Meteorological telemetry node based on FX.25

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Abstract: Meteorological sensor nodes were designed and prototyped for radio telemetry. Each node periodically measures the ambient temperature, humidity, and barometric pressure and transmits its APRS-compliant data frames over FX.25 protocol capable of forward error correction.

1. Introduction

One of the ongoing projects at Packet Radio User's Group is to gather real-time weather reports through radio telemetry. Another ongoing project is developing small and inexpensive terminal node controllers based on FX.25 protocol incorporating forward error correction capability, as reported in DCC2020. This paper presents a simple telemetry node design using the FX.25 TNC. In telemetry systems, where the radio link performance is often limited due to the antenna and transmitter output power, the error correction is beneficial.

2. Node design

A node comprises an ESP32-based PRUG FX.25 KISS TNC incorporating a software BELL.202 modem, combined with a conventional FM transceiver for AFSK communication. A custom telemetry software subsystem was added to the TNC firmware, whereby it collects, in a predetermined interval, data from one or more Bosch BME280 sensors through an I2C interface without an additional processor (Fig. 1). A BME280 measures the ambient temperature, relative humidity, and barometric pressure. The telemetry subsystem generates data frames based on a subset of the APRS features (lat/long position) and the TNC's main firmware (FX.25 protocol engine) then transmits the data frames over FX.25 protocol with forward-error correction, enhancing the communication reliability. With the noncritical nature of the telemetry data, connectionless transmission often delivers a satisfactory number of packets with forward error correction only.

The processor has spare resources for possible future expansion with additional BME280's or other I2C-connected sensors.

The TNC incorporating the telemetry subsystem is powered by a single 5 V DC, enabling a future node design integrating a QRP transmitter for battery-operated telemetry with practical runtime.
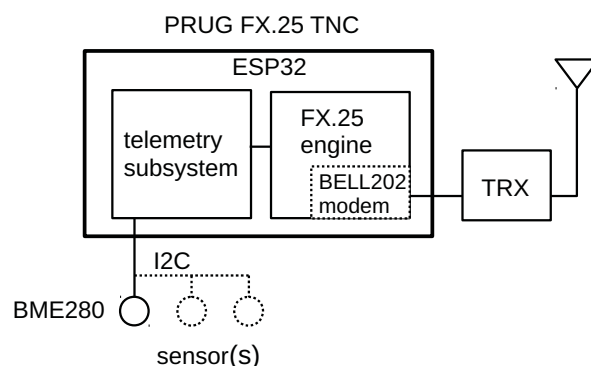

Fig.1 telemetry node design

3. Test operation

Two stations (JE1WAZ and JK1MLY) have continually and successfully operated prototypes based on this design on the 70cm band in Tokyo. Compatibility with AX.25 and APRS was confirmed.

References

1) FX.25 KISS TNC (Packet Radio Users Group in Japan)
      https://www.prug.com/fx25tnc

2) ESP32TNC (github)
      https://github.com/amedes/ESP32TNC