WHITE PAPER

Sensara Senior Lifestyle

An Internet of Things application, enabling seniors to live longer independently at home

By Cees Links, GM of Qorvo Wireless Connectivity

"Everyone wants to get old, nobody wants to be old." Unless that is, if we can use technology to make our lives more secure and more comfortable.

Elderly people, our senior citizens, often want to live at home longer because that is the environment they are used to and in many cases, they can. However, if something happens, will they be able to alert someone, will they be able to get help?

Everyone has heard of family situations where an elderly person was too incapacitated to get out of bed in the morning, or they fell and were not able to call for help. Seniors living home alone can generate a lot of concern – not only for the senior person, but also for their children, friends or caretakers. Wouldn't it be nice if some technology could help?

There is a solution that utilizes the latest generation of sensors, communication and smart cloud technologies. The Sensara Senior Lifestyle System is a new generation Internet of Things (IoT) service application that can help people to live at home longer, secure and comfortable, and that provides peace of mind to seniors, their loved ones and their caretakers. This system does not use intrusive cameras or devices that people constantly need to wear on their body.

How it Works

The Senior Lifestyle System consists of a limited number of small sensors (5 for apartments to 8 for large houses) that are installed in someone's home – a few motion sensors and a few open/close sensors. These sensors are installed at strategic places in the home (living room, bathroom, kitchen, hallway and front door) and they automatically connect wirelessly to a gateway that is plugged into a standard home internet router provided by a telephone or cable provider. Because these sensor devices are small, battery operated, and do not have to be worn, they are truly easy to install and forget.

Sensara Senior Lifestyle Package

The Sensara Senior Lifestyle System exists of a limited number of small sensors, 5 for apartments to 8 for large houses.

After installation, these sensors start to collect data about what happens in the house. This data is uploaded to an analytics engine "in the cloud" and, over time, usually a period of about two weeks, the analytics engine has enough data to be able to recognize living patterns of the person in the home: at what time someone gets up, how long the bathroom is used, how often the kitchen is used, how long one is out of the house for shopping, when are they taking a nap, etc.

When the behavioral patterns are known, exceptions can be detected and analyzed. For instance, minor exceptions like skipping a meal or major ones like not getting out of bed in the morning, or even suspicious inactivity in the afternoon.

The Sensara data analytics algorithm basically compares the inputs from the sensors (or the lack of inputs) with the normal behavior of a person. Based on detection of exceptions and anomalies, it sends a (text) message to the smartphone of a caring person, a family member or friend. The message could read something like this – "normally Ann is out of bed by now, but today she is not, maybe you want to give her a call" – and with a single click the call can be made, and further action can be taken.

The Value Provided

The Sensara Senior Lifestyle System provides something that is very valuable: peace of mind. Peace of mind for both the senior person living at home alone, as well as for family members, possibly living far away. Of course, the system cannot replace personal contact, like visits or phone calls – but it is a very welcome and easy addition. If something out of the ordinary happens, it will not go unnoticed, while at the same time the senior's privacy is fully respected, and well-meaning but worrying intrusions from family and friends ("I have not heard from you for three days") become unnecessary. The system does not require a camera and preserves personal privacy. It does not require wearing emergency buttons – for instance a fall detector – although those can be easily included as additional sensors as well.

But there is more. Something people are not always noticing is recognizing slow deterioration. These downward trends can be easily overlooked, until something critical occurs. One example of this is walking speed – how fast someone walks through the house. By collecting data over a longer period in time, the system can recognize if someone has started to walk significantly slower than two months ago. Walking slower is a good early indicator for running the risk of taking a bad fall and possibly breaking a hip. If a gradual slowdown or a change is noticed, the Sensara system will generate an alert to a family member or a caretaker.

The Senior Lifestyle System provides both short and long-term values. Short-term value, because it creates alerts on instantaneous anomalies, like not being active as usual (i.e. in case of illness or a fall) or leaving the house longer than usual (getting lost more easily?). Long-term value, because it creates alerts for family members or caretakers when people slowly change their behavior, something that is hard to identify, like walking slower or having bad sleep (caused by illness, dementia or depression?). But in all situations, it truly provides peace of mind for everyone involved.

Big Brother

A logical question that often arises is "isn't this Big Brother"? Well, in a way, actually it is. The real underlying question however is "is it worth it?" Is it not great to have a Big Brother? Since George Orwell's 1984, the term Big Brother has a bad name and reputation. But rightly so? Definitely, big brothers can be a nuisance or worse. But couldn't having a Big Brother be something special and very positive? So in a way, Sensara is a Big Brother, but a very helpful one!

It is probably time to rethink our image of the Big Brother. The new age of the IoT helps us to quantify our lives. To measure is to know. Quantifying our lives helps us to make better quality decisions, or even to assist us to actually make those tough decisions. Quantifying our lifestyle helps us to live more safely, securely and comfortably.

Several Sensara users have said that since they started using the system, their relationship with their loved ones has improved. There is more involvement, more contact moments and discussions about live situations that matter. The involved elderly appreciate that and are proud to have children who “care about” them.

But there is obviously a flipside. What about the data being collected? Is it secure, can it be abused, who owns it, etc.? Those are all valid questions, but not necessarily that different as asking the same question about using a credit card in a store. And we know that there is a serious balance between convenience and ease of use on one side and security and privacy on the other side. But in the same way as internet hacks did not stop us from using our credit cards, we will learn how to deal with security and privacy on the IoT as well.

Questions and Answers

1. How many sensors are required?

For the system to work essentially only five sensors are required. Adding more sensors is possible but not necessary. The five sensors (motion detection or open/close) need to be located on predefined, carefully selected locations to be make the system effective: the bedroom, the washroom, the fridge in the kitchen, the hall and the front door. Adding more sensors can be done and will make the system “learn” faster. Additional sensors can be placed at the back door, second washroom, living room, hobby room.

2. How does the system work?

The system uses so-called “model-based reasoning”: it uses a uniform base model of single people living at home alone. This base model has been developed and tested over a period of 15 years. Per individual situation the system is continuously collecting information via the sensors and “learns” how to adapt this base model so that it represents the real living pattern of the person living in the house. For example: every person gets up in the morning and this is something the base model “knows”. The individual getting-up patterns of persons will adjust in the base system based on sensor information to better correspond with the situation of the individual person. Based on this specific knowledge, the system can now identify exceptional situations and create alerts.

3. Does the system stop learning?

The system requires about two weeks to transform the base model into an individual specific model. However, the system never stops learning. It continuously keeps on absorbing new information (via the data collected by the sensors) and adapting the model. The consequence is that people can adopt new habits without creating alerts, but at the same time when these habits are adopted and exceptions are generated, then the alert process will automatically kick-in.

4. What is the technology behind the system?

The system is based on artificial intelligence, also more popularly known as “fuzzy-logic”. So it does not require precise “if-then-else” programming. That would become way too cumbersome anyhow. Fuzzy-logic allows the system to collect the data from the sensors and makes hypotheses about the reality (models). It makes decisions when these hypotheses need to be rejected and replaced by more justifiable ones, or whether alerts need to be created. This type of logic is not storing endless amounts of data and is also not cranking through this continuously. Therefore, it is efficient and capable of making proactive decisions.

5. Does the system also provide trend information?

Yes, the system also identifies longer term trends based on information provided via the sensors. Examples of trends are: hours of sleep, number of washroom visits and walking speed. These slowly changing indications of deterioration are sign of e.g. growing balance problems and an early indicator for breaking a hip. These changes can also report improvements, for instance after an operation. This trend information is equally important as the exception identification and the alert generation. Not being able to recognize slow changes (or pure denial) can have serious consequences.

6. What are the installation prerequisites of the system?

The system assumes that one has an internet connection (mandatory) with a router that also supports Zigbee®. For those situations that the router does not support Zigbee, a small gateway is included that connects with a short Ethernet cable into the router. No further installation is required.

7. How is the system installed?

The installation of the system is a three-step approach. First the Sensara app (available on Android and iOS) is downloaded and installed on a smartphone or tablet. Secondly the sensors are installed, hung on the wall or connected to a door. Each sensor has a sticker on the back which indicated where the sensor needs to be installed. The location of the sensor is important (it must be able to do its job), but more than common sense is not required to determine the location (e.g. do not hang a motion sensor behind a curtain). The last step is to go with the smartphone or the tablet to each individual sensor and check whether triggering a sensor is indeed confirmed on the display. That is all. Now the system is ready to start automatically its “training period” and after about two weeks, it will be able to generate alerts.

8. What about security and privacy?

The system is completely pre-configured with security keys and all data is fully encrypted. The app on the smartphone or tablet can only be accessed with a user name and password.

9. What are the advantages of the system?

The Sensara product is unique in its class because it is based on leading-edge technology that has been used in care homes for years already, and which is now being implemented into the consumer market.

Key characteristics are:

- The system is **very affordable**, even low cost. The required five sensors (and gateway) is all that is required. For the rest, the system is using existing infrastructure (internet) and hardware (smartphone and tablet).
- The system is very **easy to install**, even intuitive: the combination of wireless and an app that leads the installer through the process, makes the time from opening of the box to getting the system up and running less than an hour.
- Once the system is installed, it has become virtually **maintenance free**. The battery life of the devices exceeding 7 years, which is in most practical purposes longer than the system will be used – and even then, changing the batteries is the maximum maintenance that one can expect.
- The system is totally **non-intrusive**: once it is installed, one can totally forget about it, it does not need turn-on/off, it works without wearables: there is no need for putting devices on or off, it does not require cameras or observation, so it fully **respects privacy** of the monitored person, alerts are generated automatically. The system is **secure**, the data is fully encrypted.

10. Where is the system available?

The system is worldwide available and is using the worldwide available standards, meeting all the required certification standards. Visit: **https://sensara.eu/en/shop/**

About the Author

Cees Links was the founder and CEO of GreenPeak Technologies, which is now part of Qorvo. Under his responsibility, the first wireless LANs were developed, ultimately becoming household technology integrated into PCs and notebooks. He also pioneered the development of access points, home networking routers, and hotspot base stations. He was involved in the establishment of the IEEE 802.11 standardization committee and the Wi-Fi Alliance. He was also instrumental in establishing the IEEE 802.15 standardization committee to become the basis for the Zigbee® sense and control networking. Since GreenPeak was acquired by Qorvo, Cees has become the General Manager of the Wireless Connectivity Business Unit in Qorvo. He was recognized as **Wi-Fi pioneer with the Golden Mousetrap Lifetime Achievement award**.

For more information, please visit **www.qorvo.com**.

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