# Current Research Trend in Intelligent Robotics

#Wahidin Wahab[1]
[1]Department of Electrical Engineering, University of Indonesia
Pondok Cina Depok, email: wahidin@ee.ui.ac.id

## 1. Introduction

A Robot is known as an electromechanical system that can be programmed to do specific task to help human beings. The task, in the first instants, might be as simple as lifting a heavy load, and gradually becoming more complex task such as fast and accurate component insertions into a pc-board. And as such, the robot is built in the form of a dumb robot which is controlled manually up to a sophisticated preprogrammed self operating robot.

The first generation of robots are designed with the aim to be used in a manufacturing industry to boost-up the speed of production and the quality of products. To this point, there are four well known structures such as a cartetian Robot, silindrical robot, spherical robot and a revolute robot. Fanuc Robots, Puma Series Robots and Cincinatti Milacron T3 Robots are among the famous industrial typed robots that are used in many manufacturing system around the world.

The First generation Robot has typical characteristics such as preprogrammed, accurate, repeatable and predictable. And jobs are preprogrammed in to the robots arm manipulator to do spot-welding, material handling and fixing, pick and place task, material selection etc. But these robot are limited only for specific manufacturing environtments and well segmented working area which is completely separated from human operators, predefined simple repetitive tasks, using simple robot structures, robots and human must have seperated working area, due to their low safety definitions.

A new challenges are nowadays impossed on to robots, the robot should be working in closed interaction with humans, being fully autonomously working without interception of human operators, must have learning capability, capable of operating in undefined working environtments, have very high safety and reliability requirements, have communication capability, and should have robustness. These challenges can only be achieved by a novel applications of intelligent robots.
Intelligent Robots requires high precision control strategy, high precision tracking methods, reliable sensors, such as touch sensors, digital encoders, vision etc, knowledge processing capability, better proven operating algorithms, distributed control architecture, high power of computing capability, integrity and maintenability.

## 2. The supporting Technology

The development of high speed-microprocessors is definitely the main support of the new and advanced development of the latest intelligent robots. The 16-bits and 32-bits microcomputers offer a better programming code and higher precision in representing sensory data, capable of more complex calculations and higher speed in processing, facilitating high precision control strategy including distributed control architecture. The high computing power may be used to process video signals to aid vision in the robots.

Many well-known and newly developed sensors are now available on the shelves, such as the high precision digital encoders, electronic compass on a chip, inertial measurement unit, high speed digital vision camera, digital speed/torque sensors. Most mechanical sensors are developed based on the EMS (Electro-Mechanical System) technology. Humidity and viscosity sensors, and the intelligent nose. These sensors can provide precise data for processing in the microprocessors to get the required information for the robot to act upon. The introduction of I2C (inter Interface Connection) in the main system board, has supported high speed interchange of data between sensors and other circuitry.

The development of the application software may be using a common C programming language or a low level programming language such as the assembler. The introduction of the fifth generation programming language will ease the burden of programming such that application programming is a matter of easy doing. The creative part of the application development becomes the most crutial parts of research.

The development of new magnetic materials has also contributed in the making a high torque motors and reducing the size and weight of the motors resonably. Such that the development of high precision fingered robotic hands have shown a great success in gripping the object with precise torque required. Such a robot hand may be able to grip eggs or light bulps without any damages caused.

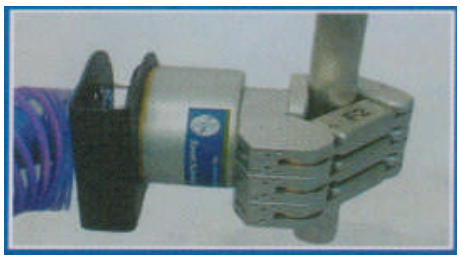


Figure 1. the fingered robot hand

## 3. The Applications of Robots

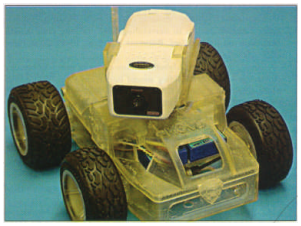
There are many areas of the newly developed intelligent robots, typical applications has been a vast research area such as, public oriented service robots, building area security inspection autonomous robots, hazardous and threat detection robots, exhibition service robots, assertive and personal care robots, medical surgery robots, new terrain exploration robots, remote oil pipes inspection robots, urban and dissaster response search and rescue robots, biomimetic inspired miniature robots and unmanned aerial vehicle (UAV), unmanned marine vehicle (UMV) etc.

Public oriented service robots, includes robots for use in the public information center, the robot is capable of answering some typical questions which are preprogrammed in to the robots.

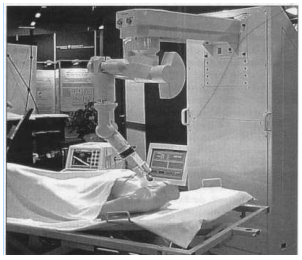

Building area security inspections robots, are used to help in securing the certain area within a building or a compound for limited access of peoples. The robot can move around the compound and scans the whole area for inspections of unauthorized personel and sending video detected by the installed camera on top of the robot.

Exhibition service robots, are multi purpose robots built to help personnel in the exhibitions area, where the robots are preloded with information about the product being exhibited, to give explanation to the audience and to reply for specific questions from visitors.
The two robots shown in the new car exhibition.

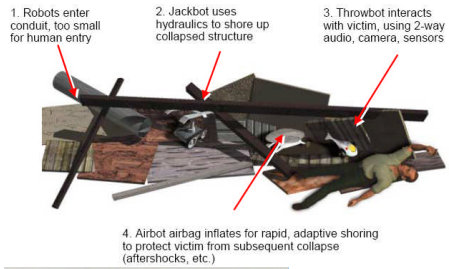
Assertive and personal care robots, these robots are meant to be operated in household, to help out the household works like cleaning the floor, washing and ironing the dresses, providing food and drinks. etc.



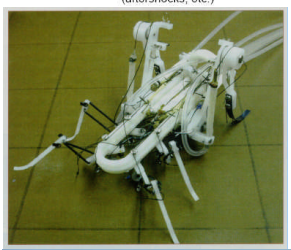
Hazardous and threat detection robots, are used to scan some heavily chemical polluted area where it is hazardous for humans to go in to the area of detection, and collects data for analysis. The robot is also equipped with camera to send the video signal to the operator.



Medical Surgery Robots, helps the medical doctor to perform surgery accurately. To reduce traumatic and fatigue of the human medical expert.




Search and rescue robots are designed in various form and structure, the aim is to let it go through small opening via a small conduit which is too small for human entry, the robot can move towards any suspected area that might consists of victims in it, using its camera and sensors, the robot sends information about the conditions of the victim found.



Biomimetic inspired miniature robots, to learn the natural sensors used by this small creature, and to learn how the nature feets are nbeing driven to move the body. The robot is built look alike to a cricket.

UAV are unmanned aerial vehicles which is build to be able to fly autonomously from the home position to a certain defined destination, and then to fly back home. During the flight period, the uav may send sensory signals to the operator, to give information about the area that are monitored during the flight.

For different targeted usage, the robot are build with different shape and structure, and also using different type of sensors to guide the movement of the robots.

Such as the medical surgery robots are used in applications in medical operation, the robot are develop based on the advantages and disadvantages of the human and the machine. The machine advantages such as Geomatric accuracy, precision in controlling Forces, Possibility to work in hostile environtment, repeatability, No fatigue, stationary and speed. And the human advantages

such as efficient natural sensors, desterity, coordination, capacity in reasoning and learning, adaptive skill, and the by noticing the human drawbacks such as subject to fatigue, instability, imprecision, unable to see through tissues, subject to radiation, as well as the machine drawbacks such as weak capacity in decision, learning, adapting, incomplete model, unreliability. Then by combining the ability of the advantages of both, it is expected to have a medical surgery robot with better accuracy, increase safety, decreased traumatic behaviour, minimally invasive surgery, decresing number of direct intervention, post operative comfort, fast recovering for pasien.

The bio-inspired miniature robots has other different background as well, it is expected that a multidisciplinery system concept for small, dedicated, low-cost bio-inspiered Explorers that can capture some of the key features of biological organisms to understand and worth to be learned. Bio-morphic robotic explorers constitute a new paradigm in mobile systems that capture key features and mobility attributes of biological systems, to enable new scientific endeavors. The general premise of biomorphic systems is to distill the principles offered by natural mechanisms to obtain the selected features/functional traits and capture the biomechatronic designs and minimalist operation principles from nature's success strategies. Bio-morphic robot are a unique combination of versatile mobility controlled by adaptive, fault tolerant biomorphic algorithms to autonomously match with the changing ambient/terrain conditions. Significant scientific payoff at a low cost is realizable by using the potential of a large number of such cooperatively operating biomorphic systems. Biomorphic robot can empower the human to obtain extended reach and sensory acquisition capability from locations otherwise hazardous/inaccessible.

## 4. Discussions

This paper has discussed very broadly the development of intelligent robotics and aplications, the developments are mainly due to the support of the advanced technology in electronics, sensors and computing. The trend of research interrest in this field is still growing fast especially in finding the way to make the robot becomes fully autonomous and adaptable to its surrounding, increasing the robot autonomy and reducing the human supervision.

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