

## **mCoMo MOSAIC II, with Connect One iChip Onboard, Uses GPRS to Monitor Rainfall in Hong Kong over the Internet**

*“Connect One’s iChip provided a faster and easier path to catch market needs and to migrate our product from SMS to GPRS-enabled...It enabled us to avoid Internet programming, while we put all of our efforts into utilizing the GPRS wireless network for regular reporting over the Internet.”*

-Dr. Andrew H. S. Lai, VP Engineering, mCommerce Online Limited

mCommerce Online Limited (mCoMo) are an innovative technology start-up spun off in 2002 from Hong Kong University’s Business Incubator, with key personnel, know-how and products from Hong Kong University's Laboratory for ITS Research. The company is focused on the development of customized second-generation (2.5G) mobile communication products and data applications for specific niche markets. The initial target markets are data collection and fleet management. mCoMo plans to market a family of wireless data products and mobile commerce solutions.

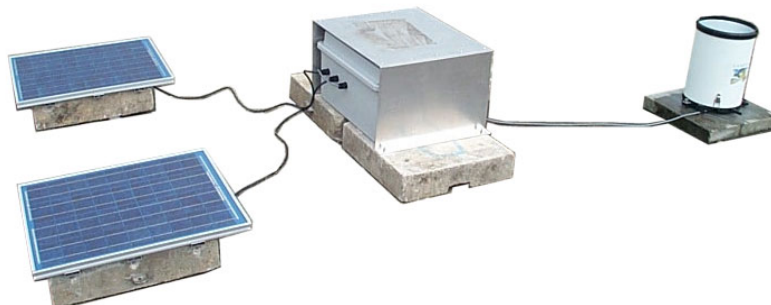
### **The Challenge**

mCoMo are a forerunner in driving wireless data application product development with initiatives such as MOSAIC – Mobile Online Surveillance And Incident Controller. MOSAIC is being used currently in Hong Kong in a rain-gauge system for monitoring temperature and rainfall, and for reporting water levels on hillsides and inside tunnels during the rainy season. Although the system today is used only to measure rainfall and temperature, it can interface to any electronic/electrical device for measuring pressure, water flow, etc. Initial customers are the Civil Engineering Department of the Government of the Hong Kong Special Administrative Region and a property management company of the Sun Hung Kai Group, one of Hong Kong’s largest publicly-traded financial service and investment firms.

While there are many similar data logging systems on the market using pagers or a wired approach to report data, MOSAIC uses the public wireless network, which has comprehensive coverage and low operating cost. The original MOSAIC product was designed to report sensor readings collected from remote locations to a control center using the Short Message Service (SMS) of a GSM wireless network. The MOSAIC system includes sensors, a GSM modem, controller electronics, and solar panels to supply power (see Photo 1 and Figure 1).

Application Note

Because it is quite expensive to use SMS for online data transmission applications, MOSAIC's original functionality was limited to being an alerting system that only reports changes in sensor readings, rather than as a 7×24 monitoring system.



*Photo 1: MOSAIC (wireless rain-gauge system)*

By the middle of 2001, packet-switched GPRS wireless technology, which offers “always-on” connectivity and high data speed, was about to be launched in Hong Kong. GPRS is an advanced and low-cost wireless data communication service that runs on top of a GSM network. Simultaneously, there was a growing demand in the market for a system that can provide always-on connectivity and 7×24 continuous reporting capability with minimal operating cost. Obviously, GPRS is the right solution for this kind of applications. However, converting the MOSAIC-operating mode from SMS to GPRS-enabled is not easy and straightforward, as there are some fundamental differences between the two systems. For SMS, text messages are composed and sent to the GSM modem via industry-standard AT commands, while GPRS is an Internet Protocol (IP) connection running the TCP/IP protocol stack.

In order to shorten the product development cycle and to catch new market opportunities, we decided that an updateable, off-the-shelf, IP-enabling chip, which can handle the IP connection and TCP/IP stack, is crucial for our new GPRS-enabled MOSAIC II. Such a chip would permit us to remotely add new functionality to MOSAIC II systems deployed in the field.

### **The Solution**

After extensive engineering evaluation, mCoMo's engineering team decided to employ in our new design a readily-available IP chip that can dial-up, establish the Internet connection, handle the TCP/IP stack, and most importantly, be controlled through AT commands. Among all available products in the market, Connect One's iChip fits our entire requirement. It is now a standard component placed between the microcontroller and the GSM/GPRS wireless modem in the new MOSAIC II. We produced the first MOSAIC II with iChip and a GPRS phone (Motorola P7389i), and later tested it with Siemens, Nokia and Wavecom GPRS phones and modems.

Application Note

iChip is controlled by Connect One's AT+i™ Application Program Interface, a command protocol that contains intuitive commands, written in ASCII text, to access the Internet. It enabled us to avoid Internet programming, while we put all of our efforts into utilizing the GPRS wireless network for regular reporting over the Internet.

MOSAIC II is the first GPRS-based data logger in Asia-Pacific region. In September 2001 it was installed in the Po Toi Islands on the southeastern side of Hong Kong. Since then, rainfall readings have been measured, collected and reported to the control center continuously at five-minute intervals.

Figure 1 depicts the original system design used in MOSAIC I. Sensor inputs are collected by a microprocessor via a peripheral controller and sent to the GSM wireless modem through an RS232 serial connection. Without modifying the core circuitry, Figure 2 shows MOSAIC II using an iChip that is placed between the microprocessor and the GPRS wireless modem. The microprocessor still uses its RS232 output to do the communication, but iChip handles all the dial-up and Internet connectivity tasks.

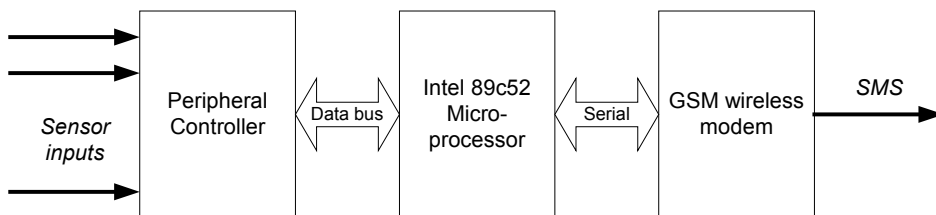


Figure 1: MOSAIC I System Design

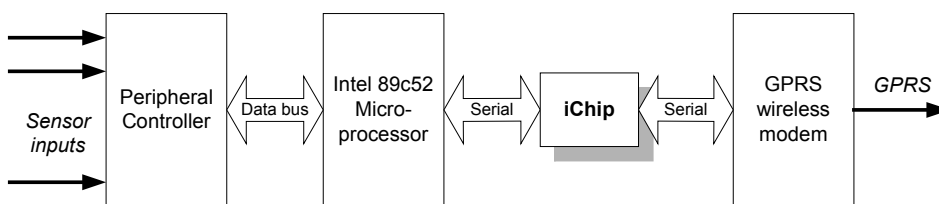


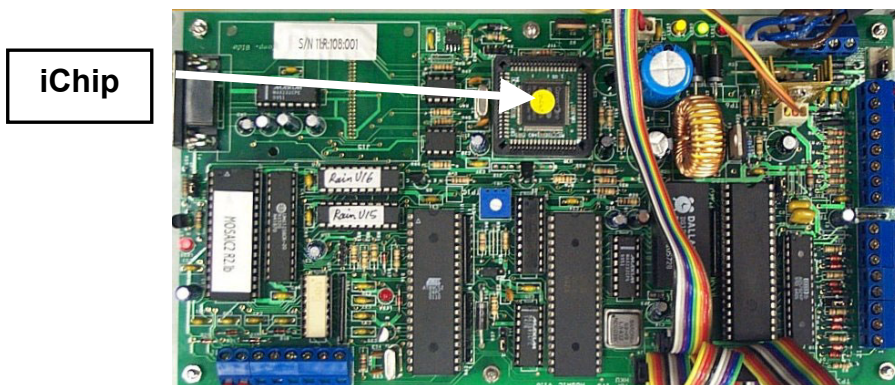
Figure 2: MOSAIC II System Design

**Technical Implementation**

Integration of iChip into MOSAIC II was straightforward and without too many changes in the circuit design. The overall design/development/production cycle was finished in about six weeks. According to Jerry Tam, Senior System Engineer of mCoMo, “Operating at 5-volts is a merit of iChip, because it could be easily integrated into our existing circuitry, which is also running at 5-volts.”



Ensuring integration of iChip into the GPRS network of wireless operator Hong Kong CSL was equally simple. Only one line of code in the GPRS modem application (AT+CGDCONT=1, "IP", "INTERNET") needed to be changed in order to define the GPRS PDP context. The modem type, GPRS service dial-up number, user name, and password, as well as a few commands for invoking the TCP protocol, were added to the host application with a few lines of AT+i commands.



The TCP protocol was selected because it is common and easy to use. Each TCP session includes an upload of approximately 40 bytes of data from the remote unit to the control center, which is running a data collection and analysis program written in Windows. MOSAIC II has been reporting to the control center continuously since September 2001. More installations are scheduled at different remote locations in Hong Kong before the next rainy season. Although the system now is used only for data analysis, it will be used for rainstorm warnings in the future.

mCoMo plans to export MOSAIC II to Mainland China and other Asia/Pacific countries. Target customers include government bodies and corporations that need to monitor climatic conditions.

mCoMo is currently developing a product targeted at the fleet management market. It will use the GSM/GPRS service to dispatch ad-hoc job orders to truck drivers and to collect job status. mCoMo is working closely with Connect One to develop a new version of iChip firmware that is specially designed for GPRS wireless modems. "We are confident that with our experience in GPRS and the technical expertise of Connect One in Internet connectivity, all of our customers will enjoy more low-cost GPRS services and applications in the near future," said Dr. Andrew Lai.

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