



The latest and biggest project of Kansas University's New Cities Initiative is the Housing Lab, a prototype senior housing unit featuring high-tech devices such as dehydration sensing toilets and fall-detecting motion sensors.

## KU Today: Medical technology meets senior housing in New Cities project



by Sara Shepherd  
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Lawrence - Smart toilets, fall-sensing cameras, automated medicine dispensers, gait analysis detectors — this isn't your typical senior housing unit.

As so many things evolve to keep up with the latest technology, so is Kansas University's New Cities Initiative. The New Cities Housing Lab is one of the latest and biggest projects of the New Cities Initiative, an interdisciplinary research project based at KU's School of Architecture, Design and Planning. It aims to address

the “built environment” needs of the country’s aging population. The New Cities Initiative, started in 2010, spurred research, seminars, classes, design studios, and talks including the Boomer Futures Think Tank.

“It sort of elevated KU as a real player in the field of gerontology,” said Joe Colistra, associate professor of architecture and a lead researcher with the New Cities Initiative. Founding director and architecture professor Dennis Domer retired from KU last year but remains involved with the initiative.

One major project was designing an intergenerational neighborhood, dubbed Campus Village. While plans to physically construct such a community in Lawrence didn’t come to fruition when they reached the city a few years ago, students continue to work on the concept. The Housing Lab project focuses on a smaller part of senior living: a single unit. It builds on information gathered over the past few years, Colistra said. “We’ve begun to translate it into industry,” Colistra said. “This is really game-changing for housing.”

Features of the Housing Lab unit offer solutions to problems older residents face.

KU groups helping to identify those problems include KU Medical Center’s Landon Center on Aging, the KU Gerontology Center and the KU Life Span Institute, Colistra said. Manufacturing companies are hoped to partner and provide needed technology.

Proposed features include:

- **Motion Sensors/Fall Detection** Among older adults, falls are the leading cause of both fatal and nonfatal injuries. Motion sensors can be used to not only detect when someone is in need of assistance after a fall but video capture and rewind functions can assist care providers in determining what caused the fall, whether the subject hit his or her head, and what factors in the living environment may have contributed to the fall. Data can be collected over time to monitor activity, but more importantly, advances in predictive algorithms can allow the system to “learn” about the typical activities of a resident and to sense irregularities that may be a cause for concern.
- **Gait-Analysis and the Built Environment** Both active (wearable) and passive (camera) sensors collect data on stride and body movements and detect imperceptible dysfunction and deterioration in coordination and balance. Again, advances in predictive algorithms can determine early stages of diseases such as Alzheimer’s and Parkinson’s. This can allow for earlier treatment and monitoring of a resident. Data collected by force-plates in the floor structure monitor sway and balance over time and can be used to predict and prevent falls.
- **Smart Toilets** Disorientation brought on by dehydration is a leading cause of falls. Smart Toilet technology can collect data on hydration, blood in the urinary tract, blood pressure, and heart rate. This newer generation of technology-enhanced toilets can collect the necessary data that can alert care providers and physicians of potential problems.
- **Smart Environments for Geriatric Pharmaceuticals** Automated medicine dispensers assist in regulating a patient’s dosage schedule. Voice-assist units remind residents when to take their medication. It also reminds them when a scheduled dose has already been taken. One example of the potential networking of these technologies is found in the dispensing of diuretics. Often taken in combination with heart and blood pressure

medication, diuretics allow the body to expel unneeded water and salt through urine allowing the heart to work more efficiently. An automated medicine dispenser networked to data collection from a smart toilet would allow for real time adjustment and monitoring of hydration levels and diuretics.

The special housing unit is a ways from becoming reality.

- **Sleep Sensing** Older Americans often suffer from inadequate sleep. Many need to get up to go to the bathroom more frequently. They may also suffer from reduced levels of melatonin, the hormone that promotes sleep. Bed sensors utilizing hydraulic monitoring enabling the collection of data on heart rate, respiration, and restlessness.

- **Automated LED Smart-Spectrum Lighting** The gradual yellowing of the lenses in our eyes brought on by aging can filter out a significant portion of blue light that helps to regulate the body's circadian rhythms that balance the release of melatonin in the evening and cortisol in the morning. The resulting imbalance is believed to play a major role in many of the conditions one associates with aging: memory loss, slower reaction time, insomnia, and even depression. Smart mirrors that can monitor a number of health-related conditions (including skin abnormalities, tooth plaque build-up, eye-tracking dysfunction) also meter lens yellowing. This data can be used to color-correct ambient light through LED lighting technology and provide custom lighting spectrum therapy.

For now, KU architecture studio classes are working on the project, Colistra said. Over the next year, they hope to get industrial partners on board and construct a 600 - 700 square foot prototype unit inside the architecture school's East Hills Construction Innovation Lab. With a model unit, Colistra said, students could test products and design, and — hopefully — eventually get their senior housing solution built and on the market in the real world.