

## Appendix A

**Table 1.** Humanoid robots

Robot Name	Manufacturer	Application(s)	Description
<i>NAO</i>	Softbank-Aldebaran	Human interaction and assistance	A human-like appearance and comes with four microphones, two loudspeakers, tactile sensors, and LED lights that are dispersed around the head, torso, and extremities <sup>[47]</sup> . It has the ability to walk, dance, speak, and recognize faces and objects <sup>[47]</sup> .
<i>RIA (Robo Idoso Activo, or Elderly Active Robot)</i>	Engineering Institute of Coimbra (ISEC)	Monitoring vital signals and environment	An extension of NAO that equips it with several sensors to monitor multiple parameters, such as blood glucose levels, blood pressure, heart rate, and body temperature. It can also monitor environmental levels including temperature, humidity, and gas and fire detection <sup>[6,33]</sup>
<i>Pepper</i>	Softbank-Aldebaran	Act as a companion, assist and supervise independent-living elderly people, promote quality of life, facilitate relationships	An omnidirectional wheeled base that stands at 1.2m in height. The robot has a head, arms, and a torso attached to a stable body <sup>[48]</sup> . The three wheel system attached to a uniform body is more stable than the normal two robotic legs <sup>[31]</sup> . Additional features include advanced language and facial recognition, tactile sensors, tablet connected to its torso, cameras, microphones, and a flexible programming interface <sup>[31]</sup>
<i>Pearl of the Nursebot project</i>	Carnegie Mellon University, University of Pittsburgh, University of Michigan	Assist and supervise independent-living elderly people and those with mild cognitive impairment, issue daily reminders, promote healthy habits (such as taking medicine)	A mobile robot that is equipped with microphones for speech recognition, speakers for speech synthesis, touch-sensitive graphic displays, actuated head units, and stereo camera systems <sup>[14]</sup> .
<i>Robin of the GIRAFFPLUS project</i>	Örebro University, Sweden	Assist and supervise independent-living elderly people, connect elderly people to their family and healthcare professionals, monitor elderly peoples' health and at-home activities	A home telepresence robot consisting of a mobile wheel base attached to a tablet-based head that can be used for video calls <sup>[6]</sup> . Sensors attached to the robot detect elderly people's activities and health.
<i>CareBotTM</i>	Gecko Systems	Assist and supervise independent-living elderly people, helps monitor active children and disabled family members, automatic emergency notification	A personal mobile robot equipped with multiple vital sign sensors <sup>[4,6]</sup> . It has an aluminum frame, two independently driven wheels, multiple sensor system, and onboard computers <sup>[49]</sup> .
<i>RP-7</i> <sup>[6]</sup>	InTouch Technologies, Inc	Enables medical specialists to mentor physicians or surgeons	A tele-operated, mobile robot that stands at 5 feet, 5 inches in height and is guided by a computerized ControlStation. The head consists of a display screen with two-way cameras, microphones, and wireless technology to provide real-time video and audio.
<i>PaPeRo (Partner-type-Personal-Robot)/Matild</i> <sup>[17]</sup>	NEC company	Human interaction and perform autonomous actions, allow family members to supervise one another	A humanoid robot with a face similar to that of a baby <sup>[30]</sup> . It has cameras to recognize the face, track the object, microphones to detect the sound direction and recognize speech, speakers, sensors such as ultrasonic and bumpers for identifying the obstacles and distance, and touch sensors to responde the user touches. It is equipped with wheels so it can move around and also can move its head to different directions <sup>[17]</sup> .

<i>Robovie</i> <sup>[17]</sup>	Advanced Telecommunications Research Institute International	Assist and supervise independent-living elderly people, provide guidance for elderly or visually impaired people, assist in grocery shopping	A humanoid robot that has sensors including camera, microphone, tactile, and ultrasonic, for observing the environment, detecting objects and obstacles, and responding to the environment <sup>[17]</sup> . It can move its eyes, head, and arms which allow it to perform different tasks <sup>[17]</sup>
The <i>Care-O-bot</i> <sup>[50]</sup>	Fraunhofer Institute for Manufacturing Engineering and Automation.	Actively support humans in everyday tasks	A mobile robot assistant that is currently on its fourth generation. The robot is shaped using five modules: base, torso, arm, sensor ring, and head. The robot can be manipulated to equip one, two, or no arms. In addition, it also has pivot points in its neck and hips to be very agile in its work environment. Alternative configurations can be utilized depending on the circumstance. <i>Care-O-bot</i> serves a wide range of functions that centers on commercial service robot solutions <sup>[50]</sup>
Asimo <sup>[51]</sup>	Honda	Interact and assist humans and recognizes the environment	A robot that stands at a height of 4 ft, 3 in and weighs 54 kg. It has sensors that assist the robot in autonomous navigation. There are two cameras on the sides of its head that act as visual sensors to detect obstacles. There are also laser sensors on the lower torso to detect the ground surface.
Wakamaru	Mitsubishi Heavy Industries	Perform natural communication with humans	A yellow, mobile robot that stands 3 ft tall and looks like a samurai in formal wear <sup>[51]</sup> . The structure consists of a bottom base with a wheel and three body components. There are sensors in its eyes, which can detect a variety of obstacles. Additional features include a charging station, broadband router, touch panel, directional microphones, speakers, and a computer <sup>[51]</sup> . These features allow the robot to interact with the human by reminding them to take the medicine, talking to, and having emergency calls if something is wrong <sup>[21]</sup> .
Robovie	Vstone Corporation	Communication with humans	A social robot that has two LED eyes and audio output to enhance expression. It has a versatile body frame for optimal customization. A PSD sensor allows the robot to react to humans or objects <sup>[51]</sup>
ReBorg-Q <sup>[51]</sup>	ALSOK: Sohgo Security Services	Guard an area, detects emergency situations (leak, fire, smoke), identify the current time or weather	A guard robot that is remotely controlled through joysticks. There are four cameras attached to its head and shoulders to recognize danger. Additional features include touch screen monitor, a RFID card reader, and a voice synthesizer.
Actroid <sup>[51]</sup>	Kokoro Company Ltd.	Only used for fictional robots. It can mimic functions like blinking, speaking, and breathing	A type of android that has been modeled after a young Japanese woman. There are air actuators and points of articulation in the upper body to contribute to the life-like appearance. There is also a visual system that allows the robot to imitate human movements. Microphones are used to incorporate speech recognition to produce live speech.
Partner Robot <sup>[51]</sup>	Toyota	Help people with tasks in factories or at home, entertain and play music like the violin or trumpet	There are five versions of the Partner robot. Version 1 is a bipedal robot, version 2 and 3 have segway-like wheels, version 4 has a unique wire system, and version 5 is mountable with two legs.
Nuvo <sup>[51]</sup>	ZIP	Play music, dance, and tell time, serve as a baby monitor and home security device	A household helpmate robot that stands at 15 in height. The robot can respond to voice commands. It can also sync to a mobile phone to receive commands and send images of your home with the camera located inside its head.

BIRON	University of Bielefeld	Human interaction	This is a modified version of PeopleBot from ActiveMedia with the ability of learning from humans, identifying the object and obstacles using its cameras and a laser range finder <sup>[21]</sup>
Pino <sup>[51]</sup>	ZMP	Create a Linux-like open platform for robotics, aiding in disaster relief	A humanoid robot standing at 75 cm in height. The robot has a head sensor, two hand sensors, infrared visor, and a nose-mounted light sensor.
Giraff <sup>[34]</sup>	Comanio Care	Assist and supervise independent-living elderly people, connect elderly people to their family and healthcare professionals, rehabilitation for people with acquired brain injuries	A mobile, telepresence robot that can be operated by a remote user. The user can be displayed on its screen and can maneuver the household as if they were physically present.
Hobbit - The Mutual Care Robot	EU's 7th Framework Programme with Vienna University of Technology	Assist and supervise independent-living elderly people, entertain, promote quality of life, detect emergency situations and trigger appropriate alarm	A mobile robot with differential drive kinematics. The robot is equipped with a sensor system, human-like arms, and a gripping system. It has a multi modal user interface through a touch screen mounted on the top of the robot.
<i>Nodding Kabochan</i>	PIP Co, ltd and Wiz Corporation	Communication with humans, help elderly with cognitive functions	A doll-like robot that has an appearance similar to a three years old boy <sup>[17]</sup> . This robot is able to sing, talk, and respond to touch <sup>[17]</sup> .

**Table 2.** Non-humanoid robots

Robot Name	Manufacturer	Application(s)	Description
<i>PARO</i>	National Institute of Advanced Industrial Science and Technology (AIST)	Therapeutic robot promoting intimate social reactions	A seal shaped robot consists of five sensors: tactile, light, audition, temperature, and posture to perceive the person and their surrounding environment. It can interact with people through moving its head and legs, producing sounds, and showing your preferred behavior <sup>[4,52]</sup>
<i>AIBO</i>	Sony	Stress control, entertaining, and improving quality of life <sup>[6,8]</sup>	A dog shaped robot with all the features of a real-life dog with the addition of a front-facing camera for simultaneous location and mapping, Wi-Fi and LTE connectivity, voice command, and a phone application for personal management <sup>[53]</sup> .
<i>iCat</i>	Philips	Game buddy for children, TV assistant	A cat-like robot that can express emotions such as happy and sad with its face <sup>[8]</sup> . iCat's design allows movement of its eyes, eyelids, eyebrows, mouth, and head <sup>[17]</sup> . Also, it has a camera, microphones, speakers, and touch sensors for communicating with the user <sup>[30]</sup> .
RoboLAB10	French Robosoft	Provide daily-life services to people staying at home including the disabled and the elderly.	A telepresence robot that acts as a home-assistance robot designed to assist in home care of the elderly <sup>[6]</sup> .
<i>NeCoRo (OMRON)</i>	Omron Corporation	Act as a lap-cat for elderly people	A cat-like robot with several sensors including sight, sound, touch, and orientation that allow it to responde the user verbally and nonverbally by meowing, tail wagging, stretching the body and paws, and cuddling if it is touched <sup>[17]</sup> . There are few features to this robot including responding to human movement/emotions, adjusting its personality to the owner, and remembering and acknowledging its name when called.

Companion Systems for Ability & Security (CompanionAble)	Robotic	Integrated Assistive and Domotic	Cognitive	Cognitive training Working as a reminder for medicine, water drinking, smart home device controller, Remote controlling, Emergency notifier Personal contact assistant.	The specific robot created by this project is named <i>Hector</i> . It is a mobile robot that can collaboratively assist with a smart home to support elderly people. The frame of the robot is a simplistic structure consisting of a wheeled-based, a tablet interface, and two light-up eyes. Video calling, playing games, monitoring health and providing daily reminders can all be done through the tablet [6,54].
<i>Iffbot</i>		Business Laboratory	Design	Communication with humans, ability to express emotions, moods, and other feelings	The humanoid robot is able to move its eyes, eyelids, and head using its motors. This robot communicates with the elderly by asking questions and responding to the words [17,51]. It is equipped with 10 motors and 104 LEDs. The robot also possesses 5-layer perception to extract facial expressions.
<i>SMOOTH</i> project		The Maersk Mc-Kinney Moller Institute and SDU Robotics		Assist and supervise independent-living elderly people, laundry and garbage collection, serving fluids, guidance	The mobile, welfare robot is equipped with wheels, a handle to move it easily, and a basket for carrying either a person's laundry or drink [4,36]. The robot consists of a three-wheeled mobile platform. The platform has two actuated wheels and a single caster wheel. There are three current designs: the swan, mouse, and penguin. The designs differ in the way they handle the modular attachments, sensors, and user interface on top of the mobile platform [36].
<i>RIBA</i> (Robot for Interactive Assistance)	for Body	RIKEN-TRI Collaboration Center for Human-Interactive Robot Research		A lift assistance robot	It has omnidirectional wheels, 2 cameras, 2 microphones, upper arms, forearms, hands, shoulders, and a unique head that resembles a bear. It is able to lift humans using its strong human-like arms and high-accuracy tactile sensors [37]. Other supporter features include stable joints, the ability to follow the operator based on audio and visuals, and tactile guidance [18].
Healthbot		University of Auckland/Auckland UniServices in New Zealand, with ETRI and Yujin Robot Co. Ltd		Service robot for vital signs measurement (blood pressure, and blood oxygen saturation), medication, falls, schedule reminding, and entertainment	A mobile robot that has features of a tray fixed to its torso, sonar sensors, speakers, a touch-screen attached to an actuated head, USB ports, and a camera [40,55].
<i>Nabaztag/Karotz</i>		Violet		Connect to the internet and do internet calls, and access to TV channels, news, and weather and notify the user about the update on Facebook and Twitter [30].	A rabbit shaped robot that is 23 cm in height. It can send and receive MP3s and messages that can be read aloud. It has a webcam, speaker, and a headphone and can answer some predefined commands, but it does not have learning memory [17].
<i>Wonder</i>				Deliver daily information to an elderly from a distant place such as local government office or welfare institution, as well as monitoring the elderly	A wombat shaped robot equipped with a microphone and speaker for speech recognition [30]. It can move its body parts (head, ears, eyes, and head) [17,56]
Tama		JSK Laboratories		Companionship, appointment reminder, entertainment, health monitoring	A cat-like robot with capabilities similar to iCat [7]