

Review of IoT Based Home Automation System Using Lora Wan Technology

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Abstract

Our surrounding i.e., Home and civilization are surrounded by “things” which are associated to each other, like wise directly or indirectly via internet of things. IoT helps for controlling and monitoring the appliances remotely with accuracy within the network which is needed the key factor in the process of automation. There are several aspects in the automation that needs to be developed and enhance it. This research gives an explanation for correct and undeviating authority and automatic detection of current state of devices with the use of android application. Lora WAN technology comes up with applied implementation of domiciliary and industrial automation and observance system with higher efficiency as compared to other technologies. The systems based on Lora WAN web work have large range and minimum power consumption with data transmission from sensor node to cloud service. The system of web services is highly scale able and utilizes data stream for analytics purposes. This system is robust to interference.

Keywords: *Domiciliary and Industrial Automation, Internet of Things, LoRaWAN, Low Power Consumption, Sensor Node*

INTRODUCTION

Internet of things (IOT) may be very difficult to interpret but it can be expressed as a system of closely or loosely

computing devices, cognate, mechanical and digital machineries, animals or people that have been uniquely marked with acquirer. The idea of IoT was given birth

to from the union of technologies that had been in existence for decemvirate. These technologies involve electromechanical systems, wireless automation and the internet. Using the design of IoT to develop automation has become a thing to desired and have implemented. As with every technology, automation is in its enlargement stages and as such needs a lot of researches and intakes from industries, academia and professionals alike. The Long-Range Wireless Area Network i.e., LoRaWAN is the latest technology which is highly efficient and simple for the automation applications.

By the use of LoRaWAN technology, the gadgets, huge machineries, agricultural pumping equipments, etc. can be control and check status of the gadgets using internet of things i.e. IoT and LoRa module. In this system, the status of the entire running system i.e., electrical parameters like voltage, current, power, power factor, phase sequences, etc., mechanical parameters, temperature, switching, etc. can be control wirelessly using LoRa. The LoRa system owns very large range of 0 KM to 100 KM without internet facility and can have broad network with the approach of IoT. In this system, there are two transceivers, one is LoRa module and other is IoT server

which is located anywhere in the system and using internet gadgets can be control and monitor easily.

So, it is solution for all the problems regarding real time monitoring system for domiciliary, industrial and agricultural pumping systems, etc. thus, with the use of modern techniques in society must be equipped with sufficient usage of resources.

In a recent enlargement, different communication alternatives had been employed in IoT repositioning for various controlling and monitoring applications. These technology includes RFID, Zigbee, WSN, Cellular systems (GSM, 3G, 4G, VoLTE, etc.).

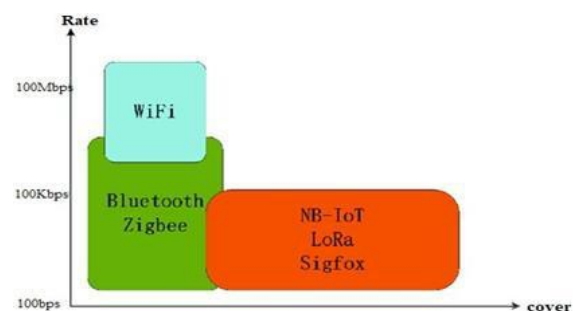


Fig.-1: Comparison of Different Communication Technologies for Data Transfer Rate and Communication Range

There are many defects in monitoring gadgets using these technologies which

include lowest efficiency in terms of energy, higher cost, short range communications, etc. Fig.-1. shows the comparison of different communication technologies for data transfer rate and communication range.

PROPOSED SYSTEM

In presented system, IoT based appliance control and monitoring system using LoRaWAN technology is the Long-Range Wide Area Network which transmit and receive information over longer distances wirelessly with more efficiency and low expenditure and low maintenance. For

controlling the gadgets IoT can be the best choice, but it has certain defects which are overcome by simply using the LoRa module. In this system, using transceiver system LoRa modules transmit and receive data and microcontroller take decision on command send by user and switch on the relay system. It is large range system that s transmits data wirelessly which ranges up to 20KM to 100KM depends totally on bandwidth. Fig.-1.1 shows block diagram of Review of IoT based appliance control and monitoring system using LoRaWAN technology.

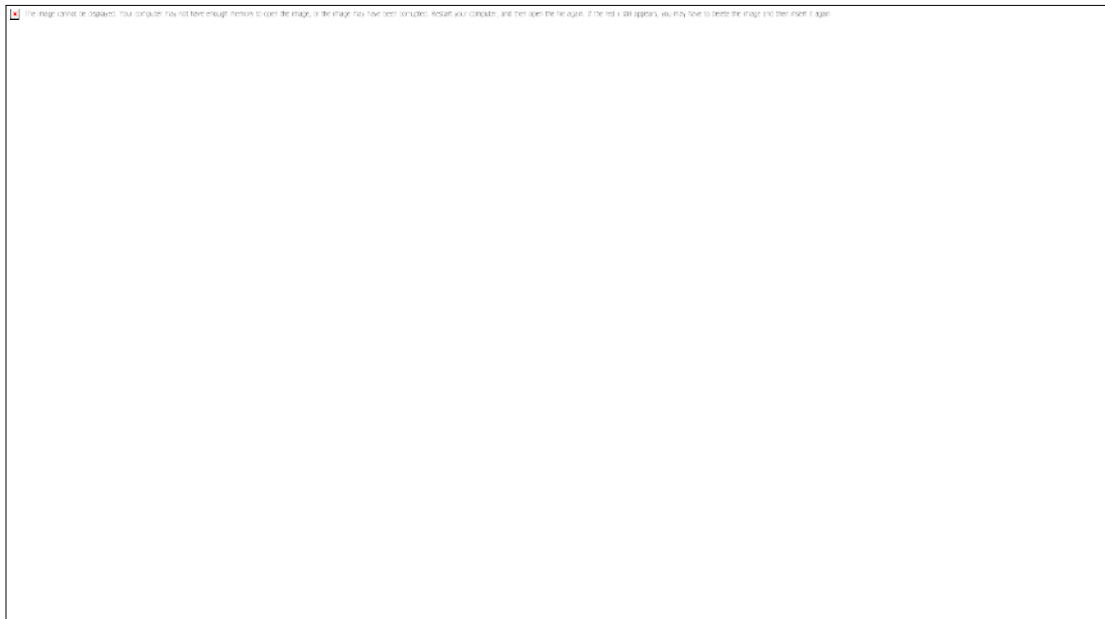


Fig.-2: Block Diagram of Review of IoT Based Appliance Control and Monitoring System Using LoRaWAN Technology

The three main components used in the block are LoRa module, IoT server, Magnetic relays and Microcontroller. IoT server is applied to make communication between transmitter and receiver. LoRa module is the module which establish wireless, large range communication between controlling site to server and service is at no cost. User send command to the server; server read the command and perform desired action on the command and feedback send to user. The system have two parts i.e., transmitter and receiver which is connected to the IoT server. Relays are electromagnetic switches which are used to open and close the circuit. Circuit also pushes the sensors which senses the failures and if fault occurs, opens the circuit immediately.

HARDWARE DESCRIPTION

Microcontroller ATmega328P

The ATmega328P is a with less power high performance CMOS 8bit microcontroller with 32k bytes of in-system programmable flash memory. It also contains of 1 KB EEPROM, 23 general purpose I/O lines, 2 KB SRAM, 32 general purpose working registers, internal and external interrupts, three flexible timers with compare modes, serial programmable USART, a byte-oriented SPI serial port, 6 channels 10-bit A/D

converter, 2 wire serial interfaces, programmable watchdog timer with internal oscillator and five software selectable power saving modes algorithm. This system consists microcontroller as brain of the system.



Fig: 3 Microcontroller ATmega328P

IoT Server Esp32

ESP32 is a series which requires minimum power and pushes lower-cost system on chip microcontrollers with integrated dual-mode Wi-Fi and Bluetooth (BT). The ESP32 series engages a Tensilica Xtensa LX6 microprocessor in both single-core and dual-core alteration and includes built-in antenna switches, power amplifier, low-noise receiver amplifier, RF balancing, filters, and power management modules & it is developed by Espressif Systems. Here ESP32 is used as IoT server.



Fig.-4: IoT Server ESP32

Lora Module

LoRa (LoRa) is a low power wide area network (LPWAN) protocol design and manufactured by semtech technologies. It is based on spread spectrum modulation techniques getting from the chirp spread spectrum (CSS) technology. LoRa module operates on technology named LoRaWAN that is the communication protocols and system architectonics for the networks, while the LoRa systems corporal layer enables the large-range communication links.

LoRaWAN also controls the communication frequencies, power, and data rate for all devices. Devices in the network are asynchronous and bring when they have data accessible to send. Data convey by an end-node device is composed by multiple gateways, which forward the data packets to a centralize network server. The network server filters duplicate packets, carryout security checks, and control the network. Data is the forwarded to supplication servers. The technology shows extreme reliability for the moderate load; however, on basis of administration, it has some issues related to sending acknowledgements.

LoRa uses license-free spectrum sub-gigahertz radio frequency bands like 915

MHz, 868 MHz (Europe), 433 MHz (Australia and North America), 865 MHz to 867 MHz (India) and 923 MHz (Asia). LoRa authorize long-range data transmissions (more than 10 km in rural areas) with minimum power consumption. The technology occupies the physical layer, while other protocols and technologies such as LoRaWAN (Long Range Wide Area Network) occupy the upper layers. It can achieve data rate from 0.3 Kbps to 27 Kbps depending upon the spreading factor.

New LoRa chipsets were invented with lowest power consumption, highest transmission power, and with small size compared to older generation. Lora s devices have Global Capabilities used for the trilateration locations of gadgets via timestamps from gateways. LoRa and LoRaWAN allows long-range connectivity for Internet of things (IoT) devices in different kinds of industries. Range extenders of LoRaWAN are called LoRaX.

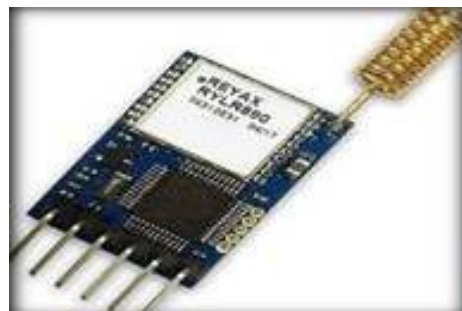


Fig.-5: LoRa Module

Relay

A relay is an electrically operated switch. The switch may have different number of contacts in multi-contact forms, such as open connection, close connection, or combinations thereof. The conventional form of a relay uses an electromagnet to open or close the connections, but other operating principles have been invented, such as the functional solid-state relays which use semiconductor standards for control relay without the moving parts. Relays with calibrated operating standards and sometimes multi operating coils are used to protect electrical circuits from over-currents, overloads or faults these functions are performed in modern electric power systems by digital devices still called protective relays.

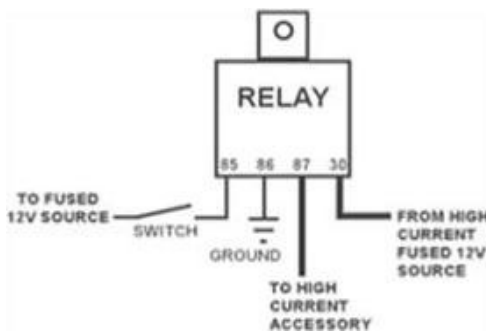


Fig -6: Relay

Battery Unit

Batteries produce power by chemical reaction and a physical wonder modification technique. The supply of power might be conductive substance like

a semiconductor gem stone to those polluting influences are extra. At the point when the gem is struck by lightweight, electrons are thrown out from the surface of the previous stone and move toward the elective platform. There they re put together as a flow of power. Lithium Iron Phosphate (LiFePO_4) batteries are rechargeable and requires less maintenance compared to lead acid battery.



Fig.-7: Battery

Software Details

In this system, some software is necessary for successful implementation. Arduino IDE 1.8.15 is being employed for programming and establishes communication with microcontroller ATmega328P and IoT server ESP32. Arduino IDE compiler is used to translate high level language to object code.

In the program, first begin and organised the connection with LoRaWAN. If connection not organised, system retry to connect with LoRaWAN. After sheltered connection with LoRaWAN, it firstly sends all the data regarding the phase voltages, healthy phases, status of gadgets,

etc. when operator sends command, after analyzing the parameters, the relay activate and supply is given to the load. Running status of load is continuously transmitted to the user. LCD display (optional) is used in the system to show the specifications directly on screen. In case any fault occurs, the relay senses the fault and suddenly trips the circuit and notification of fault sends to the user by using LoRa module. In this way, the module works.

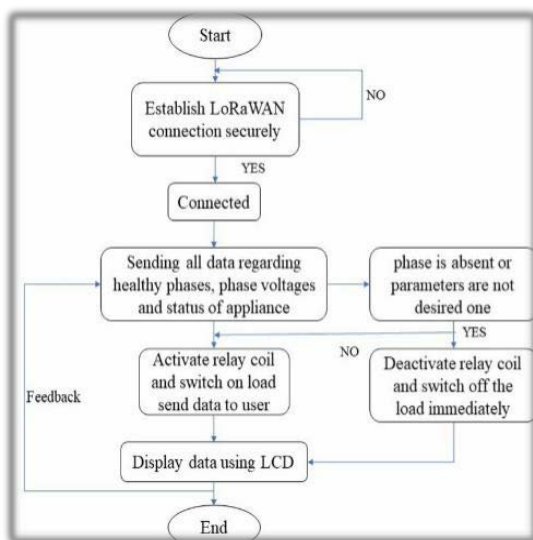


Fig -2.6: Flowchart of Software Details

CONCLUSIONS

Technologies arranged for home automation that are available in the association are based on platforms which help to connect devices or things around the home, the goal is to make the home intelligent or smart with ease. To achieve this with precision by the use of static IP

addresses and having the ability to detect the current state of devices by use of state function was achieved. In conclusion, it has been seen that home automation using internet of things over LoRa technology with the help of Android application is both cost effective and user friendly. The success rate of this model is about 95% according to results obtained from the analysis. Further work on this system shall cover aspects of cost reduction in implementation and further reduction in the power consumption of such models.

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