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GPS Tracking System Using LoRaWan

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Abstract: ***LoRa presents interesting features in Long range low power communication so it is used in transmission of data like geo-location. So here geo-location is transmitted from client to node by LoRa WAN and from the node it pushed to the cloud by the help of Esp 8266 Wi-Fi module, and the Server linked with Google map so the obtained data is directly mapped on the Google map from where we can track the location.***

Keywords: IOT; Embedded System; LoRa; LoRaWAN; Esp8266

1. Introduction

Nowadays a localization of vehicles are done by using Global Navigation Satellite system receivers. GNSS is also used for tracking of Wildlife animals, Ships, Vehicles used in Coal mines and industries. GPS along with GPRS is used for the communication of coordinates for the past few years but experiencing a major problem of network connectivity and high power consumption. At present there are many reasonable GPS and GPRS modules available but the main issue that arises is the high power exhaustion for the regular and continuous reception of data by the receivers. The present dissipation of power via GPRS module during transmission is average 250 mA, and during receiving 20 to 40mA, nowadays it is consider to be very much high power consumer system.and the other limitation of GPRS system is network connectivity , We can't use GPRS system in such places where network strength is weak like Coal mines, Mountain side, Forest etc. For instance, a LoRaWAN module working at a 915MHz band dissipates 2.8mA of current in the active state, 60 mA of current dissipates for transmitting data and 14.5 mA of current dissipates for reception of data and it is also used in anywhere without the problem of network connectivity and Asynchronous data transfer. Hence the LoRa module can be used because of its advanced features of very low power consumption and absence of GPS and GPRS for data communication.

1) LoRa for Transmission

LoRa presents interesting features in Long range low power communication so it is used in transmission of data like geo-location . Due to the better susceptibility of the LoRa WAN receiver (-115dB), the total path of the link reached up to 155dB.The total path of the link reached upto 155 dB Another much developed feature of LoRaWAN is the larger bandwidth from the other IOT technology and it is cable of transmit or tracked in such a Scenario where reflections are present. LoRa is based on chirp modulation technology therefore it used whole bandwidth for signal transmission which make it robust to channel noise, Doppler effect, and fading. In chirp Spread spectrum there are 6 spreading factor are present SF=7 to SF=12 which make the data transmission at different rate.

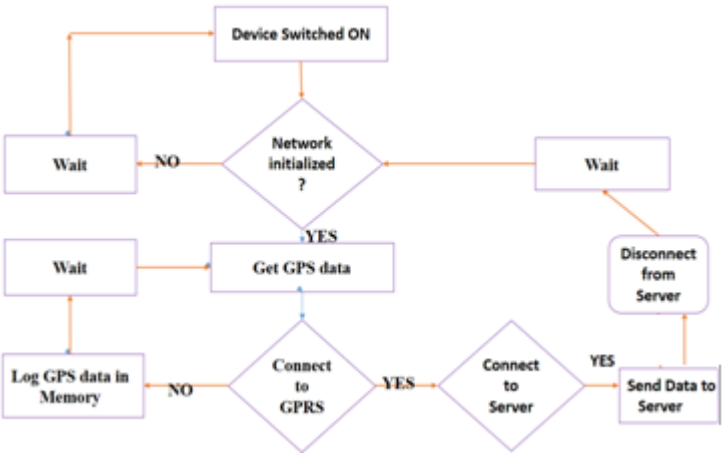
2) Previous Model

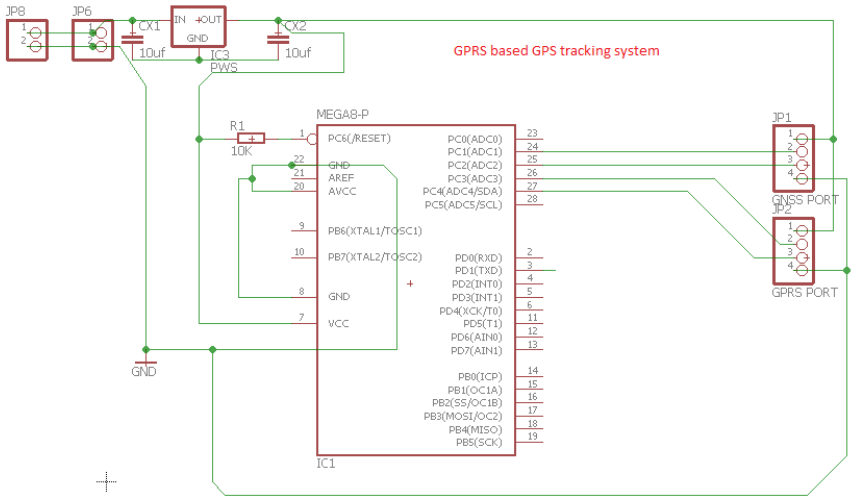
In Previous models of tracking system GPRS System is used for coordinate transmission but it Consumes much power and Sometime transmit the data asynchronously due to weak signal strength in area like Coal mines, Mountains, Industries[8-10].

3) GPS & GPRS

This model of tracking system consists of two systems.

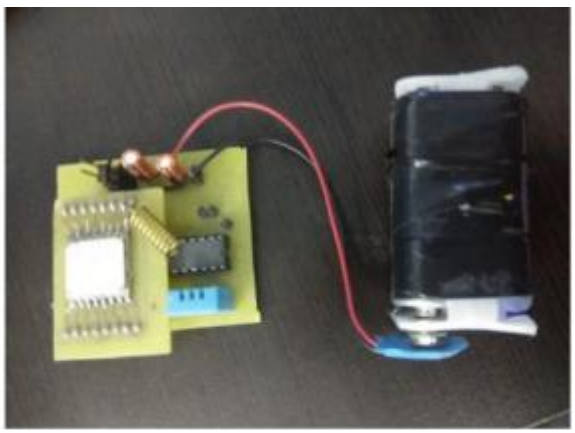
- First the Client System consist of GPS receiver module which is used for collect the coordinates of current location and the coordinate is send to the Application/Server using GPRS module with their client id.In the case of weak network connectivity it logs the data on the memory of storage device embedded with Micro- controller and update whenever it get good network strength but in this case some time it update the day[3].
- Second is the Server which analyze the incoming data and tracked the location according to the coordinate and identify the client id by comparing with MYSQL [6] according to which it tracked the location of vehicles[4].





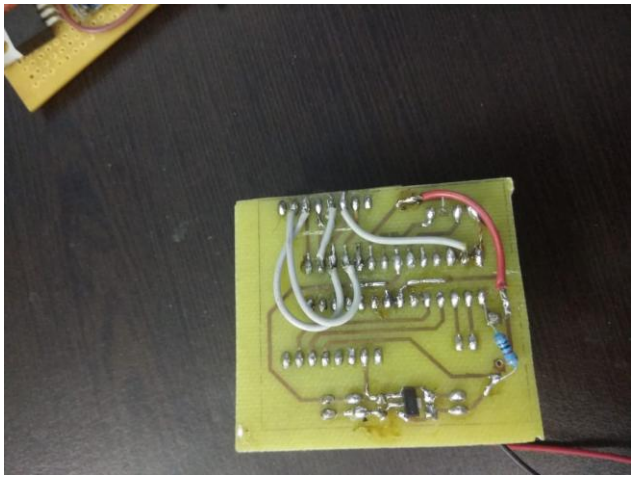
4) Designing of system

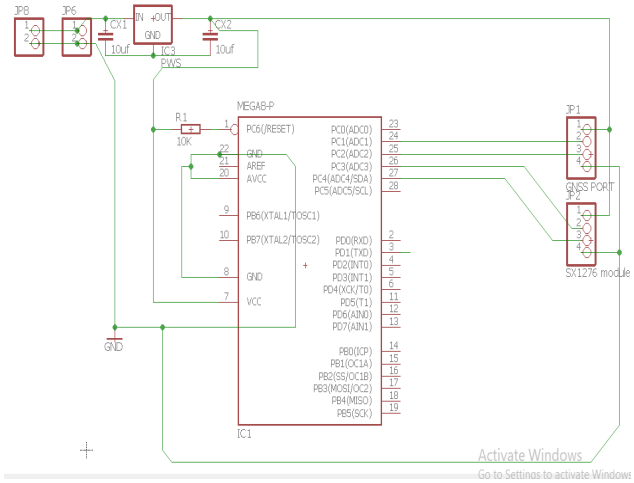
The entire system comprises of four subsidiaries that are an end node, gateways, Server and an end user application. The end node subsystem transmitted the data using LoRa transmitter module in the space medium using LoRaWAN protocol and the gateways that can be found within the area range of 3Km used for reception of data. After that, the gateways progress the received data such as the reception time, etc. via UDP/IP protocol to the dedicated server. Afterwards, Server analyzes the data received from all the gateways and processes it and routed the derived message to the application with the help of Message Queue Telemetry Transport (MQTT).



a) End-Node

The end node has the duty of transmitting the obtained data from the GPS receiver module via space medium using a LoRaWAN module. The main controller board is the master of all the system that analyzed and acquires data from other slave modules.At the end node we used GPS receiver for get the geo-location and logs into the memory of the controller and then controller send the coordinate of the location get by the GPS to the gateway using LoRa module at 915MHz frequency and LoRaWAN protocol. The coordinates determine by the GPS were send to the LoRaWAN module in period of every 10 second. In between this 10 second LoRa module (SX1276) are in Sleep mode so it takes zero power.It is also able to transmit during moving [7].





b) Gateway

The principle operation of the gateways is to route the received information to the dedicated server via UDP/IP protocol. Gateway is divided into two systems.

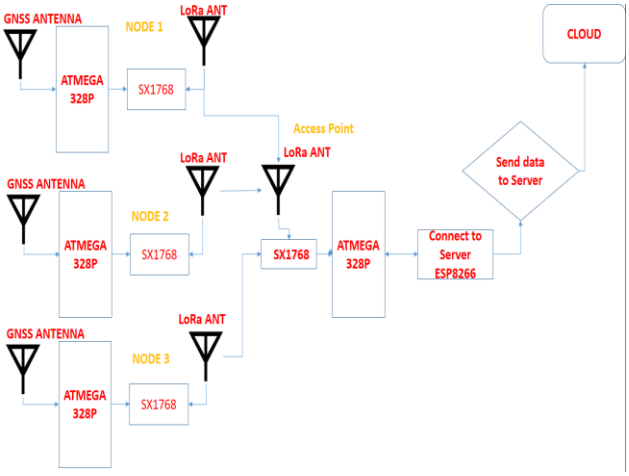
- First System is Net of the Network in which LoRa (SX1276) [1-2] module configured as a receiver at a frequency 915MHz .Which receives the data Send by the nearest end node and again forward to other receiver nearest to it and configured at the same frequency and in this way a net of the network is formed between LoRa module .
- Second system consist of Esp8266 module which update the data (coordinate of the GPS) get from the LoRa receiver module to the server along with Client id and identification number.It required a network connection for update the data on the Server it update in every10 second and between this time gap it is in the sleep mode and save power.

c) Server

The main operation of the server is to process the data from various gateways and send it to the third party application. It is necessary that the information envelops received from the different gateways containing same data but changed time received by the server.Server analyzes Client id and the identification number of the gateway and according to id it maps the location of different gateways and their client on the Googlemap [7].

d) The End User Application

The end user application comprises mainly of two subsystems that is Java application and other one is MySQL database. The main operation of the end user application is to synthesize the data coming from the network server and store it into its database. It provides access to the user to use the data of the database as per the requirement of the user. It can also transfer the data in the message packet using MQTT protocol. For the operation, the user require a subscription that is already encoded inside the Java application with the desired topic for specific devices that are already registered for the data transfer and reception.



2. Advantages

- Very less power consumption.
- No network dependencies for transmissionof data soSynchronous and Continuous data transmission.[2]
- The setup and construction are cheap any easilyapplicable.
- Used anywhere like Coal mines, Hilly areas, foggy conditions, Windy area.
- The setup of their gateway is cheapest and very simple[2].

3. Conclusion

Low power Consumption and Synchronous and Continuous data transfer is one of the main objectives in the field of Wide Area communication and the whole paper is designed by to get this objective. The paper explains a complete IOT tracking system that is working for the ease of present day scenario with more efficiency and accuracy using the advanced LoRa technology. This technology required very less power for transmission and receiver as well as it transmit continuously and Synchronously. This tracking system is very useful for such area where network Strength is poor and continuous tracking is required like coal mines, mountain areas etc.

4. Acknowledgement

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