Automated Wireless Power Transmission Using Lora Technology

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ABSTRACT

The paper focuses on developing an automatic wireless simulator located at a field end and can be remotely controlled for Test & Evaluation (T&E) purpose in the test facilities of IPRC. Here, LoRa technology is used for long range communication. It enhances the system to access automatically by reducing power consumption. The proposed system has Raspberry kit with inbuilt controller and interfaced via GPIO pins to AD/DA HAT boards. The python coding is used which is suited for Raspbian OS which is simple and efficient.

Keywords : Test & Evaluation, GPIO, IPRC. Here, LoRa technology

I. INTRODUCTION

The main objective is to develop a simulator that can be controlled using wireless technology. In today's scenario there are number of existing wireless technologies. Where, Wi-Fi, Zigbee, Bluetooth, LoRa were examined, and it is observed that LoRa technology is better than other technologies with respect to long range transmission and security. Hence LoRa protocol is chosen for the proposed model.

II. LITERATURE SURVEY

2.1 Optimized Environmental Data Acquisition Technique for Monitoring Air Quality and Crop Plantation for Developing aSmart City Using LoRa Network.

Every day municipal operations are made more efficient with LoRa technology's long Range, low power, secure, and GPS- free geo location features. By connecting city services such as lighting, parking, waste removal and more cities can optimize the use of utilities and personnel to save time and money. Not withstanding the way that a lot of research work has been done about the ampleness of LoRa Network for low power remote sensor frameworks, there are still openings in the expounding on the sensible pieces of structure and execution of such systems. This endeavor revolves around issue of realizing a constrained sensor arrange for a sharp air quality examination and yield domain system for a 8 splendid city application using LoRa Network as the central correspondence development. A structure for checking air nature of the earth and yield bequest is executed using negligible exertion game plans available in the market. So, to keep up the yield prerequisite sensors are set in soil and

LoRa innovation is utilized for information transmission.

## 2.2 Using LoRa for Industrial Wireless Networks

The new concept of Industry 4.0 has been developed: it includes both Internet of Things (IoT) structure and the local networks that are still needed to carry out real-time tasks. However, forecasts of mass application of consumer IoT system have stimulated the development of new wireless technologies that may also be interesting for industry. Today, the Internet of Thinks is one of the most cited topic in scientific and public media. The IoT fascinating idea of having brilliance of smart devices for sensing the real world is transforming the telecommunication research. Moreover, the interaction between the real world and its digital counterpart using secure and real-time technologies may lead to the solution of many issues related to the smart cities, pollution monitoring, transportation, remote health care and more.

2.3 IOT Based Street Light Monitoring & Control with LoRa

Smart street lighting uses wireless technologies to control and monitor the actual amount of energy consumed by these streetlights. This data is then used to initiate suitable measures to reduce energy consumption through power conditioning. TheSmartness of the streetlights is derived from a microcontroller and some sensors coupled with a wireless module. This entire unit is called the controller. This, when installed on the streetlight pole, would communicate data between streetlights and thus control LED street lighting depending on traffic flow. With enterprises can benefit from savings in electricity bills, civic authorities will benefit from the ability to implement and manage street lighting in a much more efficient and cost-effective way. Smart lighting solution will minimize disruption in service, allowprompt servicing and centralized governance and

orchestration streetlights that are spread across cities. In the second model like street lamp pole where number of appliances grows only in one direction, instead of wired configuration LoRa used. The study covers the area of energy saving electrical device Surveillance based on IOT along with the help of WIFI & LoRa for effective communication between users & control devices LoRa uses radio frequency transmission for data transfer which is free of cost & long range of operation which can replace the wired network infrastructure of higher cost. LoRa operates in different frequency bands 433MHz, 915MHz and 868MHz for different regions.

III. PROPOSED MODEL
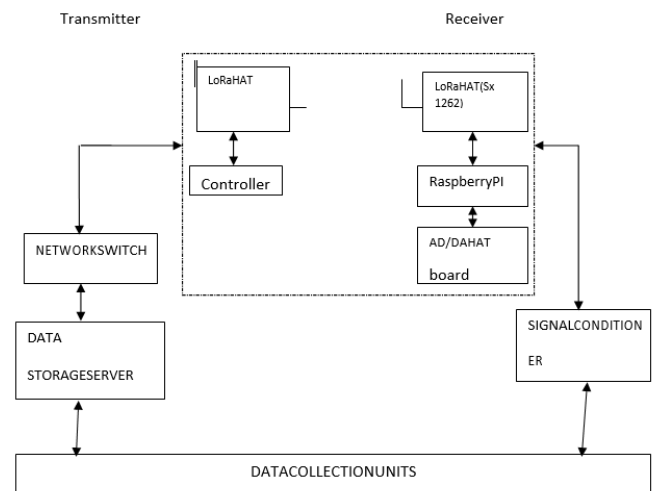
3.1 Hardware Requirements

- ✓ Raspberrypi 3ModelB+
- ✓ HighPrecisionAD/DABoard
- ✓ Sx1262868 MHzLoRaHAT

3.1.1 Raspberrypi 3ModelB+

The Raspberry pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. Raspberry pi 3 Model B+ is proposed here. It is a single board Computer which uses Linux based OS and that can be directly used in electronics projects because it has GPIO pins right on the board. Many other HAT boards

like precision AD/DA board, LoRa board etc, can be interfaced via GPIO pins. It is a simple portable low cost device. It is a single board computer based on ARM 11 processor. The Raspberry pi work with many operating systems like Android, Linux, windows 10 and etc.

3.1.2 HighprecisionAD/DAboard

The High-Precision AD/DA Board is used to add AD/DA functions to the Raspberry Pi. The features are

- ✓ On-board ADS1256, 8ch 24bit high-precision ADC (4ch differential input), 30ksps sampling rate
- ✓ On-board DAC8532, 2ch 16bit high-precision DAC
- ✓ On-board input interface via pin headers, for connecting analog signal
- ✓ On-board input/output interface viascrewterminals, for connecting analog/digital signal
- ✓ It has a AD/DA detect circuit, easy for the demonstration of the signal strength.

3.1.3 LoRa HAT Board

Raspberry pi LoRa HAT based on SX1262 covers 868Hz frequency band. It allows data transmission upto 15 km through the serial port. LoRa networking is an open-source technology that enables autonomous network set-up at low cost. LoRa networks have been widely deployed for many applications and research systems. The physical layer of LoRa technology uses Chirp Spread Spectrum (CSS). Chirps are the signals whose frequency varies linearly with time within the available bandwidth LoRa technology communicates data over long distances. While the message is transmitted over the air, it is possible for the data to get corrupted or lost due to channel effects, environmental conditions or collisions

Modes of operation

MODE 0: Transmission mode, Module transmit data when users send data to UART interface. Wireless receiving is enabled to receive data and send to UART interface when idle.

MODE 1: When is defined to Transmit, user need to add wakeup codes before transmitting, receiving is same as mode 0.

MODE 2: Wireless transmitand wireless receive are disabled, users can configure configuration according to Registers configuration.

MODE3: Wireless transmit and wireless receive are disabled, module enter deep sleep mode. module will configure when switching to other modes.

3.1.4 SX1262 RF TRANSCEIVER BLOCK DIAGRAM

The SX1262 transceiver is capable of transmitting up to +22 dBm in the presence of power amplifiers. Continuous frequency coverage of over 150MHz to 960MHz which supports the major ISM bands.These drivers support LoRa modulation for LPWAN use cases and FSK modulation for legacy use cases. The device are highly configurable to meet different application requirements utilizing the global LoRaWAN standard or proprietary protocols.The devices are designed to comply with the physical layer requirements of the LoRaWAN specifications released by the LoRa alliance. The SX1262 transceivers are ideal for long range wireless communication. The block diagram of SX1262 transceiver block diagram is shown in given below
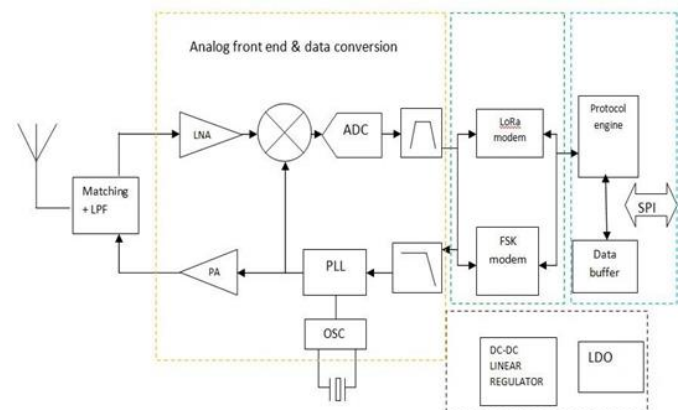
a) LOWNOISEAMPLIFIER(LNA)

A LNA is an electronic amplifier that amplifies a very low power signalwithout significantly degrading its signal to noise ratio. LNA are designedtominimize that the additional noise. Designers can minimize additional noise by choosing low noisecomponents,

operating points, and circuit topologies. LNA's are found in radiocommunications systems, medical instruments and electronic test equipment. Atypical LNA may supply the power gain of 100 while decreasing the signal to noise ratio by less than the factor of two. In analogy front end and data conversion system of sx1262 transceiver through antenna ,from matching and low pass filter the output is fed into the low noise amplifier circuit in which the amplifier will increase the power of both the signal and decrease the noise present at its input, but the amplifier will also introduce some additional noise. Lani's also found in Lani's, Lani's.

b) PHASELOCKEDLOOP(PLL)

A phase-locked loop or phase lock loop is a control system that generates an output signal whose phase is related to the phase of an input signal. It consistsofavariablefrequencyoscillatorandafeedbackloop.Theoscillatorgeneratesaperiodic signal and the phase detectors compares the phase of the input periodic signal, adjusting the oscillator to keep the phase matched. The PLL frequency is achieved by the crystal oscillator circuit in the presence of an external 32MHzcrystalreference.ThiscircuitgetstheinputfromtheLoRamodemandFSK modem by performing both the modulation and demodulation process bymeansofwhichthedemodulatedsignalisfedintothePLLcircuitforautocalibration purpose and their by maintaining same hopping time between thesignals.Thephaselockedloopsarewidelyemployedin radio,telecommunications, computers and computers and. Theycan beusedinademodulatedsignal,recoverasignalfromanoisycommunicationschannel, generate a stable frequency or distribute precisely timed clock pulses indigital logic circuits suchasmicroprocessors.

c) LDOREGULATOR

computers and output voltage even when the supply voltage is very close to the output voltage.

computers and the modes of operations were present, but the transceiver will use DC-DCwhenselectedforparticularmodeofoperationbasedontherequirements. Alternatively, a high efficiency DC to DC back converter can beenabledinFs,Rx,Txmodes.Theadvantagesofalowdropoutvoltageregulatorover other DC to DC regulators include the absence of switching noise, smaller device size neither large inductors nor transformers are greater design smaller device a reference, an amplifier.

d) Lora MODEM

LoRa is a low power wide area network technology. It based onspreadspectrummodulationtechniquesderivedfromchirpspreadspectrumtechnology.ItwasdevelopedbycyceloofGrenoble,France and acquired by SimTech the founding member of the LoRa alliance. TheLoRamodemusesspreadspectrum(CSS)modulation andforwarderrorcorrection(FEC)techniquestoincrease therangeandrobustnessofradiocommunicationlinks compared to traditional Skated modulation.

ARCHITECTUREOFSX1262RFTRANSCEIVER

TheSX1262transceiversareidealforlongrangewirelessapplications. Both devices are designed for long battery life with just4.2ma of active receive current consumption. The SX1262 comprises Offerman components namely,

ANALOGFRONTEND

An analogy front end is a set of analogy signal conditioning circuitry that uses sensitive analogy amplifiers, often operational amplifiers, filters and sometimesapplicationsspecificintegratedcircuitsforsensors,radioreceiversandother circuittoprovideconfigurable.TheSX1262transceiveris capableofoutputting+22dBmmaximumoutputpowerunderDC-DCconverterorLDOsupply.

DIGITAL MODEMBANK

A range of modulation options available in the SX1262: LoRa® Rx/analogy = 7.8 - 500 kHz, SF5 to SF12, BR = 0.018 - 62.5 kb/s :(G)FSK Rx/Tx, with =0.6 -300kb/s DIGITALINTERFACEANDCONTROL

Digital interface is a medium passthrough which humans interact withcomputers.Interfacesrepresentanamalgamationof visual,auditory,andfunctional components that people see, hear, touch, or talk to as they interact with comprises all polyaddition protocol processing.

POWERDISTRIBUTION

Two forms of voltage regulation, DC-DC or linear regulator LDO, areavailable.Thisisthefinalstageinthedeliveryofelectric power;itcarrieselectricity polyaddition consumers.

3.2 Software Requirement – PYTHON

It is an object-oriented approach which helps the programmers to write clear, logical code for small- and large-scale projects. python is often described as a batteries includedlanguageduetoitscomprehensivestandardlibrary.Pythoninterpretersareavailableformanyoperatingsystems.

File like API with 'read' and 'write' are supported. Serial Communication is one of the most important types of communication for embedded. In Computing, a serial port is a Serial Communication interface through which information transfers in(or)out sequentially one bit at a time. This is in contract to a parallel port which communicates multiple bits simultaneous. These interfaces send data as a serial stream of bits. Modern computers without serial ports may require USB to serial stream allow compatibility with RS-232serialdevice.

IV. RESULTS

Remote Operated Wireless Simulator output is shown in given allow compatibility allow compatibility operated automatically and the remote controller is located to the control terminal room tractable set tractable main controller.

V. CONCLUSION

Remote Operated Wireless Simulator was designed and the communication is established between the field end and the Control Termination Room (CTR).This proposed model is portable and can be used in the field without the need for AC power & communication cable. Wireless power transmission is the way to transfer power without using wire. Wireless power transmission helps to connect those area where people are unable to get a suitable power source. Everyone can get clean and green wireless power. In future all the devices will relate to the and green. The and green the successful experimental attempts to transmit power wirelessly and future scope of wireless power transmission. The LoRa technology is proposed is used for transmitting smaller amount of data packets. So, future work is to increase the transmission rate and efficiency.

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