

DESIGN AND IMPLEMENTATION OF AN IEEE 802.15.4 / ZIGBEE BASED STAR NETWORK FOR DATA ACQUISITION AND MONITORING

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Why this project has been taken up ?

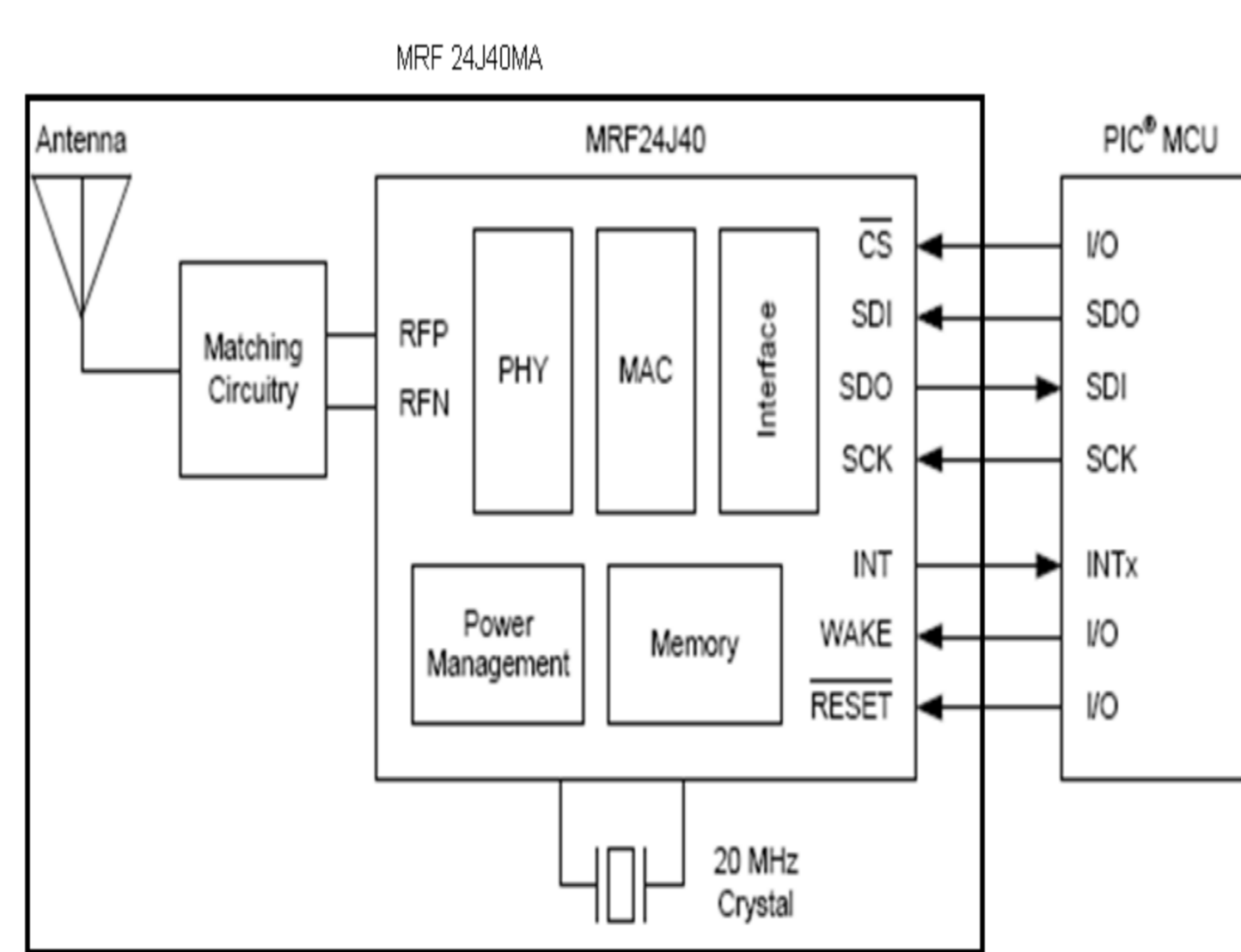
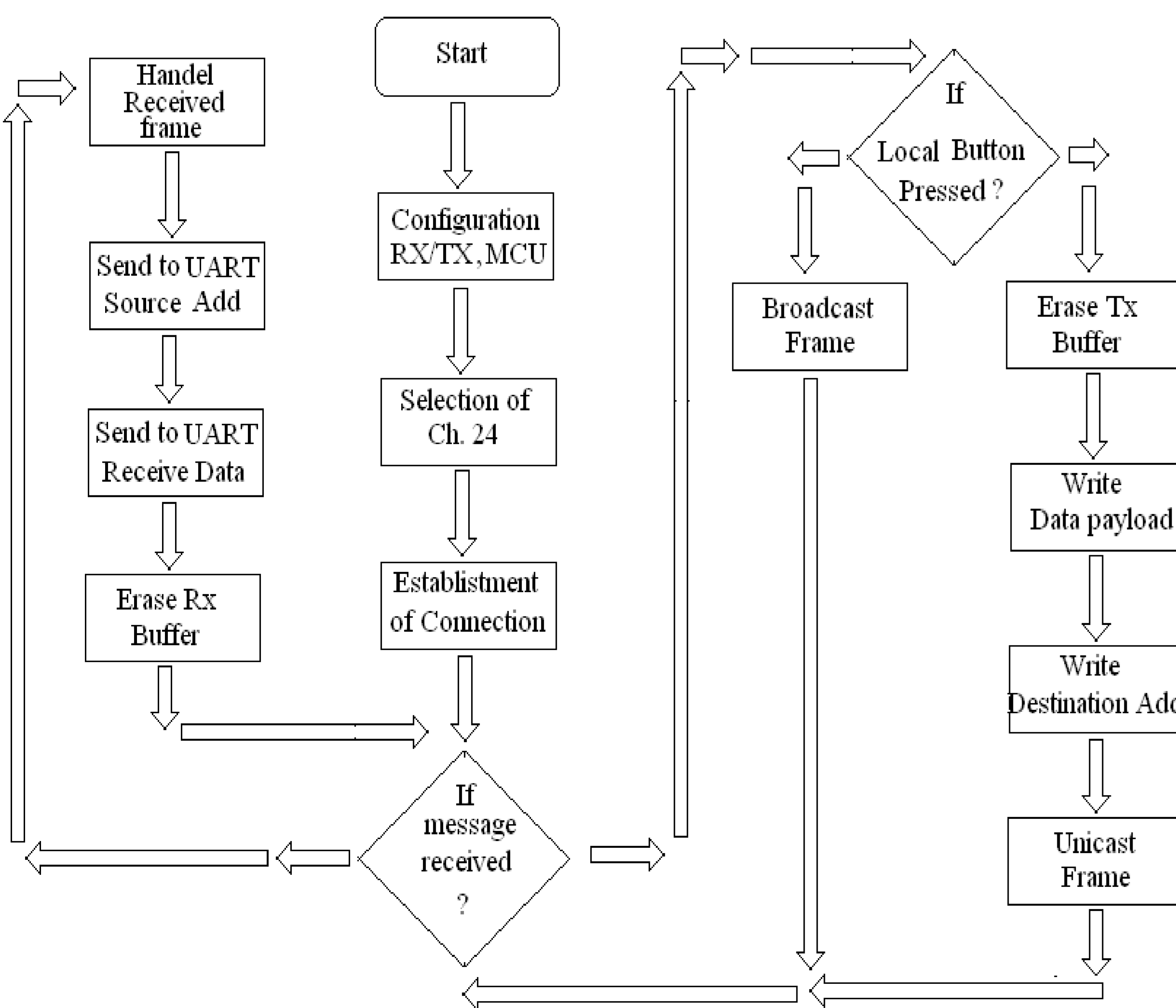
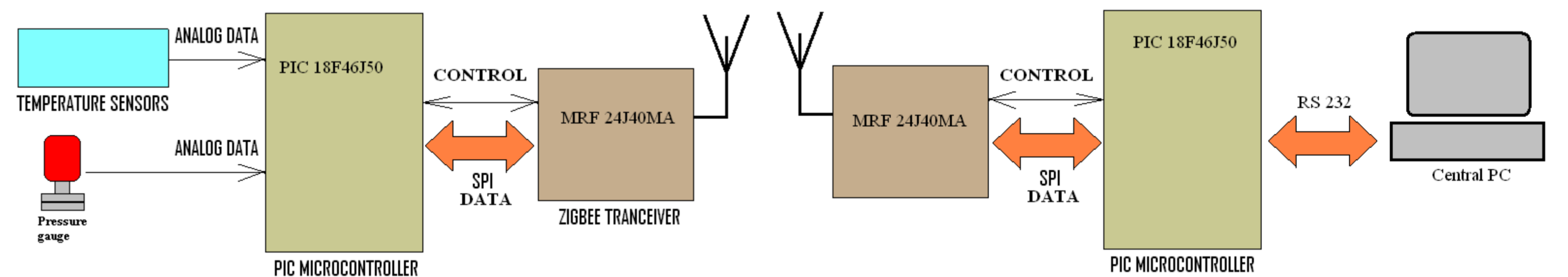
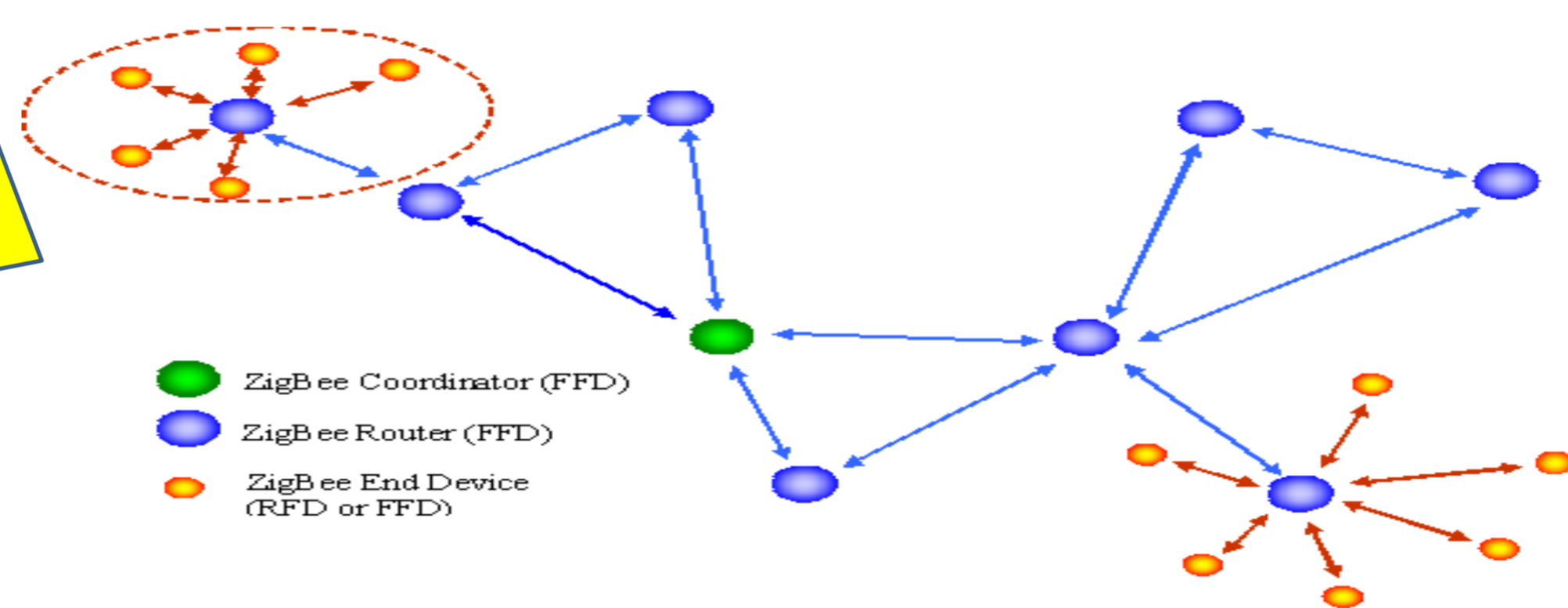
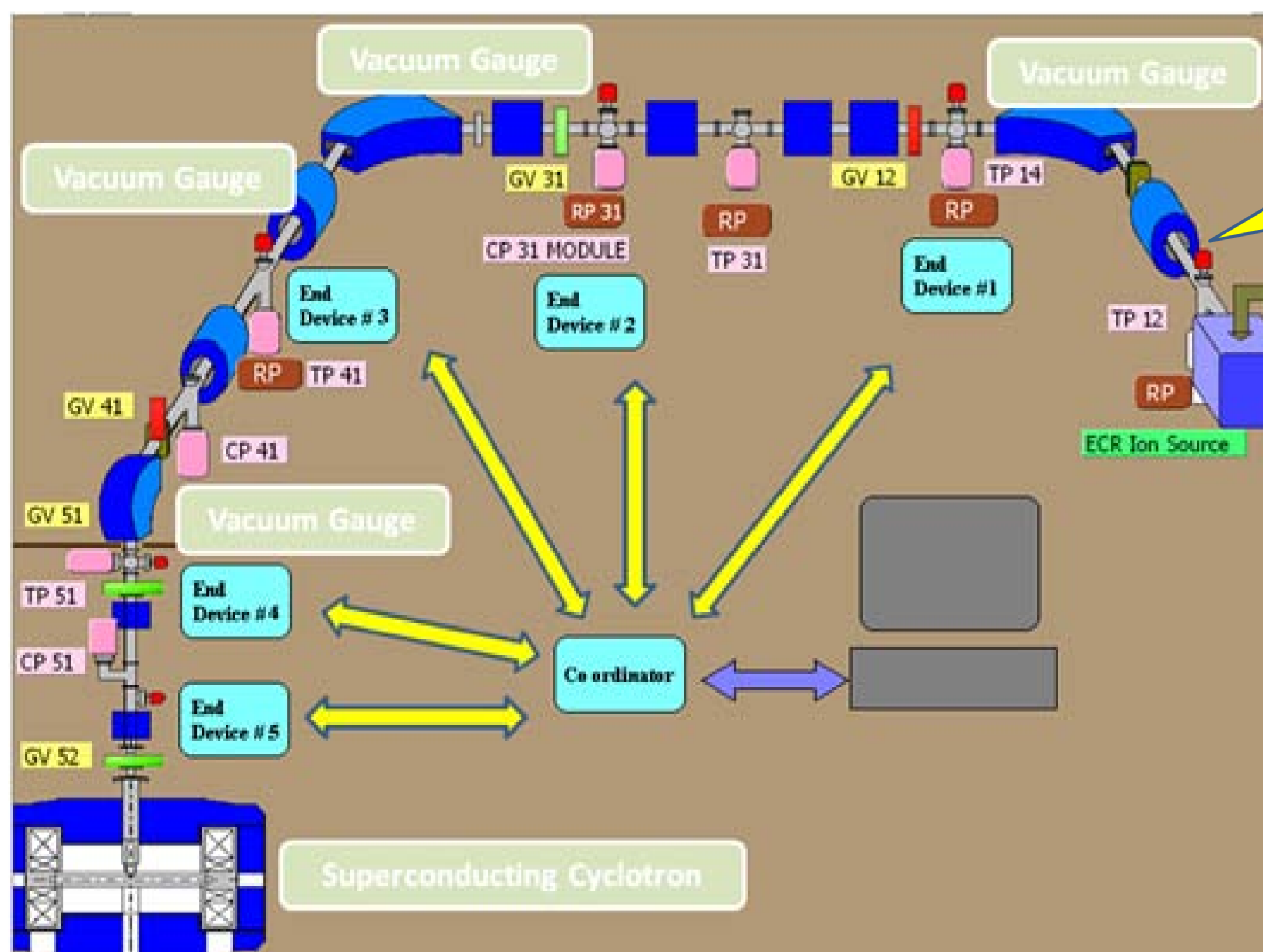
The aim was to provide a low cost, low power, secured, mid ranged, wire less network solution for monitoring of parameters from several distributed vacuum pumping modules installed in the Superconducting Cyclotron injection line. The parameters include pump RPM, input current and pressure reading of different vacuum gauges.

Why IEEE 802.15.4 ?

- Fully hand shakable protocol for transfer reliability
- Low power consumption facilitating remote controlled battery operated systems and sensor network.
- Utilizes the lowest two layers of OSI Physical Layer (PHY) and Data Link Sub Layer (MAC – Media Access Control Sub Layer)
- Data transfer rate around 250 Kbps and 16 channels in the 2.4 GHz ISM band
- Supports several network topologies
- Very much immune to **ambient noise**

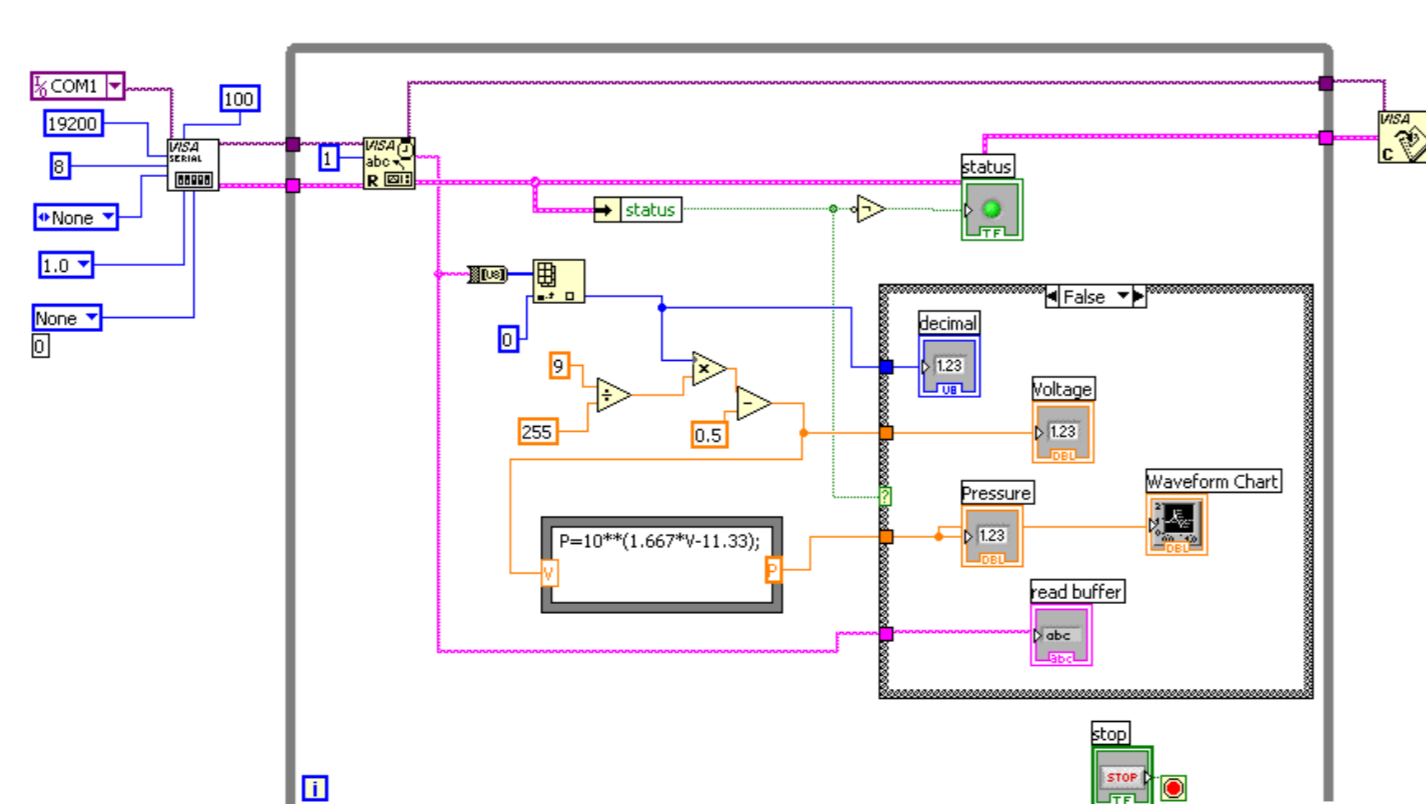
Scheme of the system

The star network is using two kind of Zigbee nodes. End nodes designed for the vacuum pumping modules, receives information regarding current drawn by the turbo pump, pumping speed and the pressure information of the vacuum gauges. These information are being sent in the form of Zigbee data frame to the coordinator against a request being received from it. At the coordinator after successful receipt of a frame from different end nodes the data payload is sent to control PC via Serial RS232 connectivity.



Hardware Software Stack and GUI

- Nodes are using Microchip 8 bit PIC 18F46J50 MCU with 64K Flash
- IEEE 802.15.4 standard compliant 2.4GHz RF transceiver MRF24J40 MA
- RF Transceiver communicates with MCU via 4 wire serial SPI
- The end node acquires analog signals (0 – 10 V DC) from turbo pump controller and vacuum gauges.
- These analog signals are sequentially sampled and the digital equivalent data are stored in an array.
- The coordinator communicates with the central PC for sending the acquired information via Serial RS232



- The software protocol stack is written by using MPLab C18 Compiler concentrating on MAC and PHY layers of IEEE 802.15.4 specification.
- 8 byte Extended Organizationally Unique Identifier (EUI) or MAC address and 2 byte PAN address have been used for each nodes.
- Channel # 24 on 2.4GHz ISM band has been utilized here
- Only Data frames are utilized.
- Only 8 numbers of Extended Address Registers (EAD) has to be configured while replacing any defective node.
- User end Lab VIEW application program receives data bytes from coordinator and displays on monitor.