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Automated Water Meter: Prediction of Bill for Water Conservation

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Abstract - The conservation of water by using an Automated Water meter system that also aims at automating the bill generation process. The need for water is increasing every day with an increase in population and thus conservation of water resources becomes one of the most important aspects to meet the needs of the ever-growing population. Implementing this system, which includes a rank list will be able to enthuse and also create awareness about everyday water usage amongst people thus helping them in reducing water consumption.

***Key Words*: Automated Water Meter (AWM), Conservation of Water, Smart City, Smart Meters, Urbanization.**

1. INTRODUCTION

The world is continually trying to acquire new technologies in order to enhance the quality of living. The quality of life can ensured by automating technologies which in turn increase accuracy and efficiency [3]. Automating technologies by reducing human intervention gives rise to urbanization and making of smart cites.

Smart cites are created using smart technologies there used to connect various devices together using technologies such as IOT, sensor, Wireless Network, Cloud, etc [4]. One such smart device adding to the urbanization and smart city technology includes Automated Water Meters (AWM). India depends on manual water-metering system to supervise water consumption and distribution.

The long-established and conventional water management systems have always been a delicate task especially with managing varying customers.

This standard method involves human error and is not efficient. To increase the accuracy and efficiency and to decrease the manual intervention AWM be used which is cost efficient in the long run and is ascendable [5].

In order to enhance the efficiency of metering systems, researchers have proposed various models of smart meters using technologies like IOT and Machine Learning. Internet of Things (IOT) plays a major role in development and making of smart cites. It is defined as technology that connects two or more devices together over the internet and these devices can be controlled at anytime, from anywhere and by anyone. It can also be defined as, communication of two or more devices over the internet [8].

2. APPLICATION WORKFLOW

The above flowchart represents the workflow of a structure.A flowchart is a formalized graphic representation of a logic sequence, work or manufacturing process, organization chart, or similar formalized structure. Flowcharts use simple geometric symbols and arrows to define relationship

A flow chart can also be defined as a diagrammatic representation of an algorithm, a step by step approach to solve a task.

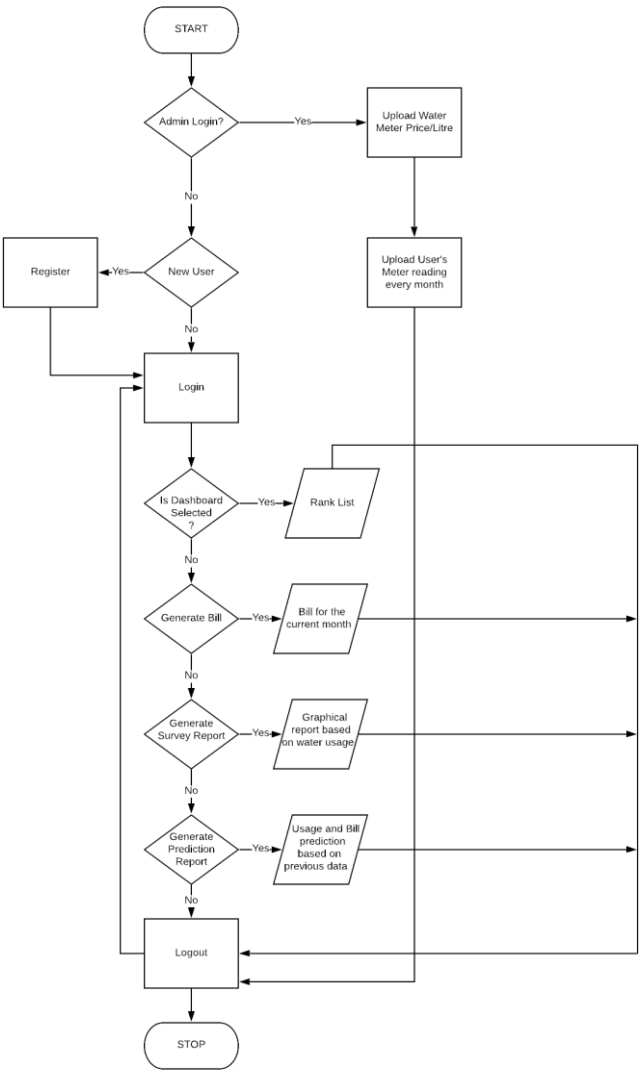


Figure 1: Application Flow Chart

3. SYSTEM ARCHITECTURE

System architecture is a very essential part of any framework. It contains the main entities, overall architecture, and all the elements holding the framework. The aim of this framework is to provide a decentralized, tamper-proof, secure and efficient application.

Figure2: System Architecture

The user registers into the system by providing the required details and then logs into the application. After successful login in the first screen contains user information, dash board in the form of ranklist with respect to least water consumed user and some other services are bill generation, survey report and prediction of water usage and bill for next 4 weeks are available.

When user click bill generation service and choose the option to which a bill is to be generated, the app requests user, on allowing request bill in the form of snapshot is stored onto the user gallery.

When user click survey report and choose the year and month to that particular option the survey report of water usage is displayed in the form of bar graph and line graph.

When user click prediction based on the previous data the water usage and bill for the next 4 weeks is predicted.

Admin side view is also present in the application. When admin logs in with admin credential admin is directed to admin home page. Through firebase cloud storage the admin can modify the user information .

Last option is that when user on click logout button the user is navigated back to the login page

4. IMPLEMENTATION

For implementing the automated water meter system previous meter reading data is taken as training data, current meter reading data is taken as test data.

Data Collection: The previous meter reading data is obtained by capturing the water meter images consicutively at multiple houses. The images were captured by team members everyday. Once the images was received that data had been fed directly into the linear regression model. Below are a few images of the water meter.

Figure 3.water meter

4.1 UI DESIGN

User interface design is the design of user interfaces for machines and software, such as computers, home appliances, mobile devices, and other electronic devices, with the focus on maximizing usability and the user experience. The goal of user interface design is to make the user's interaction as simple and efficient as possible, in terms of accomplishing user goals (user-centered design). Good user interface design facilitates finishing the task at hand without drawing unnecessary attention to itself. Graphic design and typography are utilized to support its usability, influencing how the user performs certain interactions and improving the aesthetic appeal of the design; design aesthetics may enhance or detract from the ability of users to use the functions of the interface. The design process must balance technical functionality and visual elements (e.g., mental model) to create a system that is not only operational but also usable and adaptable to changing user needs.

Interface design is involved in a wide range of projects from computer systems, to cars, to commercial planes; all of these projects involve much of the same basic human interactions yet also require some unique skills and knowledge. As a result, designers tend to specialize in certain types of projects and have skills centered on their expertise, whether that be software design, user research, web design, or industrial design.

There are several phases and processes in the user interface design, some of which are more demanded upon than others, depending on the project.

- Functionality requirements gathering
- User and task analysis
- Information architecture
- Usability inspection
- Usability testing
- Graphical user interface design
- Software Maintenance

4.2 Programming languages

JavaScript:

JavaScript, often abbreviated as JS, is a programming language that conforms to the ECMAScript specification. JavaScript is high-level, often just-in-time compiled, and multi-paradigm. It has curly-bracket syntax, dynamic typing, prototype-based , and first-class functions.

Alongside HTML and CSS, JavaScript is one of the core technologies of the World Wide Web. JavaScript enables interactive web pages and is an essential part of web applications. The vast majority of websites use it for client-side page behavior, and all major web browsers have a dedicated JavaScript engine to execute it.

As a multi-paradigm language, JavaScript supports event-driven, functional, and imperative programming styles. It has application programming interfaces (APIs) for working with text, dates, regular expressions, standard data structures, and the Document Object Model (DOM). However, the language itself does not include any input/output (I/O), such as networking, storage, or graphics facilities, as the host environment (usually a web browser) provides those APIs.

JavaScript engines were originally used only in web browsers, but they are now embedded in some servers, usually via Node.js. They are also embedded in a variety of applications created with frameworks such as Electron and Cordova.

Although there are similarities between JavaScript and Java, including language name, syntax, and respective standard libraries, the two languages are distinct and differ greatly in design.

```
main.py X
ML python > main.py
48      y = np.array( df['label'] )
49
50      accuracy=0
51      loop=0
52      data={}
53      data["Status"]="Success"
54      while accuracy < .70 :
55          X_train, X_test, y_train, y_test = train_test_split( X, y, test_size = 0.2 )
56          clf = svm.SVR();                    ## USING SVM
57          clf = LinearRegression(n_jobs = 1000)            ##FOR LINEAR REGRESSION
58          clf.fit( X_train, y_train )
59          accuracy = clf.score(X_test, y_test )
60          if(loop>100000):
61              data["Status"]="Data is not sufficent the accuracy will decrease"
62              break
63          loop+=1
```

Figure 4.1 :code snippet of algorithm

The above figure 4.1 shows the machine learning algorithms we have been used linear regression algorithm. In this dataset will be collected, feature extraction will be done and above mentioned machine learning algorithms will be applied, the algorithm will produce models, that model will be evaluated with test data

5. SNAPSHOTS OF RESULTS

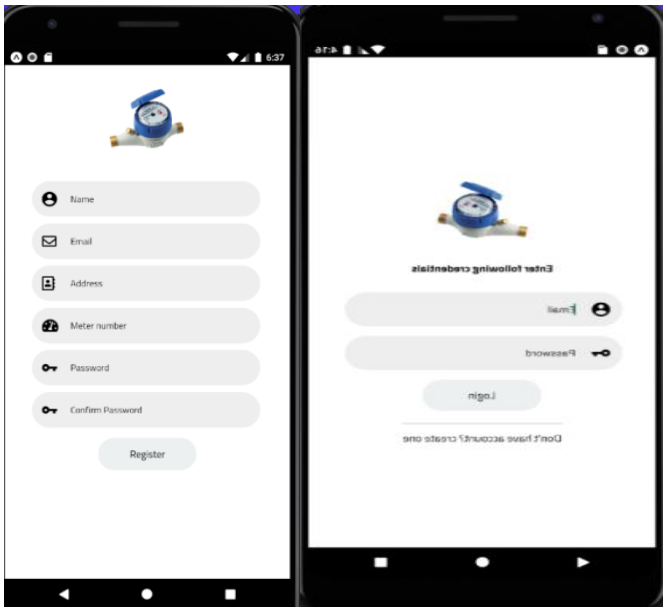


Figure 4. User Registration and Login screen

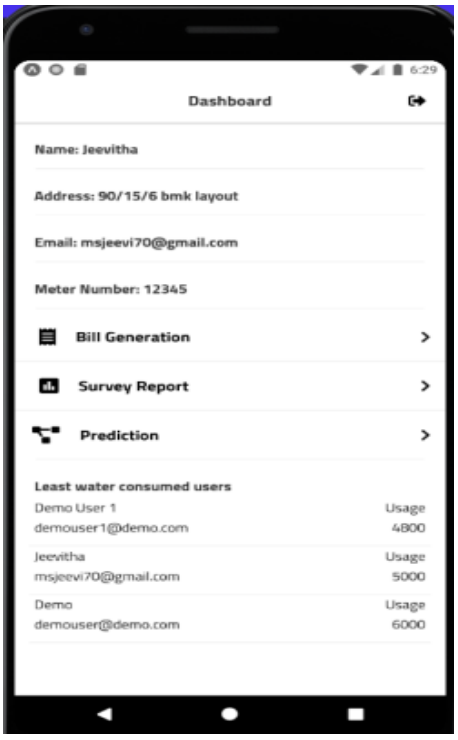


Figure 5. User screen with dash board

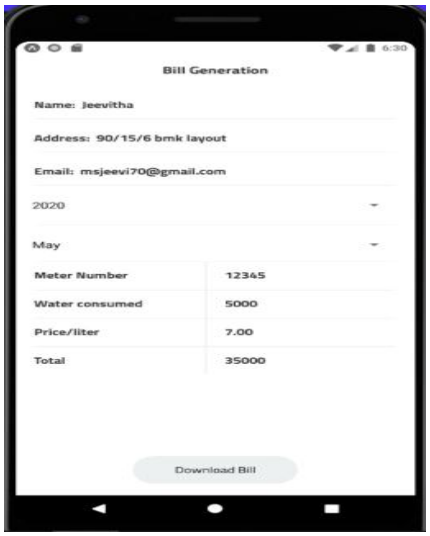
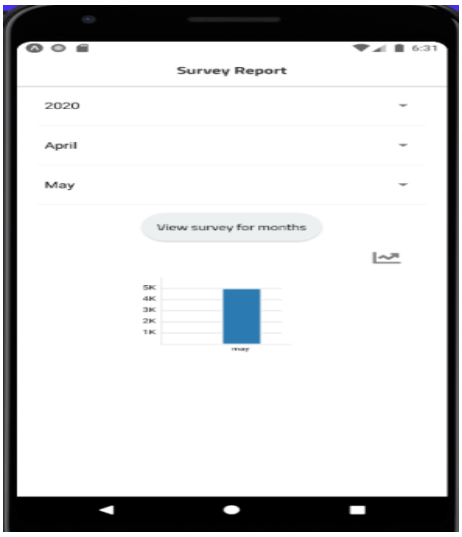


Figure 6. User Bill generation screen



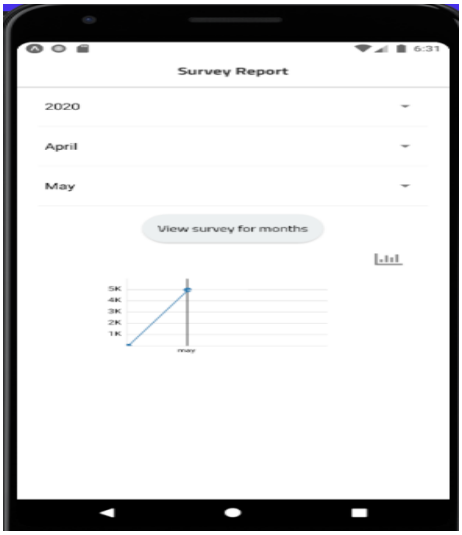


Figure 7. User Survey report screen

Figure 6. User Bill prediction page

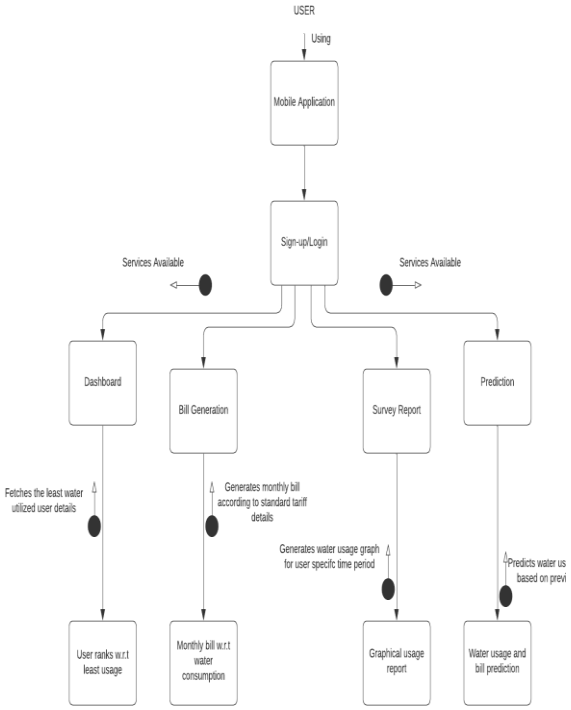
6. CONCLUSION AND FUTURE WORK

In this paper, we have discussed about how Automated Water Meter is a solution for smart meters that not only enthuses the consumer to conserve water but also allows the consumer to have a better control over the usage of water by providing the predicted usage report for a fixed time interval. It also helps in reducing the human errors and increase the efficiency by automating the bill generation process.

Get instant alerts on leakages: The meters play a double role-clong with metering they also detect leaks. Being Connected devices they raise an alarm when notice an abnormal consumption immediately.

Bringing gamification to drive behavioural change:

Further implementation includes elements of gamification to motivate and reward users for various activities towards water conservation. The user will be able to user reward points to avail discounts in their water bills.



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