

Automatic Billing System: Data Acquisition and Detection using Optical Character Recognition

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ABSTRACT

In the proposed system, an android application and a desktop application are used for online meter reading. The android application converts the captured reading into the text and then transfer it to the desktop application. Next, the desktop application stores the received information at predefined locations in the database system. The meter readers can install the application on their smartphones while the desktop application will run on the systems in the electric supply company. Readings from electric meters can be automatically stored in the database according to the corresponding meter numbers.

Keywords: *Smart Billing, Smart Meter Reader, Electric Supply Company*

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1. INTRODUCTION

In Pakistan, an electric supply company is using a manual entering system for maintaining records of meter readings and generating customer bills. The current system has many issues such as inefficient time utilization and manual work. The meter reader captures image of meter reading using smartphone which is used for customer satisfaction as a proof of accurate reading. Besides, manual reading of every meter is a tedious task and susceptible to errors. Readings entered in excel file along with the pictures are transferred to the company daily where each picture is compared with the stored reading in the excel file. After the cross check, this data is sent to main server of the company. However, bill printing and cost calculation is another problem.

In the current system, the meter reader and computer operator are dependent on each other. The meter reader cannot start work till they get their batch files from computer operator, while computer operator waits for the captured images of meter reading. The electric supply company is facing criticisms of over billing and over charging by the public users. In most cases, the problem of overbilling in customer bill is caused due to the slip-ups in the entering system.

In this paper, an automatic system for billing is proposed in order to help electric supply

company in Pakistan to perform their work with efficiency and accuracy. The organization of the rest of the paper is as follows: Section 2 discusses the existing automatic systems for billing and the proposed method for the electric supply company in Pakistan is presented in Section 3. The implementation details are described in Section 4 and finally conclusions are drawn.

2. LITERATURE REVIEW

Bane et al. [1] proposed a controlled and remote meter reading system. In this system, a meter like interface is used with the ability to be activated or deactivated but cannot be operated in both states. To measure communication activity the meter interface is activated. If communication exists, meter is turned to message monitoring mode. If a message is received in activated monitoring mode, mode is extended. And for the time being when no message is received, meter automatically goes into deactivate mode. Shuey et al. [2] used repeater technology that is actually based on the idea to access difficultly accessible meters. It consisted of a fixed network structure. It reduced the cost by using components of radio system required for two-way communication. Each meter has ability to repeat message as much as it can. The invention is based on AMR networks and the main components used are radio frequency transceiver, metering means and controller. The meter has the ability to receive signals in the form of Amplitude Sift Keying (ASK) and to transmit the message in the form of Frequency Shift Keying (FSK). ASK is used because it is less expensive and FSK is used because it is fast and robust.

Nabil et al. [3] proposed a prepaid energy meter from GSM network, which is giving benefit to homes and regions in different countries. In this system, information theft is a direct power according to central authority. This system has many flaws, like, there are chances to hack the system because system is dependent on the GSM. In addition, if there will be no internet available then what will be their choice. GSM is not only the application of the notion of connection prepaid electricity, but also conducive to using the smart utility power meter and flight control power. Himawan et al. [4] assessed the accuracy and by measuring the resulting current mode. The simulation results show that our proposed prepaid counter compared to the actual volts generating the smallest error. This article describes the prepaid simulation counter relies on the Proteus program. The cost is minimized, because the analog experiments were carried out using the program.

Batz et al. [5] invented system to obtain information by using a provided system from multiplicity of distantly placed information representing gadgets. Such as related to observing gadget and used to accumulate statistics over a time frame or to offer immediate readings of a circumstance measured with the aid of the equipment. By method of instance, the system is described in a utility for presenting the remote readout of a meter check in. The Transponder employs strong country circuits the use of low-price, low-strength stable-

state gadgets, which include subject-effect transistors. Such circuits may be synthetic the use of kingdom of the artwork strategies wherein issue fee is decreased and production expenses are minimized.

Jenny et al. [6] proposed a technique for measuring commodity and for transmitting the size over a worldwide computer network to a faraway region. The equipment contains a records acquisition, reporting device and an automatic meter studying tool operatively organized to degree use of a commodity and transmit the dimension over an international information community. Its miles expected then, that deregulation will in all likelihood enable utilities and power agents to shop for and sell power at real-time fees determined by way of deliver and demand, similar to different commodities. In order for this to occur, but, era must be capable of degree and communicate strength usage on a real-time foundation.

Pirak et al. [7] designed and implemented wireless sensor network and protocol for smart energy application meters. The system includes a digital power meter and zig-bee coordinator management program. Zig-bee technology a wireless technology used in various reliability and high capacity systems. In this article, the authors design wireless sensor network protocols and smart meter applications.

3. PROPOSED MODEL

Keeping in mind the end goal to conquer the troubles in the current system and to give the practical and easy to use scenario for customers, the additional configuration is proposed in this paper. The proposed system includes the following: (i) Android Mobile Phone and (ii) Computer having capability to handle a Database.

Main components of the system are, Visual Studio, Database and Desktop Application. Software used for implementation is Android Studio, Visual Studio and SQL server. Visual Studio uses many languages but we used C# Language to implement. Android Studio uses Java while SQL server uses MYSQL language. In order to print bill crystal software is used. The main display of domestic meters displays meter number and meter reading. Android application is used by meter reader.

Meter reader captures the full picture of meter using a built-in camera of Mobile Phone by using Smart City Meter Reader Application. All data from textual form is converted to text and a list of all texts detected in image is displayed to meter reading employee. Employee can select the exact data that is sent to the main server that is the desktop application created in the Computer.

The desktop application sends this data to database. The database is designed to store records. It contains records of all employees, users and admins. The meter reading is added to its current location, i.e. in front of the accurate meter number. Desktop application retrieves old and new data from database. Bill is printed using desktop application.

4. IMPLEMENTATION DETAILS

In this section, implementation details regarding the interface of the proposed application is presented for the better understanding of the readers.

A. Login

The android app authenticates the registered members to login only. The meter readers authenticate according to data given by the administrator then they can access the next activity. If meter reader enters the wrong user name or password then a toast will be shown to enter correct Authentication. Username and password is built-in in mobile application by the administrator. So only the register meter numbers can login in that application.

B. HOME Page

Camera Option of the HOME page allows to use camera of the phone to take picture. User guide activity consists of instructions for the meter readers which consists of textual guideline to use the application and to take the reading of meters. Contact us activity contains the contacts of developers of that application and logout button is used for exit the application.

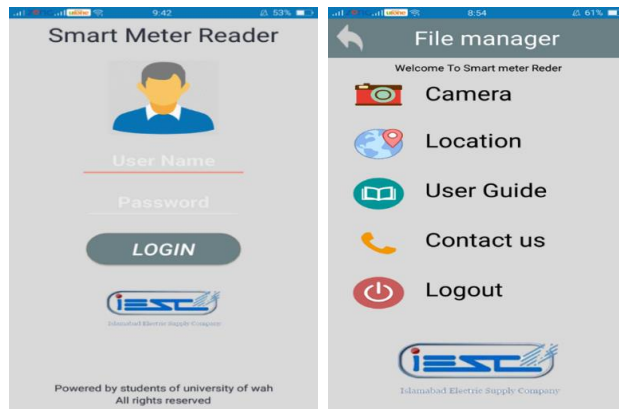


Fig. 1. Android Application Login and Home Page

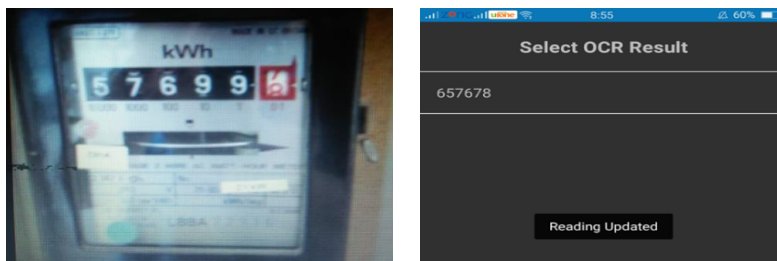


Fig. 2 Android Application Image Detection

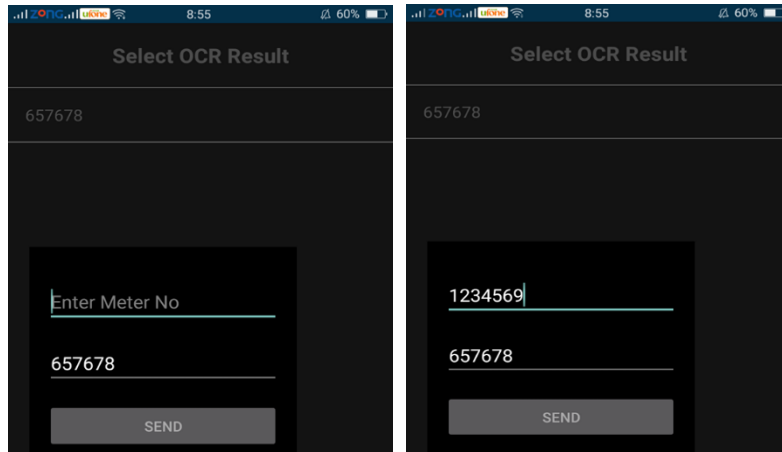


Fig. 3. Android Application Meter number

C. Built-in Camera

Camera option from home page leads to a new activity that contains built-in camera. With the help of it meter reader can take the picture of meter. Instructions for taking picture are given in user guide and the picture should be clear because it has to be converted into string otherwise there is possibility of incorrect data retrieval.

D. Image Detection

Image Detection feature allows to detect the image and convert it into text. Text is displayed to user in the form of a list.

E. Meter Number

From the list of converted strings, on selection of meter reading the app pops up a window and asks for meter number. This popup gives the user capability to edit meter reading and meter number as well.

F. Data Transfer

After entering the accurate meter number, the data is forwarded to server. Meter reading must be correct, otherwise error may occur.

G. Desktop Application

Desktop Application is used to store incoming data from android application and for accessing the database where the admin authenticates.

Invalid entered data will not be allowed to be authenticated. After entering the correct user name and password that is predefined, the admin will successfully logged-in. After the successful login, main page of desktop application can be accessed. Each menu item has its own functionality, for example, in application menu, item two sub menus are inserted and

first one is add user and other one is for exit. By clicking exit the desktop application will be closed and by selecting the add user, user registration form will be displayed. Similarly, all the menu items will work like these. The user interface is shown in Fig. 4.

H. Add Customer

Our software allows admin to Create, Retrieve, Update and Delete (CRUD) operations. Fig. 5(a) shows the layout which is used to add new consumer data in database.

I. User Registration

User Registration layout allows admin to add new user or meter reader data in database. This layout asks the admin to enter the name, contact information, email address, user type and a username that is optional as shown in Fig. 5(b).

J. Search Customer

With search operation, admin can search some specific customer with his/her meter number and record will be displayed. This record can be updated here as well.

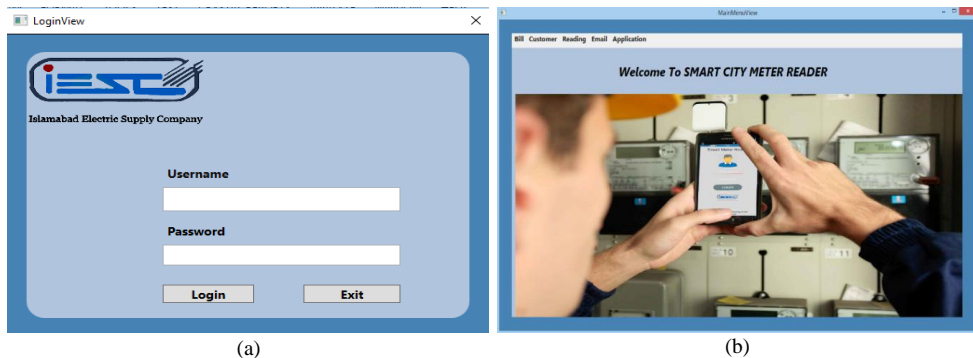


Fig. 4. Desktop Application (a) Login View and (b) Main page

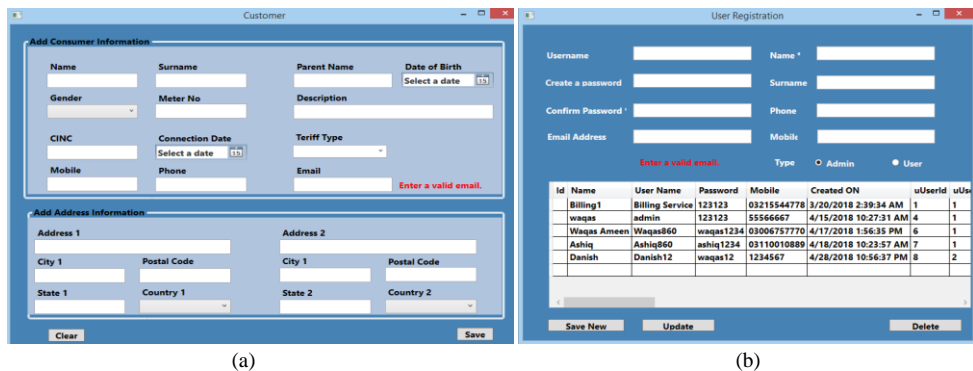


Fig. 5. Registration interface (a) Customer (b) User

K. Database Visualization

In Microsoft SQL server management studio with the help of queries, data can be displayed.

L. Bill Printing

The Most important part of this project is the Result that is in the form of Printed Bill. Below is the picture showing bill of a consumer. Bill includes the consumer name, Address, Meter Number, Previous Reading, Current reading, Tax and the amount to be paid.

The existing system in the electric supply company based on manual data entering that is time consuming as well as more susceptible to errors as more human efforts are involved than technology support. Automatic billing system can prove to be an efficient and accurate compared to the existing system.

5. CONCLUSIONS

Due to growing technologies, industrial development has brought new challenges. One of the main challenges is automation and time reduction. In order to improve the efficiency and precision of metering system, automatic billing system is proposed for an electric supply company in Pakistan. In this system, data from meters is automatically retrieved to textual format and is automatically referred to the main server with the help of android application. The desktop application helps to manage, update, add and delete users. It also gets the data from android application and sends it to the database. The received data is automatically stored in the specified location. In advanced metering infrastructure, acknowledgeable work is in progress to make work automated. In future, the security aspect of the proposed application can be discussed and enhanced in order to provide reliable service to the company and its consumers.

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