

4. Acknowledgments

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5. References

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USING AN EMBEDDED CONTROLLER TO PRE-PROCESS LARGE AMOUNT OF RAW DATA ON A SUBSURFACE INSTRUMENT FRAME TO ALLOW A REAL TIME TELEMETRY

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At present the Proudman Oceanographic Laboratory has a pilot coastal observatory situated in Liverpool Bay. The aim of the observatory is to understand, through effective continuous measurement and modelling, a coastal sea's response to natural and anthropogenic forcing.

The coastal observatory in part consists of two instrumentation frames which lie on the sea bed at two separate sites. These frames measure various physical characteristics of the sea. Recently it has been shown that it is feasible to transmit data from these subsurface frames back to the POL labs via an acoustic/satellite telemetry system. Unfortunately there is a drawback to the system; the real-time raw data that is output by the various instruments is too large to be

transmitted. Only part of the data from one of the instruments is currently transmitted in real time.

This paper shows how a low cost, low power, off-the-shelf embedded controller (the persistor CF2) can be used to pre-process large amounts of raw data. This enables useful data to be telemetered back to POL in near real-time to be displayed on the Coastal Observatory website. Two instruments were used to demonstrate the system, a 600kHz RDI ADCP and a Seabird 16+. Using data output from these instruments the following parameters were calculated and output along with a reduced data set from the instrument, specific wave height, peak period and average wave direction.

DATA ACQUISITION SYSTEM WITH GPRS COMMUNICATIONS

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1. Introduction

This paper presents the implementation of a low cost environmental data acquisition system with the capability of sending the measured data using a high speed link based on the GPRS technology [1]. The equipment is based in low power Digital Signal Processor; this allows develop digital algorithms to preprocess the signal. The system is powered from batteries and solar panels what enable its use at isolated locations. The equipment can be controlled locally using a RS232 channel or remotely using a GPRS link, so it has no built in user interface. The equipment is enclosing in an ABS plastic case with IP65 grade, to work in strong weather environmental.

2. Hardware architecture

The figure 1 shows the overall architecture of the system. The core of the system is a digital signal processor that controls all the peripherals and implements the measurement algorithms and the communication protocols. The processor runs at 150 MHz, and the memory block, which stores the program code and the data, is made of an 8Mb SDRAM and a 4Mb flash memory.

The system includes a class 8 GPRS modem to allow its remote control. It also includes an A/D audio converter and A/D converters for the environmental sensors. A TCP/IP/PPP protocols' stack has been

implemented to enable the GPRS communication using TCP and UDP sockets [2][3]. All the software has been implemented using DSP-BIOS [4].

Since the system is intended to work at isolated locations using a solar panel, a low power fixed point TMS320C5501 processor is used in order to optimise power consumption. In a normal operation mode, with low complexity algorithms working in real time and being annexed to the GPRS network, the system consumes 70 mA from the 12 V power supply. When sending data over the GPRS network peaks up to 200 mA are observed.

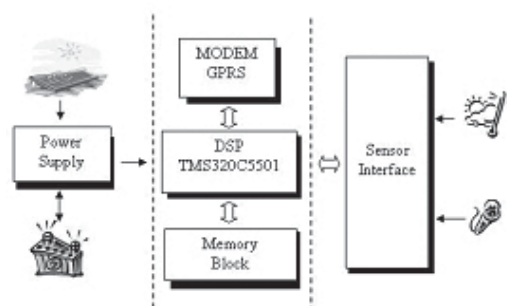


Figure 1. Block Diagram.



3. Communications subsystem

The measurement system developed doesn't have a human user interface. It can be controlled locally through an RS232 interface or remotely using several platforms (i.e. PC, PDA, etc.). The designed client/server architecture is composed by three types of elements, joined through the Internet as shown in figure 2: measurement systems, a name server and the clients.

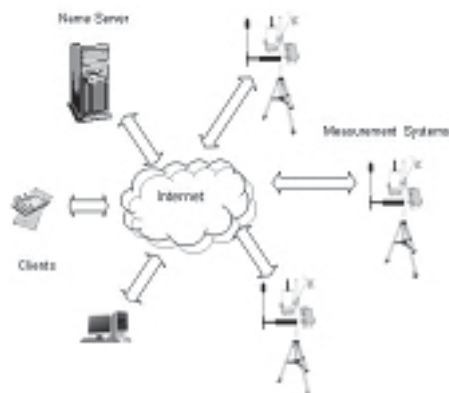


Figure 2. System architecture.

Measurement systems are connected to the Internet by means of a GPRS MODEM. During the initialization process each system registers itself in a name server. It then waits for a client to establish a connection. The name server is used to maintain a list of all the operative systems. Each system name is linked with its IP address. This is important because the Internet provider assigns dynamically a different IP address during system start-up.

The third element consists in one or more clients. To connect to a measurement station, each client needs to know its IP address. So first, the client requests the desired system's IP address to the name server. Once the client receives the IP address, it establishes a direct connection with the measurement system to obtain the stored measurements, get measurement results in real time and/or configure it. To be able to send and receive data through the Internet, it has been necessary to implement in the measurement system the net IP protocol and the transport TCP and UDP protocols. Furthermore the PPP protocol has also been implemented to negotiate with the Internet

provider the connection parameters and to obtain the IP address. The PPP protocol includes the link protocol HDLC. The implemented protocols are arranged conforming to the classic layered protocol stack structure, as shown in figure 3. This organization allows each layer to offer services to its upper layer while using the services provided by its lower

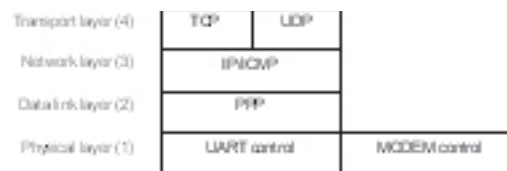


Figure 3. Implemented OSI levels.

It's important to observe that although the physical layer is managed by a GPRS MODEM, the communication with it is done using the DSP's internal UART.

4. Conclusions

To verify the functionality of the equipment a measure environmental noise system has been implemented. The system measures the next parameters:

- Noise with different frequency weighting (A, B, C and Z) and three time weightings (Fast, Slow e impulsive).
- Wind direction and velocity.
- Temperature.
- Humidity.
- Atmospheric pressure.

A TMS320VC5501 fixed point DSP has been used to minimize the system's power consumption. Thereby all mathematics operations have been adapted to fit the desired precision (24 bits). The system works in real time with a 2.3 Mbits conversion rate and an input margin range of 100 dB. Due its low power consumption the system is suited to work in insulates places to monitoring different parameters.

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THE ACOUSTIC OCEANOGRAPHIC BUOY: A VERSATILE ACOUSTIC DATA ACQUISITION SYSTEM

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I. INTRODUCTION

The Acoustic Oceanographic Buoy (AOB) is a light underwater acoustic data acquisition system, which uses a surface buoy and an underwater vertical array of acoustic and non-acoustic sensors [1], [2]. The surface buoy includes a digital storage unit for the acquired data, a communications system for remote monitoring and data transmission, a digital processing unit for pre-processing of acquired data and a battery power supply, and GPS antenna for positioning recording and monitoring. The communication system allows for easy integration of the buoys in a computer network using standard network protocols. The AOB was developed under the AOB Joint Research Project, which was proposed in a consortium of several institutions, aiming at the development and validation of acoustic-oceanographic remote

sensing systems and data inversion-integration methods for the reliable, rapid environmental assessment (REA) of shallow water areas. The AOB is currently in its second version and two exemplars of this version were constructed.

II. EXPERIMENTAL RESULTS

This paper gives an overview of the hardware and software used in the AOB, and points out its versatility since it has been tested in a wide range of applications covering ocean acoustic tomography and environmental inversion, underwater communications, and underwater acoustic barriers. The number of sea trials involving the AOB in the last years is remarkable. The first version was used during the Maritime REA '03 (Mediterranean) and '04 (Atlantic) sea trials, and the

