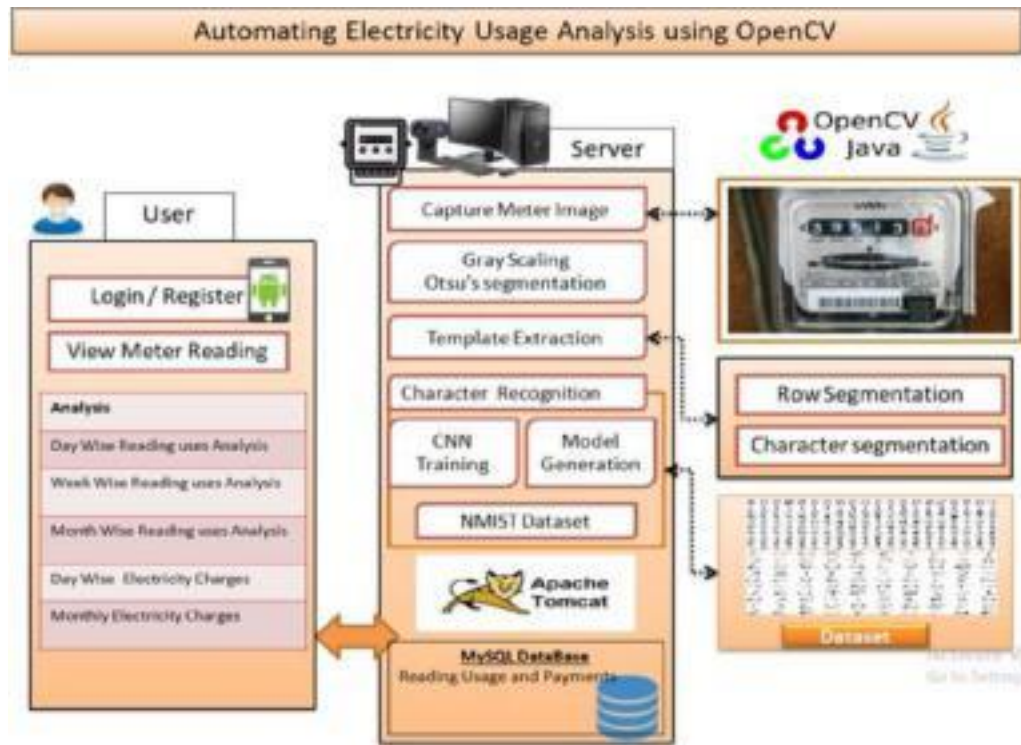


Figure 2.0 (Architecture)

6. ALGORITHMS

Capture Image:

Camera captures the Meter image and sends it to the server.

Apply Otsu's Thresolding Techniques:

Noise represents unwanted information which deteriorates image quality. Noise can degrade the images at the time of capturing or transmission of the image. Before applying image processing tools to an image, noise removal from images is done at highest priority. We are going to use Otsu's algorithm to perform thresholding on the grayscale image. Reading of Units

• ROW SEGMENTATION:

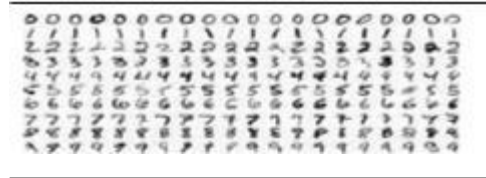
Character height wise row segmentation will do in row segmentation stage. In which we can extract the meaning full information from the Meter Image. Such as • Reading of Unit

• CHARACTER SEGMENTATION:

Segment characters from image like "123456789" is the no of Units from meter we have to detect using image processing then we have to capture image and segment all character from given image and then send input to CNN for Number recognition. In this step we are doing one by one character segmentation and create segmented character images

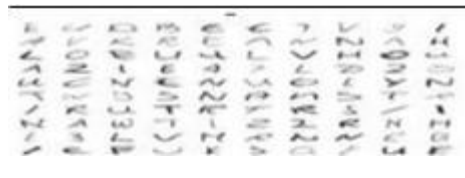
- **CHARACTER RECOGNITION:**

A. Number Recognition: 0-9 number recognition in this stage.



This kind of dataset will used for recognize number from segmented images.

B. CHARACTER RECOGNITION:



This kind of dataset will used for recognize character segmented from images.

CNN Training on Predefined Highlights dataset:

Download dataset from <http://yann.lecun.com/exdb/mnist/> this website. This is the MNIST database of handwritten digits. Four files are available on this site: trainimagesidx3ubyte.gz: training set images (9912422 bytes) trainlabelsidx1ubyte.gz: training set labels (28881 bytes) t10kimagesidx3ubyte.gz: test set images (1648877 bytes) t10klabelsidx1ubyte.gz: test set labels (4542 bytes)

1. Training set of 60,000 examples 2. Test set of 10,000 examples

A CNN consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of Convolutional layers, pooling layers, fully connected layers and normalization layers. CNN will be used to train the images analytics engine for recognizing important data from images.

- **STORE RECOGNIZED DATA ON SERVER:**

Recognized reading now stored in the data base for the further use.

7. CONCLUSION

In recent years, with the growing requirements of intelligent life, the automatic meter reading system is becoming more and more popular. The meter can be a gas meter, a water meter or an electric meter. The traditional way to get a meter's data is to send a man read meters house by house. It is inefficient and errors will easily occur if a careless man was sent to read meters. Again reducing energy use reduces energy costs and may result in a financial cost saving to consumers if the energy savings of set any additional costs of implementing an energy efficient technology. This paper gives the different techniques used by the researcher for an automatic meter reading system

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