A Stroll Through the Universal-Designed Smart Home for the 21st Century

Universal Smart Home Design is the process of designing products and housing environments that can be used to the greatest extent possible for people of all ages, abilities and physical disabilities.

Universal Design (UD) is based on six principles known simply as "The Principles of Universal Design." Until now, UD has been regarded as an approach that incorporates products and building features. The UD Smart Home is inclusive in that it addresses the entire environment as a whole. In this article I will not discuss the principles of UD but instead I will take you through a room-by-room "strolling tour" (both walking and rolling) through the *Universal-Designed Smart Home for the 21st Century.*

During the development of the home plan book, titled above, I had the opportunity to discuss the future UD home with parents of children with special needs, individuals with physical disabilities, physicians, caretakers, and the elderly. Requests included traditional UD, clean indoor air quality, alternate energy sources and energy efficiency. Many also preferred sustainable "green" building products that had no volatile organic compounds (VOC's) and are formaldehyde free. Clean indoor air has not, until now, been addressed as a universal design feature. As many of you are aware, respiratory disabilities in the US have the highest rate among children under 18 and the fourth highest among adults. The US Green Building Council also promotes and encourages natural day-lighting, proper ventilation, lighting control, and clean indoor air.

Several people also requested a safe room—a place of refuge in the case of a tornado, hurricane or man-made disaster. It is not always easy for a person using a wheelchair or anyone with limited mobility to evacuate to a place of refuge in an emergency. It occurred to me that the UD bathroom, which is more spacious than those often built, would double up nicely as a safe-room.

This became the rationale behind *Universal Designed Smart Homes for the 21st Century*. The home designs are truly innovative in that, along with traditional UD home design features, they include energy efficient construction, safety, security, and sustainable "Green" building products that provide clean indoor air. The homes are also designed to receive an Energy Star label. This will save you 30 percent annually on your energy bill.

Let's begin our UD strolling tour

Upon entering the driveway, you will notice the double-car garage is 28'0" or 32'-0" wide. This allows for a 5'-0" or 8'-0" aisle in between cars. This benefits wheelchair users, simplifies car unload-

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ing, etc. The non-slip garage floor is a gentle slope of 1 foot in 20. All of the garages have a minimum 5'-0" diameter level entry area and a maximum 1/2" threshold at the 3'-0" wide house door. As long as the floor at the garage door is 6" lower than the house door, the garage will meet International Residential code requirements.

When we park in the driveway we stroll along a gentle path to the front door, again with a maximum 1/20 slope. Landscaping and site grading is designed to avoid "ramps," which have a 1/12 slope and require handrails. The pathway has contrasting brick or concrete colored edging for visual definition. The paths feature a motion sensor lantern to aid evening visitors. The minimum 5'-6" wide entry area is covered at the front porch. These porches are reminiscent of historical homes. You will appreciate the covered porch when looking for your keys during inclement weather, pushing a baby stroller or just enjoying the neighborhood.

The front door is 3'-0" wide, has two peepholes at upper and lower heights or a sidelight to easily view guests. Many of the homes have doors to home offices. The entry doors have lever handles and a maximum 1/2" door threshold. The front porch also has a package shelf and/or a bench. Many provide a through-wall mail/package drop. This allows you to receive your parcels without going outside. The large address numbers beside the door are illuminated at night. The door may have an automatic lock or be connected to a home automation system. The door lock is located at a height that is easily reached by a seated person. Elderly people using wheelchairs, home movers and emergency personnel will appreciate the zero-step entry and wide front door.

Inside the UD Home

Upon entering the home you may notice a large closet with a 4'-6" x 5'-0" inside dimension. If the home has an upper or lower level, it is designed with a removable floor. It can be converted to an in-home elevator in the future. I have named this the "Mobility closet/Robot room." It includes electrical outlets for recharging mobility devices and storage. It may serve as a room for "Osimo," your future in home robot. Many people with special needs already employ robots in their homes. One day they will be common in the 21st century home. Nonetheless, the closet provides welcome additional storage.

The entry foyer also has a standard coat closet with height adjustable coat rods. It is designed with barrier-free door hinges that provide a clear opening, allowing close approach and easy reach. The foyer floor has a hard non-slip, glare-free surface and sustainable floor materials. These flooring types are an option throughout the house. The hallways are all a minimum of 3'-6" wide and many have a 5'-0" turning diameter toward the end. The homes have at least one bedroom and bathroom suite, on the fist floor. The majority of the home designs are one level ranch styles. However, the mobility closet and wider stairs allow for a stair lift and make the two-story home accessible. Every room in the home is designed to be fully accessible, including the upper and lower levels.

Electrical outlets are 24-27" above the floor making them more accessible for everyone. All of the passage doors have a minimum 2'-10" clear opening and lever handles. These will assist those with limited hand strength or arthritis. Mechanical controls, such as easy to read programmable thermostats and rocker type light switches are 48" maximum above the finished floor. A 1-5 to 2'0" clear space is provided on the pull side of all doors and a minimum 4'-0" space is provided inside the room and in front of the door. This makes it easier for a wheelchair user to open the door. This feature is another benefit on moving day. The homes have optional home automation and control systems that can be remote or voice activated. Automatic door openers are also an option.

Bedrooms

The bedrooms have windows with sills no higher than 36" above the floor. The 36" high sill allows for clear viewing outside while seated and can aid in emergencies if egress is required. They are often located near a closet with a 5'0" diameter space in front. Locating the closet near the window provides day lighting near the closet. Closets also have automatic light switches that go on when the door is open and off when closed. They have adjustable rods or

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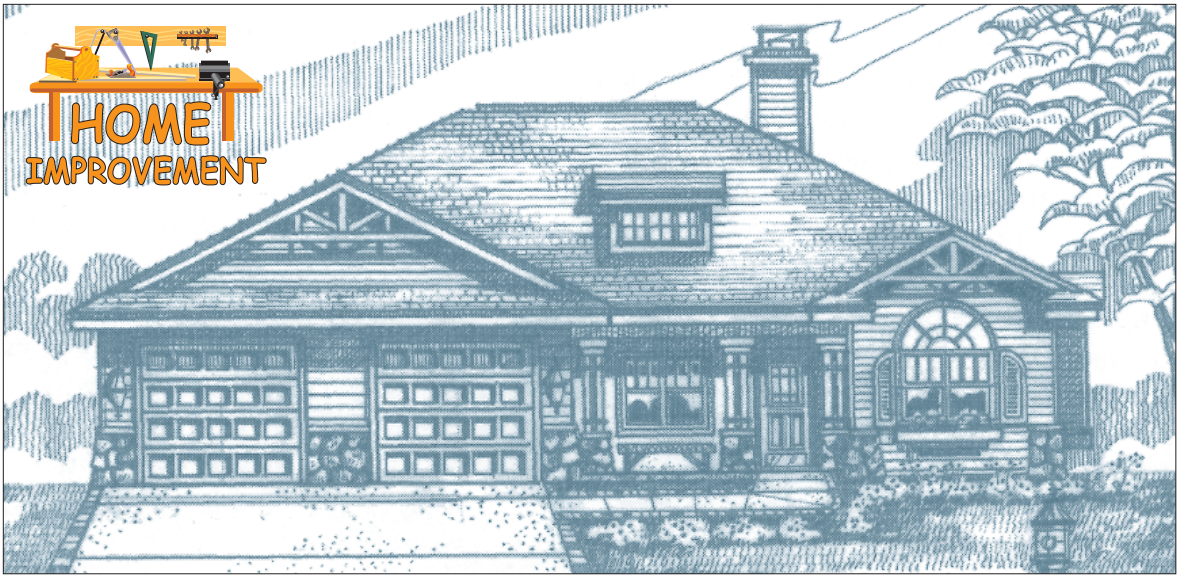
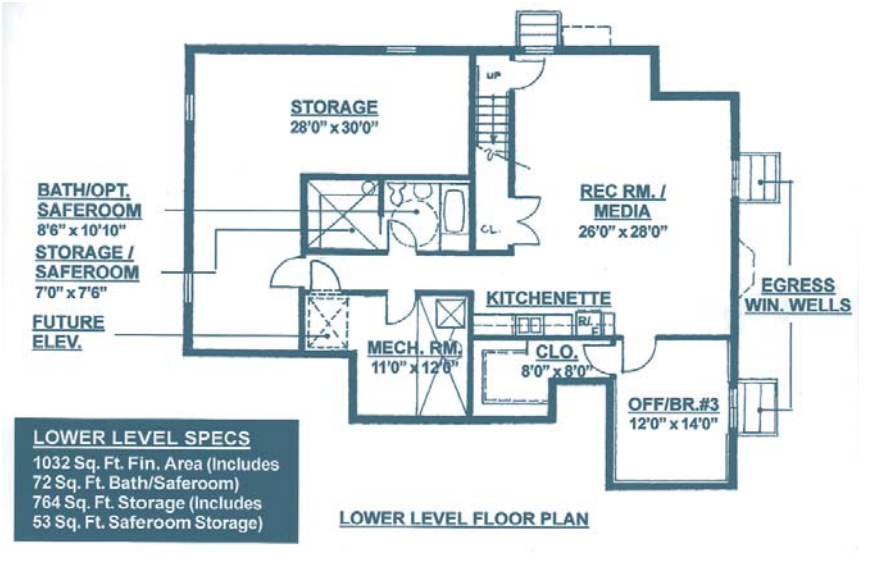
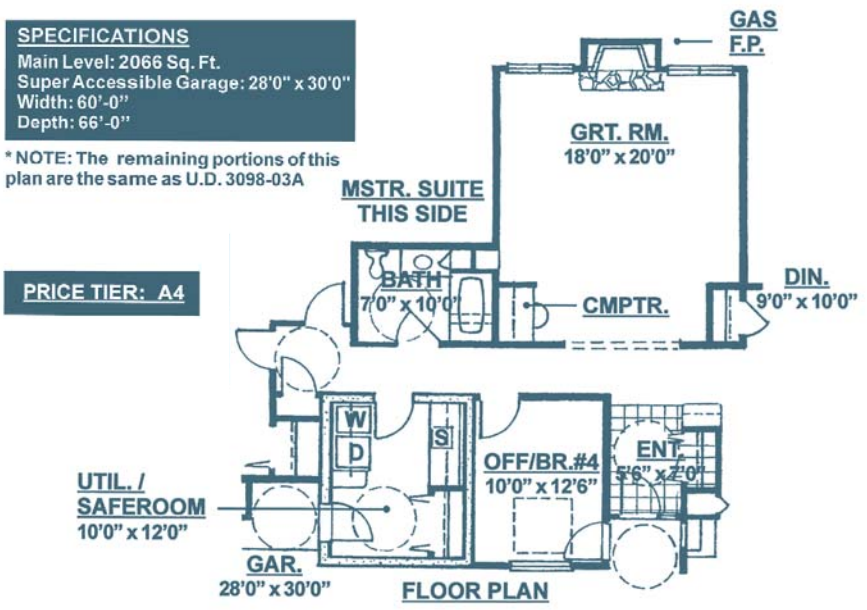


Left: A sketch of a Universally Designed Smart Home.

Below: Diagrams display the upper and lower levels of one UD home.





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universal designed closet systems. Optional sensor switches that turn lights on and off are specified in bedrooms for those who are forgetful. They also conserve energy. Walk-in closets are designed large enough for wheelchair use.

The homes with stairs are well lighted and designed for maximum safety. Stairways have light switches at both the top and bottom. Many have a solar-tubular skylight for improved visibility. The treads are a maximum 10-3/4" deep (most are 11") and the risers are 7" max. The treads have a closed riser and a non-slip surface: this will help avoid tripping. The stairwell is a minimum 3'6" wide and has handrails on both sides. The handrails extend 1'-0" past the top riser, and 2'-0" past the bottom riser. This is a safety feature that accommodates the inclination to "reach" for the handrail, which may cause a fall.

Bathrooms

The UD Smart Bathroom is a pleasant departure from the bathroom of the 20th Century. Upon entering through the 3'-0" door with a lever handle (many are pocket doors) you will notice a minimum 5'-0" turnaround space in front of the sink. The floor is a non-slip, glare free surface or a low-pile micro bacterial, waterproof carpet. The faucet is a lever type and can be located on the wall side toward the front of the sink. It should not be located further than 21" from the front of the counter. This makes it easier for seated people and small children to reach. Tankless, point-of-use water heaters conserve energy as they heat the water immediately before it is needed. Combined with a foot operated "Water Pedal" product, an automatic faucet sensor and/or faucet aerators you will con-

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serve both energy and water. These are innovative "green" features of the UD Smart bathroom.

At least one sink is not higher than 32" above the floor and has open knee space underneath. Cabinet door hardware with open D shape pulls and slide-away hardware allow the cabinet doors to open and slide back into the cabinet. This makes the vanity cabinet with open knee space look the same as others that do not have this feature. Automatic sinks with front of unit switches that rise from 28-38" are also available. This may be desirable when only one sink is available. The vanity also has an 8-1/2" high x 6" deep toe kick. This effectively enlarges the bathroom for wheelchair users. The hot water pipes have scald-protection covers that protect legs from burns. The sink is maximum 71/2"deep and can half an elongated bowl that extends past the counter front for greater accessibility.

Vanity lighting is provided along the sides of the mirror that reduces shadows on the face from lighting above. Full height cabinet drawers with full extension hardware make it easy to view and retrieve the contents within the most accessible heights, 22-48" above the floor. Electric fog free mirrors and mirrors located directly above the backsplash enhance viewing for a seated user. Mirrors can also be slightly tilted at the top, helping view the sink contents while seated. Bathrooms have a full-length mirror for full body grooming and dressing. A wall-hung hair dryer is a handy appliance. All of the outlets within 6'-0" of a water source have GFCI water protection. A wall side-swinging mirror is also useful for close grooming. Many of the UD Smart bathrooms are specified with the solar-tubular skylights with built in fans for natural daylight and ventilation.

The toilet is centered 18" from a sidewall. Wood blocking or marine grade plywood is installed beside and in back of the toilet for immediate or future grab bar placement. Many designs have enough space on the other side for a wheelchair or caretaker. Toilet height is often a personal choice. Wheelchair users prefer a toilet height close to that of their wheelchair height, while those with weak leg strength or the elderly may prefer a 17-19" or higher seat height. We design at least two different heights within the home. The use of automatic toilet lifts also provides varying heights that accommodate everyone.

Every home has at least one curb-less shower and most have options for a "wet-room" area where the toilet and the shower are adjacent each other and a weighted shower curtain slides in front of both. A flexible/collapsible water dam keeps the water in the wet area. Height adjustable, hand held shower units with 7'-0" hoses slide on a vertical grab bar. We specify a product that allows you to control the water flow from the hand held unit. Wall controls are installed toward the front of the shower in both prefab and custom shower applications. The pressure balanced shower control provides scald free protection. Grab bars are included in prefabricated units or waterproofed marine grade plywood backing is installed behind tile. This allows grab bar placement at any location. The shower has a vapor proof light/fan unit above. For those who also prefer a tub, automatic tub lifts are available to lower you after you have made a side chair slide transfer. Ceiling transfer lifts are also an option for people with these needs. Phones are included in bathrooms and may be connected to an emergency alert system.

Kitchen

Everyone will be able to participate in the UD Smart Kitchen. The sink is located between the refrigerator and the stove. This allows a person with limited strength to slide items between all three without having to pick them up. The appliances are Energy Star rated and are not closer than 4'-0" nor further than 9'-0" from each other, as measured from the center of the unit. The kitchen space is designed so that it functions well for left and right-handed people. Appliances are usable from the left, right, and front approach. A minimum of 30" by 48" space in front of each appliance is provided. Most kitchen designs have a 5'0" diameter space in front of each appliance. We strive to provide 12-18 (or more) counter space on each side of the main appliances. This is often difficult in smaller homes. The majority of kitchens are designed so that people may work together at the same time without being in each other's way. Pathways of 48" provide ample room for everyone.

Varying counter heights make the kitchen usable by everyone. The counters have a rounded or beveled edge for safety and contrasting color for visual definition. This makes it easier for those with limited vision to see the edge of the counter. One sink is 32" above the floor and adjustable with open knee space below. It has a rollout bin underneath for added storage and uses the same slide away cabinet door hardware as in the bathroom. The garbage disposal is offset to the left of the knee space allowing more clear space underneath. The dishwasher is adjacent to the sink and can be raised so that the counter above is 42" above the floor. This makes it easier to load and unload the dishwasher without excessive bending and provides another higher workspace for standing users. The higher counter does however become an obstacle if sliding objects along the countertop is necessary. This feature is your personal choice.

For the cook-top we recommend a level ceramic top surface with cool to the touch inductive burners with easy to use front of unit controls. This allows one to reach the back burners without reaching directly over heated elements. It is preferable to have another knee space opposite one side of the cook-top with the microwave located above.

The microwave countertop should be on the counter or 3" lower than the cabinet within easy reach. Raised side swing ovens are best located adjacent this knee space and have a pull out shelf underneath. Everyone will be able to reach all three cooking appliances from one location without having to bend over to use the oven.

The refrigerator is located on the other side of the sink with generous counter space in between. It is of the side-by-side refrigerator /freezer type that allows access to both at every height. It also has a front of unit accessible ice and water dispenser.

The lower cabinets have lazy susans, pop up shelves and full drawer extension hardware. The upper cabinets are lowered 3" below the old 18" standard. This will greatly increase upper cabinet accessibility for everyone and still allow a 15" vertical space for other appliances. Low voltage task lighting is located in front and under the upper cabinets. This is also a good location for additional outlets. Lower fronts of cabinet outlets are helpful for seated users but they can be dangerous for small children. Since portions of the counter and the upper cabinets are lowered, they will be accessible and out of reach for small children.

UD Smart Kitchens offer more features such as islands, variable height breakfast bars, accessible pantries, recycle and work areas. Natural day lighting and windows with front crank out windows are also accessible features.

I hope this "stroll" through Universal Designed Smart Homes for the 21st Century has been helpful for you, your family, caregivers, and patients.

The new July printing of Universal Designed Smart Homes for the 21st Century *is updated to include 82 (and growing) home plans you can order for construction and build your own home. There are also 22 pages of room-by-room features and benefits of the UD Smart home that expand on those noted above. It also includes UD Smart home offices, indoor air quality, garages, home theatres, accessible gardening, safe-rooms, laundry rooms, home elevators, home automation, and more.*

The principles of Universal Design "Green" building and the Energy Star home label are discussed in depth. An extensive resources, references, and consultant section is included for further study. The new addition price is $34.95. EP readers receive a $5 discount with mail order in July only. We will also include a list of certified accessible housing contractors in your state upon request. Send $29.95 incl. to Schwab Publishers, PO Box 533, Moline, IL. 61266 ISBN 0-9748559-0-1 phone: (309) 792 4599 www.universaldesignonline.com EP