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"Implementation of an Energy Monitoring, Device control and Location tracking using IOT"

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ABSTRACT"- ***Energy monitoring and conservation holds prime importance in today's world because of the imbalance between power generation and demand monitoring systems available in the market. Many times, consumers are dissatisfied with the power bill as it does not show the power consumed at the device level. This paper presents the design and implementation of an energy meter using Arduino microcontroller which can be used to measure the power consumed by any individual electrical appliance. The main intention of the proposed energy meter is to monitor the power consumption at the device level, upload it to the server and establish remote control of any appliance. So we can monitor the power consumption remotely and shut down devices if necessary. The automobile sector is also one of the application domains where vehicle can be made intelligent by using "IOT". So a vehicle tracking system is also implemented to monitor movement of vehicles remotely.***

Keywords: Internet of Things (IOT), Arduino UNO, GPS Module, Energy meter, Liquid Crystal display.

I: INTRODUCTION

Conservation of energy is one of the most important needs of the day. The concept of energy efficient devices has come up in various areas such as lighting, air conditioning and so on. Energy monitoring is an important tool for determining the energy efficiency of various devices. This paper implements an energy monitoring system which displays the power consumed by individual or multiple devices. This can help a user to detect any errors in the electricity bill. Many a times the domestic electricity bill shows excess amount which causes consumer dissatisfaction. The aim of embedded intelligence in a machine through an application specific embedded microcontroller, sensor shields integrated with signal conditioning and signal processing circuitry, communication modules, smart power management system, is to interact with other machines equipped with similar facilities, in the form of machine to machine (M2M) communication.

II: BLOCK DIAGRAM

The proposed block diagram of the project is as shown in fig-1. As shown in the block diagram, the design is very versatile and includes a lot of advance features which consists of energy monitoring of electrical loads, sending that information to server through GSM SIM 900 module using Internet of things, if required controlling the devices from remote location, using GPS module tracking the location of the device and sending location information to server. So broadly there are eight blocks in the design. First one is power supply which very important for any electronic system. A reliable power supply is very essential for any such system.

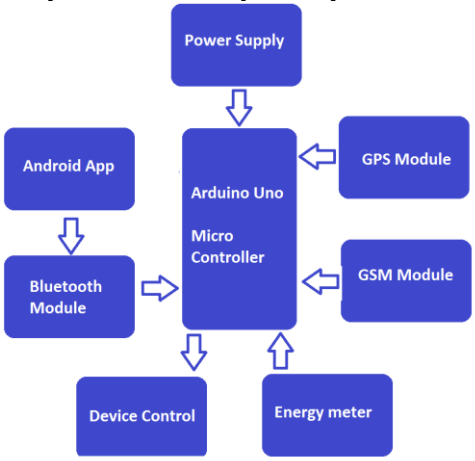


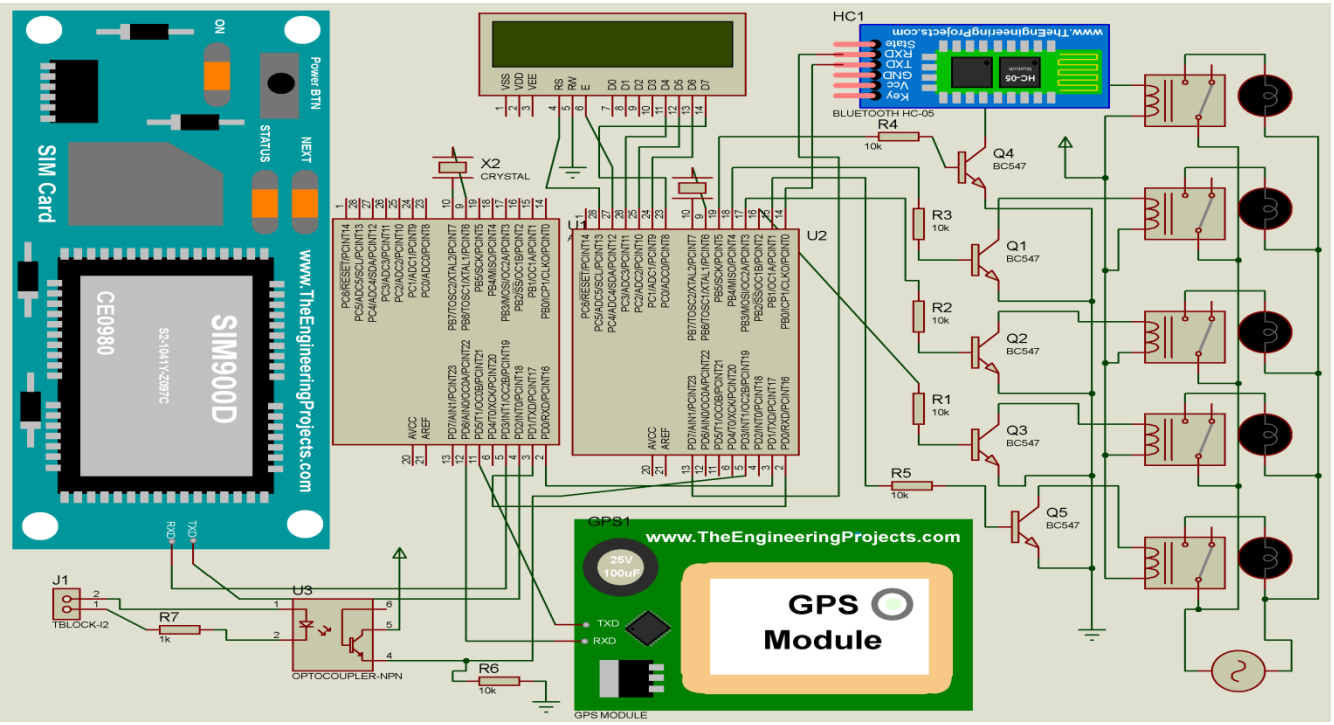
Fig-1 Block diagram for the proposed system

Second block and the most important block is Arduino Uno based micro-controller which is being programmed. This controller takes information from different modules; send this information to server using IOT and based on feedback from remote user can control the devices too. Next is GPS module which gives the information of location to Arduino Uno. Now, GSM module ends and receives data from/to server using GPRS communication. Energy meter is another block which measures the energy consumed by the load and sends this information to Arduino. Then there is Bluetooth module attached which communicates with an android app through Bluetooth communication and sends that information to Arduino Uno. Arduino acts based on this information like controlling the devices. Finally control device block which includes relays to switch on and off the devices is controlled by Arduino Uno.

III: PROPOSED SYSTEM DESIGN CIRCUIT DIAGRAM

GPS will be fixed in the vehicle to monitor and to find out location of the vehicle. With the help of the GPS value, the distance can calculated with respect to time. The direction and the distance are fed into the

microcontroller and that will be transmitted to GSM through digital modulation techniques. At the receiver end the signal will be detected and demodulated with digital demodulation technique. Then the signal will be given to Android mobile. In this system GPS, GSM is interfaced with Arduino Uno. A 16x2 LCD display is used to show some message to the user. The circuit diagram of the project is shown in figure-2.



IV: COMPONENT DESCRIPTION

Detailed description of various components used is as under:-

Arduino: - it is an open source computer hardware and software company, project, and user community that designs and manufactures single board microcontroller and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open source hardware and software. The manufacturing of Arduino boards and software distribution can be done by anyone. Arduino boards are available commercially in preassembled form, or as do it self kits. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including universal serial bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the processing language project. Arduino board is the heart of our system. Entire functioning of system depends on this board. Arduino reacts to the 5v supply given by opto-coupler and keeps on counting the supply and then calculates the power consumed and also the cost. This data, it continuously stores on webpage, so that users can visit any time and check their consumption. It even reacts accordingly as per programmed, to the situations like message sending during threshold value etc.

Overview of Internet of Things (IOT)

The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber physical system, which also encompasses technologies such as smart grids, virtual power plants, smart homes and smart cities. Each thing is uniquely identified through its embedded computing system but is able to interoperate within the existing internet infrastructure. People also want to communicate with all non-living things through internet such as home appliances, furniture's, stationeries, cloths etc. The people already have a lot of technologies to interact with living things but IOT enables to communicate with non-living things with comfort manner. IoT is a convergence of several technologies like ubiquitous, pervasive computing, Ambient Intelligence, Sensors, Actuators,

Communications technologies, Internet Technologies, Embedded systems etc.

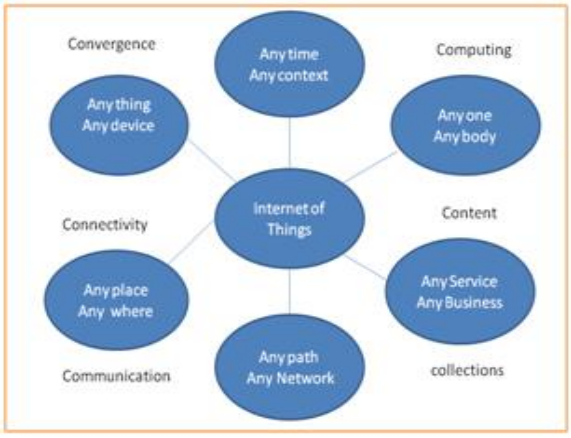


Fig-3: IOT Representation

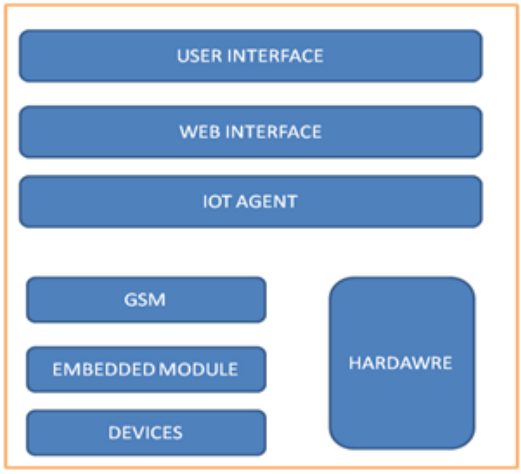


Fig-4: Interfacing of Hardware

GSM Module (SIM-900):
GSM stands for Global System for Mobile communication. It is widely used mobile communication modem system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHZ, 900MHZ, 1800MHZ, 1900MHZ frequency bands. It has ability to carry 64kbps to 120Mbps of data rates. In our system GSM is used to send the notification of threshold reaching to consumer and for sending message of total consumption of unit with cost to the service provider and consumer.

GPS Module:
The Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites. It is maintained by the United States government and is freely accessible by anyone with a GPS receiver. The GPS project was started in 1973 to overcome the limitations of previous navigation systems, integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. GPS was created and realized by the U.S. Department of Defense (USDOD) and was originally run with 24 satellites. It became fully operational in 1994.

Bluetooth Module:-
HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

Hardware Features
- Typical -80dBm sensitivity.
- Up to +4dBm RF transmits power.
- 3.3 to 5 V I/O.
- PIO (Programmable I/O) control.
- UART interface with programmable baud rate.
- With integrated antenna.
- With edge connector.

Software Features
- Slave default Baud rate-9600, Data bits-8, Stop bit-1, Parity-No parity.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:"1234" as default.

Energy Meter:
Energy meter or watt-hour meter is an electrical instrument that measures the amount of electrical energy used by the consumers. Utilities is one of the electrical departments, which install these instruments at every place like homes, industries, organizations, commercial buildings to charge for the electricity consumption by loads such as lights, fans, refrigerators and other home appliances. Energy meter measures the rapid voltage and currents, calculate their product and give instantaneous power. This power is integrated over a time interval, which gives the energy utilized over that time period. Our system does not contain very vast and difficult calculations. Usually different meters have different readings. Some have,

3200 blinks = 1 unit

Mostly, 3200 blinks = 1 unit depends on manufacturer. In our case 3200 blinks of LED is 1 unit. Let,
X = number of blinks of LED
Y = number of units of electricity.

Z = cost of consumption.

Basically, No. of units (Y) = (X/3200). If consumer doesn't react and increase the threshold value then meter will automatically get OFF. Again to turn it ON consumer has to visit webpage again to increase threshold value. For practical purpose increment and decrement of threshold can be done by +5units or -5units. Normally, basic unit of electricity is Kilowatt hour (KWh).

1kWh = 1000 watt for 1 hour.

Example- Ten, 100watt bulbs used for 1 hour gives 1kWh.

VI: - CONCLUSION AND FUTURE SCOPE

An attempt has been made to make a practical model of 'IOT' Based Smart Energy Meter.' The propagated model is used to calculate the energy consumption of the household, and even make the energy unit reading to be handy. Hence it reduces the wastage of energy and brings awareness among all. Even it will deduct the manual intervention. Various applications of this project includes Old age person or woman Safety, Vehicle tracking, Vehicle safety during emergency, Remote Energy auditing, Remote device controlling, mobile phone based device controls and increasing energy efficiency of industry or house-holds. In future this project can be integrated with advance 'IOT' systems and can be implemented in all households which will lead to huge energy savings on national level.

References

[1]. Sanket Thakare, Akshay Shriyan, Vikas Thale, Prakash Yasarp, Keerthi Unni '' Implementation of an Energy Monitoring and Control Device based on IOT ''Electronics and Telecommunication Engineering F.C.R.I.T. Vashi-400703, India.

[2]. P. Siva Nagendra Reddy, ''An IOT based Home Automation Using Android Application'' Assistant Professor, Department of ECE, Kuppam Engineering College, Kuppam, Chittoor, A.P, India.

[3]. Vishwajeet H. Bhide, "A Survey on the Smart Homes using Internet of Things (IOT)", International journal of advance research in computer science and management studies, volume 2, issue 12, December 2014.

[4]. Ahmed ElShafee, Karim Alaa Hamed , "Design and Implementation of a Wi-Fi Based Home Automation System", World Academy of Science, Engineering and Technology International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:6, No:8, 2012.

[5]. Satish Palaniappan et all, " Home Automation Systems – A study", International Journal of Computer Applications (0975 – 8887) Volume 116 – No. 11, April 2015

[6]. Vinay sagar K N ,Kusuma S M, " Home Automation Internet of Things", International Research Journal of Engineering and Technology (IRJET) , Volume: 02 Issue: 03 | June-2015.

[7]. Mamata Khatu et all , " Implementation of Internet of Things for Home Automation", International Journal of Emerging Engineering Research and Technology Volume 3, Issue 2, February 2015, PP 7-11.

[8]. Rajeev Piyare, " Internet of Things: Ubiquitous Home Control and Monitoring System using Android based Smart Phone", International Journal of Internet of Things 2013, 2(1): 5-11.

[9]. Ashwin Agarwal / Pivotal Inc., Bala Thumma / Synopsys Inc., Koushik Rajan / Yahoo Inc., Murali Repakula / Juniper Networks, Inc, "Internet Of Things at Home", Insights in Engineering Leadership White Paper.

[10].P BHASKAR RAO, S.K. UMA, "Raspberry Pi Home Automation With Wireless Sensors Using Smart Phone", International Journal of Computer Science and Mobile Computing, IJCSMC, Vol. 4, Issue. 5, May 2015, pg.797 – 803.

[11].Subhajit Dey ET all, "Web Based Real-Time Home Automation And Security System", International journal of electrical and electronic engineering and telecommunications, Vol. 4, No. 3, July 2015.