# *White Paper: Cost Comparison for Several Different Multi-Family Environmental Monitoring Approaches*

Issue 2.0: 12/15/2015
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## Introduction

Based on discussions with property insurance agents, the number one category of property claims for homeowners in a second home market is water damage due to frozen pipes in the winter. Water damage from leaking pipes during the other seasons also contributes to the high premiums that homeowners and condo associations pay for property insurance coverage. If a particular property is left unattended for months at a time, a water leak can indeed do considerable damage. This damage may be due to a leak in one unit of a multi-family building but the resulting damage may cover several units. All homeowners or renters in a multi-family building have a stake in this problem since the common portion of a building usually often has insurance claims even if a leak is due to a problem in one unit. For this reason, many homeowner associations pay for routine visits to their owner's units when they are away.

While an individual or association insurance policy would cover such hazards as fire and theft as well as water damage, the odds of a fire in a condominium is much lower that a water leak or other property damage due to a furnace outage in the winter. A simple thing like a power outage or power surge may disable a furnace long enough to cause problems. Other events, such as wind blown tree limbs that break a window, can cause property damage that may result in the furnace being unable to keep the place warm.

This paper is intended to demonstrate the value of using water and temperature alert detection systems as a means for early detection of the above types of property damages. The author is the owner and founder of a new company called Willabay Design that has developed custom software for some new devices that can support this type of alert detection.

## Total System Packages versus Water and Temperature Detection

Many alarm system packages are available from security companies and alarm system contractors that will provide total system coverage, including alert detection for fire, smoke, break-ins, and intruder detection as well as monitoring for such alert conditions as low temperatures and surface water on a floor. These systems are generally very expensive and all of them must have the alert reported to an outside agency or reporting network. In general, fire detection systems will result in the immediate reporting of the event and the subsequent immediate dispatch of the fire department.

If such an alarm system package includes temperature or water detection alerts, these typically are also reported immediately and require the same kind of monthly service

charges for the monitoring of a property. Such systems can easily cost several thousand dollars for a large residence, not counting the annual reporting service fees.

In a single family home, the individual homeowner is responsible for the whole house thus can have one system installed for the entire home. That homeowner will then be notified by the alarm system or alarm system service when there is an incident in the home. This alert notification can be by phone, email, text message, etc. Recent cost reductions have brought down the price for those systems that incorporate a cellular or internet based interface for outgoing alarm reports.

In a multi-family arrangement such as an apartment or condominium, the reporting mechanism is more complicated. An alert originating in an individual unit will typically be reported to that individual unit's owner, the alarm service, or a property manager. This would depend on the type of alert, be it fire, water, low temperature, etc. An alert in the common area would typically be reported to the alarm service.

If the property that is being monitored already has a fire detection system in place or the owner is mostly interested in a means of detecting environmental alerts (low temperature, water, etc), systems are available that are much less expensive and do not need to meet the criteria for immediate response that a fire system would require. They also do not have to utilize the services of an alarm service that imposes monthly fees. This paper is directed at an overview of the cost of monitoring a multi-family complex where the alert condition being monitored is limited to high or low temperature detection and water detection. As long as an alert condition is detected in a short period of time (5-15 minutes), the system should be considered effective. The main requirements for such a system is that it has to be extremely reliable and easy to use.

In the discussion below, the examples shown will assume that a multi-family building has four units per building. In general, the cost per unit drops as the number of units in a building increase. This is of course limited by the architecture of the alert management system, building layout, distance considerations, and other factors.

**Approach 1: Individual Unit Devices Only**

The most inexpensive means that an individual homeowner has for detecting environmental alerts is a small dedicated detector or set of detectors tied to one system. These systems typically are connected to a standard phone line for reporting an event. Some newer systems are capable of making a cellular phone call to report an event. The cellular based system still requires a cell phone line per system.

In general, these systems are available from online home automation or security firms for as little as $100. The author has experience with some very good systems that sell for about $160 that can be programmed to detect a specific low temperature alert or water alert. One such device is made by Protected Home (Model FA-I-CCA) and sold via several outlets. This device is shown below.


**Freeze Alarm Model FA-I-CCA**

Sensaphone is another excellent company that manufactures home monitoring devices that are in the range of $350-$535 (Models 400, 800, Web600). These devices can be connected to phone lines or an internet connection on a router. Sensaphone and other manufacturers are also marketing cell phone based solutions that operate in a similar manner but require a cell phone line. The Sensaphone product (Model Cell682) sells for over $1000. Two of these units are shown below.



**Sensaphone Model 400** **Sensaphone Model Web600**

For various reasons, only a small percentage of homeowners in multi-family residences actually use these devices for alert monitoring of their homes. Some feel the devices are too expensive and some do not like the idea of paying for a separate phone line or cell phone line for a security box. Another issue is that these devices typically will only report an alert to one of a few phone numbers or send one email. The more inexpensive systems such as the Protected Home FA-B-CCA (cost is around $60) do not have the means to allow the owner to remotely manage the system over the phone or an internet connection.

Some very good online sources for this type of system are The Home Security Store (http://www.homesecuritystore.com) or Smarthome (http://www.smarthome.com). Another such online firm is DIY Controls (http://www.diycontrols.com ). These firms carry a broad line of products aimed at individual homeowners that do not require the services of an alarm reporting agency.

More recently, a number of devices have come on the market that would allow an individual homeowner to connect a detection device to an internet router and access their system from anywhere over the internet. While these devices are coming down in price, the network connection is still the homeowner's responsibility. To use one of these, you have to have a wired or wireless network in place and subscribe to a broadband internet service. While full time residents may already have such a service, not all second homeowners are willing to face the monthly fees for such a service. One drawback with systems such as these is that the network aspects of the setup appears complicated to those not familiar with the equipment.

One such product is made by IpDatatel and is offered through alarm system contractors and security firms. Estimates for a standard configuration using this product with an alarm panel and wireless sensors for 4 units would be in the area of $500 to $600. These systems still require an outside alarm service for reporting alerts; along with the requisite monthly subscription fee. This estimate assumes that a basic alarm panel is configured for low temperature reporting only.

Sensaphone (http://www.sensaphone.com) and AutomationTec (http://www.automationtec.com) are also marketing internet based solutions for one or more areas in a home or business. The Sensaphone Web600 (shown in the figure above) sells for $355 and monitors up to 6 inputs but requires an external network for remote sensor connections. If these sensor connections are wireless, it would add at least another $300 to the above Web600 cost.

Another firm called Temperature@alert (http://www.temperaturealert.com ) has a system available that will connect via a wifi network and report alert conditions on up to two sensors. Their product sells for $299 on Smarthome. A cellular version of their product is available for $399. This system has a temperature sensor directly attached to their box. Their wifi enabled device is shown in the figure below. For applications where a homeowner wants to connect a single device to their existing network, and monitor the temperature in one location, this product is one of the least expensive solutions currently available.


**Temperature Alert Wifi Model**

The author has not had any direct experience with either of these internet based products but the Sensaphone versions of these products are able to support more sensors and have been around longer. All of these products require the device to be set up properly to function with the homeowner's internet access.

The devices made by AutomationTec are less expensive but can connect to more remote sensors. However, the cost of these sensors is over $100 each. One of their models is shown below.

**AutomationTec AT100 Remote Hub**

While Sensaphone markets systems that can support far more inputs, the cost goes up accordingly. With the possible exception of Sensaphone, none of the above manufacturers market systems applicable to a multi-family market. Most of them can; however, be used in such buildings.

Since Willabay Design started developing the AMMS system, a few companies have introduced internet based systems that are very inexpensive and use wireless technology to access their remote sensors. As an example, La Cross Technologies now has a combined Wi-Fi Gateway and Sensor product that sells for around $100, including one Temperature and Humidity sensor. It is available directly from La Cross at https://www.lacrossetechnology.com/alerts/remote-monitoring.php. This La Cross system supports up to 5 additional remote temperature and humidity sensors that are around $65 each. While La Cross requires purchasers to sign up for a service plan for online access to their data, these plans are very inexpensive. We have not yet had any direct experience with this promising new product line from La Cross.

Another fairly new development that has hit the market is alert system monitoring via the cable companies. Firms such as Comcast have expanded their offerings by adding devices that will monitor your home and report any alert to their service. Again, this kind of setup requires a monthly fee on top of your existing cable fees.

In the author's opinion, a multi-family residential complex is not adequately protected unless all of the unit owners in a given building have deployed systems that can monitor their property. They all also have to maintain their equipment; a task often forgotten or not understood well enough to perform well. A system that takes very little "in unit" maintenance but depends more on equipment placed in a common area seems like it would be more reliable in the long run for all of the property owners involved. If an individual owner can be assured that they have to do nothing other than keep a battery going in a sensor device, most owners will opt for that type of system. That is the reason why the author has concentrated on the design of a system that matches the needs of a condo or apartment complex. This is described in the following section.

**Approach 2: Shared System Deployed in a Common Area and in Units**

As opposed to the deployment of systems in every unit, a shared system can be constructed today using readily available components. One example would be to deploy a Sensaphone system in a common area of the building such as a utility room. Various sensors or networks of sensors can then be deployed in every unit. The "smarts" of the system is placed in a central location and maintained by the association or property owner in the case of an apartment. A system consisting of a Sensaphone Model 400 product with a separate wireless sensor network would run about $700 to $900 for four residential units. The major alarm system manufacturers such as Honeywell or Elk also have available alarm panel configurations that can be used in a multi-family application but they are much more expensive.

The main issue with a system like this is that the "smarts" get fairly expensive and the per-building device still requires a phone line or internet connection for it to operate correctly. One good model for a system like this would be to have an alarm system panel installed in a common utility area and connect it via phone wires to the outside world. Various wireless sensors can then be placed in every unit. These sensors can detect water or temperature extremes. Another model would be to deploy an internet network over the

whole complex that would interconnect devices that are placed in every building. Such a system would allow owners and property managers to remotely monitor the property.

As in the case of the systems that are deployed per unit, this kind of arrangement gets expensive because it requires the payment of monthly fees as well as maintenance of the whole system. Because many of these systems are fairly complicated, they can get expensive to maintain.

One variation on the above internet network model would be to use a relatively simple network interconnection device at a common location in a multi-family building. This device could connect to an internet network via wireless wifi technology so that wired connections are not needed between buildings. The network device would function as an input/output server to the outside world and would connect to a standard alarm system sensor network inside the building. The only equipment that would remain in the individual units would be the temperature or water sensors and small transmitters that connect to a receiver in the common area. Once a system like this is set up, it would need very little maintenance if the network server had the smarts to keep everything up and running.

**Willabay Design AMMS Introduction**

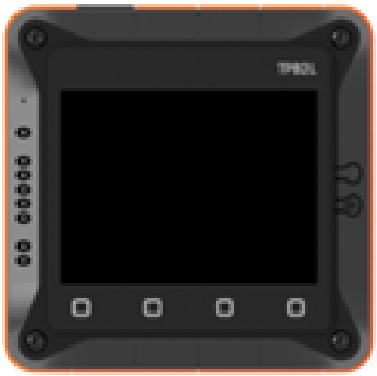
In order to address this market for an inexpensive means of monitoring a distributed network of properties, Willabay Design spent a few years developing a product that we now call the Alert Monitoring and Management System (AMMS). Our software was originally designed for a number of different internet enabled Input/Output devices made by Tibbo Technologies in Taiwan. Information on Tibbo's products can be found at http://www.tibbo.com. Until recently, the only available Tibbo devices that were available as a fully enclosed device or controller was their DS1005 or DS1015 programmable controller. Both of these controllers allow up to 8 input sensors to be connected to the input lines on the device and also support 6 output lines with internal relays.

The basic version of their controller product is the DS1005 which has no built in wifi interface. It is generally available from US distributors for around $260. Tibbo's newer wireless version of this device is about $380 including the Wi-Fi interface. The DS1015 was still too expensive for the market we were addressing so we restricted our initial AMMS development to the DS1005. A Tibbo Model DS1015 is shown in the photo below and the full datasheet on this product can be found at http://www.tibbo.com/downloads/open/datasheet_ds10x5.pdf.

**Tibbo DS1015 with attached wifi antenna**

The Tibbo Model DS1005 controller looks exactly the same without the wifi antenna. Power to this device can be either a 12v dc plug in adaptor or a wired 12v connection to the jack provided. The approximate DS10x5 dimensions are 4" H x 3.5" W x 4" D (not including the antenna) and can be wall mounted. The Tibbo DS1005 devices are extremely well built and are comparable to industrial controllers that cost far more.

In early 2015, Willabay Design started to look at an entirely new product line that Tibbo had introduced called their TPS system. This product line was available in many forms, including kits. The most important aspect of this system in our view was that it was a way to support virtually an unlimited number of IO options on one box. We started development of a TPS (TPP2 only at first) early in 2015 and now have our AMMS product working as a fully supported Beta release. Additional details on Tibbo's TPS system can be found at http://tibbo.com/tps.html. A complete TPP2L assembly, including their optional LCD screen, is shown in the figure below. While the AMMS does not yet support software that will utilize this LCD feature, we are definitely planning on doing so in the near future and already have the software functioning in our EDMS/EDA product.



**Tibbo TPP2L (with LCD) Version of their TPS Product**

Current base retail pricing for the TPP2 hardware, not including any optional Tibbits or the LCD screen is around $100. The LCD version runs about $60 more. When compared with any other available Tibbo device that can run our software, the TPS platform is clearly the way to go. Even when you add the necessary internal connection and IO circuits that Tibbo calls Tibbits, the base price will still be very reasonable. While the DS1005 is an excellent solution for applications that need a very robust and water resistant device, the TPP2 works perfectly well in a dry location.

The additional electronics that are needed to connect to a DS1005 or TPP2 for a temperature detection system are available from standard suppliers. The author has worked with equipment made by Visonic, an Israeli firm. This includes a receiver (Model MCR-308) and several transmitters (MCT-100). A complete system also requires the actual temperature and/or water sensors. The total receiver cost for the AMMS system in one building is about $400 or $100 per unit when shared over 4 units. An additional four inputs can be used for water detection at a cost of about $70 more per unit. The Visonic MCR308 receiver is shown below.

**Visonic MCR-308 4 channel receiver**

Once you add the cost of the basic AMMS package on a TPP2 and the required external receiver equipment (or equivalent), the overall cost per unit is around $160 per unit, not including any installation or any necessary internet access equipment. While this starts to be competitive with some of the above alternatives, it is still fairly expensive when you have few monitored locations.

The advantage of such a system is that it allows for individual access of the system by any owner and does not require the association or the owners to pay any monthly fee other than the internet access fee for a small number of wifi access points on the network. This in effect distributes the system in such a way that a relative few buildings need the necessary router or access point equipment for a wifi network and every building supports its own web server that can monitor every sensor in the building.

The above cost estimates include installation but do not include the hardware and installation cost of the base wifi network that a homeowners association would need to support such a network of servers. Because the bulk of this arrangement is wireless, the

installation cost is minimized. Comparable systems made by the main alarm system firms such as Elk or Honeywell would be at least twice as much per building.

More information on the operation of the Willabay Design/Tibbo product can be found on the Willabay Design website at http://www.willabaydesign.com. The Willabay Design AMMS product has completed a trial phase where two prototype versions of the hardware were used as building monitors since late 2011. Other than when they were down for upgrades, the trial system devices were running 24 hours a day. The servers have automatically recovered from any wireless or power interruptions and have been accessible to external access connections throughout the trial.

**Additional Considerations**

It should also be noted that in the event a given customer chooses to start to use a competitive supplier for the web server portion of this system, the other components, such as the radio receivers and transmitters can still be used as is. A future network could also use receivers and transmitters from other vendors. The author expects Tibbo to be around for a long time since their products are made by a very large and reputable electronics firm in Taiwan.

Additional information regarding Willabay Design may be obtained at the company web site, http://www.willabaydesign.com.

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