TINI In the Eye of the Hurricane
By Ron Therrien, InfoTech Plus

For those of you who think that the TINI® isn’t ready for prime time – think again!

TINI tangles with Gordon

When hurricane Gordon recently made its trek up the Gulf coast of Florida, it caused coastal flooding. TINI was on the job as the first line of defense at a couple of flooded installations (including my own barrier island home). Here is how TINI saved the day:

When a hurricane warning was received from the NOAA weather radio, TINI paged the owner to confirm that the flood shields would be closed and subsequently closed the flood shields.

Several hours later the storm arrived. Gordon’s storm surge caused many waves to break over the island. Two feet of water soon surrounded the house putting the flood shields to the test. After an hour, water started to seep through the walls and was detected by TINI’s water sensors, prompting TINI to start the sump pumps, removing water as fast as it came. Power was lost, but the power back-up system (solar panels, generator, and battery bank) kept the pumps and TINI operating for another four hours until the water receded.

Once the danger was over, TINI turned off the sump pumps, opened the flood shields, and notified the owner that the area was secure.

I was at my home during the whole storm and was very pleased to see that TINI was up for the task. In the case of my clients’ home, the owner was up north for the summer. They were able to run the system console on their wireless Palm to monitor the closing of the flood shields, sump pumps going on and off, etc. They felt more secure knowing TINI was on the job.

One of the neighbors’ homes (without a TINI system) had 12 inches of water inside, which caused several thousand dollars in damage.

Background
My interests in TINI and the 1-Wire® technology grew out of a desire to have a low-cost method to provide monitoring and control functions for home and business owners via the Internet. I am located on the southern part of Tampa Bay, Florida on a barrier island three feet above sea level. As you may imagine, coastal flooding is a major concern here. With all of Florida being so close to water, hurricane preparedness is a top priority statewide.

Much of Florida has a large influx of “snowbirds” during the winter months. Most are retired and own homes in both Florida and up north. Many of these seasonal people are away during hurricane season but are obviously interested in what is happening to their homes in Florida. Similarly, many snowbirds are also interested in what is happening in their homes up north while they spend their winters in the warmth of Florida. Is the heat working? Did the pipes freeze?

When you cannot be there, you want a first line of defense that takes an active role in protecting your home. Enter ROOMY – the roommate you always wish you had! ROOMY is an intelligent decision-maker that provides monitoring/control services, where the status of multiple homes or businesses can be viewed and controlled simultaneously. ROOMY can control lighting, air conditioning, and so forth, from any location via the Internet or local console. For portability, a PDA is used as the primary console but the software is written in Java allowing it to run on most devices from desktops to laptops to handhelds. Using the KISS (Keep It Simple Stupid) principle the initial ROOMY product focused in two areas heating and air conditioning and flood monitoring and control.

**Heating and air conditioning**

Temperatures and humidity are monitored at critical locations throughout a building. Based on user defined high / low set points alarms are generated. In addition, power on/off and power usage is monitored. Layout A shows a typical configuration. Temperature is monitored in the living room, bedroom and garage. Humidity and A/C power are monitored in the garage. Based on the alarm generated, LED’s are lit, buzzers sounded, alarms spoken, or emails sent. Sensors shown in Layout A include the following:

- Four light LED modules in the bedroom and living room
- Buzzer and speech modules in the living room
- Humidity sensor in the garage
- A/C power monitor in the garage
- Temperature sensors in the living room, bedroom, and garage

This array is presented in the following graphic:
Flood monitoring and control – Water presence is monitored at specific locations on the interior and exterior of a building creating alarms when water is detected. The National Weather Service broadcasts are monitored and alarms are generated as appropriate. A 1-Wire weather station is also used to monitor rainfall, wind direction and wind speed. Based on alarm conditions, flood shields and hurricane shutters can be closed, sump pumps started, buzzers sounded, voice output spoken, LED’s flashed, emails sent to pagers, or messages sent to a console. Layout B shows a typical configuration. The weather radio located in the bedroom and National Weather Service EMWIN system are monitored for storm warnings. Storm warnings cause the flood shields to be closed. If the water sensors detect water, the pumps are engaged. Based on the alarm generated, LED’s are lit, buzzers sounded, alarms spoken, or email sent. Sensors shown in Layout B include the following:

- Four light LED modules in the bedroom and living room
- Buzzer and speech modules in the living room
- Weather radio in the bedroom
- Water sensor, sump pump, and flood shield at the front door
- Water sensor and sump pump in the garage

This array is presented in the following graphic:
Infrastructure
The ROOMY system is built on a solid and expandable infrastructure consisting of the following:

- 1-Wire network topology
- Modular approach to sensors / control units
- Battery backup
- TINI Internet connections
- Internet database/Java server

1-Wire network – Monitored buildings are wired with category 5 cable for both 1-Wire and 10BaseT connections. Sensors use parasite power or power provided at the required location. All 1-Wire runs are connected to a “hub” type device prior to connection to the TINI. DS2406’s are used (unable to get any samples of the DS2409, I reverted to use of the DS2406) to control the different spokes of the network. A hierarchical structure is used for the 1-Wire database so the TINI knows which devices are on which spoke. See Figure 1 for a typical configuration. In most cases, the spokes are separated by physical location and / or function. For example, the weather station and the first floor are on their own spokes.

Modular approach to sensors / control units – Standard telephone outlets are utilized whenever possible. As many of the homes in Florida are concrete block, surface mount boxes are used when flush mount units are not practical. The RJ type jacks allow clients
to plug in devices as needed. For example, simply plug a water sensor into the RJ port to monitor for the presence of water. There are surface mount boxes or surface mount covers which include LED’s, buzzers, temperature sensors, relays, DS2406’s, DS2438’s, and DS2450’s in them. The RJ jacks in the DS2406 / DS2450 / DS2438 boxes allow the user to plug analog / digital sensors right in. Figure 2 shows some standard modules utilized.

**Battery backup** – Due to long outages that can be caused by a severe storm plus the need to run sump pumps, a power backup system can be extensive. The ideal solution uses a solar battery charger with generator backup capabilities to charge the required batteries. The TINI plus all system components then run off the backup power system.

**TINI Internet connections** – In this area several configurations are supported based on the users current / planned needs. If a client has an existing computer, a LAN with a router or LAN modem for Internet access is utilized. One client even uses a Pocket PC / Windows CE device as a console. They connect the PDA to 10BaseT jacks located throughout the home and connect remotely via a modem. If the client doesn’t see a need for a general Internet connection, a different tact is taken. To keep the telephone line free, a wireless PPP connection (CDPD modem, pager modem or local RF modem network) is used. The user’s console consists of a Palm with CDPD Internet service. The Palm is used as a console, for email, and for limited Internet access. Figure 3 shows the flexibility of available options for Internet connections.

**Internet database/Java server.** This is the brains of the network. Using the ROOMY message protocol, a TINI can talk to itself, another TINI or the server. The server contains complete configuration information about all the TINIs in its network. Functions include a TINI networked disk drive and a database describing 1-Wire devices. Detailed data can be stored on the server while the TINI only keeps a summary of current conditions. Any remote TINI can pull data from this database.

**Mirror site for each TINI’s status console.** A user’s console can connect to the remote TINI or the server to get current system status. If the server does not hear from the TINI for a user-specified period, an alert is generated and appropriate action is taken.

**Backup for the TINI’s configuration data.** All TINI configuration data, program files and data files are stored here.

**A repository for National Weather Service (NWS) EMWIN satellite broadcast information.** This data is used as part of the NWS alarm verification process where data is pulled from the satellite, Internet sites and NOAA weather radio.

**A database describing 1-Wire devices (by ID), their location and their function(s).** A special TINI version of this database is downloaded to the appropriate TINI for processing. The database consists of three primary functions.
The first table is nothing more than a parts list where components are given names, device types, descriptions of where they are used and ID numbers. If a device needs to be swapped out due to failure, all that is required is an ID number change. The names are then used in all other structures.

A multi-level hierarchical structure is created using previously given names to show how the devices are connected. For example, take a water sensor by the garage door. The top level shows which TINI it is connected to, then what hub spoke and then which DS2406.

Finally, logical functions are defined. Take the water sensor installed by the garage door example. When the sensor detects water, the following sequence of events should occur: a pump starts up, a buzzer sounds, email is sent to a pager and an LED lights up on panels by the front door and in the bedroom. An output device (i.e. LED, buzzers, and email) can be set off by many different input devices. This allows the water sensor in the garage to sound the same buzzer as the water sensor by the front door while each triggers a different spoken message. The database (not yet in TINI code) even supports outputs across TINI’s. Therefore, in our example, when the water sensor went off in one home a buzzer could sound in another home.

As you can see, TINI is ready for prime time. It offers industrial strength with a commodity price tag. ROOMY simplifies the power of TINI and 1-Wire networking. Instead of writing code each time a module is added, ROOMY’s Java based GUI guides a user through the configuration process. The GUI contains the standard ROOMY modules and actions to be taken. New modules will be added as requirements dictate. For example, water depth and heating oil tank level will be added in the near future.

ROOMY is currently in beta test at several homes and businesses. As beta testing wraps up, ROOMY will be offered in a starter kit version. Home protection devices (i.e. flood shields, hurricane shutters, sump pumps, and so forth) and sensors will be available as well.

Remember, while TINI may be ready to help you face a hurricane or flood, your home may not be. Improvements like waterproofing or making structural changes to support the force of water against your home may be required. If in doubt, contact your local building official.

1-Wire Network, Modules, and Network Overview figures are below:
**1-WIRE NETWORK - FIGURE 1**

- 1-Wire Spokes
  - Weather Station
  - HVAC System
  - Second Floor
  - First Floor

- First Floor Spoke
- Second Floor Spoke

- Send messages to console
- Send messages to cellular phone, email, pager

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**STANDARD 1-WIRE MODULES - FIGURE 2**

<table>
<thead>
<tr>
<th>Input Control</th>
<th>Output Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Weather Radio</td>
<td>✓ Strobe</td>
</tr>
<tr>
<td>✓ Temperature</td>
<td>✓ LED</td>
</tr>
<tr>
<td>✓ Water Sensor</td>
<td>✓ Buzzer / Siren</td>
</tr>
<tr>
<td>✓ Pressure Sensor</td>
<td>✓ Status four light LED Panel</td>
</tr>
<tr>
<td>✓ Voltage / Current</td>
<td>✓ Speech Output</td>
</tr>
<tr>
<td>✓ Digital Input</td>
<td>✓ Relay</td>
</tr>
<tr>
<td>✓ Rain Gage Weather Station</td>
<td>✓ Digital Switch</td>
</tr>
<tr>
<td>✓ A/C Current Sensor</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External / Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Pager / Email</td>
</tr>
<tr>
<td>✓ Dialer</td>
</tr>
<tr>
<td>✓ LCD / Console</td>
</tr>
</tbody>
</table>