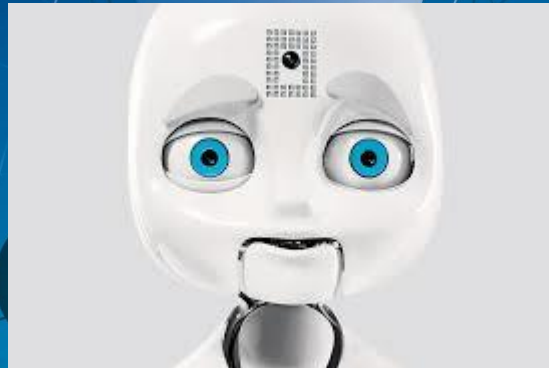# Advanced Manufacturing Technology (TechVision)
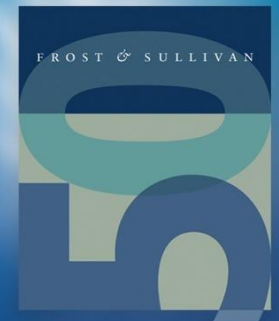
Social Robots

Social and Family Companion Robots

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Innovations in Social Robots

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Social Home Robot
Jibo Inc.–Jibo

Tech. Profile

Jibo is a social interactive home robot for family and personnel assistance. Jibo is a static robot but is capable of seeing, hearing, speaking, helping, learning and engaging in various household chores and roles such as delivering information, controlling the environment, capturing pictures, providing an educative medium for children, browsing the Web and providing relevant information, managing and co-ordinating family activities.

Competing Aspects

Jibo has a touch sensitive aluminum body which has the capability to rotate in all three axis and face the person who is addressing it. The system runs on a Linux platform and ARM processor and the data collected by the system is directly stored in the Jibo cloud.

Wide-scale Adoption

Pre-orders for Jibo have been very active from early 2015. The company is planning on shipping from April 2016. This novel innovation is expected to be commercialized over the relative near term.

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Market Opportunity

- Robotics
- Sensors
- Social/Commercial robots
- Space
- Defence and military
- Hospitality and tourism

Technology Convergence

Robotics is actually a convergence of major technologies such as sensors, microelectronics and so on. This novel technology development has opportunities to be widely adopted for different applications in various industries mentioned in market opportunities. Robotics products such as Jibo have potential to impact on the commercial electronics market.

Innovation Attributes

The in-built camera allows Jibo to identify and follow the face of the person when interacting. A high-resolution LCD touchscreen acts as the face for Jibo. The robot is approximately 28cms in height and 15cm in width and weighs around 2.7 Kg and has Wi-Fi and Bluetooth connectivity facility. The specially developed Jibo Mobile app allows users to connect their phones to Jibo.

Market Entry Strategies

Jibo started its crowd funding activities during 2014 and was one of top five companies which received the most funding in 2015. The company has been able to acquire a cumulative funding of more than $25 million to date. More than five thousand pre-sales orders for Jibo have already been placed.

Family Companion Robot
Blue Frog Robotics–Buddy

Tech. Profile

Buddy is a family companion robot which can interact with humans and at the same time help with communication, education, entertainment, home security, elder care and at the same time has the ability to move with the help of the in-built driving motors. Buddy is integrated with various advanced sensors and has the ability to map the user's house in real time to move to different locations inside the house.

Competing Aspects

Buddy is programmed to recognize French and English but support for downloading ten other languages is also available. Users can also control the robot using the specially developed mobile app which shows the robot's current location in the house and can also view what the robot is viewing.

Innovation Attributes

Buddy also acts as a security robot and patrols the house for security breaches and can detect unusual activities like fire, floods, burglars and can warn all the family members. The robot is 560 mm x 250 mm x 350 mm in size and weighs little more than 5kgs.Buddy is integrated with temperature, range finder, ground and obstacle detection sensors, and a camera, and provides 3D vision. The robot can also act as an edutainment system for children.

Wide-scale Adoption

The company is manufacturing the robot in batches for sales. Shipments of Buddy will begin in Q4 2016; and the robot has opportunities for wide scale adoption over the near-term.

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Market Opportunity

- Robotics
- Sensors
- Social/Commercial robots
- Hospitality and tourism

Technology Convergence

Robots are able to enter the consumer market due to advancements in mapping and navigation capabilities and in software; sensors; and cameras that allow of robots to have more natural, intuitive interaction with people.

Market Entry Strategies

Buddy began a crowd funding initiative in 2015. Buddy It is designed to assist family members in their daily lives. The robot is also priced to encourage more consumers to buy the product. At the Consumer Electronics Show (CES) 2016 which took place between 6th- 9th January 6 to January 9, 2016, in Las Vegas (USA), Buddy's stall attracted large crowds.

Leonardo–A Socially Interactive Robot
Personal Robots Group, MIT and Stan Winston Studio, USA

Tech. Profile

Leonardo is a socially intelligent robot designed and developed by MIT's Personal Robots Group in collaboration with Stan Winston Studio (which completed its body in 2002). Unlike traditional humanoid robots, Leonardo is designed to be a socially intelligent robot with features of animatronics characters. Leonardo is a social robot developed with state-of-the art robotic science and has a compelling design from a key animatronics studio.

Competing Aspects

- Animatronic design that makes Leonardo look like a character from an animation movie.
- 69 degrees of freedom through embedded multi-axis motion controller
- Real-time face recognition system embedded in the vision system
- Tactile perception abilities for the robot to mimic human skin through sensate skin technology (for example, sensing resistors)
- Ability to show different facial expressions

Innovation Attributes

- Leonardo's biggest innovation attribute is its design and aesthetic appeal. Stan Winston Studios' expertise has enabled this by making the robot look like an animation character.
- In addition to sensate skin technology, computational somatosensory cortex with low level feature extractors and pattern recognition algorithms are being developed for tactile perception

Wide-scale Adoption

Leonardo, the socially intelligent expressive robot, is a prototype currently being used at MIT's Personal Robots Group lab. The researchers are developing more advanced features to make this robot useful for many applications.

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Market Opportunity

- Personal robotic assistants
- Media and entertainment
- Therapeutics
- Animatronics
- Social cognitive robotics

Technology Convergence

Leonardo's design is proof to demonstrate the high degree of technology convergence in robotics. Leonardo involves technologies that would enable it to exhibit and often mimic human emotions and behavior to interact more closely with humans. Advanced sensors, motion control technologies, artificial intelligence, tactile sensing, and visionary sensing are some of the technologies that have contributed to the successful design of Leonardo.

Market Entry Strategies

Although Leonardo's market entry is undetermined at this moment, with enhancements in its sensate skin, Leonardo has potential to interact with humans more naturally and to allow untrained humans to better interact with and train a robot.

Keepon® Pro
BeatBots LLC, San Francisco, CA, USA

Tech. Profile

- Keepon® Pro is a social robot designed and developed by BeatBots LLC, a California-based robotics startup.
- Keepon® Pro is designed to be a social robot to interact with children.
- The interaction abilities of Keepon® Pro are focused on interaction with children suffering from developmental disorders, such as autism.

Wide-scale Adoption

BeatBots LLC has developed many other social robots and robotic toys that are commercially available. The social robots of BeatBot along with Keepon® have a very good reception among kids and therapists who use them to treat autistic children.

Market Opportunity

- Personal robotic assistants
- Education robotics
- Social development/behavior therapy (primary application)
- Robotic toys

Competing Aspects

- Simple design
- Robust hardware and software platform for greater interactivity
- Four degrees of freedom
- Attention directed by turning +/- 180 degrees, or nodding through and angle +/- 40 degrees
- Emotional expression achieved by rocking the head of the robot side to side +/- 25 degrees, or bouncing or compressing (up to 15 mm)

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Technology Convergence

Keepon Pro is a simple social robot that provides a robotic platform to aid in therapy for autistic kids. Like other social robots, Keepon® Pro combines various technologies to accomplish interactivity with humans--the very purpose of social robots. Vision sensors, audio sensors, motion controllers, and soft materials are some of the technology elements that converge to create a novel and useful social robot--Keepon Pro.

Innovation Attributes

- Keepon Pro's most striking innovation attribute is its simple design, which revolves around the principle of creating cute social robots with a personality through a minimalist approach.
- Keepon® Pro has embedded cameras in its eyes and a microphone in it's nose, enabling the robot to record and transmit interactions of autistic kids who play with it.

Market Entry Strategies

- BeatBot has already created or commercialized interactive robot characters for therapy, research, entertainment, education, art, toys. robots and robotic toys.
- The simple design and minimal elements used in the construction of the robots can ensure price competitiveness.
- As toys and as therapeutic devices, BeatBot's robots are gradually finding increased opportunities.

Strategic Insights

Competitive Landscape

- More social robot research programs from universities are branching off, leading to independent, spin-off companies

- The competition among social robot companies may not be so intense as each company and research project can be human needs or different applications.

- The North American region takes precedence in social robot companies and research followed by the European Union.

Growth Potential

- The number of application areas where social robots will help humans is increasing over the years. Key technologies (such as enhanced navigation, sensing, and vision) are converging to create more interactive features in social robots, which in the near future, can enable social robots to completely replicate some human capabilities.

- There are many research projects and start-up companies that are working on social robots with multiple capabilities. However, there is also an increase in the number of social robots that are designed to cater to specific human needs.

Funding Focus

- Funding support by government and venture capitalists is expected to accelerate the commercialization of prototypes and products. Technology developers would be able to bring innovative ideas to the market with financial support.

- While venture capital firms and other funding agencies continue to fund collaborative start-ups, government grants and loans are helping further research and product development in universities and industries in the United States and European Union with social robot projects.

R&D Focus Areas

Research and development is key to propelling the growth of any technology. Social robots are no exception to this phenomenon. Some areas of research that require more attention are

- Emotional response and emotional capabilities

- Cognitive abilities

- Sensory abilities

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Key Patents

No.	Patent No.	Publication Date	Title	Assignee
1	WO2016011159	21.01.2016	Apparatus and methods for providing a persistent companion device	Jibo Inc.
	A development platform for developing a skill for a persistent companion device (PCD) includes an asset development library having an application programming interface (API) configured to enable a developer to at least one of find, create, edit and access one or more content assets utilizable for creating a skill, an expression tool suite having one or more APIs via which are received one or more expressions associated with the skill as specified by the developer wherein the skill is executable by the PCD in response to at least one defined input, a behavior editor for specifying one or more behavioral sequences of the PCD for the skill and a skill deployment facility having an API for deploying the skill to an execution engine of the PCD.			
2	CN104924310	23.09.2015	Smart home voice interaction robot	Shanghai Pt Info Co. Ltd.
	The invention provides a smart home voice interaction robot. The robot comprises a human-computer interaction device, a power supply device, a baseplate, a controller and a shell, wherein the shell comprises a head shell, a rotating shell and a bottom shell; the rotating shell is connected with a first motor; the head shell is connected with the first motor through a gear; a second motor is arranged in the head shell; the human-computer interaction device is fixedly connected with the head shell; the bottom shell, the controller and the power supply device are respectively mounted on the baseplate; the power supply device is respectively connected with the human-computer interaction device, the controller, the first motor and the second motor; the controller is respectively connected with the first motor and the second motor; the controller further comprises a voice signal receiver; and the voice signal receiver is connected with the power supply device. The smart home voice interaction robot can realize the voice interaction between users and the robot.			

Key Patents

No.	Patent No.	Publication Date	Title	Assignee
3	CN104571114	29.04.2015	Intelligent Home robot	Shenzhen Semisky Technology Co. Ltd.
	The invention relates to intelligent equipment, belongs to the field of intelligent home equipment, and particularly relates to an intelligent home robot. The intelligent home robot comprises a data collecting module, an experience knowledge base, a man-machine interaction module and an intelligent control module. The intelligent home robot has the following advantages that many kinds of data collecting equipment are integrated so that the robot can adapt to the home environment; a mobile internet interface is integrated, and therefore remote intelligent control over the robot can be achieved; based on an ARM framework hardware platform, the equipment structure is simpler, and maintenance and use are convenient; based on an Android operation system, an application program can be developed and upgraded more conveniently.			
4	CN104400785	11.03.2015	Interactive intelligent home service robot	Hunan City University
	The invention provides a smart home voice interaction robot. The robot comprises a human-computer interaction device, a power supply device, a baseplate, a controller and a shell, wherein the shell comprises a head shell, a rotating shell and a bottom shell; the rotating shell is connected with a first motor; the head shell is connected with the first motor through a gear; a second motor is arranged in the head shell; the human-computer interaction device is fixedly connected with the head shell; the bottom shell, the controller and the power supply device are respectively mounted on the baseplate; the power supply device is respectively connected with the human-computer interaction device, the controller, the first motor and the second motor; the controller is respectively connected with the first motor and the second motor; the controller further comprises a voice signal receiver; and the voice signal receiver is connected with the power supply device. The smart home voice interaction robot can realize the voice interaction between users and the robot.			

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