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IoT Smart Energy Meter Monitoring with Web and Blynk App

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ABSTRACT

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Accepted : 02 July 2021 Published : 09 July 2021 Electricity is a crucial innovation that would render life on Earth impossible. As a result, there is a clear requirement to track the amount of power used. The wattmeter does this, but a GEB representative must visit each customer's home to evaluate power use and estimate the bill amount. As a result, it entails a lot of physical labor and takes time. We planned to build an IoT-based energy meter for each of GEB's customers. As a result, the suggested energy meter monitors the amount of power utilized and uploads it to the Thingspeak cloud, where the reading may be viewed by the person concerned. ESP 8266, a Wi-Fi module, can be used to send the power reading to the cloud. The opt coupler analyzes the power reading from the digital wattmeter and feeds it digitally to the Arduino. As a way, it uses IoT to automate the process of measuring energy usage at households, allowing remote access and digitalization for each GEB subscriber. **Keywords :** Internet of Things, NodeMCU ESP8266, PZEM-004T, Blynk, HTML.

I. INTRODUCTION

Smart metering is the monitoring the electricity consumption through modern metering devices connected to the Internet via IoT technology. ... Smart meters, which collect consumption data and periodically send it to a central server for processing. And via internet anyone from any part of the world can monitor and control the loads through their handsets. It consists different methods like GSM communication, Real time clock, Internet of things (IoT), Automatic Meter reading etc.

Current Problems with Normal energy meter:

- Government officer have to go Door to door for meter reading.
- People don't get to know their bill until it comes.

- If any problems occurred then they don't able to cut off the loads remotely.
- one cannot track their usage and spend
- cannot Monitoring the electric system and its fault.
- Increasing the number of frauds.

Advantages: -

- The electric utility may profit from smart meters.
- Eliminating manual measurements
- Increasing the speed with which the electric system is monitored
- Allowing more effective use of power resources
- Providing real-time data useful for balancing electric loads and reducing power outages (blackouts)

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- Enabling dynamic pricing (increasing or decreasing the cost of electricity dependent on demand)
- Assisting in the optimization of income with existing resources
- You won't have to submit metre readings
- You'll be able to keep a careful eye on your spending and use
- You'll get accurate invoices instead of guesswork!

Disadvantages:-

- Transitioning to new technology and processes
- Managing public response and consumer adoption of the new meters.
- Making a long-term financial commitment to the new metering technology and accompanying software . Managing and storing vast quantities of metering data
- Ensuring the safety of metering data.
- Older meters become "dumb" as you switch
- Poor signal

Pzem-004t is used as electrical parameter measurement function (voltage, current, active

power). 4 piece display function (display voltage, current, active power). The serial communication function (comes with TTL serial interface, via various terminals communicate with the adapter plate, read, and set the parameters). PZEM-004T AC communication module, the module is mainly used for measuring AC voltage, current, active power, frequency, power factor and active energy, the module is without display function, the data is read through the TTL interface.

PZEM-004T-10A: Measuring Range 10A (Built-in Shunt)

PZEM-004T-100A: Measuring Range 100A (external transformer)

Voltage: Measuring range: $80 \sim 260$ V,Measurement accuracy: 0.5%. **Active power:** Measuring range: $0 \sim 2.3$ kW(PZEM-004T-10A); $0 \sim 23$ kW(PZEM-004T-100A). Starting measure power: 0.4W. **Power factor**: Measuring range: 0.00 \sim 1.00, Measurement accuracy: 1%. **Frequency:** Measuring range: 45Hz \sim 65HZ, Mmeasurement accuracy: 0.5.

II. Work Done Till Date

Table 1. Previous Related Works

Authors	Year	Methods	Advantage	Limitation
Amrita Singh	2018	ESP8266, Energy unit reading is New		Need Java language
and et. All		HTML, Java accurate. Knowled		Knowledge.
				Not Provided
				Mobile View.
Win Adiyansyah	2018	Real Time Clock	Customers have the	Users cannot
Indra,		(RTC),	ability to monitor their	control their bill,
And Fatimah Bt		Mobile	current bill or power	usage, power
Morad, et all		Communication	consumption from	consumptions by
		(GSM),	anywhere.	themselves
		Automatic Meter		remotely from their
		Reading (AMR),		mobile phones
Lavanya Garg	2018	(FDI) Fault	The bill can be paid in	Need of utilization



Charul SharmaIsolation, Internet of Things, (IoE), (IoT)technical difficulty occurs, that would be notified to the user. It offers to check the power consumption remotely.which can be used in various space whenever there's deficiency of power.Pooja D Talwar1 And Prof. S B Kulkarni2016Automatic Meter Reading (ARM), WIFI ESP8266 modulereducing energy consumption in house, generate bill automaticallyThere must be installed WIFI hotspots in each area.K. Lova Raju And K. Yaswanth Pavankalyan, et all2020Automatic Meter Reading (ARM), internet of things (IOT)Keep tracks of consumer unit handy.needs to develop web application unit handy.MARTIN MISKUF And ERIK KAJATI2017real-time internet of things (IOT)We can identify running appliances and its consumption patterns, this system having fault detection so we can easily find out fault occurs in system.Privacy is a big issue. All the data must be encrypted		Detection	advance. In case any	of vitality meter
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system.			detection so we can easily	
· · ·			find out fault occurs in	
			system.	
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et all energy used by failure with			energy used by	failure with
customers., It shows time complex systems.			customers., It shows time	complex systems.
to time power utilization			to time power utilization	
of the load/loads			of the load/loads	
connected to the system.			connected to the system.	
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Tejashree RaviGSMawareness; Monthlybe automatically	e Ravi	Ravi GSM	awareness; Monthly	be automatically
, et all consumption of power switch ON or OFF			consumption of power	switch ON or OFF.
will be sent as message to			will be sent as message to	
the consumer with total			the consumer with total	
bill of electricity			bill of electricity	
Somchai2017Internet ofA solution is a low-cost,complications step	20	2017 Internet of	A solution is a low-cost,	complications steps
Thepphaengthings (IOT),simple-to-implement, and	eng	eng things (IOT),	simple-to-implement, and	
And Realtime clock easy-to-manage energy		Realtime clock	easy-to-manage energy	

Varunyou		(RTC)	monitoring system for	
Nontaboot		(MIC)	our daily use of	
INOIItaboot			electricity. This	
			•	
			eliminates human errors,	
			manual labor, and lowers	
			energy consumption costs	
			while increasing	
			efficiency.	
Rishabh Jain	2019	Internet of	To reduce wastage of	The system is
And Sharvi		things (IOT),	energy, Prevent	mainly intended for
Gupta,et all		Automatic Meter	electricity shortage	smart cities with
1		Reading System	during dry seasons.	public Wi-Fi
		(ARMS)	0 7	hotspots. If net
				connection lost
				then don't work
				properly
				Property
M. M.	2018	Internet of	Detect and control the	Chances of failure
Mohamed		things (IOT),	energy theft.,	of digital
Mufassirin		Automatic Meter	consumptions are	equipment's and
And A. L.		Reading System	calculated automatically.	corrupts the data.
Hanees		(ARM)		
K. Lova Raju and	2020	Internet of	energy unit reading can	implementation of
K. Yaswanth	2020	things (IOT),	be handy,	this system is
Pavankalyan,et		Real time	save and manage power.	complex.
all		application	save and manage power.	complex.
an		application		
Shahajan Miah	2019	Internet of	minimize the technical	Complicated
And G.M.		things (IOT),	mistakes,	operations.
Jahedul Islam,et		convectional	transfer data over a	
all		method	network without human	
			interactions.	
Satien Janpla1	2020	Internet of	Smart power outlet.,	Continuous power
and Chaiwat		things (IOT),	Calculate power	supply to the
Jewpanich ,et all		Automatic Meter	consumption	Arduino and wife
		Reading (AMR)		module.
V.Badri Rama	2019	Internet of	Maximum use of energy	Some steps are
	1	-		1

Krishnan and		things (IOT),	sources in cheapest way,	complicated.
Keerthana		real time	Smart energy	
Sandepudi, et all		application	management.	
Md Redwanul	2019	Internet of	The goal is to reduce	implementation of
Islam and		things (IOT),	manual labour and	this system is
Supriya Sarker,		Automatic Meter	human error when	complex.
et all		Reading (ARM)	measuring electricity	
			units.	

Proposed System

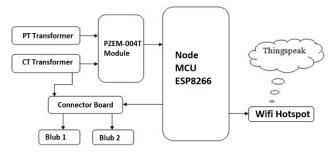
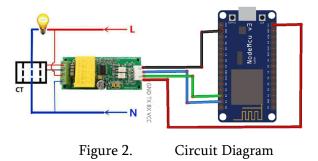


Figure 1. Block Diagram

The project's main goal is to create an IOT (internet of things)-based energy meter that displays units consumed and costs in a chart and gauge format over the internet. We used a digital energy meter for this ground breaking project in which Current and Power Transformer are interfaced to a microcontroller through a Signal Conditioning Board. The Signal Condition gives reading each time to the microcontroller when connected loads are ON. First, PZM-004T module takes this analogy reading and convert it into digital data then after it sends it to the cloud using ESP 8266. PZM-004T is a voltage and current reader with inbuilt current transformer which is interfaced with the microcontroller. Here, As a microcontroller, the ESP8266 is used. The data is serially transmitted from the ESP 8266 to the Thing speak web page, resulting in a multi-level graphical display that can be viewed from anywhere in the world. The PZM-004T module requires a 5V supply, while the ESP 8266 requires a 7.5V adapter. In the same Arduino IDE, the ESP8266 is programmed using

ARDUINO software, and the Wi-Fi module is programmed using AT commands. On the Thing speak website, the consumed power reading is displayed in graphical and gauge format, along with the cost to be paid for consumption, Simulation and Circuit Diagram

In below circuit diagram we can observe that 220 V single phase power supply is connected with the current transformer of the PZM module. Current transformer is inbuilt connected with the PZM. PZEM-004TAC AC voltage, current, active power, frequency, power factor, and active energy are all measured with this module. And this PZEM module is interfaced with the Wi-Fi module ESP8266. All the current variation is measured by current transformer. Then after this variation of current and voltage analogy value is send to the microcontroller ESP8266. Microcontroller converts it into the digital binary value and then after it also be sent into the internet clouds from which we can see our consumption via webpage in our devices.



💿 CodeNew1.ino /	rduino 1.8.13			
File Edit Sketch To	ls Help			
	*			
CodeNew1.ino				
<pre>#include<esp82< pre=""></esp82<></pre>	6WiFi.h>			
<pre>#include<wific< pre=""></wific<></pre>	ient.h>			
<pre>#include<esp82< pre=""></esp82<></pre>				
finclude <pzem< td=""><td></td><td></td><td></td><td></td></pzem<>				
	n(D1,D2); //RX/T			
	d = "Vyas_home_4g	';//Replace w	ith your networ	k SSID
const char* pa	sword = "vyas@202	l #"; //Replace	with your netw	ork password
ESP8266WebServe		_	with your netw	fork password
ESP8266WebServe float voltage,e	server(80);	_	with your netw	Fork password
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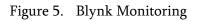
Figure 3. Coding Arduino interface

eter using IoT	© ☆	<u></u> ¥ ₩	-	-
Value	Units		1	
207.00	Volts]	
0.06	Amperes			
1.00	xxxx			
11.80	Watts			
50.0	Hz		1	
	207.00 0.06 1.00 11.80	207.00 Volts 0.06 Amperes 1.00 XXXX 11.80 Watts	207.00 Volts 0.06 Amperes 1.00 XXXX 11.80 Watts	207.00 Volts 0.06 Amperes 1.00 XXXX 11.80 Watts

Figure 4.

Web Monitoring

(子) en	ergy meter		
voltage	FREQUENCY	current	^{power}
258.5		0.04	10.8
TIME	energy	unit	PRICE
206034	0.95	0. 17	1.36



III. CONCLUSION

This IoT and ESP-8266 module-based energy meter use to access meter reading and bill amount by the use of web server and help consumer to avoid unwanted use of electricity as well as to detect any kind of theft of electricity. Following are the future scope in order to save electric power and to detect theft:-

- There can be a system where Automatic Switching of electric equipment by the use of IoT is applied.
- Create a system where consumers can receive SMS notifications if their electricity usage exceeds a certain threshold.
- Create an Internet of Things (IoT) system that allows users to track their energy usage and pay their electricity bills digitally.
- When a theft is detected at the consumer's end, the user receives a Notifications.
- Application of IoT based theft detection buzzer with Energy Meter.

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