AERIAL - DISRUPTIVE APPROACH TO ELDER CARE

INTRODUCTION

Thanks to modern science, people are living longer than our ancestors could have ever imagined. Yet today, the gift of extra life is not without its challenges. As time goes on, it becomes far more difficult to get by without the help of those around us. Eventually, many require full-time assistance. Today, almost 30% of the world's population is over 65 years of age, and around 30% of these are living independently at home. The senior population is projected to double in the next 50 years[1], and this growing population worldwide will force us to change how we take care of our elderly communities.

That's where Wi-Fi Sensing comes in: assistance that isn't intrusive or stigmatizing. This technology provides remote care options that don't require additional hardware or effort to use, but ultimately aid empowerment. Unlike a camera, Wi-Fi Sensing doesn't create any "images" of what's happening in the home, but rather, it characterizes motion and presence that illuminates behavioural patterns and routines. The result, connecting families and establishing peace of mind without the baggage of a wearable sensor. This is what Wi-Fi Sensing enables: invisibly maintaining one's freedom and daily routine, while offering peace of mind.

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[1] United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Ageing 2017 - Highlights (ST/ESA/SER.A/397).

DESCRIPTION OF THE CASE

Today, we observe the growing trend of independent living (around 37 per cent circa 2010 compared to 24 per cent circa 1990). This substantial changes in the living arrangements of seniors has taken place everywhere around the globe. In Asia, the proportion living independently increased by 9 percentage points, the Latin America and the Caribbean saw the largest increase in the proportion of older persons living alone, from 9 per cent circa 1990 to 13 per cent circa 2010. The prevalence of independent living also increased markedly among the older population of Europe, from 66 per cent circa 1990 to 76 per cent circa 2010[2]. This independent living comes with it challenges, 33% of seniors fall at least once every year and only 40%[3] tell their doctor or relatives. With 85%[4] of seniors preferring living in their own home, this trend will continue to grow as the population get older. This new reality will force us to change how we take care of our elderly communities and find sustainable ways to empower their independence.

FIGURE: PREFERENCE FOR LONG-TERM CARE

- Assisted Living Facility
- Family Member Home
- Nursing Home
- Own Home
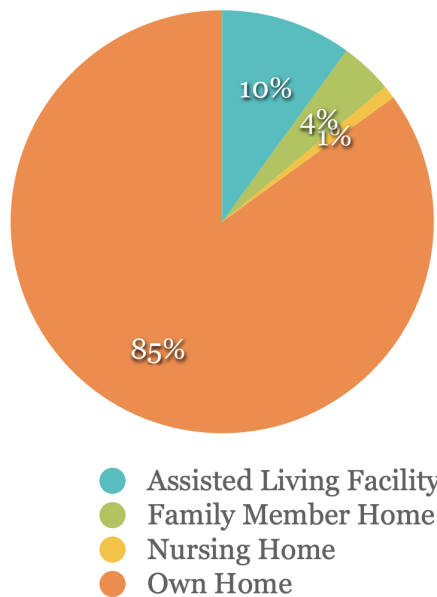
SOURCE: MERRILL LYNCH

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[2] United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Ageing 2017 - Highlights (ST/ESA/SER.A/397).

[3] United States Census Bureau

[4] Merril Lynch

The existing Remote Care solutions (wearables, sensors, cameras) that we can find on the market today are good technologies, but there are a few challenges that they are failing to address in order for the seniors and caregivers to profit on those Remote Care solutions:

1. **Usability**. Only 20% of elderly people who own wearables such as bracelets or pendants are wearing them. The margin of error is immense and can contribute to decreasing the independence of the elders and even be fatal. This is a recurring problem for wearable companies. Even when a senior accepts to wear it, several other usability problems can take place : Not wearing the device in the shower where the risk of falling is the highest in the home, forgetting to charge the device, placing the pendant inside their clothing so it becomes inaccessible during a fall, creating false alarm by dropping the pendant on the floor and, perhaps, the most troubling is 83% of elders did not activate the emergency button after a fall where they stayed on the floor for more than 5 minutes.

2. **Cost**. This is cited by caregivers as one of the greater barriers to access remote care technology. Most solutions on the market are expensive, and the senior community is generally not wealthy. It is important to create a Remote Care solution for those who need it, not only the ones that can afford it. Elder care should be accessible to all, regardless of their income or retirement fund.

3. **Deployment.** A great challenge today is also the need to install and maintain this modern equipment. The more hardware in the home the more time you need to spend on ensuring it is effective and working properly. This complexity and time-consuming tasks are huge barriers for its target audience; the elders. A simple plug, play and forget deployment is crucial to ensure adoption of these solutions.

In 2020, an estimated 45 million Americans provided unpaid care to an adult. That's around 1 in every 6 adults[5]. In addition to the daily stress and emotions of caregiving, caregiving takes a substantial commitment of time and effort, "21% of caregivers perform 21-40 hours of care per week, and 30% care for 41 or more hours per week!"[6] That's essentially a full-time job.

While 71% profess interest in caregiving technologies, only 6.8% are already using this technology. The two biggest barriers to adoption are awareness and cost.

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[5] Caregivers & Technology: What They Want and Need A guide for innovators – research from a nationally representative sample of America's 40 million family caregivers

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One area of particular interest to caregivers is technology that can help connect them to a loved one, offering peace of mind that they are well, even when they are apart:

› Alerts when a loved-one needs urgent care (72.4% interest)

› Ability to remotely check in on a loved one (76.4% interest)

› Monitoring daily patterns (59.0% interest)[7]

The market is in great need of a remote care solution for independent living that is affordable, easy to deploy and doesn't require any effort to use.
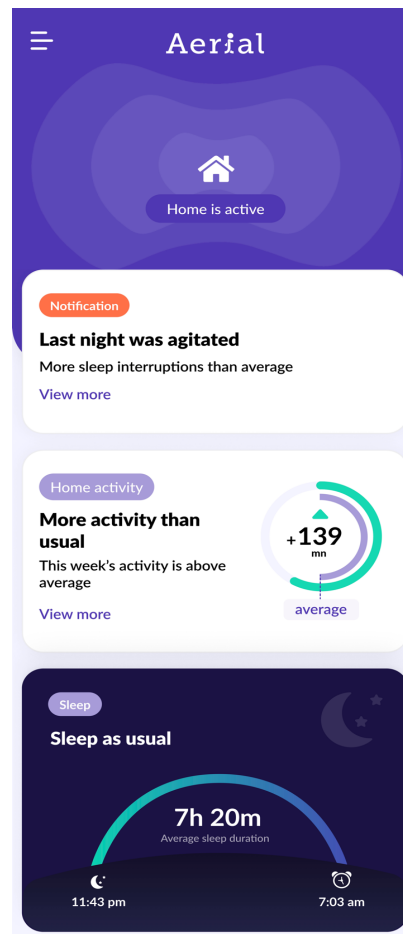
SOLUTIONS

Wi-Fi Sensing is key to a Remote Care solution that empowers the seniors, preserves their privacy and doesn't require any effort to use.

When an object moves through a space, it disturbs the Wi-Fi signals. These signal disturbances can be leveraged to characterize motion and presence. The result, Wi-Fi Sensing enables passive monitoring of loved ones in their homes and establishes peace of mind, all without the baggage of a wearable sensor.

Aerial Technologies launched the world's first AI-based Wi-Fi Sensing Remote Care Solution. This new technology enables broader access to Remote Care at a fraction of the cost, as well as greater convenience with its passive non-invasive approach.

Analyzing the disruption created by motion in the Wi-Fi signals in the home, Aerial's AI processing infers human activities to create smart solutions. Aerial's Remote Care allows the family or caregiver to obtain key indicators and valuable insights into the state of an elder's well-being as well as being informed of any concerning behavioral trends or events via an accompanying smartphone App.

This SaaS solution requires a small software agent to be installed on the home router. By leveraging the existing Wi-Fi infrastructure in the home to create a sensing aera, this solution can be deployed ubiquitously and reduce operational risk, cost and complexity.

The performance optimization mechanisms used in modern Wi-Fi communication systems are always improving, generating fine-grained data in order to have a perfect understanding of the conditions of the wireless channel at any given point in time. The data captured during the sounding of the wireless systems is an excellent input for performing motion activity classification by applying digital signal processing (DSP) and machine learning (ML) techniques. The process of collecting and analyzing this Channel State Information (CSI) measurements between Wi-Fi devices connected to an access point (AP) can be summarized in a simple way, ignoring additive noise and/or interference.

Wi-Fi coverage is important for ensuring adequate Wi-Fi sensing performance. For areas where the Wi-Fi coverage is poor, mesh nodes can be employed to form a natural mesh sensing network. MIMO provides high spatial diversity and feedback for sensing Wi-Fi signals used for capturing CSI. The 4x4, 5x5, 8x8 MIMO based solutions provide maximum coverage within the home by helping overcome impairments, noise, walls, and obstacles that impact Wi-Fi range in a home. The QCS-AX and QCS-AX2 Wi-Fi 6 solutions from ON Semiconductor support advanced spatial diagnostic technology allows for rapid capture of precise high-order MIMO CSI, enabling higher resolution sensing capabilities.

Optionally, Aerial's compact Motion Capture Plug, powered by ON Semiconductor's QV 2x2 Wi-Fi 5 (802.11ac) chipset, can be deployed in the home in the situation where the service provider does not supply the Wi-Fi infrastructure in the home. The Motion Capture Plugs establish motion-sensing areas between it and the serving Wi-Fi access point or repeater to create motion-sensing coverage throughout the living space.

IMPACTS TO PEOPLE AND INDUSTRY

Aerial's Remote Care solution solves all 3 challenges of the market (cost, deployment, usability) at once. No need for installation, no hardware, wearables or invasive camera. An invisible update of the router and the solution is now enabled in the home. How is this disruptive promise holding on with real users? The data gathered from one of our pilots shows a robust and accurate solution[8]:

› Aerial's solution has an accuracy over 99.5%. In a recent customer evaluation, out of 14,500 Motion Detection notifications, only 7 were reported as unexpected.

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[8] Pre-commercial pilot with Telefonica Spain based on 700,000 testing hours on 221 customers over 4 months.

> The solution has 100% true positive. Every time someone was home, they were correctly detected. There were no reported missed events.

> The vast majority (80%) of customers used the application regularly (average of 17 times per month) and demonstrated a level of engagement 2X higher than existing Smart Wi-Fi mobile application.

How is this solution helping the caregivers? A user helping his 85 year old father testifed: "I was very impressed with the accuracy of the key wellness indicators. I talk to my father often, but the days that we are not in touch I like to look at the application to know that everything is ok. It gives me the peace of mind that my father is doing well and that he is going about his day normally." Wi-Fi Sensing helps overcome the typical challenges that caregivers face when they are trying to give proactive support to elders:

> Preserve freedom. That means preserving an elder's control and privacy.

> Enhance rather than take away. Independence is about empowerment and growing one's capabilities, not limiting them.

> Protect from stigma. Invisibility is key. Nobody wants a form of assistance that might flag and stigmatize them amongst their peers. Even if someone needs a walking stick, they'll tend to hide it away when guests come over rather than keep it in the open. As a result, it's important to ensure that assistive technologies are discrete and invisible while simultaneously providing the critical insights required by a remote loved-one.

Wi-Fi Sensing addresses the key elements of proactive care giving. With one unique solution, Aerial's Remote Care overcome the existing challenges on the market, support the caregiver in a meaningful way and encourage elders to receive proactive help which empower their independent lives.

CONCLUSION

Aerial Technologies developed a zero-effort solution to democratize access to affordable Remote Care for caregivers and their loved ones. This new technology changes the paradigm of the TeleCare industry; it provides Remote Care at a low cost, without the need for any additional devices or any efforts from the user. This is a solution that the caregivers want and that the elders need: invisibly maintaining one's freedom, privacy and daily routine, while offering peace of mind.

By analyzing the disturbance in the Wi-Fi signals using its AI trained models, Aerial Technologies is able to provide a unique Remote Care solution, but this is just the tip of the iceberg. This technology has applications in Smart Home Automation, Security, Healthcare, Enterprise and more. Wi-Fi Sensing is set to become a corner stone enabling technology for the Smart Home and Smart Building ecosystem.

Aerial Technologies is working actively with ISPs which are well positioned to improve residential access to affordable remote care. From the ISP perspective, Aerial's Remote Care Solution is trivial to implement while providing an invaluable service to family caregivers and their loved ones. It's a simple way to make an important and meaningful social contribution to those who are at greatest risk while monetizing existing Wi-Fi infrastructure investments.