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IOT BASED PREPAID ENERGY METER

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Abstract

Power utilities in various countries, especially in developed countries, have little control over energy usage. This proposal suggests a prepaid energy metering system that allows users to monitor how much energy they have used.In this process, each consumer device has a smart energy meter installed, and the service provider maintains a server. The IOT module is installed on both the meter and the server, allowing bidirectional communication between the two ends through the IOT interface. By using their user ID, consumers can conveniently recharge their energy meter in the database. The service provider will have complete leverage over the customer side thanks to bidirectional IOT connectivity. Electricity theft can be significantly minimised by combining the new steps with the prepaid metering system.

Keywords: Prepaid energy meter, Internet of things, Analog to digital converter.

I. Introduction

Consumers who use the IoT-based prepaid energy meter will monitor their real-time energy usage in the web database, as well as manage their whole device from the web database. To make it easier, the number of units required can also be charged in that database. As a result, the user can see how many units have been consumed and how many units remain. Once the given units have been consumed by the customer, the supply will be shut off and the consumer will receive a warning note indicating that all of the paid units have been consumed. In the event of non-payment or any other problem, the supplier retains complete leverage over the customer and can shut off the supply at any time.

If the market for energy-efficient systems grows, effective control of device power and use becomes more critical, and it's a challenge that more engineers will have to solve. One approach is to use an analogue to digital converter (ADC) for both current and voltage, then multiply the result in a processor to get power. However, since both the current and the voltage will differ independently of one another, the communications delay and overhead in obtaining the current and voltage information causes time alignment errors in the power calculation. The processor will need to devote enough computing power to ADC communications and power calculations to minimise the delay between voltage and current measurements. Even if the processor is devoted solely to this task, connections with other instruments in the system will cause voltage and current measurements to be delayed, decreasing power monitoring precision. Adding additional tasks to the processor, such as averaging the device voltage, current, and electricity, as well as

energy control, will start to overburden it. A simpler way to track power is to use a digital current monitor to do the mathematical processing, freeing up the processor to handle other system activities and alerting it if higher level system actions are needed. To fix this issue, Texas Instruments offers a variety of digital power and current monitors. The INA233 is one such power, current, and voltage control. The INA233 uses an I2C, SMBus, and PMBus compliant interface to control voltage, current, electricity, and energy.

Prepaid Systems are progressively more popular in the delivery of urban services, particularly for electricity and water. The use of prepayment system is irregular, with some countries dynamically seeking the use of prepayment, while others are apprehensively making steps towards the adoption of this system. In the context of the Millennium Development Goals, the case for prepayment of utility services has been predominantly applicable.

Mahfuzet al (2020) proposed the power monitoring of the consumed energy is one of the main concepts. Once the power is monitored it is sent to the consumer through SMS and a feedback control is taken from the SMS to the microcontroller for the relay control. Mishra, J. K et al (2018) presented old meter is made as new smart meter that has an Electronic Meter Automation Device that sends the output data to the webpage and smart app for the real-time monitor of the power consumed. And the feedback control is connected in between webpage and microcontroller for the control of Electronic Meter.Ali Zaidi et al (2008) presented in his work the proposed system consists of the digital billing and power consumption on lcd display.Gautam A. Raiker et al presented the paper the load is monitored in the web database through the IOT. And the energy management in a demand side is clearly mentioned what are the necessary things needs to be followed. On switching of the on load or off load is made simple.

II. BLOCK DIAGRAM

This project is about the prepaid use of energy by the consumers that helps in the energy management. The consumers will have pay for their amount of energy needed for them in pre hand, so that the consumers will have a check on the amount of energy consumed. The consumers can view in real-time the usage of the energy graphically. Figure 1shows the block diagram of prepaid energy meter. In case of any misuse of the energy the provider can easily cut of the supply to the consumers directly.In this project the load is connected to the ac source through the relays. Here for consideration, only two loads are used for test cases. The raspberry pi is interfaced with MCP3008 which is used as a A/D converter since the raspberry pi has no inbuilt converter the two current and voltage sensor is interface to MCP3008 which continuously monitors the power and sends the data to cloud using thing speak web server and also the app has on/off button which controls the button automatically from the web server.

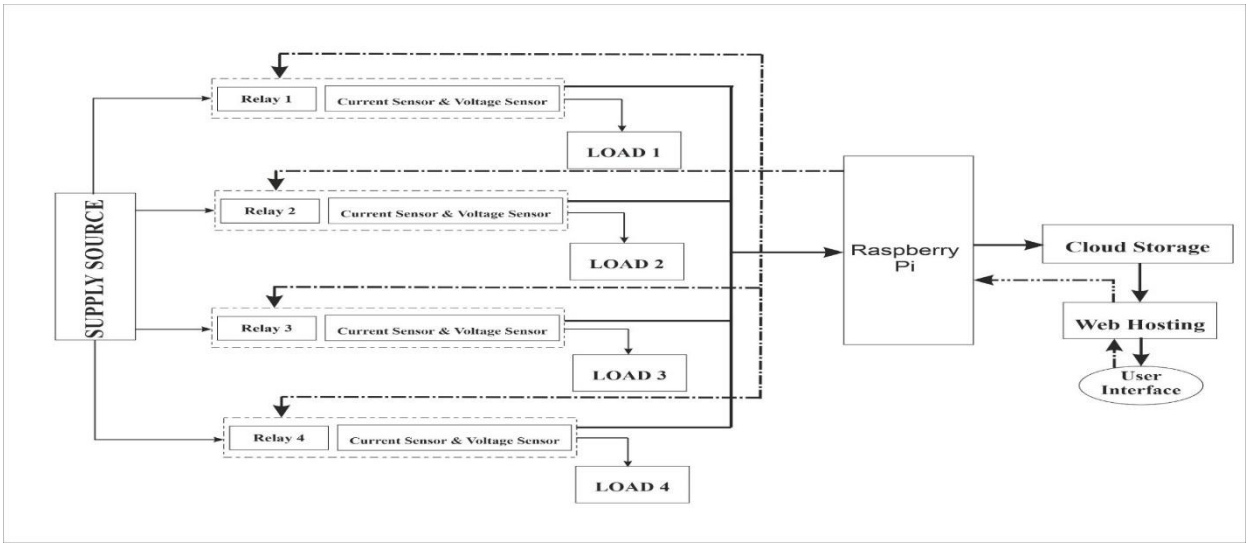

Figure 1. Block diagram of prepaid energy meter.

Figure 2 show the complete circuit diagram of proposed system. The Figure 3 explains flow diagram of prepaid energy meter how the load is monitored and controlled by service provider.

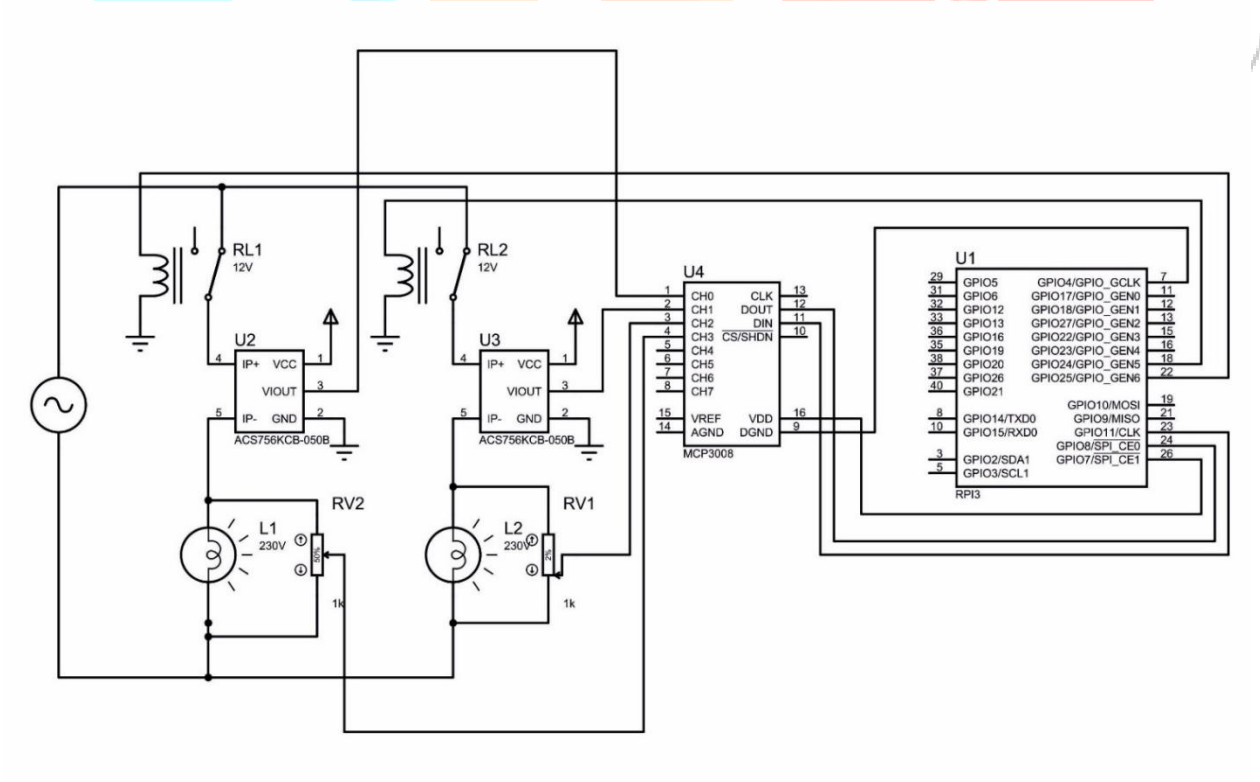

Figure.2 Circuit diagram of proposed model

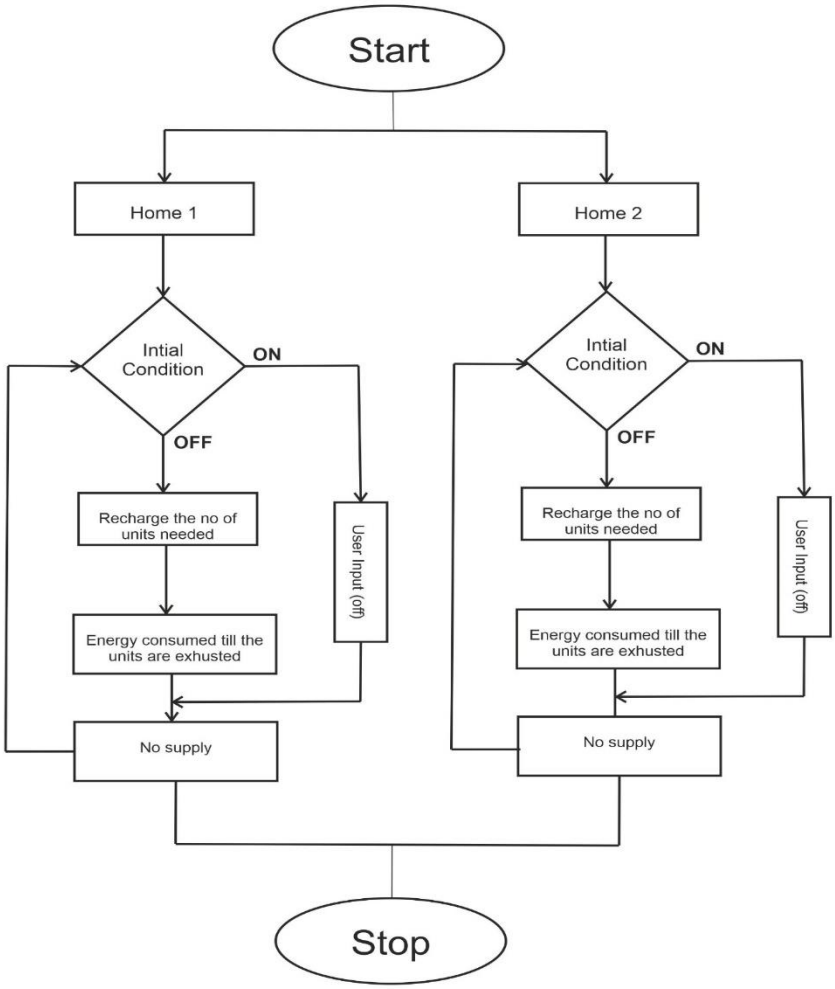

Figure.3 Flow diagram of prepaid energy meter

III. Results and Discussion

This Figure 4 shows the front-end of service provider. Payment page clearly explains the what are details required form customer. The frontend was designed using python coding.

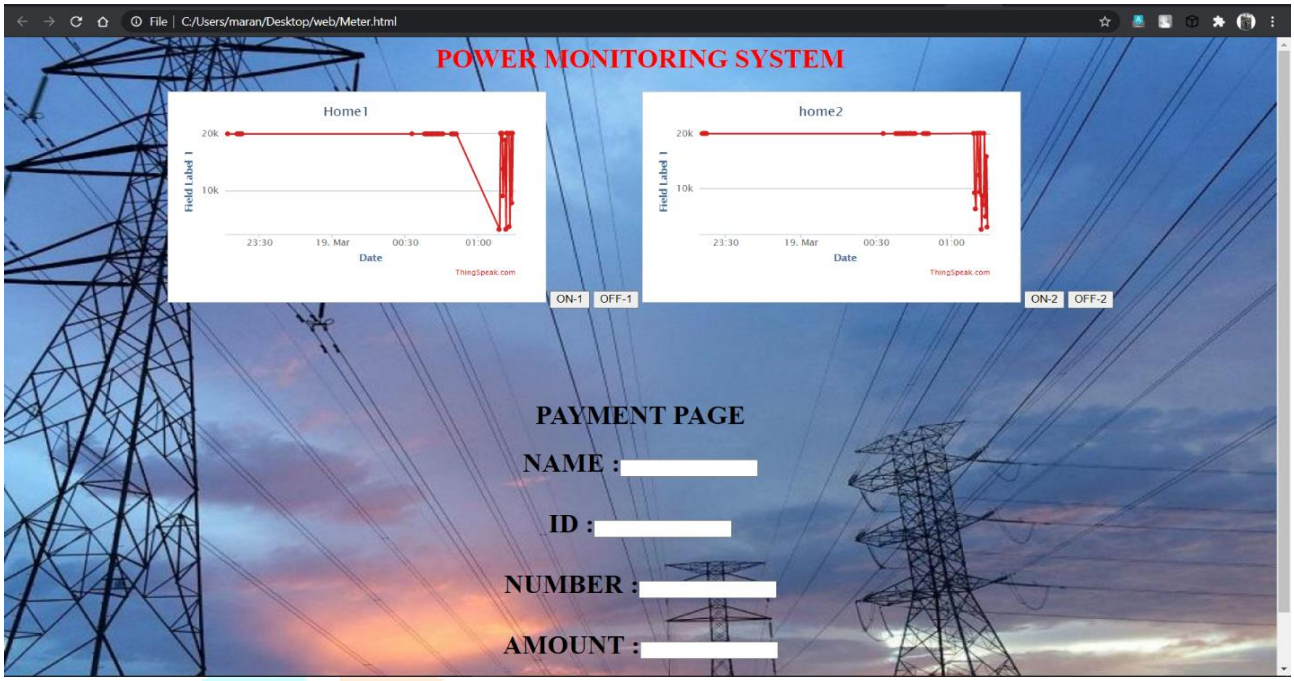

Figure 4. Frontend of payment page.

Table. 1 Sample data considering two home loads.

S.No	Recharge Status	Load Condition	Time (min)	Power Consumed (Watts)	
				Home 1	Home 2
1.	Not Paid	Off	13:45	0	0
2.	Not Paid	Off	13:46	0	0
3.	Paid	On	13:47	83.26	2.53
4.	Paid	On	13:48	81.42	2.23
5.	Paid	On	13:49	81.65	2.07
6.	Paid	On	13:50	80.73	2.23
7.	Paid	On	13:51	80.73	2.23
8.	Not Paid	Off	13:52	0	0
9.	Not Paid	Off	13:53	0	0

IV. CONCLUSION

The database of real-time power usage and prepaid energy use is addressed in this work. By using this method, the vendor will have complete oversight of the consumer's side of the transaction and will be able to monitor the system on a daily basis to ensure that no fraud is occurring. From the user to the supplier, this device can have very fast feedback. Due to non-payment of the required unit from the user side, no load was in the active stage at the outset, as seen in table 1 Power usage of loads. As a result, the service provider made them inactive. If the invoice has been received, the user side is enabled with the use of loads, making it easier for the service provider to operate on a wide scale with several connections. Because of the simple feedback mechanism used in this proposal, there is less manpower required to manage power consumption.

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