EMD: ELECTRICITY MONITORING DEVICE FOR USER AWARENESS

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EMD: Electricity Monitoring Device for User Awareness

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Abstract— Electricity bill charges usually dependents on the amount of electricity usage. The increment in the electricity usage will cause the users to pay more. This situation always happens when users are not aware about their growing usage. Hence, a system is needed where it can monitor and measure the electricity usage and update users on the increasing electricity utilization. This paper will discuss about EMD research methodology and process development of a device to monitoring real-time electricity utilization. This system will indirectly help the users to monitor the amount of electricity usage which will help them to control and overcome wastage of electric power.

Keywords- Electricity Utilization; Electricity Monitoring Device; Real-Time Electricity Device; Monitoring Electricity Utilization; Electric Power

I. INTRODUCTION

Malaysia is growing toward to a high technology developed country. Due to this, the demand on utility usage is increasing which causes the public are unsure on how to reduce the utility usage. Hence, this caused the individuals to pay more and more when technology is integral into their daily life style. Many individuals questioned why the improvement of technology has still yet to reduce their utility charges especially their electricity charges. Although technologies have been integrated into some systems such as inverter into air-condition systems and energy saving systems for lighting systems it yet helps to reduce the utility charges. This reason has opened many opportunities for many individuals to develop some products which can monitor the electricity utilization.

II. LITERATURE REVIEW

Analysis shows that most of industries utilize electricity around the clock while home usually utilize electricity approximately for 18 hours per day [1, 2]. Due to 24 hours of electricity utilization, large losses always exist in industries [3, 4]. Thus, there are many potential ways to improve the electrical utilization in terms of improve efficient and optimization.

Wide research have been carried out and published about electricity analysis for different kind of industries [5–9]. The analysis raised concern about accessing the electricity utilization efficiently. Malaysian industries are expected to increase 6% of electricity demand starting from year 2005 to

year 2010 [10]. The rapid development of urbanization areas are the cause of increasing demand in electricity usage. Hence, various devices to monitor electricity utilization are developed and installed to provide a standard level of awareness about efficiency.

Study also has been carried out to analyze electricity demand for residential sector. The analysis shows 4.9% increasing in electricity demand per year due to the improvement in living standards [11].
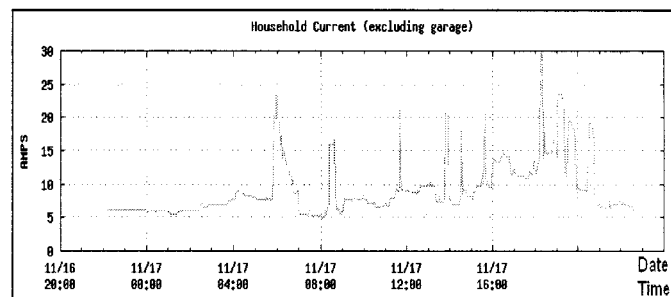

Figure 1: Electrical Energy Consumption for Home.

Figure 1 is showing about the electricity consumption of homes in US, homes in US consume approximately 16 hours of electricity daily [12]. The electricity consumption starts to increase at 4am and 6am. During these hours the residents starts to prepare their children for school and work. The electricity consumption starts to increase at 8am till it reaches maximum utilization because of daily activities then it is gradually reduce by 9pm [12].

Figure 2 describe that the demand of electricity usage is proportional towards the utilization of electrical devices. Based on the graph, charges of electricity increase proportionally towards electrical consumption during increase electrical consumption.

All these aspects have been put together to design an Electricity Monitoring Device (EMD). This product will present the measure the electricity usage and helps the user to monitor on their daily usage. The purpose of this product is to overcome electricity wastage while creating high level of awareness among the users. Addition to that, this device also will monitor and record daily power utilization. This aspect is important to allow the users to estimate on their utilization.

EMD is an inexpensive, small size and user friendly device. EMD system is developed based on electronics integration, digital display system and programming. The concepts of EMD system is each time user utilize the electricity the LCD display will show the used amount. Based on this the users can assume their daily utilization. All information and notification will be displayed on the LCD displays. EMD system will allow users to manage and monitor their daily used electricity consumption. Instead, users can compare the previous meter reading from supplier with our product to ensure that their electrical usage is synchronized.
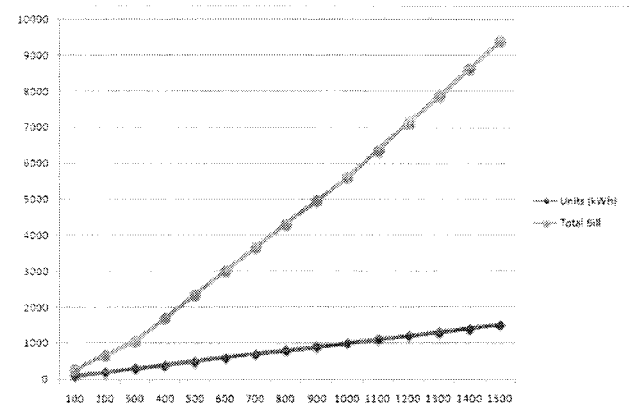

Figure 2: Electrical Energy Consumption is Proportional towards the Usage of Electrical Devices.

The EMD system will monitor all the information about power flow and help to identify the total of the electricity utilization. Thus it is essential to install an effective monitoring system for power reliability assurance for both power supplier and customers.

III. RESEARCH METHODOLOGY

EMD system is design based on the study carried out in section 1. The idea will be adopted to increase awareness among electricity users. Initially, a survey and study on the electrical power consumption by the user's is conducted to idealize the EMD system designing. EMD system will provide a user friendly and efficient system to observe the electrical utilization. Short research is conducted to analyze the design structure of the Electricity Measuring Device (EMD). The system design consists of 4 bits digital flip-flop circuit that is used as a counter. The 4 bits digital flip flop counter display up count value during utilization of electricity.

The research methodology also carries out a study on how to transform the generated frequency wave for value measuring on the seven segment display. After understanding the concept, a simulation system is developed to capture the frequency wave into measured value.

Figure 3 illustrates EMD system development process at initial stage. The flowchart explains the stages of development and the rectifying process when a failure is encounter at a stage. The design stage plays the most important role while proceeding to the next stage. During at design stage, developments at each stage need to be plan out precisely. A mistake at this stage will cause failure to the whole development process.

IV. CIRCUIT AND SYSTEM DEVELOPMENT METHODOLOGY

The electric supply from the main tower will be divert to the homes through the panel power meter which is located at user's home or factory power station. High voltage input is then step down to transform it to digital signal. The digital waveform is filtered to provide as an input to the clock at the counter circuit. When the digital waveform is at high rise, the up count will begin to count the input value for the power which is being utilized by the user. This value will be then continuously updated each and every time the digital waveform clock at high rise.
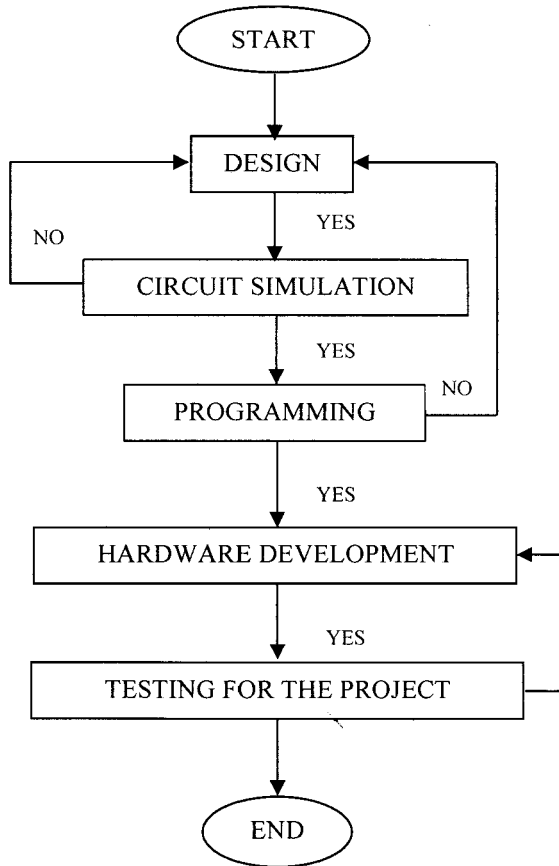

Figure 3: Electricity Monitoring Device Development Process Flowchart

Counter will display the electricity utilized value on the seven segment display. Displayed digital data on the seven

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segment display will be sent as a recorded value to the microcontroller. These data are saved in the microcontroller for analysis purposes. At the same time the LCD will display the amount of electricity has been utilized for a single day.

Figure 4 shows integration between seven segment display to a microcontroller. Four bits seven segment display are connected to the input of microcontroller to display the electricity utilization counting. Let say, the first seven segment display is connected to microcontroller inputs A_0, A_1, A_2 and A_3 and is grouped as A. It then, followed by second seven segment display is connected to microcontroller inputs B_0, B_1, B_2, and B_3 and is grouped as B, this is then followed up with the third, fourth, fifth and six seven segment display and are grouped as C, D, E and F as shown in Figure 5. The group names A, B, C, D, E and F completes four bits up counter for electrical utilization and also for counting monitoring process.
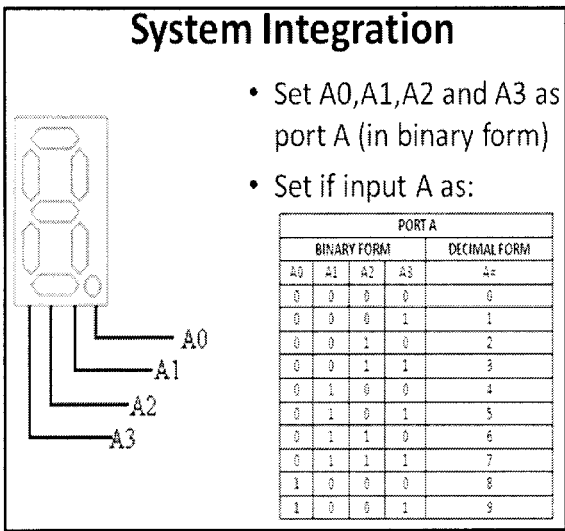

System Integration

- Set A0,A1,A2 and A3 as port A (in binary form)
- Set if input A as:

PORT A				
BINARY FORM				DECIMAL FORM
A0	A1	A2	A3	A=
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9

Figure 4: Seven Segment Display to Microcontroller.
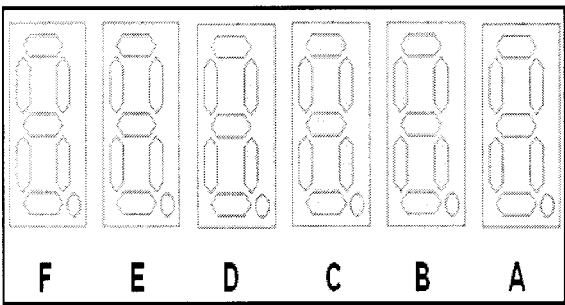

F   E   D   C   B   A

Figure 5: Seven Segment Display Counter.

V. RESULTS AND DISCUSSION

Electricity Monitoring Device is actually a simple device that can monitor our home and factory electricity consumption. This device will assist the home and factory users to monitor their daily electricity consumption which increase their awareness on the electricity consumption. Whereby, this device also will be able to assist the user to check on their monthly billing cost in terms of the power calculation and costing. At the same time, this device is an alternate to reduce the energy usage during unoccupied period.
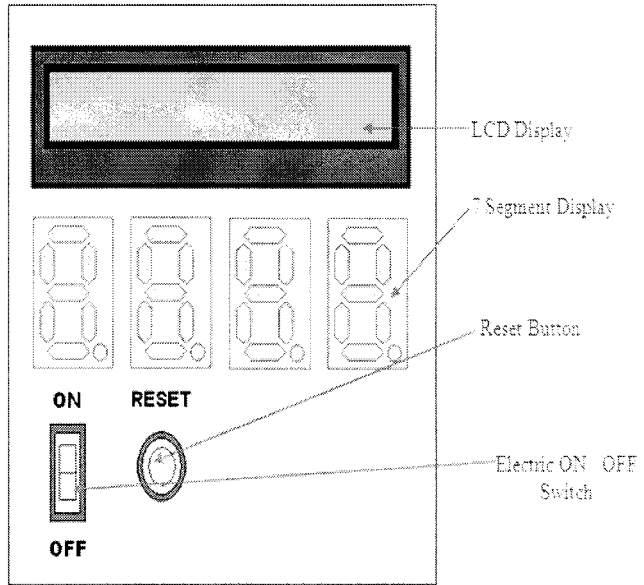

Figure 6: Illustration of Electricity Monitoring Device.

VI. CONCLUSION

The Electricity Monitoring Device will be able to help the user to monitor their electricity utilization and reduce or maximize their electricity utilization. This device also uses the simple circuit integration which is compatible at any installation.

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