



## Smart home as a telemedicine tool for senior healthcare

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**Abstract:** The development of IT solutions has generated an infiltration of them in all areas of life. Smart home technology can be a real benefit in help out and really start to take care of seniors. Essential aspects of telehealth in smart home were designed. Healthcare scenarios, using wearable devices, were applied for different use cases. Smart displays, tablets and smartphones are used as the main control and teleconferencing tool with medical professionals.

**Keywords:** IT, Smart Home, wearable technology.

### Introduction

Our health is the most important thing in our lives. As we age, it is important to understand how diseases affects the mind and body. Immediate emergency response has become the only way to save lives.

For last two years hospitals, physicians and the medical community has been overwhelmed. Social distancing and quarantine measures have forced more doctors to cancel routine and non-emergency appointments. Thus, more and more governments, private institutions and organizations are turning to telemedicine solutions in order to meet the new challenges.

Health care systems has been stretched to the brink. It might be getting all the headlines, but patients are getting sick from other diseases and injuries. In this situation, doctors had to look for other ways to treat them. It is important to be able to reduce the number of contacts with patients. Smart home offer good

opportunities for this purpose by providing a monitored environment. It use a combination of technologies to generate solutions for remote patient care. Therefore, it can become a powerful tool in fighting disease and prolonging human life.

All smart homes devices are designed to make life more convenient. A readjustment of existing devices and the development of new ones will make our lives healthier.

### Essential aspects

Telemedicine means providing healthcare services using information and communication technologies when the healthcare professional and the patient - or even two healthcare professionals - are not in the same place. It is about the secure transmission of medical data and information in the form of text, sound, images or other forms that are necessary for the prevention, diagnosis, treatment and follow-up of patients.

On March 3rd 2011, the National Consortium for

eHealth and Telemedicine was established in the Republic of Moldova, which aims to strengthen the efforts to maintain an open and engaged dialogue between civil society organizations, educational institutions and state institutions for the development of eHealth to bundle, which will really contribute to strengthening the health of the population of the Republic of Moldova. [1]

A special development of this field has taken place in the last two years. "Telemedicine" has been launched in Moldovan hospitals. This means that doctors will be able to exchange information online about the treatment of coronavirus-infected patients and will be able to consult with reputable specialists in severe cases.

The implementation of this project will minimize the unnecessary transport of patients to long-distance hospitals. Using the images, experts can virtually examine a patient and make recommendations on the best treatment plan.

### **Telemedicine as a medical care option during the pandemic**

Another technology that has become increasingly popular during the last period is telemedicine. Here you can talk to your doctor via special portals and do not have to come to the practice for a consultation or to have a new prescription issued, thus avoiding unnecessary contact. In addition, the application can be seen as a great support in everyday life and enables more efficient and intensive care of patients. Speech therapy, for example, can be held online.

On the one hand, the contact restrictions are observed, but on the other hand, the patient or therapist saves the trip to the practice/to the patient. This type of tele-speech therapy thus opens up opportunities to optimize care, especially in rural areas, in the outpatient sector but also in care facilities, and thus to counteract the shortage of therapy places and staff. The fact that medical consultation hours via video telephone, virtual contact with therapy or nursing staff or the Ambient Assisted Living (AAL), which will be addressed later,

does not replace a visit to the doctor or physical care, is nevertheless obvious and must be made clear (Figure 1) [2]. However, telemedicine can still be used as a supplement to improve the provision of comprehensive, needs-based medical care close to home.



**Figure 1.** Video conferencing technology

### **Environmental sensors**

The systematic literature research has made it clear that the largest selection of smart home solutions can be found in the field of environmental sensors. They can be installed in a variety of forms in the house, for example as pressure sensors under the floor and carpet or set up in different rooms as a camera. The elderly behavior monitoring system uses magnetic switches to record movements in rooms, infrared sensors to detect activities, and sound sensors to determine the type of activities [3]. These systems can distinguish living people from non-living objects and thus carry out targeted measurements.

So far, these technologies have mainly been used to detect falls and to monitor the activities of the residents of a house. Their functions include assessing gestures, touches, actions and circumstances and can use these to influence the well-being of residents. The data received can be transmitted via wired or wireless systems for further processing to a central node such as a gateway integrated in the house and sent to the respective recipients. These can include doctors,

nurses or family members, who can then act accordingly.

### Monitoring and security through a smart home

In addition to telemedicine, there is also the possibility to make the home safer with the help of AAL and to contribute to enabling a largely independent life or living. Smart home systems in particular are used for this. There are now networked carpets that use integrated sensors to detect whether people have fallen and are lying motionless on the floor and then, for example, call the outpatient care service.

For other surfaces which are not covered with carpets, a sensor based floor where proposed. The floor-based sensor system includes the sensor data acquisition, data manipulating, data reading, storage, display, and communication. [4]

A monitoring and communication system can also be installed on the bed for people who are severely restricted in their mobility, which measures values such as blood pressure or heart rate and continuously transmits them to the responsible nursing station. This enables remote monitoring and avoids additional contact during the pandemic situation. It is also possible to contact a nurse or doctor via the screen if you do not feel well. In addition to these very advanced technologies, there is also the option of emergency call bracelets with which the wearer can call a stored emergency number after a fall or similar. There is also the option of just informing a relative, who can then decide, for example, whether an ambulance is needed.

### Wearable devices and data acquisition

The second most popular portable device is smart watch (Figure 2) [6]. Nowadays, it can perform the functions of such medical devices as: body scale, heart rate monitor, blood pressure monitor, electrocardiogram, oximeter, fetal Doppler. It is important to mention that downward trend in the price of smart products has slowed in recent years. This is caused not only by the price of the built-in sensors but also by the software component.



**Figure 2.** Smart watch as data acquisition tool

Handheld devices have radically changed the patient-reported outcomes (PRO) landscape and accelerated the transition to electronic patient-reported outcomes (ePRO) data collection. Smartphones make up the majority of portable devices. They have become the main tools of ePRO data collection. Especially for remote PRO data acquisition, they offer significant advantages due to their mobility and touchscreen functionality. These devices support access to web-based data collection portals (e.g. interactive web response systems) through downloading apps with ePRO capabilities or through device-based systems. It should be noted here that the tool automatically adapts to the operating system, browser and screen size of the device when accessing a data collection portal. Primarily, the collected data from portable devices was synchronized offline, i.e. the data was temporarily stored on the device until uploaded to a local or central server. With advances in cellular and mobile phones, data can now be instantly stored on a central server or database [5].

### Conclusion

The use of smart devices in the medical sector allows the creation of a preventive and proactive healthcare system focused on prevention. Hence, telemedicine use technology to deliver care from a distance.

Older people are not a burden or a problem, but are valuable members of society who just need some support to continue living a full life in their own homes. It is therefore the task of scientists and the younger part of society to continue researching in these areas. In this way, they are above all helpful to their

fellow human beings, but at the same time provide for their own future.

The results of this scientific work indicate that a smart home system can serve as health, safety and well-being services for the users in their own home using modern technologies such as environmental and medical sensors, actuators and wireless communication platforms.

Smart homes could enable continuous, remote observation and monitoring of the health and well-being of older people at low cost. This would allow older people to stay in their comfortable home environment instead of moving to expensive and limited healthcare facilities.

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