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SENSOR READINGS

The weekly magazine
for the robotics and
automation industry

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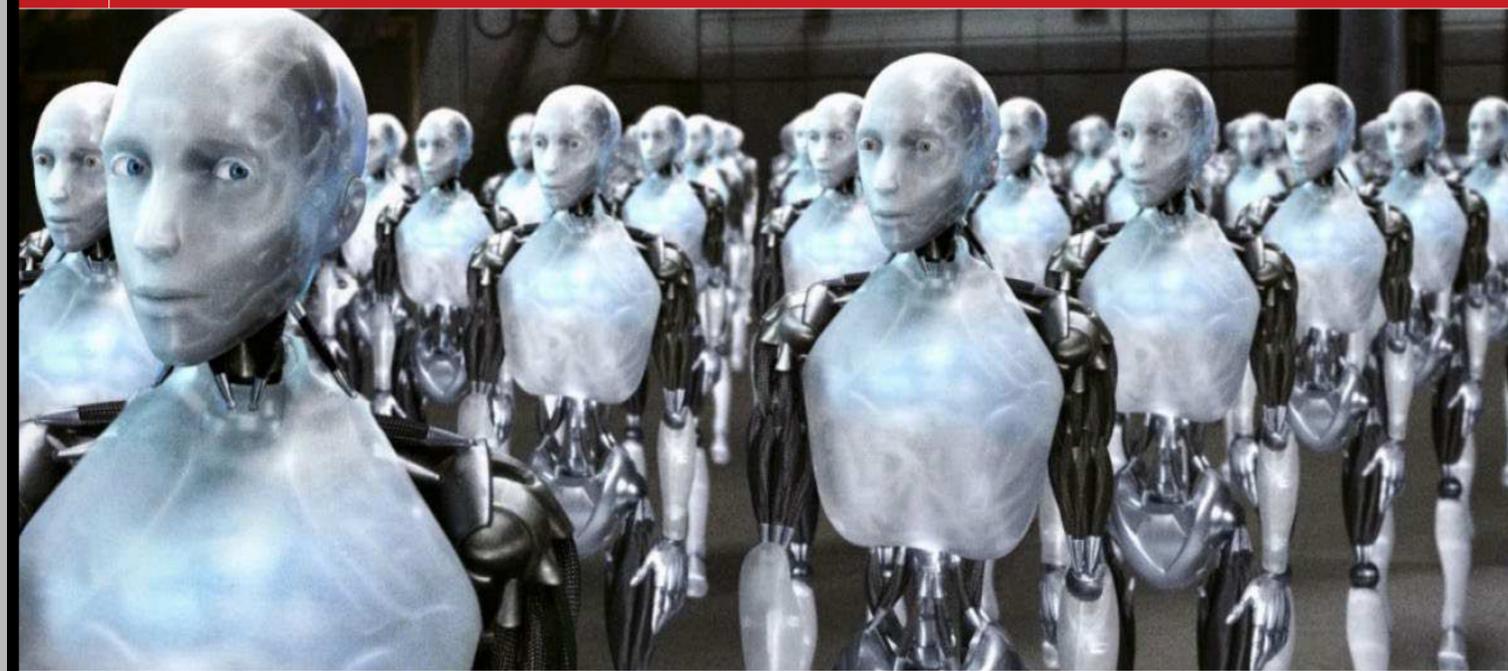
Brave new robotics

The most important trends in robotics, according to an expert



Opinion

Daniel Theobald, CEO of Vecna, on the new wave of robotics



Could Yaskawa change?

Yaskawa could add launch 'collaborative robots'



Case studies

Automation:
Advantech and
Rockwell

Honda uses all-robot cell

Automaker Geely-Volvo awards Kuka big-money contract



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Running out of steam, into robotics

Abdul Montaqim
Editor

Although the history of robots is traced back by some to ancient times, the conditions for a real robotics revolution has never been present until now, with the emergence of powerful supercomputers and cloud computing platforms, as well as advances in sensing technologies, to name just two of the conditions.

The mechanical and perhaps the engineering knowhow – in the old sense of the phrase – have been present since the industrial age, or the steam age, as some call it. Steam was, of course, the power that drove the trains and giant machines that characterised the industrial revolution.

The industrial revolution, which historians say started in the mid-1700s and lasted until the mid-1800s, was the most transformative era in the history of humanity, on a par with the emergence of global religions and empires.

The empires built during the industrial revolution still exist today. In fact, not only do they exist, those empires are still empires, commanding vast power and resources around the world. After all, we are still living in the echoes of the industrial revolution.

Space travel, computers and robotics may have matured some decades ago but now they have grown to a point where they can merge with each other, as well as other technologies, to create an entirely new technological era.

And truth be told, it may well be the same industrial-age empires that pass into the new world with their power not only intact but perhaps even magnified. But there is a chance that new empires will be built.

We have seen how Google, Apple and number of other companies have seemingly appeared out of nowhere to dominate the “virtual” world, through which they are increasingly influencing the “real” world. What’s to say there will not be robotics companies that replicate the success of those tech giants and find themselves among the largest companies in the world? It’s not only possible. It’s only matter of time. ●



Opinion

Daniel Theobald, CEO of Vecna, on the new wave of robotics
10

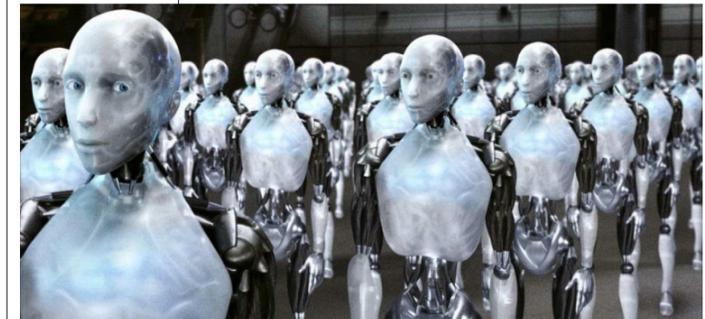


Faster than most drones

Sony launches drone that travels more than 100mph
5

Brave new robotics

The most important trends in robotics, according to expert
6



ASI CEO Torrie to give talk at China robotics exhibition	4
Pepper sells out in a minute – again	4
Neato launches Wi-Fi enable robotic vacuum cleaner	5
Honda claims ‘world’s first’ robot MIG work cell	5
The most important trends in robotics	6
New mobile robots end old traditions	10
Will Yaskawa change?	14
Marketplace	18

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News

In Brief

Foxconn joins Siliconware

Toyota has made a number of moves which would indicate that is preparing to launch a robotic car. The company has formed research partnerships with MIT and Stanford universities, as well as poaching the man behind DARPA's robotics challenge, Dr Gill Pratt. Toyota did not clearly state that it is working on an autonomous car, only saying that it is developing "future mobility" solutions with a view to "improving the human condition". Pratt, meanwhile, says: "The focus of the effort today is more on the autonomy of people, of human beings," Pratt says, "regardless of the limits imposed by age or illness."

Acer invests in Jibo

Taiwanese computer company Acer has reportedly made a significant investment in Jibo, the home help robot. Jibo raised a total amount in the region of \$40 million since January, and has launched its robot at a price of \$750 each. Acer CEO Jason Chen said acquiring shares in Jibo would give the company an option to research the robotics sector, which it sees is booming at the moment. But Chen did not say how much Acer had invested in Jibo.



Samsung unveils SmartThings Hub

Samsung has launched its smart home hub, a small connectivity device which can monitor video and sense motion. The SmartThings Hub can monitor and manage a home, and can operate without an internet connection – just an internal connection at home. It can be controlled through a smartphone and has 10 hours of battery life. Alex Hawkinson, CEO and founder of SmartThings, says the device lets users watch over and protect their home from anywhere in the world. "You'll get a text, alert or video notification if there is smoke or anything else happens in your home. So you can act before it turns into a disaster," he said.



ASI's CEO Torrie to give talk at China robotics exhibition

ASI co-founder and CEO, Mel Torrie will be the keynote speaker at the First World Congress of Robotics (WCR-2015) in Shenyang, China.

ASI says Torre is planning to talk about the keys to success in fielding robotics, and lessons that ASI has learned over its 15 years of automating vehicles in industries like mining, agriculture, automotive, and industrial automation.

It has been a busy speaking year for Torrie, giving presentations at conferences around the world including events in Australia, Germany, China, South Africa, and the UK.

Most recently, Torrie spoke at the RISE tech conference in Hong Kong and he is scheduled to speak in Russia and Egypt before the end of the year.

"There are amazing things happening in the driverless vehicle industry and it is thrill-

ing to visit with people around the world in how we can bring this disruption to a reality."

The 1st China Shenyang International Robot Expo will be held on September 1-5, 2015 at Shenyang International Exhibition Center. The organisers say it will bring "well-known robot enterprises and high class buyers home and abroad" together.

The WCR-2015 is co-organized with Siasun Robot and Automation Company, which is regarded as one of the most innovative and influential robotics brands in China.

More than 100 speakers will make presentations, covering topical issues and cutting-edge technology in the industry.

Around 500 exhibitors will be showcasing emerging new products and technologies, and organisers are expecting more than 3,000 visitors.

Pepper sells out in less than 1 minute

SoftBank Robotics says it sold 1,000 units of its Pepper humanoid robot in less than 60 seconds, repeating the achievement of last month.

Pepper is claimed to be the world's first personal robot that has its own emotions, sold out in one minute, and the company says orders are no longer being taken.

Sales of 1,000 units of Pepper



for September is scheduled to start from 10am on September 26, 2015.

Customers will be able to place orders online at the SoftBank website.

Pepper was developed by Aldebaran, which is a robotics developer owned by SoftBank, which is itself a telecommunications company.

The robot is being built by Foxconn, which also makes the iPhone.

News

In Brief

Foxconn links with Siliconware

Hon Hai Precision Industry (Foxconn) and Siliconware Precision Industries have formed a strategic alliance through the exchange of shares, with Foxconn holding more than 20 per cent of SPIL shares, and SPIL holding more than 2 per cent of Foxconn shares. The companies say the alliance will provide customers with "the best integrated service program through future collaboration on technology and business". Foxconn is believed to operate one of the largest number of robots of any company in the world.

Kuka to showcase at IROS

Kuka is to showcase its products at this year's International Conference on Intelligent Robots and Systems (IROS), in Hamburg. From 29 September to 1 October 2015, researchers and developers will not

only be able to get an up-close look at the innovative products from Kuka across 144 sq m of booth space, but will also have an opportunity to discuss visionary future concepts with Kuka experts. The company says that at a time when the focus is on the future of robotics, there is one Kuka product that is "an absolute must" at IROS 2015: the LBR iiwa.



Bosch joins robocar group

Bosch has joined forces with a number of other suppliers, automakers, and public-sector partners to launch the "cooperative highly automated driving" (Ko-Haf) research initiative, which aims to push forward the development of automated driving. The publicly funded project will tackle the challenges of highly-automated driving, in which drivers no longer need to be constantly vigilant. But for this to happen, technical precautions are necessary.

Neato releases new Wi-Fi enabled robovac

Neato Robotics has launched the Neato Botvac Connected robot vacuum, calling the new Wi-Fi enabled model "the best cleaning robot the company has ever designed". The new product will be on sale towards the end of 2015.

The company says that in addition to enhanced features that maximize the robot's ability to pick up debris on both carpet and hardwood floors, Botvac Connected can be operated from the users' Apple or Android smartphone, using an easy to use mobile app to start, stop, schedule and monitor the vacuuming run.

"Picture this: you're at work when you learn that unexpected company is on the way to your house," said Nancy Nunziati, Neato's vice president of marketing. "You grab your smartphone, access the Neato app and with a couple of taps your Neato robot immediately starts cleaning. Your floors – at least – are clean when your guests arrive."



According to Neato, Botvac Connected cleans twice the area in the same amount of time and has twice the airflow of competitors. And when cleaning carpet, Neato picks up 50 per cent more fine dust and cleans four times closer to walls.

"Add to this our unique laser-guided navigation and the ability to vacuum your home right from your smartphone and it's easy to see why Botvac Connected is setting a new standard for robot vacuums," said Giacomo Marini, Neato's chairman and chief executive officer.

The new Botvac Connected features anytime/anywhere vacuuming: When Botvac Connected is paired with a home Wi-Fi network and the Neato app, users can remotely set up a regular vacuuming schedule, start a full house or spot clean, stop or pause the robot and get instant notifications about the status of the vacuuming run.



'World's first' robot MIG work cell

Honda says it is using an MIG welding work cell comprising entirely of robots to produce its new supercar, the Acura NSX.

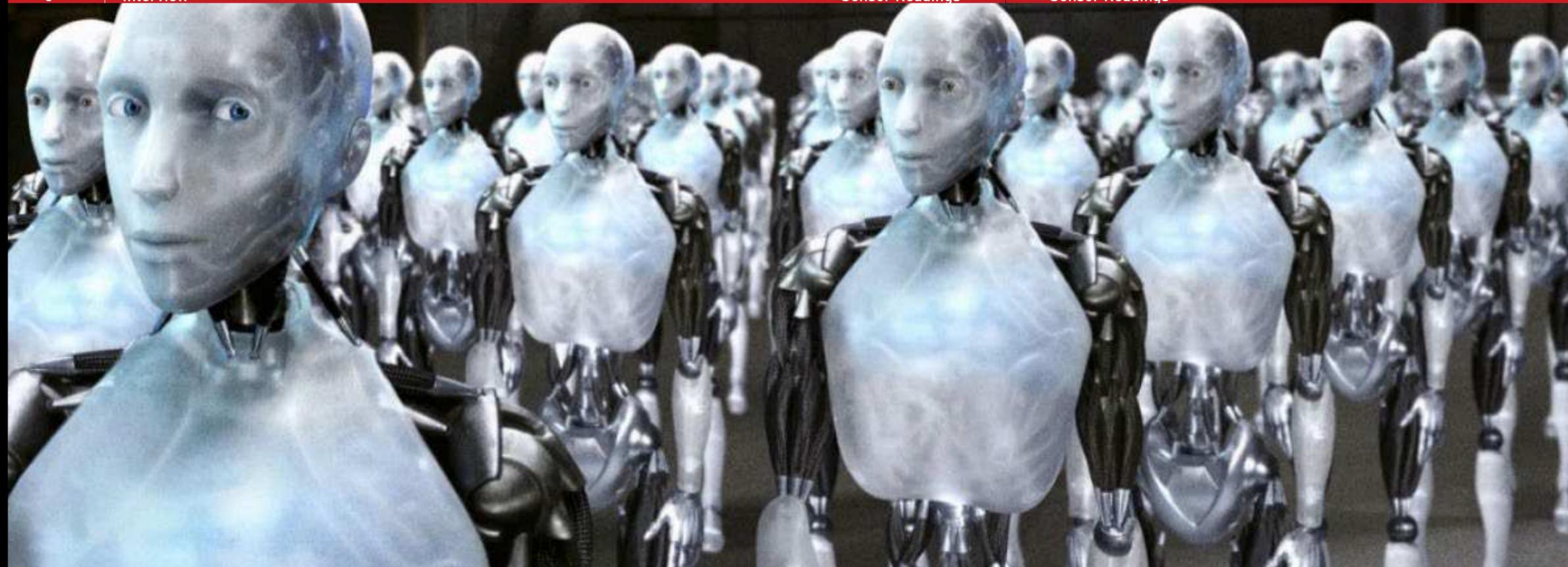
The next-generation Honda Acura NSX is being built at Honda's new, dedicated Performance Manufacturing Center (PMC) in Marysville, Ohio, using domestic and globally sourced parts.

Production is scheduled to start in Spring 2016, and the company says it will

use the "world's first weld technology".

It adds: "The world's first use of all robotic MIG welding employs eight robots to apply approximately 900 MIG welds. This surgical welding process results in a space frame that is incredibly precise, in addition to being ultra rigid and lightweight."

The Honda Acura NSX features a 9-speed dual clutch transmission with direct-drive electric motor, and front twin motor unit.



Brave new robotics

Robotics trends
Four diverse trends are having a big effect on the robotics industry worldwide, and the global media and financial gurus are paying attention to the process, says Frank Tobe

It's always interesting and useful to know what trends are affecting the robotics industry, even when it turns out to be speculation. But robotics in some ways is in its early days, so most of what might seem like speculation is likely to come to fruition as there is so much room to grow and develop. Here, Frank Tobe of the Robot Report outlines what he believes are the most important trends.

1. Broad recognition of robotics

There is broad recognition within the business world of the value of robotics and that growing awareness is spreading to the media and financial community. Efficiency, reliability, low spoilage, and higher overall productivity are the real products of advanced automation. And the newer air, land and sea service robots are providing the wow factor.

In the last 12 months there have been special sections about robotics in *The Economist*, *The Financial Times*, *The Wall Street Journal*, *Time Magazine* and many others. And many financial institutions and consulting firms such as McKinsey and Deloitte have produced special reports about the march of advanced manufacturing and its effect on jobs, job types, job creation and employment in general.

Strategic acquisitions in the robotics arena are rampant and became most visible in 2012 when Amazon acquired Kiva Systems to help bolster their warehousing methods into the future, for \$775 million. Since then, 2013, 2014 and 2015 have seen similar big-dollar acquisitions by companies and equity firms.

The most recent four are indicative of the range and types of reasoning for these types of strategic acquisitions:

- Ninebot, a Chinese maker of mobile bots similar to the Segways used by police, vacationers and security personnel, bought Segway. This settled their ongoing legal battles and enables Ninebot to acquire Segway's intellectual property.
- Kuka, a German robot manufacturer and one of the Big Four in the industry, last year bought Swisslog to add mobility to the Kuka product line. Kuka also bought Reis Robotics which had a factory in China. Kuka opened their own factory in Shanghai and thus now has two.
- China South Rail (CSR) acquired UK-based SMD, a provider of underwater robotics technologies and systems. The acquisition is expected to help China obtain core deep-sea robotic technology and equipment, and will also help CSR absorb the mature industry platform and global sales network of SMD, supporting it to enter the global deep-sea market. This will complement CSR's existing businesses in offshore wind energy, shipyard, marine engineering and drilling and help the Chinese company build an international chain for marine equipment.
- Teradyne spent \$350 million to buy up-and-coming Universal Robots, a Danish maker of one-armed safe collaborative robots and the primary competitor to American Rethink Robotics, which, although they get most of the publicity, aren't doing as well as UR.

Teradyne is an electronics manufacturer that, up until now, had no robotic presence except as a user of UR products.

And in robotics, equity funding in the first five months of 2015 has already exceeded all equity funding in 2014.

2. The China effect

Global industrial robot sales reached 225,000 units in 2014, 27% more than 2013. About 56,000 were sold in China, a growth of 58% over 2013. Chinese companies made 16,000 of the 56,000 robots sold domestically. To increase the number of domestically made robots, many local governments have provided investment credits and other attractive financial reasons to build in their areas, and the number of vendors has grown from fewer than 100 (of which even fewer were manufacturers; most were integrators and distributors) to almost 500. By the end of 2014, there were about 500+ companies in the sector, with 90% focusing on component manufacturing and integration. China Daily expects the number to increase to 800 by the end of this year, but also that there will be more than 10% manufacturers. Thus China is cultivating their own in-country robotics industry. They've set up a robotics association, the CRIA, to help mobilize and promote the new industry and so that they can poll their members and add the results to the annual tabulations made by the International Federation of Robotics (IFR) which, up until 2013, had no resource to robotic activity within China.

Driven by increasing wages and political incentives, China has been forced to become the largest buyer of industrial robots – and they are putting those robots to use by the thousands. The IFR says that China will have more robots operating in its production plants by 2017 than any other country as it cranks up automation of its car and electronics factories. A race by carmakers to build

plants in China along with wage inflation will push the number of industrial robots to more than 428,000 by 2017, the IFR estimates. Still, China lags far behind its more industrialised peers in terms of robot density. According to the IFR, China has just 30 robots per 10,000 workers employed in manufacturing industries, compared with 437 in South Korea, 323 in Japan, 282 in Germany and 152 in the United States. The low density rate is an indicator of continued fast growth to stay competitive and raise the density rate to at least that of the US.

3. Advances in visual perception

Vision-enhanced robotic systems are becoming the top reason for upgrading and deploying vision-enabled robots and a core reason for the steady upward growth of the robotics industry. Amazon just brought the issue to the public and media's attention with their recent Amazon Picking Challenge, where a variety of teams from academia used varying technologies to robotically pull various consumer items randomly placed in cubbyhole-type shelves a typical requirement of Amazon in their distribution centers. Being able to determine what and where, in 3D, makes it possible to instruct the robot to safely pick the item(s).

Visual robotic systems are quite different from old-style auto-making robots. These older systems required the part to be worked upon to be in a precise location at a specific time. The robot was blind and programmed to pick and process. Each step of the pick and process was hand programmed and quite detailed. Newer systems that use cameras and software to identify and locate parts are more flexible and enable product movement from step to step to be less rigid and precise; as a consequence, the movement system is less costly.

Artificial intelligence and various AI learning systems have been improving regarding visual perception, and many new companies (such as Universal Robotics and their Neocortex system) are now either offering vision systems that can supplement existing fixed systems or offering mobile manipulators that can find and determine how best to pick and handle all sorts of objects from plastic-wrapped toys to boxes, cases and skids of materials. Cutting the costs of expensive conveyor and movement systems and replacing them with lower-cost mobile and bin-picking robots is rapidly gaining a big following because of the possible opportunities afforded the manufacturer or warehouse operator. Startups such as Fetch Robotics, RightHand Robotics, Clearpath Robotics and more



mature companies such as Adept Technologies and Kuka/Swisslog are ones to watch in this area of mobile manipulators.

4. Human-robot collaboration

A public-private movement to figure out ways to keep labor from being offshored to lower labor cost countries started first in Europe and then followed in the US. It was focused on the small and medium-sized enterprises – factories and shops of less than 500 employees – and was called the SME movement. The concept was that if you empowered shop employees with robotic tools that improved their combined productivity, the SME would become more cost efficient and competitive and therefore not have to move offshore.

Rodney Brooks is an MIT professor emeritus who was one of the founders of iRobot, helped develop the Roomba, mentored the founders of a string of robotic startups, and created Rethink Robotics and the robots Baxter and Sawyer. He is an eloquent spokesman, speaks with a slight Australian accent, and colorfully talks about the need for

The article was written by Frank Tobe (inset) for the Robohub.org website and is reprinted with permission

Future of robotics

Applications

Caterpillar plans to develop remote controlled machines and expects to develop fully autonomous heavy robots by 2021.

It was demonstrated that a robot can perform herding.

Robots are increasingly used in manufacturing. In the auto industry they can amount for more than half of the "labor". There are even "lights off" factories such as an IBM keyboard manufacturing factory in Texas that is 100% automated.

Robots such as HOSPI are used as couriers in hospitals (hospital robot). Other hospital tasks performed by robots are receptionists, guides and porters helpers, and surgical robots such as Da Vinci)

Robots can serve as waiters and cooks. Boris is a robot that can load a dishwasher.

Materials[edit]

Soft and squishy robots: phase-change materials could allow even low-cost robots to switch between hard and soft states. Flexible machining robot: foamed polystyrene materials would cut the cost of the industrial robots.

Market evolution

Today's market is not fully mature. One or more software compatibility layers

have yet to emerge to allow the development of a rich robotics ecosystem (similar to today's personal computers one). The most commonly used software in the robotics research are Free Software solutions such as Player/Stage or cross-platform technologies such as URBI. The use of open source tools helps in improvement of the tools and algorithms for robotic research from the point one team leaves it.

Robotics timeline

- 2015-2020: every South Korean and many European households will have a robot, The Ministry of Information and Communication

- 2018: robots will carry out surgery

- 2022: intelligent robots that sense their environment, make decisions, and learn are used in 30 per cent of households and organizations

- 2030: robots capable of performing at human level at most manual jobs

- 2034: robots (home automation systems) performing most household tasks, Helen Greiner, chairman of iRobot

- 2050: robot "brains" based on computers that execute 100 trillion instructions per second will start rivaling human intelligence

Military robots

- 2015: one third of US fighting strength will be composed of robots

- 2035: first completely autonomous robot soldiers in operation

Wikipedia



human and robot collaboration. He makes similar points as the European SME movement but enhances that need by describing how, through the use of co-bots such as Baxter, SME workers become more productive, happier with their jobs, and their overall productivity becomes more cost efficient for the company.

Because the Baxter robot wasn't up to factory standards when it was launched, the beneficiary of Brooks' marketing efforts was the competing company, Universal Robots, a Danish startup whose one-armed robots (shown above) had all the attributes that the SME movement and Brooks were espousing. Universal just added a third robot to its product line and now has almost 200 integrators and distributors around the world, and thousands of sold robots at work in SME and larger factories. All three of their robots are identical one-armed robots except in size and carry. The UR3, UR5 and UR10 can carry up to 3, 5 and 10 kilograms of load (6.6, 11 and 22 pounds).

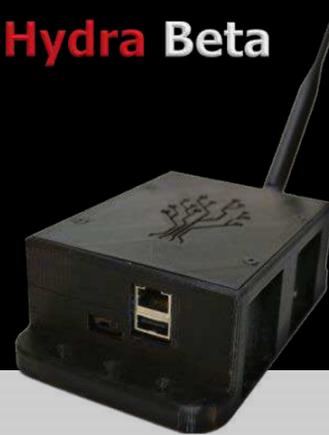
Combined, the SME, Brooks and Universal marketing effort helped make people aware of and understand the benefits of collaborative robotics and the business opportunities that it could bring.

Another and perhaps bigger use of co-bots has been found by automaker BMW, which already has 7,500 robots at work in their factories. BMW has been testing UR robots alongside factory workers who had been tasked with ergonomically-challenging assignments. The robots were quickly trained for those tasks and performed perfectly while freeing up the worker to do even more of what he or she was doing. The results of the tests turned out so well that a BMW spokesman who oversaw the testing, said that it was likely that BMW would soon double or even triple their number of robots by the use of these low-cost, easy-to-program, relatively portable and safe-to-work-alongside robots. Thus one can easily see why Teradyne would pay \$350,000,000 for Universal Robots with that kind of endorsement and prospect for the future.

At present, collaborative robots represent 5% of the overall robot market, but have strong growth expectations for the future. ABB, with its recent acquisition of gomTec and their Roberta co-bot (see photo at right) will probably be one of the leaders. Also, Rethink Robotics has improved their systems to be speedier and more precise so that, along with their new one-armed Sawyer robot, they will become a true competitor to the market leader Universal Robots. Because it's such a booming market, many other companies will soon be offering their products as well. Insiders suggest that collaborative lightweight robots will become the top seller in the industry in about 2 years, selling hundreds of thousands of them and with prices falling to the \$10,000 price point. ●

The pictures on this page and the previous page are from the film I, Robot, which is set in a future world where robots have dreams

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New mobile robots end old traditions



Opinion
Daniel Theobald,
CEO of Vecna
Technologies,
says a new
wave of robotics
technologies
are not only
breaking with
tradition, but they
could bring back
manufacturing to
the US

A new wave of automation is building, and it will affect everything. Robotic technology was once limited to operating behind cages and doors. Now, mobile robots are breaking away from traditional confines to appear in dynamic, peopled environments like offices, health-care facilities, classrooms, agriculture, and distribution centers.

The convergence of better sensors, actuators, computation, and algorithms has reached a crucial threshold, bringing advanced robotics out of the lab and driving significant industry investment into these new technologies. Combined with increased competition and lower costs, it is driving the Automation Age, the most influential period of technological advancement since the steam engine.

Investment in robotics promises handsome dividends for decades, and may determine the next global superpowers. Automation is the key to onshoring much of the US manufacturing base lost in the past several decades, as well as creating opportunities in such industries as apparel manufacturing, food distribution and service, and entertainment. To establish a global leadership position will require a commitment to invest in automation technologies if the US is to capitalize on these benefits.

Automation is an ideal tool for performing the dull, dirty, and dangerous tasks – shifting humans to greater value-adding activities. New technologies like advanced sensing and flexible manipulation are making robots safer and more efficient in interacting with humans. And interoperability and resource optimization are preparing workplaces for close collaboration of humans and robots as well as lights-out automation.

Safety through advanced sensing

Mobile robots operating in close proximity and in cooperation with humans need several layers of sensing, planning, and motion control. Advanced sensing gives robots the ability to build accurate 3D models of their surroundings and then reason about their environment beyond just distinguishing obstacles from free space. This level of understanding was superfluous when robots were in cages, but is critical for them to be coworkers with humans.

For example, modern robots can distinguish between a human and an inanimate object, understand the difference between the two, and take the appropriate action. The equipment is not just sensing the surroundings; it is making sense of its environment. When a robot comes into contact with a human, compliant actuation and tactile sensing allows it to move in a safe manner that avoids injury and minimizes any force of impact. Understanding and making sense of its environment is a key enabler to plan tasks and motions that are predictable and acceptable to human coworkers.

These inherently safe systems stand in contrast to old industrial robot arms that were trained for a specific function. They had, perhaps, one sensor that knew when something had entered its space and shut down the whole system.

Sensorized equipment

The same advance sensing that gives a robot its autonomous capabilities can first be used for basic safety monitoring



aboard equipment already used by human operators. By “sensorizing” a piece of industrial equipment for safety, all sectors can prevent injury, damage, and delays, and save billions of dollars annually.

Sensorizing industrial equipment for safety implicitly includes computing capabilities to process the sensor data. The processing power already available can provide more capabilities than just operational aids and awareness; features can be introduced to make it more

fully autonomous.

For example, a robot begins as a safety-enabled operator-unit—much like a car today is outfitted with forward collision avoidance and side-view assist. All its sensors are enabled and collecting data, but its ability to “act” on its environment is limited to alerting the human operator

or bringing the vehicle to a safe stop.

For example, a forklift that is fitted with sensors for safety could perceive a human in its path and come to a full stop before the operator can even react, potentially curbing the 110,000 annual major forklift accidents that are responsible for one in six workplace deaths. The National Safety Council estimated that the total cost of wage and productivity losses from safety-related death and injury was \$188.9 billion in 2011. With the cost savings from reduced accidents through a safety-enabled sensorized forklift, businesses can fund additional features toward full autonomy.

QC Bot is Vecna’s autonomous mobile robot, powered by an intelligent navigation system

Machine perception

Advanced algorithms allow robots to identify humans in various poses even with just monocular cameras, and

therefore enable advanced safety features. Adding this information as an overlay to existing rear view or other assistive camera systems available for industrial equipment is a simple first step. Making the same information available to a safety system installed on the equipment can do even better by removing the need for the operator to continually interpret a marked-up video feed or other interface.

That augmented safety system could be configured to audibly alert the operator of the presence of humans in the vicinity, and also limit the equipment’s velocity in directions that bring it close to detected pedestrians. The simple presence of a pedestrian near industrial equipment is not necessarily cause for concern. Much depends on what that person is doing, where the person is looking, and whether or not he or she is aware of the machine close by. Understanding a person’s activity and gaze from sensor data can help to determine what kind of warning or action is appropriate.

In addition to sensing a human coworker’s gaze and pose, a robot can take direction from nonverbal cues. This is particularly helpful in noisy environments. For example, by recognizing air marshalling gestures, a pedestrian can command or interact with a piece of automated equipment, whether the person is actively involved in the robot’s activity or pursuing an activity that brings them close to the machine.

Flexible manipulation

Being able to effectively manipulate objects in semistructured environments gives robots the dexterity and agility to not only work alongside humans more efficiently, but to match or exceed them in skill and speed. In the past, for robot arms to be effective, the work piece had to be precisely fixtured to millimeter accuracy. This was because the arms usually did not actively sense the work piece, and instead carried out blind motions based on prerecorded paths. The new sensing and computing allows much of the costly fixturing to go away and enables robot arms to provide value in new areas.

This allows robots to weigh less. For robots to achieve blind motion submillimeter accuracy over a large workspace, they needed to be exceptionally rigid. Any flexibility in the arm would lead to a lack of accuracy. This is why traditional arms generally weighed 100 times more than objects they were able to lift. Rigidity requires bulk.

In contrast, the human arm can lift about 10 times its own weight. When you “close the loop” with vision sensors, the bulk can go away, and with it much of the cost as well. Lightweight, low-precision arms coupled with advanced vision systems are being successfully applied in many areas. Taking the next step of effectively combining autonomous mobility and manipulation will allow a new range of applications that only humans could previously perform.

Achieving efficient operations

Enabled by machine vision, safe and nimble next-generation robots must integrate with their surroundings and their coworkers. In the same way that consumers expect their PCs

This opinion piece was written by Daniel Theobald, CTO, Vecna Technologies, and first appeared on InTech Magazine. We are republishing it here with permission from Vecna.



Vecna expands range of robots VGo purchase

Vecna Technologies, a robotic logistics and IT healthcare solutions company, expanded its portfolio of robots by acquiring VGo Communications, a robotic telepresence solutions provider for healthcare, education and business.

"Vecna and VGo's missions are highly aligned. We believe robots can enhance the quality of life for people everywhere," said Daniel Theobald,

Vecna's co-Founder and CTO.

"VGo brings a great product and a large satisfied customer base which is complementary to Vecna's existing product installations in over 500 sites worldwide.

"Customers from both companies will benefit from adding VGo to Vecna's industry leading portfolio of solutions with applications in healthcare, hospitality, manufacturing, distribution, and education. Vecna and VGo have been partners for years and with this acquisition are positioned to have a major impact in the market."

VGo's president and CEO Peter Vicars said: "Like Vecna, VGo's mission has been to empower people through robotics. We connect people across great distances, just as if they were there. VGo is extremely pleased about the expansion of the product line and the tremendous opportunities that the merged company is poised to capture." ●



Vecna's telepresence robot, originally manufactured by VGo

to run third-party software and to connect to the Internet, robots must be able to work with other machines and with people in their environment.

Interoperability

Unlike a pallet truck or a conveyor belt, robots have added intelligence that, when connected to other things in a dynamic environment, creates enormous potential for efficiency and cost savings. If your robots cannot interoperate, their value is ultimately limited. To maximize return on investment (ROI) through automation requires a multidisciplinary approach to integrate with other hardware and software systems in your facility through open interfaces and standard protocols. These systems include other robots from the same or third-party vendors, facility doors and elevators, and fire systems, as well as asset tracking, order fulfillment, or warehouse management software.

To that end, it is important to find a partner who will bring an interoperable automation ecosystem to the table, not just a single robotic product that operates independently. This approach allows for quick ROI by plugging specific robots into critical-path activities, but also lays the groundwork for fully autonomous lights-out operations and long-range ROI through complete system integration.

Resource optimization

Vecna's QC Bot navigates corridors and warehouses autonomously, removing the burden of manual transport.

When imagining robots, humans, and facility infrastructure as part of the same system, organizations must also manage it as such, especially in environments where robots navigate in peopled spaces and often share responsibility with people. A mission optimization planner improves system efficiency by employing the unique strengths of both humans and robots through resource management.

The ultimate goal of the mission optimization planner is to sort and process all tasks in the shortest time and with the fewest resources possible, while ensuring that priorities are properly handled. Mission optimization planners actively control workflow rates, allowing humans and robots to work together safely and at maximum efficiency.

A mission optimization planner will also autonomously assign on-demand tasks to either robot or human based on resource availability and the urgency of the task. If a bottleneck starts to occur that cannot be buffered autonomously, the system can immediately inform supervisors and recommend reallocation of staff to address the issue. Mission optimization planners provide the strategic advantage of a single backbone to meet a large variety of needs, including multiple disparate autonomous platforms working together seamlessly with humans within a facility.

The autonomous workplace

What does all of this mean? With advanced sensing, mobility, manipulation, interoperability, and resource optimization, robots will take on more activities traditionally performed by humans. Many interpret this trend as a threat to the human worker. And it is if we do not start to change our ways of thinking.

I would like to see robots make it possible for us to accomplish more than just outcompeting others in the global marketplace. Robotics should allow us to raise the standard of living for everyone on this planet and allow us to pursue the arts and sciences to a greater degree than ever before. If we are to enable this social structure, we need to start figuring it out now.

I say let the robots do the dirty, dull, and dangerous, and let humans enjoy the life they have worked so hard to build since the invention of the steam engine. ●



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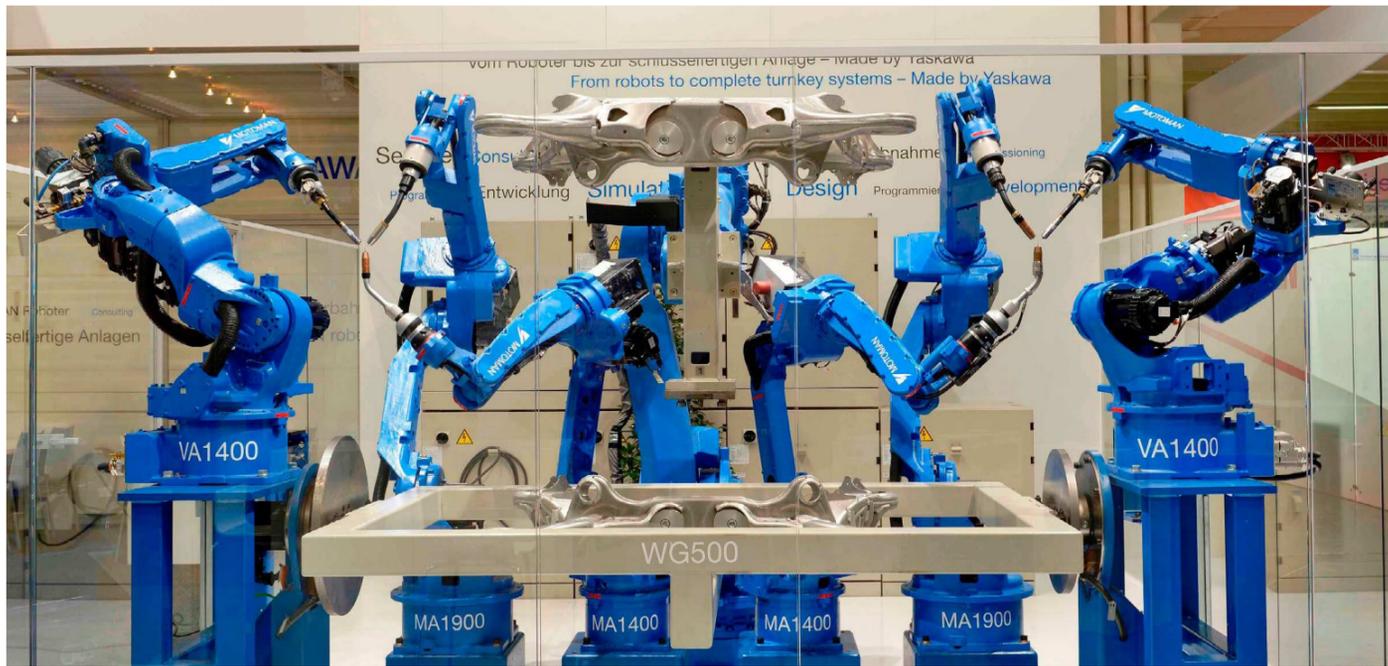
Certificate robots. Check the accuracy of your robots with a ballbar test. Obtain a PDF report describing the accuracy and repeatability of your robots. RoboDK allows you to calibrate your robots and improve production results. Contact us for more information.

Python powered

RoboDK is a robot development kit that allows you to program any robot from any brand through Python. Python is easy to learn yet powerful and flexible. Robot offline programming has no limits with RoboDK's Python API.

Extended library

The RoboDK Library has many robots, external axes and tools from different brands. We are constantly adding new robots to RoboDK. The library can be directly accessed from our desktop app.



Yaskawa has the highest number of industrial robots installed globally, but not many of them are 'collaborative' in the commonly understood meaning of the word

Will Yaskawa change?

I recently saw some statistics from Robotics and Automation News that really surprised me. In fact the study ranked the different robot brands in terms of active robots on a worldwide scale.

Well what surprised me the most was the fact that the top robot manufacturer is not even manufacturing a collaborative robot. Although this market is really young, what could be stopping a large company like Yaskawa Motoman from getting into collaborative robots?

With a more than 300,000 active robot install base, Yaskawa Motoman is leading this ranking by a wide margin. In fact the second biggest robot manufacturer is Fanuc with 250,000 robots.

By digging a little deeper into what Yaskawa is selling, I quickly realized that they have a bunch of robot models. In fact, with more than 100 different robots, they can cover a LOT of applications.

From pick and place scara robots to specific robots for welding or painting, they've got them all. However, no collaborative robots?

Perhaps, we should clarify that what they don't have is power and force limited robots. In other words, none of their robot models is monitoring the external force applied by impact/objects.

So they can perform applications that are considered 'collaborative' such as hand guiding, but these are not considered to be force limited. This part of the market is getting bigger and bigger each year because collaborative robots have easy integration, easy programming, safe use, fast ROI and space saving geometry. So what gives?

My guess is that Yaskawa has decided to remain focused on the heavy industrial applications (like automotive) that it obviously does well and does not have time or money to invest in the collaborative robot market especially considering that it has a piddly 5,000 active

Co-bots

Yaskawa is the largest industrial robot maker in the world by some measures, but it does not have many robots that are considered 'collaborative' in the way some new robots are. Mathieu Bélanger-Barrette, an engineer at Robotiq, wonders if there is change on the way

This is abridged version of an article which appeared on www.robotiq.com. Republished with permission.

robots worldwide. And as our friend Erik Nieves from Yaskawa Motoman explains in the following video, why would you need a force limited robot when you can have a robot that is capable of doing collaborative application using speed and separation monitoring.

In fact, the ultimate goal is that you don't want the robot to hit anyone, you want it to work as fast as it can and slow down and eventually stop when a worker comes too close.

However, speed and separation monitoring is not the reality of all companies. Some will need smaller force limited robots to achieve special applications that require close collaboration with humans.

In any case, the question remains, Why isn't Yaskawa manufacturing force limited robots? Why has Fanuc designed a force limited robot while Yaskawa has kept with its traditional markets.

Well, maybe we could say Fanuc simply had an idea that was unconventional with regards to the present market and went with it. Creating a force limited robot with a payload of 35 kg was a great idea, because nobody was doing it. So instead of starting from scratch with a different robot concept, they simply put a sensitive cover on the top of an existing robot and BOOM their innovative collaborative robot was born.

So, will Yaskawa develop a technology like this, who knows, but that would be the fastest way to convert some robot models into collaborative robots.

And it would make them available for those applications which are not conducive to speed and separation monitoring as a mechanism for robot and/or application safety.

With a bunch of plants already using Yaskawa robot, it would be a great move to add force limited robots similar to CR-35iA to their product line. So, they can fit these robots into automotive plants for example. ●



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Steel factory in Asia improves its furnace distributed control systems

Advantech installs an advanced monitoring and control solution for continuous casting machines in a steel factory

With a very broad range of applications, steel is an important material and has been developed into the most extensive alloy in the engineering world. Since delivering high quality is absolutely crucial for steel plants, ensuring maximum productivity and the best quality production are the keys to competitiveness in the steel industry. Additionally, working conditions in steel factories are not suitable for workers to stay in for long periods of time, so manufacturers usually adopt various machines to complete the steel production processes. However, the precision of these machines is often overestimated and the lack of flexibility also makes supervisors unable to adjust operating procedures.

A renowned steel factory in Asia planned to improve its Distributed Control System (DCS) of furnaces as well as addressing the problem of insufficient accuracy. However, most well-known international equipment suppliers can not

provide a satisfactory solution and local maintenance because the project needed new technologies to more accurately control equipment operations. By implementing Advantech's automated monitoring and control solution, steel factories can not only improve the manufacturing processes but can also allow users to add additional functions to the existing system so as to make sure the operation runs at high efficiency.

Therefore the company decided to utilize its own extensive expertise and cooperated with the System Integrator to develop the required subsystems so that enhancing the billet surface quality and dynamic mold level control based on the original framework.

Apart from software, the improvement of the continuous casting process needed to come with powerful and robust devices to provide reliable system operation, the models were required to: support Microsoft operating systems to easily

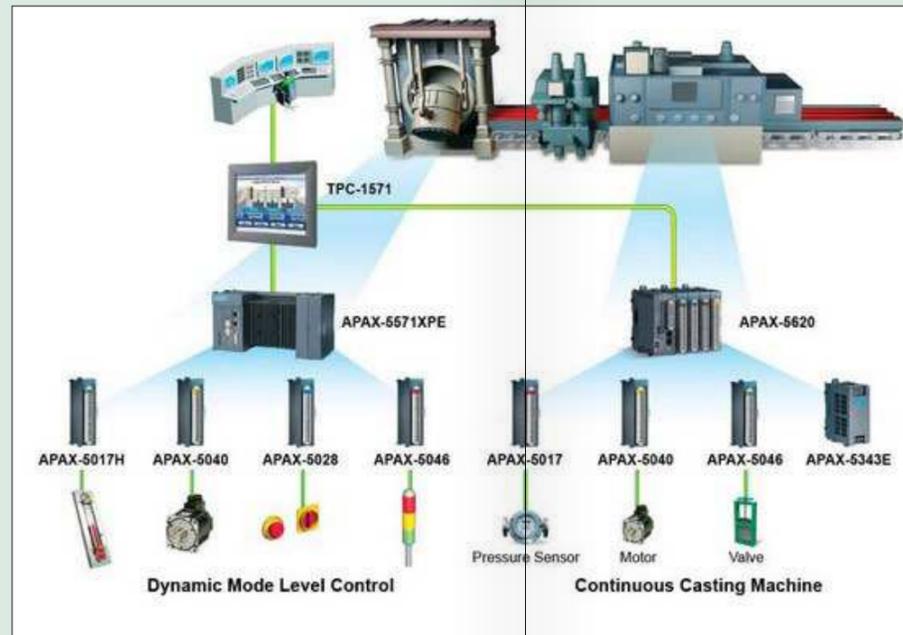
develop customized programs; have better CPU performance to run software; offer various I/O interfaces and expandable connections to meet the required functions; have a wide operating temperature range and anti-interference ability to resist harsh industrial and high electromagnetic environments.

System Description:

According to the customer's requirements, two subsystems needed to be implemented in the continuous casting machine, including the mold level control system and hydraulic cylinder control system. For the first subsystem, Advantech proposed the TPC-1571 Touch Panel Computer, embedded in the electrical cabinet, to be used as the HMI for users to communicate with the APAX-5571XPE Programmable Automation Controller (PAC) and a variety of APAX-5000 I/O modules (APAX-5017H, APAX-5028, APAX-5040 and APAX-5046). The APAX models are to be used as a compensator in order to provide the stabilization of the molten steel in the mold of a continuous casting machine.

With an Intel Atom Dual Core processor, the TPC-1571 is a powerful computer and is able to deal with large amounts of data while its panel features and mounting options offer a better user interface and save installation space compared to a desktop PC with monitor. The APAX-5571XPE, with Intel Celeron M grade CPU and built-in Windows XP Embedded operating system, makes it a high performance and application ready platform to shorten user's development time.

By using the APAX I/O modules to collect the signals (including pressure, level, sliding gate, motor, temperature, switch and light), this mold level control system can fully monitor various devices and conditions as well as controlling the casting processes. When the original PID controller is unable to deliver enough signals, managers can switch to the new subsystem which provides faster data acquisition (up to 1000 samples) so as to compensate DCS dynamic level control. Furthermore, since they have been designed with isolated protection, Advantech's APAX



serial products are very resistant to field interference.

As for the second subsystem, the APAX-5620 RISC-based controller is responsible for executing hydraulic cylinder control tasks by connecting to different APAX-5000 I/O modules (APAX-5017, APAX-5040, APAX-5046 and APAX-5343E).

By providing a CAN bus communication interface, the APAX-5620 can control the steel's thickness via a CANopen sensor.

Unlike the competitor's products, to add an extra pipe to cool the system down, Advantech's controller and modules support wider operating temperatures to ensure that devices would not be damaged by high temperatures since the control box has to be installed next to the machine and the field temperature is often above 50 deg C.

The developer can also configure related hardware settings for the I/O modules through built-in utilities and can effortlessly create the related application programs under the Microsoft Visual Studio .NET or C/C++ programming environment. ●

ALD installs Rockwell Automation solution

ALD Vacuum Technologies (ALD) is a manufacturer of vacuum process plants for metallurgy and heat treatment. The company is a leading provider of vacuum systems and vacuum process technologies; covering all areas of vacuum metallurgy and vacuum heat treatment.

The company's new "SmartCoater", part of its offering for the Electron Beam/Physical Vapor Deposition (EB/PVD) product segment, has been developed for coating turbine blades. While the company's existing XXL-Coater is used for production, the smaller SmartCoater, which deploys a Logix-based control solution from Rockwell Automation, is designed for laboratory use and repairs.

The prototype SmartCoater has been successfully installed in "Aviation Valley" in south-east Poland for a Polish university. During process commissioning ALD was quickly able to demonstrate stable, reproducible production parameters and the high quality and uniformity of the coatings produced.

A manipulator transports the turbine blades to be heated and coated in a vacuum. A heating- and gas-profile is followed. A ceramic material is then vaporised, using a high-voltage electron beam. The turbine blades are moved in the emerging ceramic vapour cloud using an individual motion program, which comprises multiple axis movements suited to the defined process conditions (pressure and temperature). The ceramic is then deposited onto the blades in a precise uniform manner.

During the selection of the automation platform ALD faced an issue in that it needed a solution that could combine all the aspects of the technologies deployed in the process. The controller had to be able to undertake complex measurement and control tasks such as regulating pressures and temperatures. Also, exact movement profiles for the multiple-servo-axes system had to be reliably co-ordinated. Interfaces to measuring equipment and control systems from various other manufacturers was also a

requirement. The Allen-Bradley ControlLogix and GuardLogix programmable automation controllers (PAC) offered the necessary performance with an easy-to-use development environment. The high degree of integration of the PAC, I/O modules and the programming software also reduces the time required for development and commissioning.

Standard PACs and safety PACs are installed in a common rack in order that the safety functions can be implemented easily alongside the control program, addressing the functional safety requirements in conformity with the Machinery directive. Integrated motion modules simplify the control of the servo axes and their incorporation into the process program.

To control the process plant, various measurement and control tasks must also be undertaken using an array of instruments and features, all of which are connected to the PAC using a variety of communication interfaces.

The control of pumps, valves and analogue measurements is realised using remote Flex I/O nodes that are accessed via ControlNet. The pressure measuring equipment is accessed via DeviceNet as are the gas controllers. The control unit that controls the electron beam, which is a powerful real-time system, is also operated via DeviceNet. Commands and set points can be sent directly from the PAC, making it possible to react very quickly to feedback from these control units.

From a safety perspective, the CompactBlock Guard Safety I/O is connected to the GuardLogix PAC over DeviceNet using CIP Safety. The requirements relating to the safety of machine control systems in accordance with DIN EN ISO 13849-1 can be realised efficiently and with significant cost advantages by means of integrated safety. This usage of common components for standard control systems and safety control systems also minimises costs for hardware, software, development and support.

The motion solution comprises

an Allen-Bradley Kinetix 6000 multi-axis controller, which is integrated into the control system using Sercos. The complex multiple-axis motion control for the manipulation of the turbine blades was implemented in the RSLogix5000 development environment and therefore did not require any interfaces to external systems.

Thanks to the integrated safety option for torque shutdown (Safe Torque-Off) the Kinetix servo drives meet the safety standards up to SIL3/ PLd. The stop categories can be realised within the safety routine.

The system is operated using an HMI PC and an Allen-Bradley PanelView Plus. The PC is used for recipe preparation, operating mode selection, process information display and logging, while the PanelView Plus attached to the loading chamber is used to operate the manipulator's servo axes.

The Coater comprises individual modules, each with the related vacuum components and drives. Due to the high degree of flexibility of the ControlLogix and GuardLogix systems, a modular approach was adopted, which made it possible and straightforward to react to customer requirements. Additions can also be made independent of the existing system.

One possible addition is an additional loading module. The process chamber can then be loaded from two sides and the cycle times for the system halved. A ControlLogix 1756 PAC is allocated to each side. The process module is controlled by a 1756-L61S PAC (SIL 3, Cat. 4, PLe) and the related 1756-LSP PAC, which takes over the central co-ordination of the overall system and monitors the safety functions in accordance with DIN EN ISO 13849-1.

The use of GuardLogix, with integrated safety has had advantages. The wiring effort and planning costs were reduced while commissioning times were shortened. Troubleshooting is also easier than with conventional hard-wired safety technology.

A further advantage is the possibility of displaying the safety interlocks in the display, as a result a quick diagnostic overview of the state of the system can be provided for the system operator. ●

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Marketplace

Associations: Robotics and Automation

British Automation & Robot Association
 bara.org.uk

The aim of the BARA is to promote the use of, and assist in the development of Industrial Robots and Automation in British industry. In 2009 BARA joined forces with the PPMA (Processing & Packaging Machinery Association) to become a special interest focus group.

Robotics Society of Japan
 rsj.or.jp

The Robotics Society of Japan promotes progress in academic fields and provides specialists with a venue for announcing their research and exchanging technical information.

euRobotics AISBL
 eu-robotics.net

euRobotics AISBL is a Brussels based international non-profit association for all stakeholders in European robotics. euRobotics builds upon the success of the European Robotics Technology Platform and the academic network of EURON, and will continue the cooperation between members of these two community driven organisations.

Robotic Industries Association
 robotics.org

The Robotic Industries Association (RIA) drives innovation, growth, and safety in manufacturing and service industries through education, promotion, and advancement of robotics, related automation technologies, and companies delivering integrated solutions.

International Federation of Robotics
 ifr.org

The purpose of IFR shall be to promote and strengthen the robotics industry worldwide, to protect its business interests, to cause public awareness about robotics technologies and to deal with other matters of relevance to its members.

IEEE Robotics and Automation Society
 ieee-ras.org

Our Mission is to foster the development and facilitate the exchange of scientific and technological knowledge in Robotics and Automation that benefits members, the profession and humanity. Our Vision is to be the most recognized and respected global organization in Robotics and Automation.

China Robot Industry Alliance
 cria.mei.net.cn

CRIA is a non-profit organization composed of enterprises, manufacturers, universities, research institutes, regional or local robotic associations, related organizations as well as organizations in the fields of R&D, manufacturing, application and services of the robot industry.

Actuation



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Wittenstein



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wittenstein-us.com



Ham-Let
 More than half a century of excellence servicing the high purity and process industries with designing, developing, producing and marketing of fluid system components.
ham-let.com

Rethink Robotics

Our patented SEA technology uses springs to advance the robot's motion control solution from one of rigid positioning to one of force control.
rethinkrobotics.com



ATC



The Actuator Technology Company operates independently and is located close to Amsterdam Schiphol Airport. We are acclaimed and appreciated for offering vital design support during FEED and detailed design stage (EPC).
atc-actuators.com

The Valve and Actuator Co
 We realise there is an urgent need to provide experienced technical support with competitive pricing. We carry an extensive stock of electric and pneumatic actuators and general valves.
valveandactuatorcompany.co.uk



THE VALVE & ACTUATOR COMPANY



Parker
 Parker actuators come in a wide range of construction types, ranging from compact light duty aluminum air actuators, motorized electric actuators, to heavy duty hydraulic designs.
parker.com

Marketplace: technology

Computing & Software

Arduino



Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world.

arduino.cc

Raspberry Pi



The Raspberry Pi is a series of credit card-sized single-board computers developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools.

raspberrypi.org

RoboDK



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robodk.com



Dassault Systems

Robotics Programmer provides a 3D environment where robot programmers can create, program, simulate and validate an entire robot workcell.

3ds.com



KUKA.WorkVisual

Programming. Configuration. Loading. Testing. Diagnosis. Modifying. Archiving. KUKA.WorkVisual groups all the steps of a project together in a homogenous offline development, online diagnosis and maintenance environment.

kuka-robotics.com



ABB RobotStudio

RobotStudio provides the tools to increase the profitability of your robot system by letting you perform tasks such as training, programming, and optimization without disturbing production.

abb.com

Integration & Process

Rockwell Automation

Preferred integration starts with using plug-and-play technology, which means robots connect through Ethernet/IP with software and service interfaces that simplify design, operation and maintenance efforts to improve machine and overall line OEE.

rockwellautomation.com



Evana Automation

Evana specializes in designing and implementing robotics automation solutions that fit your specific manufacturing needs. Let our robotics engineering and robotics manufacturing experts develop a custom robotics automation solution that meets your requirements.

evanaautomation.com



FANUC Authorized Integrators

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fanuamerica.com



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adept.com



NewBotic Corporation

NewBotic is a robotic systems integrator, best known for its specialized engineering services that designs advanced transformative manufacturing and warehousing processes for a wide variety of industries.

newbotic.com



Genesis Systems

Genesis Systems Group designs, builds and implements robotic arc welding systems, assembly automation systems and robotic tooling, material handling solutions, non-destructive inspection cells and robotic waterjet cutting systems like nobody else.

genesis-systems.com

Microcontrollers & Microchips



Freescale

Freescale Semiconductor enables secure, embedded processing solutions for the Internet of Tomorrow. Freescale's solutions drive a more innovative and connected world, simplifying our lives and making us safer.

freescale.com



Atmel

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atmel.com

Silicon Labs



Silicon Labs is a team of hardware and software innovators dedicated to solving our customer's toughest embedded design challenges.

silabs.com



Renesas

Renesas Electronics Corporation, the world's number one supplier of microcontrollers, is a premier supplier of advanced semiconductor solutions including microcontrollers, SoC solutions and a broad range of analog and power devices.

renesas.com

STMicroelectronics



A world leader in providing the semiconductor solutions that make a positive contribution to people's lives, both today and in the future.

st.com

Infineon

We provide semiconductor and system solutions, focusing on three central needs of our modern society: Energy Efficiency, Mobility and Security.

infineon.com



Texas Instruments

TI's microcontroller platform offers innovative devices with integrated on-chip architectures, unique intellectual property, system expertise in key markets, and a comprehensive ecosystem of software, tools and support.

ti.com



Sensors



Alphasense

Alphasense has established a reputation as a reliable source for a wide range of gas sensor technologies. We supply high-quality Oxygen, CO₂, toxic and flammable Gas sensors to many of the world's leading industrial OEMs.

alphasense.com

4D Technology



4D Technology designs and manufactures laser interferometers, surface roughness profilers and interferometry accessories.

4dtechnology.com

Sensirion

Sensirion is a leading sensor manufacturer, providing relative humidity sensors and flow sensor solutions with unique performance.

sensirion.com



Sano

Sano is a biometric sensor and software company with a patented, breakthrough sensor that will help people understand what's happening inside their bodies through continuously monitoring important markers in their bodies' chemistry.

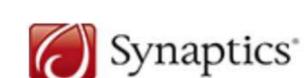
sano.co



Hansford Sensors

At Hansford Sensors, we design, develop and manufacture a wide range of high performance industrial accelerometers, vibration transmitters (loop powered sensors) and ancillary equipment.

hansfordsensors.com



Synaptics

Synaptics is a world leader in capacitive touch sensing technology. This patented technology is at the heart of our industry-standard TouchPad products and other solutions.

synaptics.com

EMX

EMX is one of the world's leading innovators of specialty sensors in the factory and process automation markets. Our sensors are used in automotive, packaging, labeling, metal stamping, paper and wood processing, plastics, electronics and pharmaceutical manufacturing.

emxinc.com



Marketplace: companies



3D Robotics

3DR helps people see their world from above. As North America's largest personal drone company, 3DR is a pioneer in making advanced, easy-to-use drone technology.
3dr.com



Yaskawa

Yaskawa Motoman offers a wide range of industrial robotic arm models for high-speed precision assembly and small part handling including high-performance six-axis robots; flexible seven-axis manipulators; dual-arm robots with 15 axes; and more.
motoman.com



Universal Robots

Universal Robots is a result of many years of intensive research in robotics. The product portfolio includes the collaborative UR3, UR5 and UR10 robot arms named after their payloads in kilos.
universal-robots.com



Vecna

Vecna's robotic logistics solutions are a family of autonomous mobile robots, built to operate within human-centric environments.
vecna.com



Kawasaki

For over 40 years, Kawasaki has been improving technology to meet the high demand of assembly applications. Kawasaki's innovative hardware and software can help you solve your complex assembly challenges.
kawasaki.com

DENSO Robotics

Cutting edge technology, class leading products and groundbreaking systems are only part of what you can expect when you choose DENSO Robotics.
densorobotics.com



Epson

With over 45,000 robots installed in factories throughout the world, many of the top manufacturing companies rely on Epson Robots every day to reduce production costs, improve product quality, increase yields and help increase their bottom line.
epson.com



TEUN

TEUN is a comprehensive concept, based on a smart unmanned machine, the PIQR. The concept has been developed to offer a solution for the frequently complex labor-intensive and expensive way of unloading containers.
teun.com



SynTouch

SynTouch LLC developed and makes the only sensor technology in the world that endows robots with the ability to replicate - and sometimes exceed - the human sense of touch.
syntouchllc.com



SCHUNK

SCHUNK is one of the largest manufacturer for automation components, toolholders and workholding equipment.
schunk.com



Robotiq

Our goal is to enable all manufacturers to take full advantage of robotics. We work with robot manufacturers, system integrators and end-users to automate applications that require flexibility.
robotiq.com



Honeybee Robotics

Since 1983, Honeybee has completed over 300 projects for NASA, the US Department of Defense, academia, industry and artists.
honeybeerobotics.com



Kawada



"Serving society through technology," has been Kawada's mission since its inception in 1922. Our mission has been accomplished through technological innovations in a vast range of operations, including projects involving transportation, energy, and information, all basic necessities of society.
global.kawada.jp

Honda Robotics

Honda has further advanced intelligence technologies enabling its advanced humanoid robot ASIMO to act autonomously and perform uninterrupted service to office guests.
honda.com



iRobot

iRobot's home robots are revolutionizing the way people clean - inside and out. More than 10 million home robots have been sold worldwide.
www.irobot.com



Future Robot

We, Future Robot, aim to create an exemplary service robot market. We deal with Coupon Advertising Robot, Mobile Infotainment Service, Robot Event Service, and many more.



Energid

Energid Technologies develops advanced software and robotic systems for the aerospace, agriculture, manufacturing, transportation, defense, and medical industries.
energid.com

Ekso Bionics



Ekso Bionics helps survivors of stroke, spinal cord injury and other forms of lower extremity weakness to walk again.
intl.eksobionics.com



Dyson

Dyson recently invested in a joint robotics lab with Imperial College London to investigate vision systems and engineer a generation of household robots.
dyson.co.uk

Clearpath Robotics

We build the world's best unmanned vehicles for research and development. Our products will save time, money and headaches on your next project.
clearpathrobotics.com



Brain Corporation

Brain Corporation develops software, hardware, and cloud services for consumer robotics. Our goal is to make intelligent and useful machines a part of everyday life with the world's first training-based operating system for robots - BrainOS.
braincorporation.com

Bosch Robotics

We are working on Personal Robotics and the enabling technologies. Our interdisciplinary team conducts research on topics such as mobile manipulation, navigation, perception and semantic analysis of 3D data.
bosch.us



ASI



Autonomous Solutions is a world leader in vendor independent vehicle automation systems. From our HQ in Utah, we serve clients in the mining, agriculture, automotive, government, and manufacturing industries with remote control, teleoperation, and fully automated solutions.
asirobots.com



Aethon

Aethon is best known for its TUG autonomous mobile delivery robot which transports medications, meals and materials through hospitals.
aethon.com

Stäubli

Stäubli is a mechatronics solutions provider with three dedicated divisions: textile, connectors and robotics, serving customers who want to increase their productivity in many industrial sectors.
staubli.com



DMG Mori Ellison

DMG Mori Ellison Technologies is a provider of advanced machining solutions to North American metal-cutting manufacturers and their global affiliates.
ellisontechnologies.com



DAIHEN

The DAIHEN Group makes it our mission to provide products and services indispensable to primary industries around the world, including first and foremost the power industry or so-called "lifeline" of society.
daihen.co.jp



Axiom

Axiom designs, manufactures and installs a complete range of automated solutions for robotic material handling (palletizing, depalletizing, case packing, and peripheral equipments) and transformation of plastic products.
axiumsolutions.com



Aurotek

Aurotek delivers high value-added services and solutions, and helping customers achieve greater value through its introduction of advanced and quality components, acquisition of new technology concepts.
robot.com.tw



Apex Automation and Robotics

Apex Automation and Robotics is an Australian company specialising in the design and manufacture of custom-built automation machines and robotic systems.
apexautomation.com.au



Adept

Adept systems provide unmatched performance and economic value throughout the production lifecycle, enabling customers to achieve precision, quality and productivity in their assembly, handling and packaging processes.
adept.com



Reis

Experts know REIS as creative pacemaker for process-oriented system solutions. Since 1957 our way has been going dynamically up. The fundamentals: Inventive genius, competence, innovative power, and reliability.
reisrobotics.de

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	Starter	Brand Builder	Corporate
Directory Listing	12 issues	24 issues	48 issues
Quarter-page advertisement	6 issues	12 issues	24 issues
Half-page advertisement	3 issues	6 issues	12 issues
Full-page advertisement	1 issue	12 issues	24 issues
DPS	Not available	6 issues	12 issues
Back-page full-page	Not available	3 issues	6 issues
Front-page full-page	Not available	1 issue	3 issues
Advertisement design service	Not available	Not available	Available
Copywriting service	Not available	Not available	Available
Video production service	Not available	Not available	Available
	£399	£599	Contact us for more details

Mechanical data

Directory Listing	40 mm X 50 mm
Quarter-page advertisement	100 mm X 150 mm
Half-page advertisement	225 mm X 150 mm
Full-page advertisement	225 mm X 300 mm
DPS	450 mm X 300 mm

Information

All measurements given in millimetres, width X height.

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