IoT Based Power Monitoring System For Rular Development

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Abstract:

Background: More than seventy percent Indian people live in villages. Their main occupation is agriculture. Internet of thing can bring a revolution by empowering millions in rural areas and connecting rural people to the mainstream India. This project focuses on the current scenario of Internet of thing in rural India, the issues mainly faces by the rural India and how the IoT is providing solutions to the problems of rural people. For this we design power management system. This system is capable to measure and analyse the electrical parameters like current, power and energy consumption of each loads. IoT software application `ThingSpeak' is used to obtain the real-time data of electrical parameters. By using this data, the consumer as well as electrical power companies in smart grid paradigm better manages the power consumption by reducing billing costs.
Key Word: thingspeak,ArduinoBCMGPIO

I. Introduction

For centuries, the progress of revolution has been consistent. Technology has been advancing at a rapid pace. The Internet of Things (IoT) is one such revolution. IoT often been dubbed as Fourth Industrial Revolution. The ratio of rural to urban population has always been substantially skewed towards the rural end of the scale. Even now, approximately seventy percent of India's population or more than 80 million people can be categorized as rural. The rural population is more cut off from modern culture and humanity than it has ever been. In such a setting, IoT may easily be the technology that aids in the construction of bridges between India's urban and rural areas. IoT has the potential to play a major role in the development of rural ecosystems by providing rural India with the same benefits as urban India. The Digital India campaign intends to connect rural and urban India through IoT, and it is an ambitious efforts that aspires to eliminate social and economic difficulties as one of its major visions. IoT is a ray of hope that could lead to a more empowered nation.

II. IOT based Power Management

Issues Mainly Faces By Rural The India : Government has now announced the electrification of all inhabited census village. Only over 20,000 families remain unconnected, according to the latest statistics on the Soubhagya website. Aside from the lack of links, the rural population faces a number of difficulties. For example, Data on difficulties with electrical supply quality is scarce. According to available statistics, metering, billing, and payment issues are at the top of the list. There are excessive delays in issuing invoices to newly connected families, as well as billing errors, meter malfunctions, and issues paying bills. Billing delays and errors result in extremely large bills etc. By observing all issue of rural India we design aIoT based power management system. In this system the cost and regular usage of the load connected to the system are monitored by the user to overcome the high bill. The IoT based power management system shows the amount of units consumed by the each load and this power consumption data transfer to both consumer and electrical board. So this helps in reducing man power. The IoT used to turn on/off the appliances used by the consumer in household, agriculture, dairy etc, by using relay and Arduino interfacing.

Objective of the Power Management :
1. Observe the electricity consumption by eachload in household as well as in agriculture, dairy etc.
2. By observing the consumption calculate the power and cost for power consumption of each device.
3. Collect monthly data of power consumption of each load.

4. By using thingspeak software analyzed and observed data and manages the power consumption to reduce the billing cost.
5. By using proper scheduling, we can also reduce the power consumption.

III Literature Survey

Monitoring System : TheNowadays people's dependency on electricity is extreme in urban as well as rural area. As power consumption has grown for past few years [1].The traditional power system is transformed into an intelligent, secure, reliable as well as efficient smart grid [2].The residential regions are made up of small energy consumers as well as users, such as houses, apartments etc. The research suggested that the residential electricity consumers [5] waste 41% of the power supplied to their homes. Several research have been shown that on average
saving of 7.8% to 16.7% household electricity can be achieved by using a home electricity monitoring system [6][7].Various case studies have been shown that electricity consumption can be reduce by modifying the lifestyle with proper habits as well as behaviorsof the consumers[8][10].The electricity monitoring system can help users or consumers to monitor their usage of electricity in efficient way. Improvement of power efficiency usage can be made by reduce due to changing habits of consumers [8].
In this modern era, monitoring systems must sort out the data, record the data in system, exploit them to get the inherent information shown in legit and innovative ways as well as access the internet to efficiently visualize it[9].A power monitoring system can be considered a user-friendly as well as unified solutions for authentic electricity management [10].This system can help users to change their behavior by providing real time feedback[11]
ControlSystem : The control system is the system which can control other things depending on which thing need to be controlled.Local control is an action in which the control unit will take action on its own, and remote control is a mechanism which remotely controls the IoT based system[11].Electrical equipment's operational status monitoring will reduce the cost of building power consumption as well as increases the building electrical energy to a reasonable as well as efficient ratio[12].
IoT Technology: Technology is one of the main cause for a country to become a well-developed country.
Innovations and technology can change people's lives and make the world more sustainable. IoT i.e. Internet of Things is a new and ever-growing network that is hot topic in peoplesconversations in the era of modern technology. IoT is a extensive and complete network of smart as well as intelligent objects which has full capability and capacity to share information, data,resources and act and react to any circumstances or atmosphere of the changing environment[13]. IoT has extemporized our quality of life and also can reduce the unessential costs of daily life. This wellness system has been implemented for many prominent things like monitoring and controlling the electricity at household.Using cloud server's home gateway, information is uploaded to the website by a server.Howeversecurity and privacy challenges have been increased due to the reliability and dependability issues of the internet.Thisis because of some connections between cyber environment and physical environment to fulfill the demands of the consumers. It is speculate that these problems will indeed be solved in the future[13]as shown in fig.2

Fig. 1. Final information uploading delay for cloud and local home gateway approach[13]
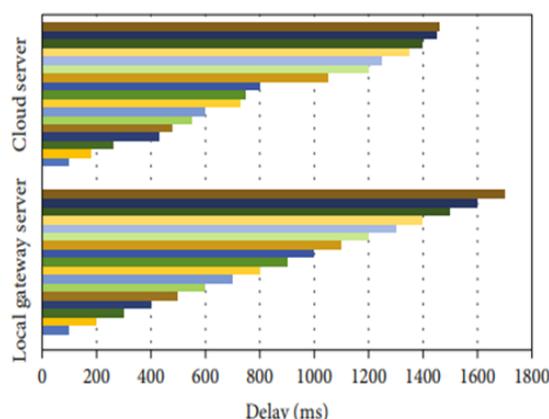
 Existing System : Existing system is the home electricity control and monitoring system where the system was developed as an embedded micro web server and a remote application by using a smartphones. The aimed of the

project is reducing bill costs and saving electricity. Other than that, this system need to control the devices and the home environments were also being monitored to maintain the amount of desired electricity consumption. Arduino UNO with the ESP 8266 WiFi module and the clamp current transformer with relay have been used for monitoring the appliances. A different AT command should also be presented by GSM-based communications as well as home control. The drawback of the system is that consumers are not given any user interface to display, as well as users have to remember the AT command to control the connected devices.

Proposed System

In propose system we use raspberry pi module rather than WiFi module and Arduino board. Because raspberry pi has built in WiFiconnectivity feature. We design a system which monitor the current, power of each load at anytime from anywhere with the help of IoT. The proposed system also calculate bill for amount of power consumed by each load in real time. For analysis of load information we also use a software application `ThingSpeak'. The stored load information enables consumers to note the load data on laptop, smartphone and computer. The stored data gives load patterns, provides dynamic billing and also support raised to manage the demand and provide of electricity. In propose system we used 16 Gbytes memory, high processing speed, stronger Processing power than the microcontroller. Also the proposed system is easy to execute some tasks such as scheduling and database storage, real time energy cost and with the use of scheduling, it is possible to reduce power consumption.

IV. System Design

Fig. 2.block diagram for IoT based power management system
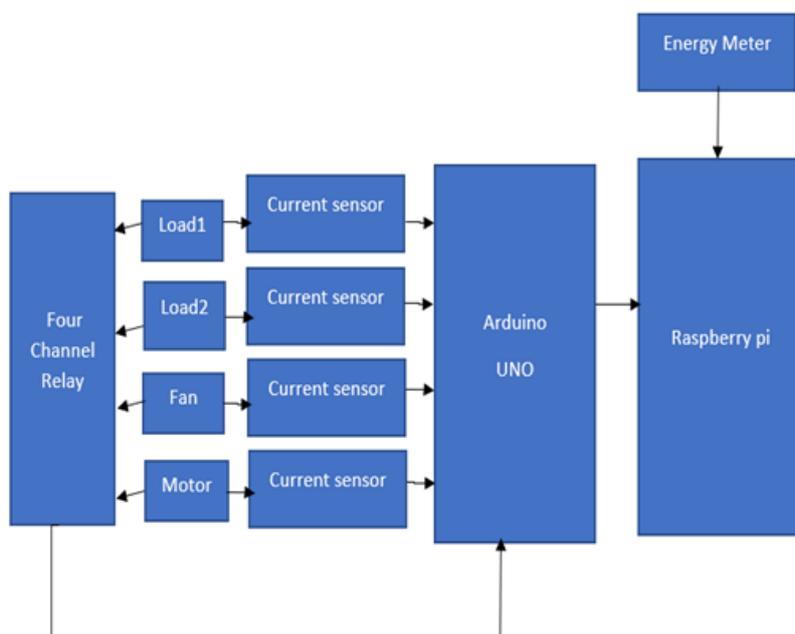
Figure 3.1 depicts the system design for an IoT-based power management system. The system consist of Energy meter, Raspberry pi, Arduino UNO, current sensor, loads such as light bulbs, fan, motor etc. and four channel relay. This system is based on the Internet of Things (IoT).The raspberry pi serves as the hub for all of the devices. The web interface is meant to access the Raspberry Pi's specific IP address. The sensor provides isolation between load and measuring part of the microcontroller. The output of the sensor is analog in nature. The raspberry pi unable to read analog signal Because of this we use Arduino UNO. So it is fed to the Arduino. The Arduino UNO has ADC feature, due to this feature the analog signal converted into digital signal and this digital signal given to raspberry pi GPIO input pin. The power management system is an internet-connected network of hardware, communication, and electronic interfaces that allow devices to communicate with one another. Each item includes a sensor and is connected to the internet via WiFi, allowing us to control them from anywhere in the world using our smartphone or tablet. This System allows us to turn on or turn off the load of the system, no matter where we are. A four-channel relay interface board was also used in the system to control

various appliances and other high-current equipment. It can be controlled directly with 5V logic signal from microcontroller.

Flow Chart For Arduino Interface With Raspberry pi:
On Arduino :
1. Define analog pins for analog sensors.
2. Initiate digital pins as a outputs.
3. Collect data from analog sensors by using the analog read() function.
4. Print value on the serial monitor.
5. Send signal to raspberry pi if predefine condition is met.
On Raspberry pi:
1. Import the required libraries.
2. Set the BCMGPIO numbering.
3. Define input pins to get data from Arduino as a digital output.
4. Set up input pins.
5. Initiate the loop.
6. Obtain information as a digital output value from Arduino by using digital input pins on Raspberry pi.
7. Print value.
8. Define conditions if needed.

Algorithm for Controller
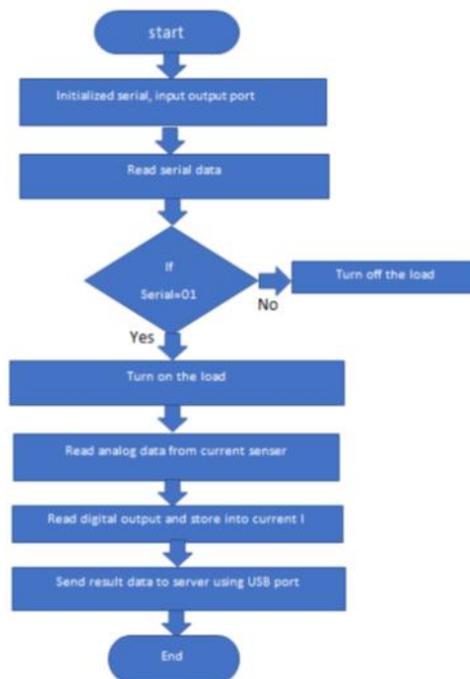
Fig:3Algorithm for Controller

Algorithm for Python
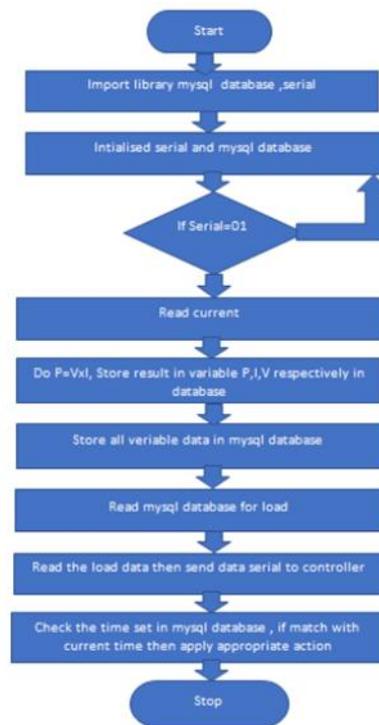
Fig:4 Algorithm forPython

V. Result Analysis

Software Requirements
- Python IDE : Python IDE (Integrated Development Environment) is a program dedicated to software development. Python IDE integrates several tools specially designed for software development.These tools usually include:
  - Editor design to handle the code (for e.g Syntax, Highlighting and Auto completion).
  - Build, Execution, Debugging tools.
  - Some form of source control.
- Network IP Scanner : The IP address of the devices is scanned using a network IP scanner.
- VNC Viewer : The Raspberry Pi can be controlled remotely via a GUI using the VNC viewer.
- Operating System-Apache : The operating system through which we interact with the pi. Apache is one of the most popular web server available for Raspberry pi.

Programming Language
Python : Python is a high-level computer language that is commonly used for general-purpose programming. Python's syntax enables programmers to convey ideas in fewer lines of code.

Result Steps
1. Search IP address of the device by using Network IP scanner.
2. Open VNC viewer and enter the IP address of the Device to access WiFi.
3. Open the file with Python program and run the program.
4. Open the Browser and login the page.
5. Set the Timing of the load and submit.
6. Check the code is running and see the result.

Fig:4 Algorithm for Python

VI. Conclusion

In this project by observing the rural issues we proposed and developed an IoT based power management system for rural development. This system was designed and built to give a practical and essential solution for power monitoring and control. The proposed system did a better job of assessing power use and managing proper power usage without wasting energyThe proposed system design uses a Raspberry Pi with an integrated WiFi module for hardware, and all communication is done through the Raspberry Pi, with data being displayed on a web server and a mobile application. The data is also tracked in real time and over time to see where it was saved in the database. Consumers can check consumption rates more easily from this system.

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