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Use of Micro Controllers in Amateur Radio Projects

A Paper from the New Zealand Association of Radio Transmitters Incorporated (NZART)
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Introduction

This paper describes some uses of micro controllers in amateur radio, based on developments in New Zealand. A series of articles have been published in the NZART journal "Break-In" on a diverse range of uses, based on a common platform.

The development of hardware, software and applications continues to be part of the challenges that involve the use of computers and micro controller devices in amateur radio. This combination of technologies provides an attractive way of recruiting new people, or retaining technically capable amateurs with interesting new projects.

Micro controllers find uses in many fields, but are increasingly being used by Amateurs for beacons, digital mode transmission and general control, test and display purposes.

Projects Using Micro Controllers

- In addition to the familiar uses for direct digital and phase-locked loop synthesis frequency generation applications, micro controllers are proving popular for a variety of other applications. These include rotator control, frequency display, Amateur Position Reporting System (APRS) tracking and GPS devices, clocks and frequency references.

- Another example is the development by Keith Dix ZL1BQE of a family of micro controller protocol converters, which operate from a common master device with a keypad and LCD display. The first application of these devices is a 23cm FM TV transmitter, where the vision carrier and two independent sound carriers are controlled, along with ancillary telemetry and control functions.

- Experimentation has been encouraged by a series of articles in our "Break-In"

magazine. The articles have now been running for more than a year during 2002 and 2003. The author, Murray Greenman ZL1BPU has presented projects as diverse as frequency counters, a digital voltmeter with data logging capability, an automatic PC controlled rotator controller, and a UTC and local time clock.

The clock project uses an inexpensive precision reference to achieve accuracy approaching one second per year. As the series continues, other devices of Amateur interest will be presented.

- Another possible use for a micro controller would be its use to generate the transmitted carrier for a convenient frequency and time reference. An accuracy of 1 part in 10^8 (0.4 Hz at 80m) can be readily achieved using a broadcast TV synchronising pulse reference. (A companion paper from NZART gives more details on proposals for simple low power beacons on 80m and 40m that could fill the gap left by the closure of standard time and frequency stations).

Hardware and Software

A "Development System" has been created by ZL1BPU to allow a series of high performance, yet practical and moderately simple projects to be developed.

All the relevant construction information has been made available on a web site http://www.qsl.net/zl1bpu/micro . This link supports the Break-In articles, and shows schematics and layouts for all the micro based projects.

The hardware includes a standard prototyping circuit board. This board contains the microprocessor, 3 transistors for input /output and RS232 interfaces, a voltage regulator, clock crystal, some resistors and capacitors, and various sockets and connectors for inputs, outputs programming and a port to a radio. The microprocessor is an AVR™ manufactured by Amtel. The AVR family is well suited to amateur projects, with built in A / D conversion, UART serial port to the PC, RAM, EEPROM and most importantly Flash memory. It can be programmed "in circuit" with a very powerful instruction set. The IC used is a fast eight-bit RISC processor.

Programming instructions are written in a simple text file. The "assembler" that runs on your PC interprets the instructions and creates a file in binary code. You can download the necessary software and development tools free from the Amtel website. It can be programmed in the "C" language for more complex functions.

Software for the projects is also available by email from ZL1BPU at modest cost. Murray can also provide by email a comprehensive microprocessor study programme for beginners that he has developed. This takes the novice through to the stage of being able to operate and program the Development System, and use the software tools to write simple programs.

The projects use relatively low cost components and are not difficult to build.

Recommendations

That

1. Region 3 Societies note the development and experimentation with micro controllers/microprocessors in New Zealand. A series of high performance, practical but moderately simple projects can be built. This provides the opportunity to learn about microprocessors, programming on a PC and interfacing the various projects to the "real world" of PCs and radios.

2. Region 3 Societies encourage their members to experiment with microprocessors. The web site operated by ZL1BPU can assist.

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