Magic Mirror - An ICT Integrated Mirror

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Different types of digital services are more and more readily available these days, but the complexity and learning curve of constantly updating services might make using them difficult for senior population. Many digital services could help elderly people with their daily lives, but they might not be familiar with such, and could be hesitant or unwilling to use them or learn how they work.

The Magic Mirror is meant to work as a gateway to these systems. It's based on a modular, open-source platform, which was created specifically for this purpose, and can be customized to the person's liking and needs. The modules can be for example a clock, calendar, weather forecast and news headlines. Also, each person can have different information on the mirror if a facial recognition module is used. Even with all this ICT integration, it still resembles a regular mirror and functions like one.

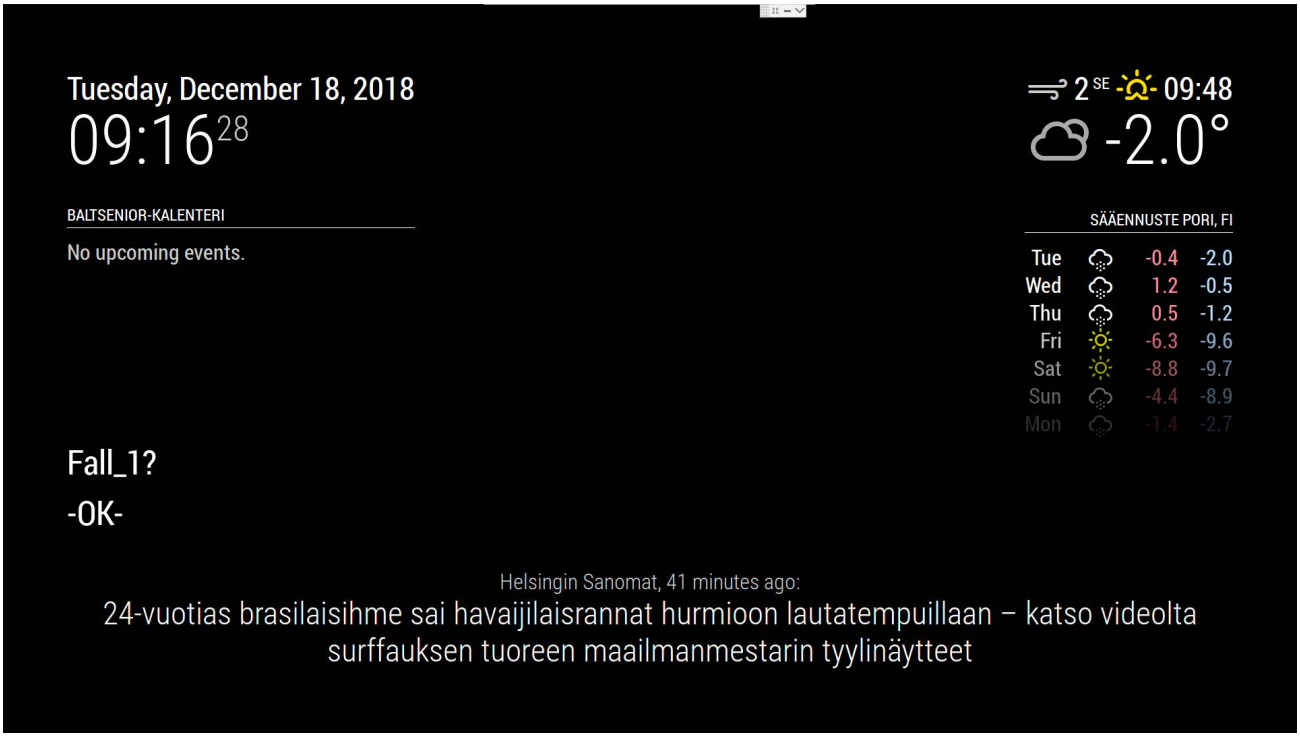
Magic Mirror on the wall of MeWet home in Ulvila, Finland. Photo: Jakub Wittchen

The software

The Magic Mirror is created using an open-source software platform called MagicMirror². It was created by Michael Teeuw from Xonay Labs, and it has since been developed and maintained by a community of enthusiasts. The platform's modular nature allows the Mirror to be highly customizable to the user's liking and needs. Modules for the mirror can either be downloaded from the Internet or created by anyone using a template, which is available online. Modules can change what information is visible on the Mirror or change how the Mirror works altogether. Many of the modules are used to fetch information from the Internet, so a network connection is almost always needed.

The Magic Mirror that was developed in Satakunta University of Applied Sciences (SAMK) contains modules that were selected based on what was thought to be useful in seniors' lives. For example a calendar is useful for anyone, but the senior population might not want to use a digital calendar due to the complexity it brings with having to have an additional device, like a smartphone for it. When the calendar is always visible on the Mirror, it is easy to check what's on today's agenda.

Other selected modules with the seniors' in mind include facial recognition for being able to select what each person sees on the Mirror, like different calendars for each user. It also tracks the use of the Mirror into a database, so for example the relatives of the user can check that the mirror has been used at certain intervals, so everything should be normal in the living environment. There is also a remote control module, which can be used to send messages to the mirror. A simple yet effective message, such as "Hello, please call me when you see this message!" can be sent by a relative or a caretaker.



A screenshot of the Magic Mirror showing different modules. The background is black, which works as a mirror when paired with a one-way mirror. The module showing "Fall_1? -OK-" was developed at SAMK to visualize information from a fall detection system that was developed at Technical University of Munich. The fall detection system is also a prototype in the BaltSe@nioR project and part of the BaltSe@nioR system like the Mirror.

The Hardware

The hardware of the Magic Mirror consists of three main parts: a computer, a display and a one-way mirror. The computer used in SAMK's Magic Mirror is a Raspberry Pi 3 Model B. Raspberry Pi is a series of single-board computers, and they are often used in embedded applications like the Mirror. It's small size, low power use and relatively good processing capability combined with the versatility of the Pi makes it a popular choice among computer hobbyists for projects. The computer's main function in the Magic Mirror is to run the MagicMirror² platform and it's modules. A Raspberry Pi Camera Module can also be added, which can then be used with the Mirror's facial recognition module.

The Raspberry Pi sends the picture to a display via HDMI. The display itself can either be a computer monitor or a TV, mostly depending on which size is wanted. For smaller displays (27-inch or smaller), a computer monitor is usually a better choice, but for bigger applications a TV is usually more cost effective. However, choosing a proper display is important: the Raspberry Pi 3 Model B's output resolution is limited, and might have problems with high resolutions like 4K. SAMK's Magic Mirror uses a Lenovo ThinkVision T24d computer monitor, which is a 24-inch display with a native resolution of 1920x1200. Also, the display technologies make a difference. The aforementioned Lenovo display uses an in-plane switching (IPS) panel, which is good, but not as good as an organic light-emitting diode (OLED) panel would be for this application, due to the amount of black parts in the mirror's picture (see screenshot above for reference). Also, the display's backlight might be visible when not using an OLED display, but it's mostly only noticeable in dark rooms.

The last part required for the Magic Mirror is a one-way mirror. The mirror is placed in front of the mirror and it's the part which turns the display and computer to a Magic Mirror. One-way mirror is a special mirror that is used for example in security control rooms, so the people inside a dark room can see to a brighter lit room, but not vice versa. The one-way mirror let's the bright colored text and symbols be visible through the screen, but the black parts are invisible, and act as a regular mirror instead. Due to this nature the mirror can easily be used as a substitute for a regular mirror, since it only minimally hinders the actual mirror use. The one-way mirrors vary in quality though, so the user's image might be a bit darker and also the display's picture doesn't come through as bright as it normally would. The one-way mirror is fixed to the display with a frame that holds everything together. The frame has to be strong enough to not break with the weight of the mirror and the display, so making it visually pleasant can be difficult when working with large size displays and mirrors.