



﴿اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ ﴿١﴾ خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ ﴿٢﴾ اقْرَأْ وَرَبُّكَ الْأَكْرَمُ ﴿٣﴾ الَّذِي عَلَّمَ

بِالْقَلَمِ ﴿٤﴾ عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ ﴿٥﴾

سورة العلق، الآيات 1 - 5

Dedication

I would like to dedicate this to my parents, brothers and sisters. I also want to dedicate it to my inspiring wife, my son and my daughters.

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I would like to thank my supervisor Dr. Mohamed Elnour Abdalla for his guidance and encouragement provided throughout the period of my thesis. His patience and valuable time eased to move my thesis in a coordinated manner.

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Abstract

In recent years the importance of Smart Grid increased, which includes monitoring and controlling the consumption of electric power. Smart meters with Global System for Mobile & General Packet Radio Service modules are commonly used all over the world even here in Sudan, and these types of modules consume energy, dependency on third party could cause availability problem and data exposed to hacking. In this thesis a Smart Electrical Power Meter had been designed and implemented using Zig-Bee wireless sensor network for wireless electrical power meter communication supported by microcontroller which is used for calculating the measured values volt and current to give the power in watt and power factor. The transmitter sends these values through Zig-Bee protocol to the base station and displays the same readings in Liquid Crystal Display in the costumer side. Microcontroller also evaluate the value of power factor when it exceeds the limit a buzzer in the base station goes high showing the meter number and a warning Short message is sent to the concerned user. Simulation design using Proteus professional software has been carried out, also hard ware unit is made and both gave the required results.

المستخلص

في السنوات الأخيرة، زادت أهمية "الشبكة الذكية"، التي تشمل رصد ومراقبة استهلاك العملاء للطاقة الكهربائية. العدادات الإلكترونية التي تستخدم وحدتي جي إس إم وجي بي آر إس أصبحت مستخدمة في كل دول العالم حتى في السودان وهي تستهلك طاقة وتعتمد على شركات الاتصالات مما يحد من توفر الخدمة في المناطق خارج التغطية وإرسال البيانات في وقتها الفعلي كما يزيد من خطر تعرضها للقرصنة. في هذا البحث، تم تصميم وبناء نظام لا سلكي ذكي لقياس استهلاك الطاقة الكهربائية يستخدم وحدة زيغبي . للحصول على البيانات ومتحكم مدمج يقوم بحسابات القدرة ومعامل القدرة من القيم المقاسة بالعداد (الفولت والتيار). تقوم وحدة الإرسال بإرسال هذه القراءات إلى المحطة الأساسية للكهرباء وتُعرض نفس القراءات في شاشة للمستخدم. يقوم المتحكم أيضا بمقارنة قيمة معامل القدرة مع الحد المسموح، وعند تجاوز قيمته الحد المسموح يقوم بإطلاق إنذار في المحطة الرئيسية لتنبيه مشغل التحكم ويقوم بعرض رقم العداد وإرسال رسالة نصية تحذيرية للمستخدم تطلب منه مقابلة المحطة الرئيسية. تم تصميم دائرة محاكاة للعداد باستخدام برنامج بروتوس و تنفيذ نموذج حي وكليهما حقق النتائج المرجوة.

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List of Abbreviations

AC	Alternative Current
CGRAM	Character Generator Random Access
DDRAM	Display Data Random Access Memory
DC	Direct Current
GPRS	General Packet Radio service
GSM	Global System for Mobile
HSDPA	High-Speed Downlink Packet Access
I	Current
I/O	Input /Out put
LAN	Local Area Network Memory
Micro	Microcontroller
P	Power
PF	Power Factor
Pot	Potentiometer
RF	Radio Frequency
SCADA	Supervisory Control and Data Acquisition
UMTS	Universal Mobile Telecommunications System
UTRAN	Universal Terrestrial Radio Access Network
V	Volt
WAN	Wide Area Network
WCDMA	Wideband Code Division Multiple Access
WSN	Wireless Sensor Network