# Introduction

A utility meter is any of the following metering devices used on utility mains: **Electricity meter**, a device for measuring electricity usage. One type of commonly used AMI applications is Smart Meters, it communicates readings to utilities for processing, analysis and communication back to customers for billing, energy feedback, and time based rates. It can also provide remote connect/disconnect, tamper detection, outage monitoring, voltage monitoring, and bidirectional measurement of electricity.

Advanced Metering Reader is an integrated system of equipment, communication and information management systems for utilities to remotely collect customer electric usage data in real time, in other countries like the US they use AMI technology to read electric meters.

There are four main components of AMR: meters, a meter interface unit (MIU) , other sensors and remotely controlled variables. Meter measure the flow to a customer connection, after which the MIU receives a hardwired signal from the meter, converting this signal to flow value, storing this flow value and then wirelessly transmitting the data to the information management system. Meters are often mechanical or solid-state meters.

The service provider (utility) employs existing, enhanced or new back office systems that collect and analyze Advanced metering Infrastructure (AMI) data to help optimize operations, economics and consumer service. For example, AMI provides immediate feedback on consumer outages and power quality, enabling the service provider to rapidly address grid deficiencies.

# Background

The company was formed in 1956 as the *Ethiopian Electric Light & Power Authority* (EELPA), which bundled all Ethiopian activities around electricity in a single organization. In 1996, EELPA was split into the *Ethiopia Electric Authority* (EEA), taking over all regulating activities and a company, *Ethiopian Electric Power Corporation* (EEPCo), bundling all activities from power generation to household delivery. In 2013, EEPCo was again split up into two companies, *Ethiopian Electric Utility* and *Ethiopian Electric Power*

Ethiopia's state-owned power company, Ethiopia Electric Utility (EEU), **provides electricity to about three million customers across the country**. The ultimate goal of EEU, and the Government of Ethiopia, is to extend electricity service to all of the nation's 100 million citizens. Ethiopian Electric Utility (EEU) the state owned electric power distribution agency of Ethiopia has many problems associated with bill collection. As we all know the current meter reading system of Ethiopian Electric Utility (EEU) requires the meter reader to go and read each and every customer’s house because of that the previous reading method is outdated, paper based, prone to error and takes much longer time to insert the reading into the system.

Advanced Metering Reader (AMR) solves this problem by giving serial number for each user, the system reads the exact consumed amount and displays to the organization. It helps pay their bills on time, reduce customer complaints and labor costs.

# Mission

The Advanced Metering Reader (AMR) will provide a faster and easier way to read and send the collected data to the system. Also benefits the customer’s time consumption and reduce their electric bills.

# Vision

Advanced Metering Reader will decrease labor cost and innovate Ethiopian Electric Utility (EEU) in the near future.

**Statement Of The Problem**

The Ethiopian Electric Utility Agency (EEUA) does not have a system that reads the meter. Due to this reason the existing manual processing has the following problems.

* The problems manual workers face while going door to door to read the meter everyday like over exertion and a rough environment.
* Customer’s unhappy treatment and complaints.
* Unaccountable and irresponsible way of reading the meter done in hurry or an uneducated guess.
* Higher estimated electricity bills.
* There are numbers of electricity outages, it takes an extensive amount of time to notify the Electric Corporations and get it fixed.
* The workers have to go to the customers house and cut off their electricity supply manually, which is a tiring process.

## Justification of the problem

The main purpose of this project is to develop a system that analyze and collect data from the meter to send it to the Ethiopian Electric Utility Agency (EEUA) or corporation.

## Objective Of the project

General objectives

The general objectives of this system are to provide a way of measuring electricity consumption and we will implement a smart meter that will compute the power consumption and communicate with the control office over the internet. Also, it will have the capability to disable some of the loads based on the current electricity price and demand. It helps with time saving to the consumers and utility companies for reporting the meter reading back to the energy providers.

Operationally, with AMR the utility knows immediately when and where an outage occurs so it can dispatch repair crews in a more timely and efficient way. Meter-level outage and restoration information accelerates the outage restoration process, which includes notifying consumers about when power is likely to return.

Specific objectives

In order to achieving the general objective, the following specific objectives will be achieved:

* To compute the consumed energy from the house.
* To notify the provider of a power outage and the consumers about when power is likely to return.
* To calculate the accumulated cost of the consumed energy.
* To update the customer with the current cost.
* To provide the electricity bill to the customer and to the company.
* To avoid estimated readings

**Feasibility Study**

A Feasibility study is an analysis that considers all of a project’s relevant factors including economic, technical, legal and scheduling considerations to ascertain the likelihood of completing the project successfully. Feasibility analysis is undertaken to prove if the proposed system is valuable to implement. The following are the major categories of feasibility concerns that the business must be in clear and right about.

**Technical feasibility**

Technical Feasibility analysis determines the feasibility of a project in terms of science and technology. It analyzes the adequacy if technology development. Our system will be an advanced metering reader that will be able to accomplish our goals and objectives written above. We can implement and develop the software while we assume that we will be able to access the hardware needed to complete the project. Therefore we strongly believe it’s technically feasible.

**Operational Feasibility**

A system is said to be operationally feasible when the proposed system satisfies the requirements identified and is also a measure of how well a proposed system solves the problem. The system we proposed may need more knowledge and expertise than we have, but with the right connections and support. We have no doubt that it will benefit the users and the providers, as for the information and guide needed to use our system; we will be able to make a manual that will be able to guide the users.

**Economical feasibility**

Economic Feasibility refers to the analysis of the cost effectiveness of a project in order to determine whether the company/corporation should undertake the project on the basis of profitability. If benefits outweigh costs, then the decision is made to design and implement the system. The costs to distribute this technology throughout this country might be a bit difficult but we hope the benefits will balance or even overshadow the costs..

**Scope and limitation**

**Scope**

The scope of this project is to develop an Advanced Metering Reader System that helps in time saving to the consumers and utility companies for reporting the meter reading back to the energy providers. This system will also be able to automatically terminating the appliances off when they are not in use and cut down unnecessary costs for electricity bills. In addition, it will notify the service provider of a power outage and to assists users to get an immediate response.

**Limitations**

Limitations are constraints that are limiting factors that can impact the project in many ways and are risks that need to be addressed to ensure the projects ultimate success. Some of the limitations for our project are the following:

* One of the limitations is lack of some of the resources in our country.
* The costs might be expensive for the reason of distributing the meter while it’s being installed for the first time; for everyone.
* Making a long-term financial commitment to the new metering technology and the related software involved raises financial problems, managing and storing vast quantities of the metering data collected raises huge technical problems.
* It might also take some time to reach everyone and to get their manual.

**Significance of the project**

The significance of the study is written statement that explains why your research was needed:

* Reduce the manual work.
* Saves time for both the customers and the providers.
* It will also reduce costs efficiently.
* The two way communication between EEU and the users will make it easier to notify of any problems.
* Has a very useful feature of automatically terminating the appliances off when they are not in use.

**Beneficiaries of the project**

Those who benefit from this project:

* The consumers which are the customers.
* The energy providers also known as Ethiopian Electric Utility (EEU).
* Also the country as a whole.

**Methodology**

**Data Source**

Our sources are documentations from Google about smart meters and the Advanced Metering Infrastructure. We also researched on the history of meters and their uses around the world from book references.

**Fact finding methodology**

**Primary sources**

**Observation**

We have observed how electric utility works from our own houses, as they come and collect data every few weeks. We also saw how the process of knocking door to door is exhausting and time consuming.

**Document Analysis**

We have reviewed and referred from existing documentations on smart meters and Advanced Metering Systems. We have found different hardware designs that have previously been made. Now we acquired enough research and data to see how it is done or made.

**Development Tools**

In order to develop the software we are going to use both hardware and software.

**Hardware Tools**

* Wire
* Micro controller: Arduino
* Wi-Fi shield
* Current transformer
* Voltage transformer
* Relays
* Load (heater, light bulbs…)
* Power factor module
* GSM Modem
* ENERGY METER
* OPTOCOUPLER
* LCD DISPLAY
* Potentiometer
* Stationary tools
* Laptop

**Software Tools**

* Arduino IDE
* JAVA Programs
* Microsoft office(Documentation)
* My SQL

**Unit testing**

In this phase of testing we tried to eliminate faults in procedure and functions point of view by using black box and white box testing.

• Prepare Test case – Input, expected outcome, purpose

• Perform the tests according to our plan.

• Outcome of the test case – Pass/fail result

• Analyze the test results.

**Required Resource with Costs**

|  |  |
| --- | --- |
| Materials | Cost |
| Laptop | 30,000ETB |
| Stationary Tools | 250ETB |
| Wi-Fi shield | 1,200ETB |
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**Schedule**

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| --- | --- | --- | --- | --- | --- |
| **Phases** | **November 20 -**  **December 6** | **December 6 -**  **January 1** | **January 1 -25** | **January 25 -**  **February 4** | **February 4 - 7** |
| Requirement gathering and Analysis |  |  |  |  |  |
| Design |  |  |  |  |  |
| Implementation |  |  |  |  |  |
| Testing |  |  |  |  |  |
| Maintenance |  |  |  |  |  |

**Team Composition**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Name** | **ID** | **Email** | **Responsibility** |
| **1** | Tsion  Tesfaye | **Ugr/19977/12** | tsiontesfayeg@yahoo.com | Documentation Analysis and Coordinating |
| **2** | Meron  Degefa | **Ugr/20401/12** |  | Database Design, Analysis and Testing |
| **3** | Hanna  Nigusu | **Ugr/20512/12** | HannaNigusu1621@gmail.com | Requirement Gathering, Designing and testing |