



A new wireless asynchronous data communications module for industrial applications



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ABSTRACT

All the sensors such as temperature, humidity, and pressure used in industry provide analog outputs as inputs for their control units. Wireless transmission of the data has advantages on wired transmission such as USB port, parallel port and serial port and therefore has great importance for industrial applications. In this work, a new wireless asynchronous data communications module has been developed to send the earth magnetic field data around a ferromagnetic material detected by a KMZ51 AMR sensor. The transmitter module transmits the analog data obtained from a source to a computer environment where they are stored and then presented in a graphical form. In this design, an amplitude shift keying (ASK) transceiver working at the frequency of 433.92 MHz which is a frequency inside the so called Industrial Scientific Medical band (ISM band) used for wireless communications. The analog data first fed into a 10-bit ADC controlled by a PIC microcontroller and then the digital data is sent to the transmitter. A preamble bit string is added in front of the data bits and another bit string for achieving synchronization and determination the start of the data is used. The data arriving at the receiver is taken by the microcontroller and sent to a LCD display as well as the serial port of a computer where it is written in a text file. A Visual Basic based graphics interface is designed to receive, store and present the data in the form of graphical shapes. In the paper, all the work has been explained in detail.

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1. Introduction

Wireless communication is a rapidly growing area for quick, easy and high quality data communications in industrial applications. In recent years, the most of the sensor based data collection and transmission processes are based on this technology. Wireless internet, data transfer through devices, automation systems, sensor networks,

etc. are some examples of it. Desiring transfer of more and more data cheaper and faster speeds up the developments in wireless communications sector [1]. Wireless communication is the wide spread application domain in electronics. It needs a carrier wave which makes it possible to transfer information in long distances in air or space. A wide range of the spectrum can be used for choosing the carrier. The most preferable choices may be to use infrared, laser and radio waves [2]. RF waves or signals cover the frequency range between 3 kHz and 3000 GHz. In this range, the spectrum has been divided as VLF, LF, MF, HF, VHF, UHF, etc. In recent years, the studies are concentrated on

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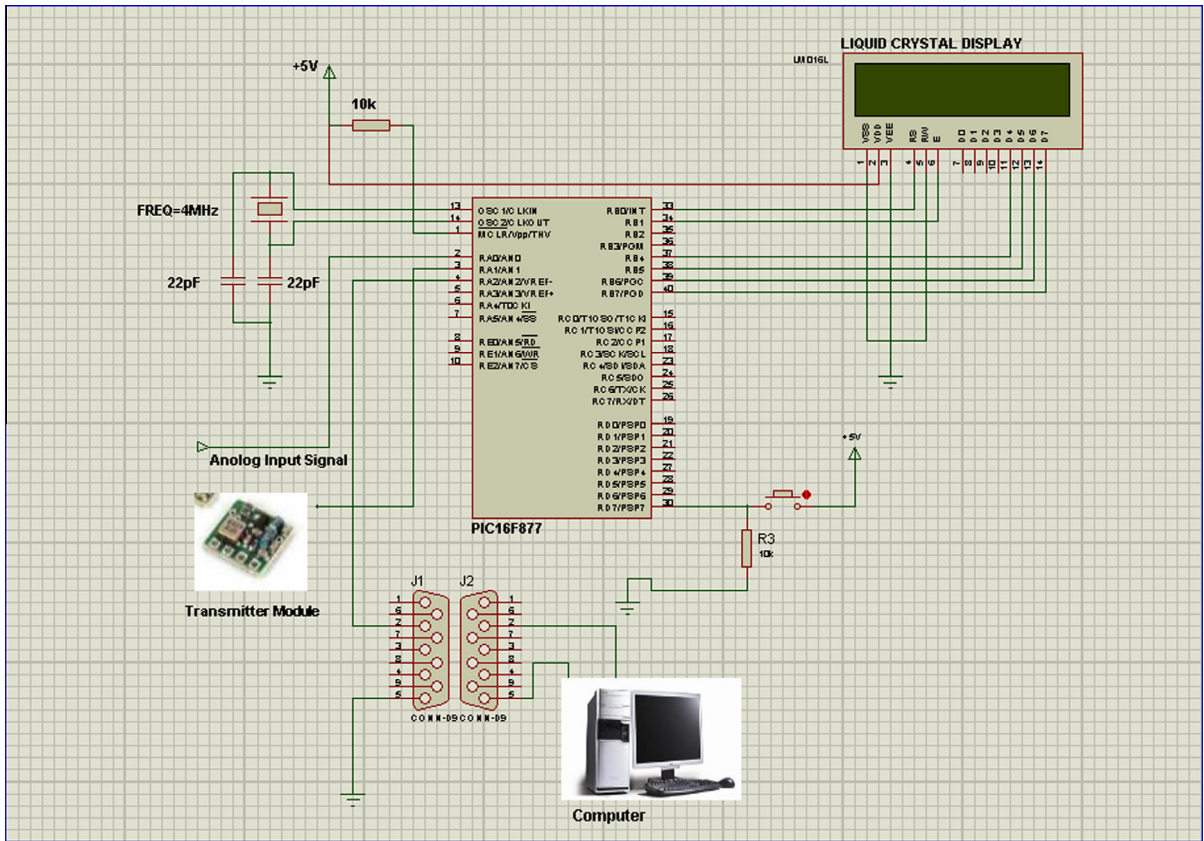


Fig. 1. Transmitter unit.

the application frequency, transmission rate, communications direction (dual or single) and reduction of energy consumption. Different types of receiver and transmitter modules have been designed taken into account the above mentioned variables. Among them ASK transceiver system-on-package (SoP) compact module working at 60 GHz [3,4], 8 Gbps CMOS ASK modulator [5], low-power ASK receiver [6–10], Single-Band RF Front-End (FEM) Module [11], compact radio-frequency (RF)/free space optical (FSO) dual mode wireless communication system [12,13]. Furthermore, low power, variable gain RF transceivers at 900 MHz have also been studied [14–16].

In communications applications only some parts of the bands can be used. Among them, the ISM (Industrial Scientific Medical band) band can be used without any certification or license in case obeying the power limitation rules. In Turkey, the frequencies commonly used in ISM band are 315 MHz, 418 MHz, 433.92 MHz, 868 MHz, 915 MHz, and 2.4 GHz. Today, modules working at these frequencies are effectively used in most technological applications such as measuring internal and external torques in real time within modern ship control systems [17], remote control systems of cars [16] and wireless sensor networks [18].

In this work, a new wireless real time asynchronous data communications module has been developed for sending the earth magnetic field data around a ferromag-

netic material detected by a KMZ51 AMR sensor. It can also easily be used for sensors such as temperature, humidity and pressure producing analog voltage for control units and used mainly in industry. This module can send the sensor voltage at 433.92 MHz with a resolution of 10-bit under the control of user at irregular time intervals. The data received by the receiver module can be stored in a PC. The data is graphically presented in real time by means of the software developed by Visual Basic. The details are given in the following sections of the paper.

2. Data communication system

The data communication system developed in this work is composed of two main units as the transmitter unit and the receiver unit. Now, we can analyze these two units in detail in the following sub sections.

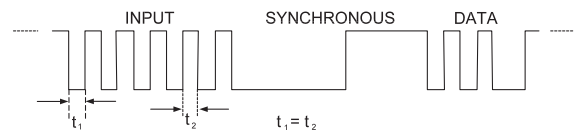


Fig. 2. Sending format.

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