Internet of Things Based Home Automation Over Powerline Communication

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Abstract **- We give an overview of the IoT Technology over Existing power line (Power Line Communication) it used to transfer the iot data over it. Its standards and an overview of to control home appliances and streetlights. this will be helpful to control IoT devices and sensors. In this part I will concentrate on the PLC applications and demonstrate issues regarding it. another part is read the power line data with the help of raspberry pi device to control relays.**

Index Terms **- Latest Technology, Power Line Communication, Internet of Things, Raspberry pi, Serial communication.**

1.INTRODUCTION

The electricity that powers homes worldwide is known as AC – alternating current – electricity. Rather than flowing directly between a pair of terminals, AC current oscillates, and the number of cycles per second is expressed as hertz. The frequency of generated electricity isn't the same in every country, but it is a uniform varying different countries 50 - 60 Hz. In general, electromagnetic energy consists of oscillating waveforms, and the frequency of the oscillations, expressed as Hz, determines the characteristics of the radiation. Power-line communications technology can use the electrical power wiring within a home for home automation: for example, remote control of lighting and appliances without installation of additional control wiring. Typically, home-control power-line communication devices operate by modulating in a carrier wave of between 20 and 200 kHz into the household wiring at the transmitter. The carrier is modulated by digital signals. Each receiver in the system has an address and can be individually commanded by the signals transmitted over the household wiring and decoded at the receiver. These devices may be either plugged into regular power outlets, or permanently wired in place.

2. PLC APPLICATIONS

A wide range of power-line communication technologies are needed for different applications, ranging from home automation, Internet Connection.

3.UART ARCHITECTURE

A universal asynchronous receiver/transmitter (UART) is a block of circuitry responsible for implementing serial communication. Essentially, the UART acts as an intermediary between parallel and serial interfaces. On one end of the UART is a bus of eight-or-so data lines (plus some control pins), on the other is the two serial wires - RX and TX.

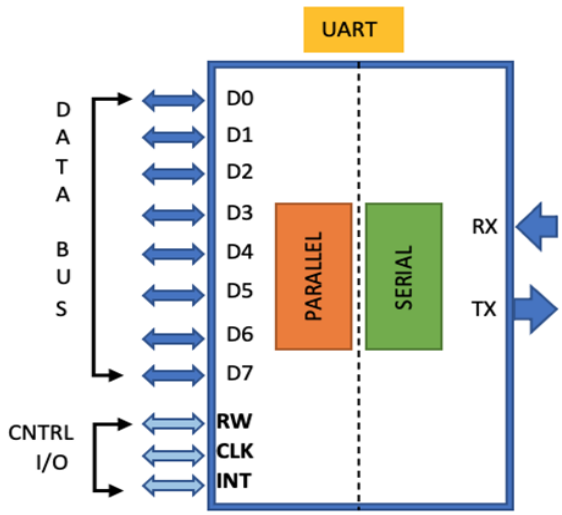

Fig.1 UART Architecture

As the RX and TX in the acronym dictate, UARTs are responsible for both sending and receiving serial data. On the transmit side, a UART must create the data packet - appending sync and parity bits - and send that packet out the TX line with precise timing (according to the set baud rate)

3.1UART Wiring Hardware

A serial bus consists of just two wires - one for sending data and another for receiving. As such, serial devices should have two serial pins: the receiver, RX, and the transmitter, TX. It's important to note that those RX and TX labels are with respect to the device itself. So the RX from one device should go to the TX of the other, and vice-versa. It's weird if you're used to hooking up VCC to VCC, GND to GND. The transmitter should be talking to the receiver, not to another transmitter.

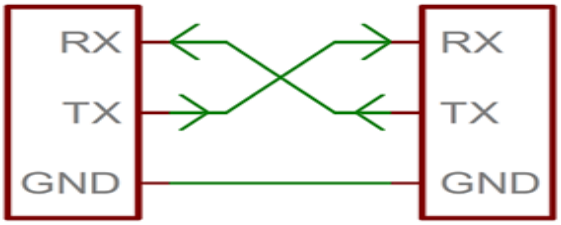

Fig.2. Rx and Tx

3.2 Serial DATA Frame

The synchronization bits are two or three special bits transferred with each chunk of data. They are the start bit and the stop bit(s). True to their name, these bits mark the beginning and end of a packet. There is always only one start bit, but the number of stop bits is configurable to either one or two (though it's commonly left at one). The start bit is always indicated by an idle data line going from 1 to 0, while the stop bit(s) will transition back to the idle state by holding the line at 1.

Fig.3. Serial Data Frame

4.POWER LINE CARRIER MODEM (KQ330)

KQ-330 Power Line Carrier module is designed to communicate between two devices through a Power line (e.g 220V power line) without any extra components. The PLC can transmit the broadband data via the power lines, which are suitable for either residential (at-home) or commercial (offices, apartments, hotels, warehouses) network applications, which utilize power lines. No need to install new wires anymore or you can connect the internet anywhere with the PLC. These adapters enable the effortless creation of a high-speed network that supports video, voice, and data. Power line communication (PLC) carries data on a conductor that is also used simultaneously for AC electric power transmission or electric power distribution to consumers. It is also known as power line carrier, power-line digital subscriber line (PDSL), mains communication, power line telecom (PLT), power line networking (PLN), and broadband over power lines (BPL)

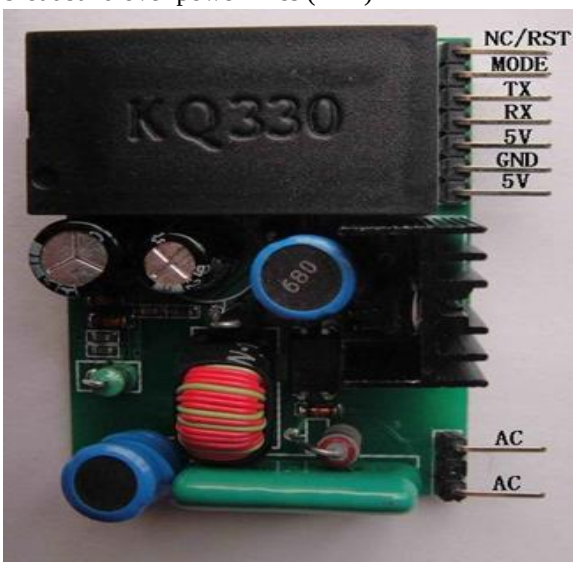

Fig.4.PLC Module

5.RASPBERRY PI GPIO

The Raspberry pi is a single computer board with credit card size, that can be used for many tasks that your computer does, like games, word processing, spreadsheets and also to play HD video. All GPIO pins revert to general-purpose inputs on power-on reset. The default pull states are also applied, which are detailed in the alternate function table in the ARM peripherals. The normal rising/falling edge detection has a small amount of synchronisation built into the detection. At the system clock frequency, the pin is sampled with the criteria for generation of an interrupt being a stable transition within a three-cycle window, i.e. a record of '1 0 0' or '0 1 1'. Asynchronous detection

bypasses this synchronisation to enable the detection of very narrow events.

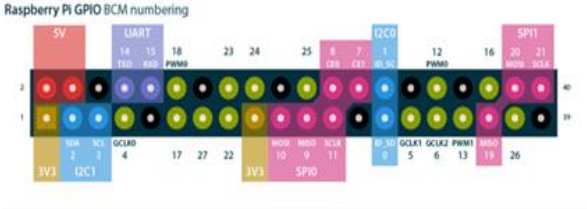

Fig.5.GPIO Pin

Almost all of the GPIO pins have alternative functions. Peripheral blocks internal to BCM2835 can be selected to appear on one or more of a set of GPIO pins, for example the I2C busses can be configured to at least 3 separate locations.

6. WORKING BLOCK DIAGRAM

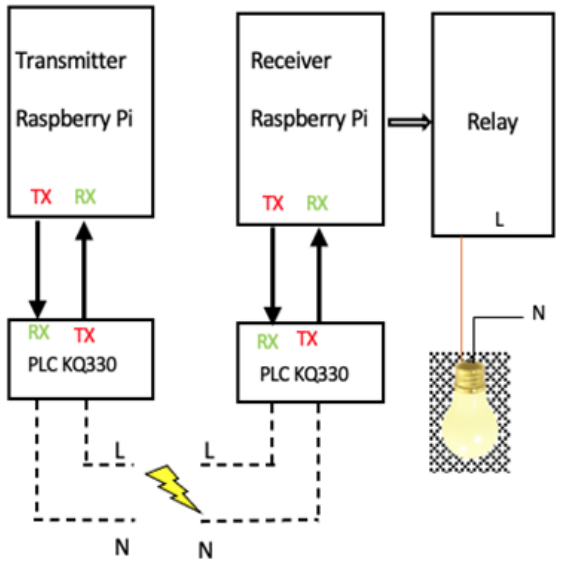

Fig.6.Block Diagram

7. TRANSMITTER PROGRAM

```
#!/usr/bin/python3
import time
import serial
import datetime
ser = serial.Serial(
port='/dev/ttyAMA0',
baudrate = 9600,
parity=serial.PARITY_NONE,
stopbits=serial.STOPBITS_ONE,
bytesize=serial.EIGHTBITS,
timeout=1
)
counter=0
on   = "1"
off = "0"
while 1:
state=input ("Enter Relay Mode: ")
print (state)
ser.write(state)
time.sleep(1)
```

7.1 Receiver Program

```
#!/usr/bin/python3
import RPi.GPIO as GPIO
import time
import serial
import string
import re
x=1
ser = serial.Serial(
port='/dev/ttyS0',
baudrate = 9600,
parity=serial.PARITY_NONE,
stopbits=serial.STOPBITS_ONE,
bytesize=serial.EIGHTBITS,
timeout=0.09
)

GPIO.setmode(GPIO.BCM)
relay = [23]
tm = 2
while x != 0:
y=ser.readline()
txt = y.decode('utf-8')
print(y)
for i in range(5):
    if "1" in txt:
        GPIO.setmode(GPIO.BCM)
        GPIO.setup(relay, GPIO.OUT)
        GPIO.output(relay, GPIO.HIGH)
        print("Relay is ON")
        time.sleep(tm);
        GPIO.cleanup()
    else:
        print("Relay is OFF")
```

8.DESIGN & OUTPUT

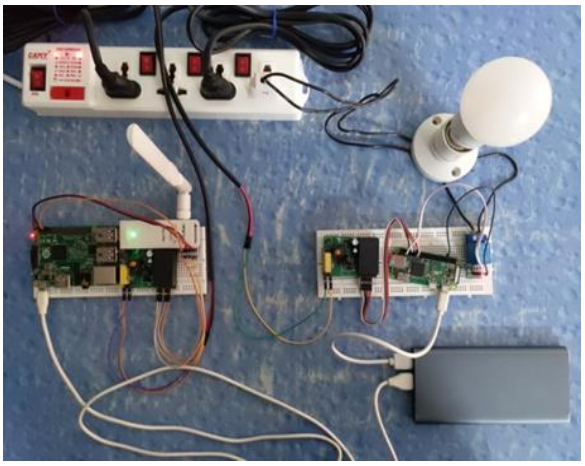

Fig.7.LED Off Condition

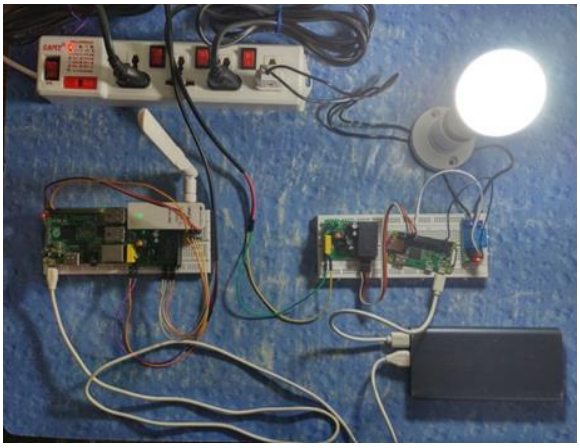

Fig.8.LED ON Condition

9. ADVANTAGES

- Used in Existing Power lines
- Easy to install.
- Control Street Lights in small city range up to 2Km.
- Control Anywhere over internet

10. APPLICATIONS

- Control Home Appliances
- Control Street Light
- Smart Meter reading

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