ZigBee-Based Communication System for Data Transfer within Future Micro grids using Rasberry Pi

Cheemalamarri Revathi
Assistant Professor,
Dept of ECE,
**Sagar Goup of Institutions, Chevella, R.R.Dist.**

Abstract:

By embedding computational capabilities in all kinds of objects and living beings, it will be possible to provide a qualitative and quantitative leap in several sectors: healthcare, logistics, domestics, entertainment, and so on. Due to the drastic changes in technology in the last decade, so many advancements were introduced in electricity departments. The electricity bill can be paid now through E-Seva centers, Net-banking and even through mobile phones.

Literature Survey:

Existing Method:

In this project electricity consumption by the user i.e. Units consumed in that meter will displayed on 16X2 LCD is provided to read units available. Whenever there is a change in count value / units in the meter gets changed.
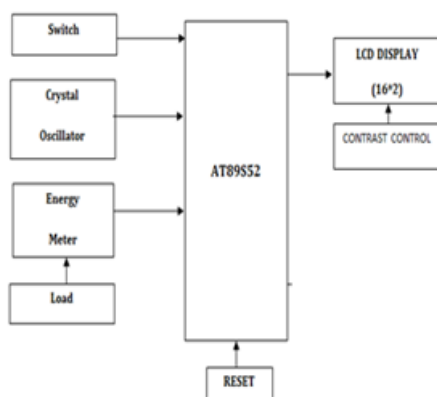

Drawback:

There is no wireless communication.
More power consumption by controller used.

Proposed System:

In this project electricity consumption by the user i.e. Units consumed in that meter will be sent to PC using zigbee module and also 16X2 LCD is provided to read units available. Whenever there is a change in count value / units in the meter gets changed, these values are displayed on LCD. Here we are using zigbee for the purpose of communication.

Block Diagram:
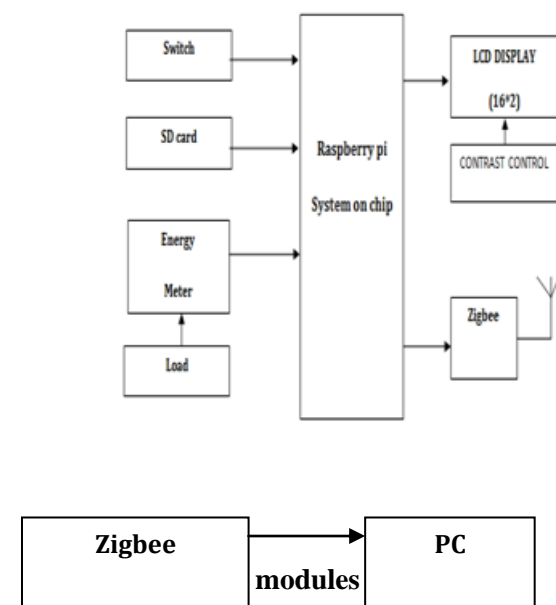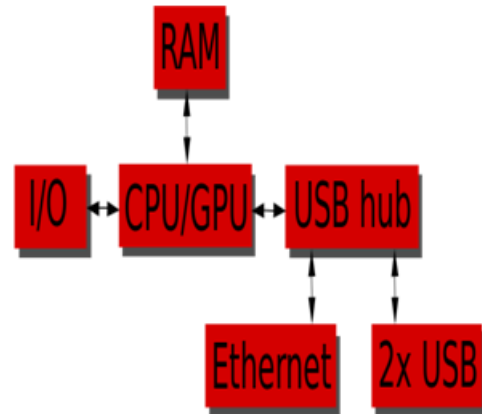
A. RASPBERRY-PI:

The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools. The Raspberry Pi is manufactured through licensed manufacturing deals with Newark element14 (Premier Farnell), RS Components and Egoman. All of these companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pis by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers.

Features:

- System Memory – 1GB LPDDR2
- Storage – micro SD card slot (push release type)
- Video & Audio Output – HDMI and AV via 3.5mm jack.
- Connectivity – 10/100M Ethernet
- USB – 4x USB 2.0 ports, 1x micro USB for power
- Expansion
  2×20 pin header for GPIOs
  Camera header
  Display header
- Power – 5V via micro USB port.
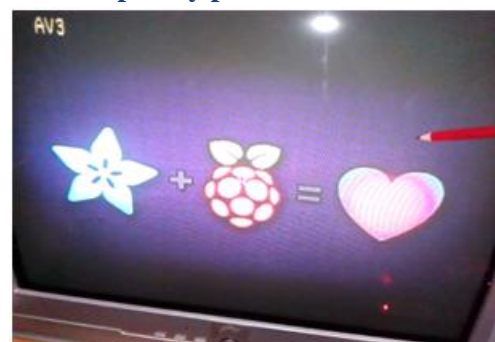- Dimensions – 85 x 56 mm
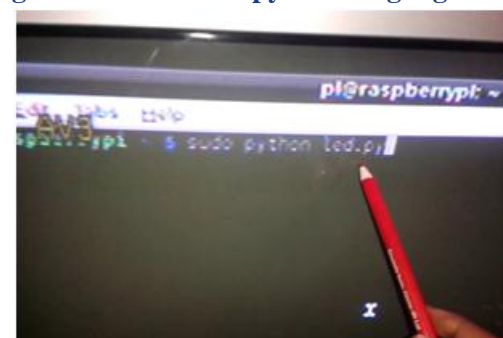
Basic Hardware of Raspberry-PI:

SD card is shown

OS used in Raspberry pi is Linux

### Coding will be done in C/python language

Raspbian OS:

The Raspberry Pi primarily uses Linux kernel-based operating systems. Raspbian is an unofficial port of Debian Wheezy arm with compilation settings adjusted to produce code that uses "hardware floating point", the "hard float" ABI and will run on the Raspberry Pi. The port is necessary because the official Debian Wheezy armhf ((**ARM hard float**) refers to an ARM architecture with the additional floating point hardware Vector Floating Point (VFP). Software packages and cross-compiler tools use the armhf vs. arm/armel suffixes to differentiate.) Release is compatible only with versions of the ARM architecture later than the one used on the Raspberry Pi (ARMv7-A CPUs and higher vs. the Raspberry Pi's ARMv6 CPU). It provides some available deb software packages, pre-compiled software bundles. A minimum size of 2 GB SD card is required for Raspbian, but a 4 GB SD card or above is recommended. The downloaded Raspbian "wheezy" image file has to be unzipped and then written to a suitable SD card, formatting it for use.

Diagram of API-Connection:
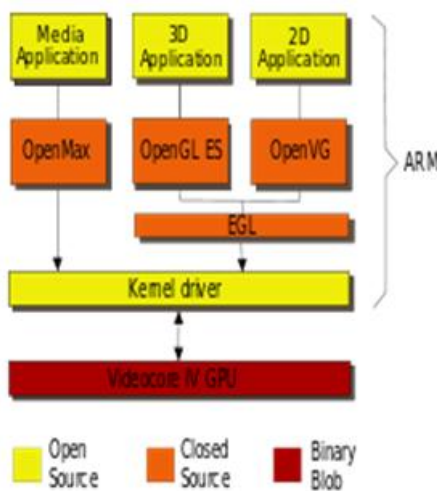
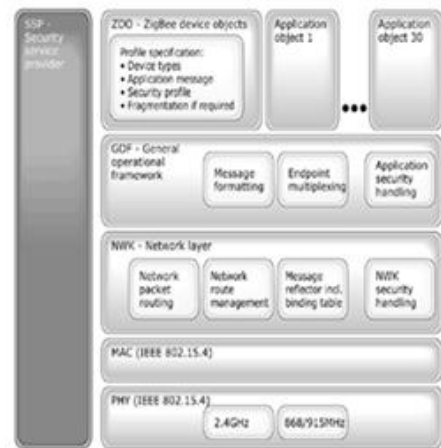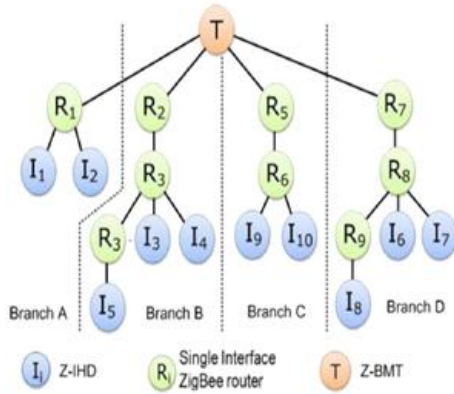### B. Zigbee
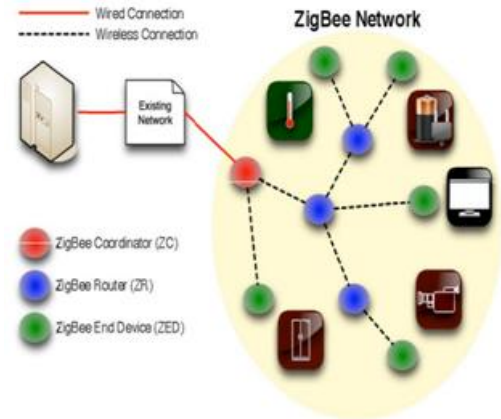
It is the wireless device for transmitting and receiving purpose or simply it called as Transceiver. Zigbee is based on the IEEE802.15.4 protocol. The range of the Zigbee is covered as 100m. It range is 10 times better than bluetooth device so it can be more preferable one in wireless device. The data rate is very low for transmission while using this device.

ARCHITECTURE:

Unlike Bluetooth or wireless USB devices, ZigBee devices have the ability to form a mesh network between nodes. Meshing is a type of daisy chaining from one device to another. This technique allows the short range of an individual node to be expanded and multiplied, covering a much larger area. Zigbee offers full wireless mesh networking and supports approximately 65,000 devices on one network. It can connect the very large range of devices in an industry into a single network.

Technical Specifications of Zigbee:

- Frequency band 2.400 — 2.483 GHz
- Number of channels 16
- Data rate 250 kbps
- Supply voltage 1.8 – 3.6 V
- Flash memory 128 kB
- RAM 8 kB
- EEPROM 4 kB Operating
- Temperature -40 — +85 °C

C. Grid:

The term grid usually refers to a network, and should not be taken to imply a particular physical layout or breadth. Grid may also be used to refer to an entire electrical network, a regional transmission network or may be used to describe a sub network such as a local utility's transmission grid or distribution grid.

D. 16x2 LCD:

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:


1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.

Ease of programming for characters and graphics.
LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).

Command	RS	RW	D7	D6	D5	D4	D3	D2	D1	D0	Execution Time
Clear display	0	0	0	0	0	0	0	0	0	1	1.64mS
Cursor home	0	0	0	0	0	0	0	0	1	x	1.64mS
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	40uS
Display on/off control	0	0	0	0	0	0	1	D	U	B	40uS
Cursor/Display Shift	0	0	0	0	0	1	D/C	R/L	x	x	40uS
Function set	0	0	0	0	1	DL	N	F	x	x	40uS
Set CGRAM address	0	0	0	1	CGRAM address						40uS
Set DDRAM address	0	0	1	DDRAM address							40uS
Read "BUSY" flag (BF)	0	1	BF	DDRAM address							-
Write to CGRAM or DDRAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	40uS
Read from CGRAM or DDRAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	40uS

II. PERFORMANCE EVALUATION:

The performance evaluation is divided into two parts: ZigBee mesh floor (horizontal communication) network and BN (vertical communication).
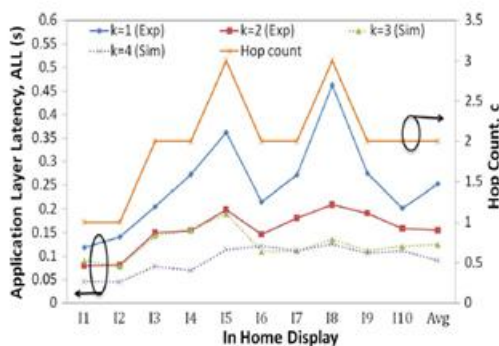
ALL and c of $I_1 - I_{10}$ for $k = 1–4$ and $n = 1$.

III. ADVANTAGES:

1. Ease of maintenance
2. Accessing the data from other place
3. Less power consumption
4. Very faster communication

IV. APPLICATIONS:

1. Industrial Automation
2. Weather stations
3. Agricultural

V. Conclusion:

To facilitate efficient deployment of metering for existing buildings this concept is very helpful using Raspberry pi and Zigbee.

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