

DEVELOPMENT AND SOME EXAMPLES OF ROBOTS IN AGRICULTURE

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Abstract—The robot is an electro-mechanical device or system that is able to autonomously, according to the program, or under the control of a man running, most dangerous, difficult and laborious, and persevering and precise tasks. They are used in all areas of human activity. The paper describes the historical development of robots, and their application in agriculture.

Keywords—information and communication technology (ICT), artificial intelligence (AI), robotics, agriculture.

I. INTRODUCTION

ROBOTICS Robotics is a discipline or branch of technology that deals with the design, construction, manufacture and application of robots and computer systems used for their control, sensory feedback, and information processing. The technologies involved in automatic machines that can be taken into a man with dangerous or manufacturing processes, and in some areas look like people. Most robots today are inspired by biological indicators of man, which makes the field of bio-inspired robotics [1, 2, 15].

The concept of creating a machine that could perform tasks independently dating from classical times the very beginning of human civilization, but research on the functionality and potential uses of robots is growing rapidly in the second half of the 20th century. Today the robotics field that is growing rapidly in the study, design and construction of new kinds of robots that are used in a variety of practical and commercial civil and military fields.

II. HISTORICAL DEVELOPMENT OF ROBOT

Throughout history, the robot was observed to mimic human behavior and often manage tasks in a similar manner. Intelligence that makes the robot has in fact a program or system program which determines the ability of the robot to recognize certain situations and to cope in them or solve them, behaving in the right way, or even from their own experience teaches you how to cope with

new situations and solve new problems. This type of intelligence is called artificial intelligence (Artificial Intelligence) and is a special branch of science.

The word robotics was derived from the word robot, which was introduced to the public by the Czech writer Karel Čapek in his play R.U.R. (Rossum's Universal Robots's) which premiered 1921st year (figure 1). The word robot comes from the Czech word slave, robot, which is used to indicate a hard, hard labor.

The robot is an electro-mechanical device or system that is able to autonomously, according to the program, or under the control of a man running, most dangerous, difficult and laborious, and persevering and precise tasks. Examples are.: Collecting nuclear waste, dismantling mines, working in mines and quarries, engines and chassis assembly automobile, welding of complex machine parts and equipment, sorting parts of the form, as well as their integration, within the flexible production lines, assembling a large number of wires by color, spray vegetables and fruits, fruit picking etc. [1, 2, 15].

Figure 2 shows the robot welding parts RTi330 famous Austrian companies IGM (URL: <http://www.igm-group.com/>), which contains six axes of rotation, with a working range \varnothing 3.890 mm. In the works [3, 5-7, 9-14] shown a large number of robots in different application areas.

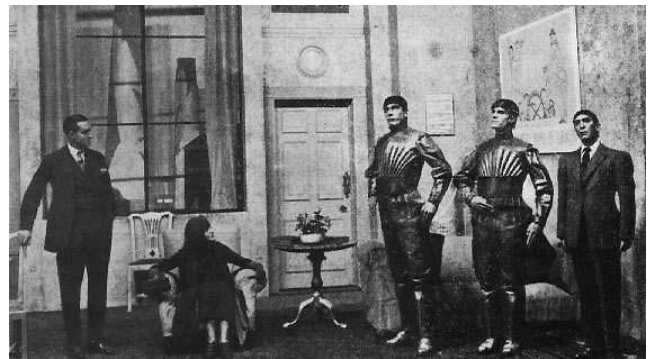


Fig. 1: A scene from Karel Čapek's 1920 play R.U.R. (Rossum's Universal Robots), showing three robots

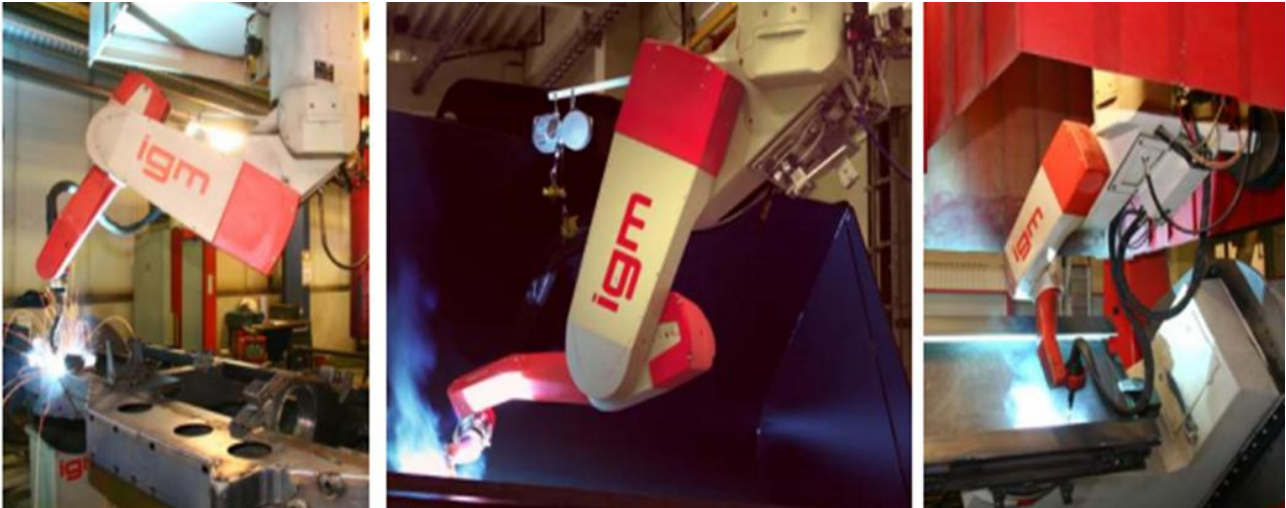


Fig. 2: Robot welding parts RTi330 famous Austrian companies IGM
 (URL: <http://www.igm-group.com/>) [13]

Plans for the first humanoid robot painted by Leonardo da Vinci (1452-1519) around the 1495th in Italy during the Renaissance.

The first true modern robot with digital control and programming was invented by George Devol 1954th I was named accounts. The first robot Unimate sold to General Motors in 1960, and it was installed in 1961 in a plant in Trenton, New Jersey to lift hot pieces of metal from a die casting machine and stack them. Devol's patent for the first digitally operated programmable

robotic arm represents the foundation of the modern robotics industry.

From that time until now have been sold and installed more than one million commercial and industrial robotic systems. Now they are widely used to perform tasks that require low cost and with greater accuracy and reliability than humans.

Table 1 shows the chronological development of robots and machines, and significant events in robotics.

Table 1: Timeline of robot and automata development and robotics event [1, 2, 4, 15]

Date	Significance	Robot name	Inventor
1st century AD and earlier	Descriptions of over a hundred machines and automata, including a fire engine, wind organ, coin-operated machine, and steam-powered aeliopile, in <i>Pneumatica</i> and <i>Automata</i> by Heron		Ctesibius, Philo, Heron and others
1206	Early programmable automata [15]	Robot band	Al-Jazari
c. 1495	Designs for a humanoid robot	Mechanical knight	Leonardo da Vinci
1738	Mechanical duck that was able to eat, flap its wings, and excrete	Digesting Duck	Jacques de Vaucanson
19th century	Japanese mechanical toys that served tea, fired arrows, and painted	<i>Karakuri</i> toys	Hisashige Tanaka
(c. 1860)	Remotely (mechanical) steered clockwork fire ship	<i>(Coastal fireship)</i>	Unknown / Giovanni Luppis
Early 1870s	Remotely controlled torpedos by John Ericsson (pneumatic), John Louis Lay (electric wire guided), and Victor von Scheliha (electric wire guided) [16]	<i>(torpedo)</i>	John Ericsson, John Louis Lay, Victor von Scheliha
1898	Tesla demonstrates the first radio controlled (wireless) vessel <i>(torpedo)</i>	<i>(torpedo)</i>	Nikola Tesla
1921	First fictional automata called "robots" appear in the play R.U.R. (Rossum's Universal Robots)	R.U.R.	Karel Čapek
1928	Humanoid robot, based on a suit of armor with electrical actuators, exhibited at the annual exhibition of the Model Engineers Society in London	Eric	W. H. Richards
1930s	Remotely controlled humanoid robot exhibited at the 1939 and 1940 World's Fairs	Elektro	Westinghouse Electric Corporation

1948	Simple robots exhibiting biological behaviors	Elsie and Elmer	William Grey Walter
1956	First commercial robot, from the Unimation company founded by George Devol and Joseph Engelberger, based on Devol's patents	Unimate	George Devol
1961	First installed industrial robot	Unimate	George Devol
1962	The first cylindrical robot	Versatran	AMF, USA
1963	First palletizing robot	Palletizer	Fuji Yusoki Kogyo
1969	Offers the first commercial painting robot		Trallfa, Norway
1973	First robot with six electromechanically driven axes	Famulus	KUKA Robotics
1973	Developed the automatic bolting robot for concrete pile and pole industry		Hitachi, Japan
1974	The first minicomputer-controlled industrial robot comes to market, called The Tomorrow Tool (T3)	T3	Richard Hohn
1974	The first fully electric, microprocessor-controlled industrial robot, IRB 6 from ASEA, Sweden, was delivered to a small mechanical engineering company in southern Sweden	IRB 6	ASEA, Sweden
1975	The Olivetti "SIGMA" a cartesian-coordinate robot, is one of the first used in assembly applications		Olivetti "SIGMA"
1976	Programmable universal manipulation arm or Programmable universal machine for assembly (PUMA), a Unimation product, developed by Unimation/Vicarm, USA, with support from General Motors	PUMA	Victor Scheinman
1978	Developed the SCARA-Robot (Selective Compliance Assembly Robot Arm)	SCARA-Robot	Hiroshi Makino (Japan)
1979	Developed the first electromotor-driven robots		Nachi, Japan
1981	Introduced its first industrial gantry robot	Gantry robot	PaR Systems, USA
1984	Introduced the Adept One, first direct-drive SCARA robot	Adept One	Adept, USA
1985	Introduced a new Z-shaped robot arm whose design ignores the traditional parallelogram		KUKA, Germany
1987	Established professional non-profit organization International Federation of Robotics (IFR) (URL: http://www.ifr.org/)		
1991	Conventional tractor modified for automatic operation		University of Illinois at Urbana-Champaign (UIUC)
1992	Remote controlled tractor with GPS controlled		Finland
1998	ABB, Sweden, developed the Flex Picker, the world's fastest picking robot based on the delta robot	Flex Picker	Reymond Clavel
1998	Lunched the "roboLoop" system, the only curved-track gantry and transfer system		Güdel, Switzerland
1999	Introduced integrated laser beam guiding within the robot arm		Reis, Germany
2004	Introduced the improved robot control system (NX100) which provided the synchronized control of four robots, up to 38 axis	NX100	Motoman, Japan
2006	Introduced the first Wireless Teach Pendant (WiTP)		Comau, Italy
2006	Presents the first "Light Weight Robot"	LWR	KUKA, Germany
2010	Launched the first "Learning Control Robot"	LCR	Fanuc, Japan
2012	Lay down robot to Mars to find out about the existence of new water and possibly some traces of life on the Red Planet	Curiosity	NASA

III. SOME EXAMPLES OF ROBOTICS IN AGRICULTURE

Robots are used in a variety of dangerous, difficult and laborious processes and operations in agriculture, as in other areas of human activity.

The increasing their use in the treatment of land, vineyards, cutting, spraying of vegetables and fruits, harvesting and harvesting of fruits and vegetables and so on.

Figure 3 shows the hardware platform of a robot tractor, with all the necessary components for automatic operation and control, based on PC [8, 12].

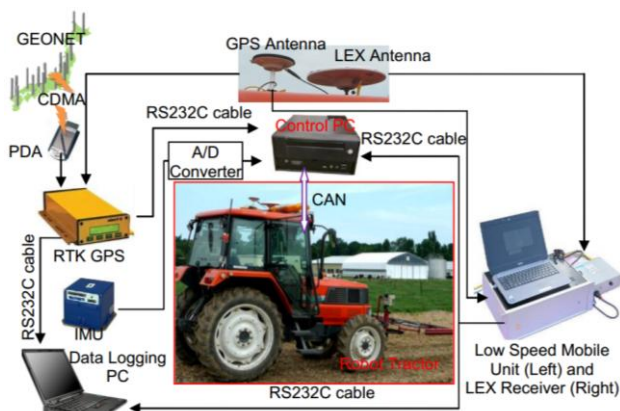


Fig. 3: Hardware platform of a robot tractor [8, 12]

Figure 4 shows the robot picking oranges. Developed the 2000-ies by the company Vision Robotics Corporation (VRC) from San Diego (California – SAD) (URL: <http://www.visionrobotics.com/>) [14].



Fig. 4: Robot for picking oranges [14]

Figure 5 shows the robot spraying. The mechanism includes a spray nozzle and a camera that allows real-time detection and precise prskenje. Developed the 2000-ies by the firm VineGuard.

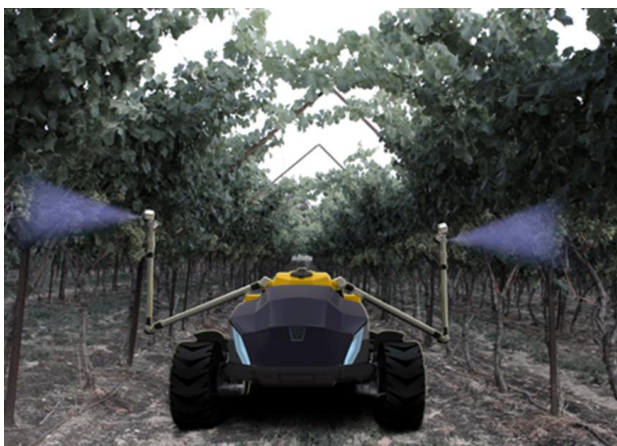


Fig. 5: Robot spraying [15]

IV. CONCLUSION

Robotics, as a field, has been steadily gaining popularity and has been applied in all spheres of human activity. Occupies an important place in all dangerous, difficult and laborious processes and operations in agriculture.

According to statistics, sales of industrial robots in the world is estimated at \$ 8.5 billion for 2011. year. Including the cost of software, peripherals and systems engineering annual turnover of robotic systems is estimated at \$ 25.5 billion for 2011. year.

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