HUMAN ROBOT

A

SEMINAR REPORT

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**CERTIFICATE**

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ABSTRACT

The field of humanoids robotics is widely recognized as the current challenge for robotics research .The humanoid research is an approach to understand and realize the complex real world interactions between a robot, an environment, and a human. The humanoid robotics motivates social interactions such as gesture communication or co-operative tasks in the same context as the physical dynamics. This is essential for three-term interaction, which aims at fusing physical and social interaction at fundamental levels.

A humanoid robot is a robot with its overall appearance, based on that of the human body , allowing interaction with made-for-human tools or environments. In general humanoid robots have a torso with a head, two arms and two legs, although some forms of humanoid robots may model only part of the body, for example, from the waist up. Some humanoid robots may also have a 'face', with 'eyes' and 'mouth'. Androids are humanoid robots built to aesthetically resemble a human. A humanoid robot is an autonomous robot because it can adapt to changes in its environment or itself and continue to reach its goal. This is the main difference between humanoid and other kinds of robots. In this context, some of the capacities of a humanoid robot may include, among others:Vself-maintenance (like recharging itself) autonomous learning (learn or gain new capabilities without outside assistance, adjust strategies based on the surroundings and adapt to new situations) avoiding harmful situations to people, property, and itself safe interacting with human beings and the environment Like other mechanical robots, humanoid refer to the following basic components too: Sensing, Actuating and Planning and Control. Since they try to simulate the human structure and behavior and they are autonomous systems, most of the times humanoid robots are more complex than other kinds of robots.

**Acknowledgement**

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CHAPTER 1. ROLE OF HUMANOIDS

1.1 INTRODUCTION

1.1.1 Beginnings of the Robotics

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CHAPTER 1 - ROLE OF HUMANOIDS

1.1 INTRODUCTION:

The field of humanoids robotics, widely recognized as the current challenge for robotics research, is attracting the interest of many research groups worldwide. Important efforts have been devoted to the objective of developing humanoids and impressive results have been produced, from the technological point of view, especially for the problem of biped walking. The humanoid research is an approach to understand and realize the complex real world interactions between a robot, an environment, and a human. The humanoid robotics motivates social interactions such as gesture communication or co-operative tasks in the same context as the physical dynamics.

A Robot is a mechanical or virtual intelligent agent that can perform tasks automatically or with guidance, typically by remote control. In practice, a robot is usually an electro-mechanical machine that is guided by computer and electronic programming. Robotics is the branch of technology that deals with the design, construction, operation, structural disposition, manufacture and applications of robots and computer systems for their control, sensory feedback and information processing.

Humanoids are robots. which perform the function that are assigned like a computer but still look and resemble a human in the looks and structure. The difference between a robot and android is only skin-deep, looks exactly like humans on the outside but with the internal mechanisms of humanoid robot. Humanoid Robots can work in human environment without a need to adapt themselves or to change the environment. It is easier for a human being to interact with a human-like being. This humanoids technology is one of the most welcomed and funded department in the research and development field. This is also called as the anthropomorphic robots. Most of these types of robots are made to work in the human environment as a substitute for them. As these machines are designed in the human form, they'll be more natural to adopt in our daily life than other robots Not all humanoids will have the entire human anatomy humanoids will most be constructed like a human arm shaped robot, leg shaped, body above the waist and more.

The Humanoid Project of the Waseda University, started in 1992, is a joint project of industry, government and academia, aiming at developing robots which support humans in the field of health care and industry during their life and that share with human information and behavioral space, so that particular attention have been posed to the problem of human-computer interaction. Within the Humanoid Project, the Waseda University developed three humanoid robots, as research platforms, namely Hadaly 2,Wabian and Wendy. Impressive results have been also obtained by Honda Motor Co. Ltd with P2 and P3, self-contained humanoid robots with two arms and two legs, able to walk, to turn while walking, to climb up and down stairs. These laboratories on their humanoid robots carry on studies on human-robot interaction, on human-like movements and behavior and on brain mechanics of human cognition and sensory-motor learning.

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Developing humanoids poses fascinating problems in the realization of manipulation capability, which is still one of most complex problem in robotics. For its scientific content and for its utility in the most robotics applications, the problem of manipulation has been deeply investigated and many results are already available, both as hands and sensors and as control schemes.

The Hitachi Ltd. Hand has proposed an approach in designing robotics hands with its radial space memory alloy (SMA) metal actuation technology. The hand is characterized by a high power-to-weight ratio and a high compactness. The Hitachi Hand uses a large number of thin SMA wires; each finger has 0.02mm diameter SMA wires that are set around the tube housing of the spring actuators. The SMA wire, when heated by passing electric current through it, reacts by contracting against the force of the spring.

The development of a robotic hand for space operations is currently ongoing also in the Robotic Systems Technology Branch at the NASA Johnson Space Center. The Robonaut Hand has a total of fourteen degrees of freedom and consists of a forearm, which houses the motors and drive electronics a two-degree of freedom wrist, and five-fingers, twelve degrees of freedom, hand. The hand itself is divided into sections: a dextrous work set which is used for manipulation and grasping set which allows the hand to maintain stable grasp while manipulating or actuating a given object.

The main goal is to manufacture human-like hands, whose main requirements are cosmetics, noiselessness and low weight and size. Myoelectrically controlled prostheses are at present the best way to partially restore the functionality of an amputated limb. Finally hybrid prostheses combine a body-powered with a myoelectric prosthesis in case of shoulder disarticulation level amputations.

The proposed approach to the design and development of humanoid robots relies on the integration of humanoid components intended both as anthropomorphic hardware systems, and as software modules implementing anthropomorphic control and behavioral schemes.

1.1.1 Beginnings of the Robotics

The word robot appeared first in 1920, in the play ‘Rossum's Universal Robots’, written by the Czech writer Karel Capek. The play depicts perfect workers – robots, endowed with emotions enabling to increase their productivity. Concepts akin to today's robot can be found as long ago as 450 B.C. when the Greek mathematician Tarentum postulated a mechanical bird he called ‘The Pigeon’ which was pro-pelled by steam. Al-Jazari (1136-1206) a Turkish inventor designed and constructed automatic machines such as water clocks, kitchen appliances and musical automats powered by water. One of the first recorded designs of a humanoid robot was made by Leonardo da Vinci in around 1495. Da Vinci's notebooks, rediscovered in the 1950s, contain detailed drawings of a mechanical knight able to sit up, wave its arms and move its head and jaw. The first known functioning robot was created in 1738 by Jacques de Vaucanson,who made an android that played the flute, as well as a mechanical duck that reportedly ate and defecated. In 1893, George Moor created a steam man. He was powered by a 0.5 hp gas fired boiler and reached a speed of 9 mph (14 kph). Westinghouse made a humanoid robot known as Electro. It was exhibited at the 1939 and 1940 World’s Fairs, whereas the first electronic autonomous robots were created by Grey Walter at Bristol University, England, in 1948. If, however, we want to look for the origin of robots as technical-tecnological category we ought to mention the Tesla's\* patent and experiment in Madison Square Garden in New York in 1898 in which he demonstrated radio control of a ship. That was in fact the first remotely controlled object, i.e. robot in a wider sense of the term. If we would like to relate the beginnings of robotics to the appearance of industrial robots we should point out that George Devol patented in the United States a first

robotic device in 1954, whereas Joseph Engel Berger, also an American, constructed first industrial robot in 1961. Therefore, the year 1961 was essential for the beginning of industrial robotics. Since 1970 we have witnessed an intensive development of industrial robotics. Robots have replaced men primarily in those jobs that were dangerous to humans and harmful to their health, and also introduced higher regularity and accuracy in machining of parts, assembly of blocks and systems, as well yielded increased productivity. For example, in the last 15-20 years car manufacturing has been automated and fully robotized, starting from the initial stage of forging, through engine manufacture, to assembly of parts into the final product – car, including its painting.

1.2 THE BIOMECHATRONIC APPROACH FOR THE DEVELOPMENT OF 1.2.1ARTIFICIAL HANDS:

The main goal in designing a novel humanoid hands is to fulfill critical requirements such as functionality, controllability, low weight, low energy consumption and noiseless. These requirements can be fulfilled by an integrated design approach called bio mechatronic design.

The first step towards this objective is to enhance the hand dexterity by increasing the DOF and reducing size of the system. The main problem in developing such a hand is the limited space available to integrate actuators within the hand. Anyway, recent progress in sensors, actuators and embedded control technologies are encouraging the development of such hand.

1.2.2 SYSTEM ARCHITECTURE:

The proposed bio mechatronic hand will be equipped with three actuators systems to provide a tripod grasping: two identical finger actuators systems and one thumb actuator system.

The finger actuator system is based on two micro actuators which drive respectively the metacarpo-phalangeal joint (MP) and the proximal inter-phalangeal joint (PIP); for cosmetic reasons, both actuators are fully integrated in the hand structure: the first in the palm and the second within the proximal phalanx. The distal inter-phalangeal (DIP) joint is driven by a four bar link connected to the PIP joint.

The grasping task is divided in two subsequent phases:

1. Reaching and shape adapting phase;

2. Grasping phase with thumb opposition.

In fact, in phase one the first actuator system allows the finger to adapt to the morphological characteristics of the grasped object by means of a low output torque motor. In phase two, the thumb actuator system provides a power opposition useful to manage critical grips, especially in case of heavy or slippery objects. One of the important parts for industrial system is sensor for optimizing control system and make system more intelligent. Except camera and microphone as vision&voice receivers, we used Touch and Force sensors for some parts of the robot used in balance calculation and some reactions.

1.2.3 KINEMATIC ARCHITECTURE:

A first analysis based on the kinematics characteristics of the human hand, during grasping tasks, led us to approach the mechanical design with a multi-DOF hand structure. Index and middle finger are equipped with active DOF respectively in the MP and in the PIP joints, while the DIP joint is actuated by one driven passive DOF.

The thumb movements are accomplished with two active DOF in the MP joint and one driven passive DOF in the IP joint. This configuration will permit to oppose the thumb to each finger.

Robonaut uses a flexible, five-fingered hand

Dexterous robot hands make it possible for a robot manipulator to grasp and manipulate objects that are not designed to be robotically compatible. While several grippers have been designed for space use and some even tested in space, no dexterous robotic hand has been

flown to space

• The Robonaut Hand is one of the first under development for space use and the closest in size and capability to a suited astronaut’s hand.

• Robonaut Hand will be able to fit into all the required places.

• Joint travel for the wrist pitch and yaw is designed to meet or exceed the human hand in a pressurized glove. The hand and wrist parts are sized to reproduce the necessary strength to meet maximum crew requirements.

• Parts made of different materials are tolerance to perform acceptably Under the extreme temperature variations.

1.2.4 PLANNING AND CONTROL:

In planning and control, the essential difference between humanoid and other kinds of robots is that the movement of robot has to be like, using legged locomotion, especially biped gait.

The ideal planning for humanoid movements during normal walking should result in minimum energy consumption, like it does in the human body. To maintain dynamic balance during the walk, a robot needs information about contact force and its current and desired motion. To allow humanoids to move in complex environments, planning and control must focus on self-collision detection, path planning and obstacle.

1.3 ANTHROPOMORPHIC SENSORY-MOTOR

1.3.1 CO-ORDINATION SCHEMES:

A general framework for artificial perception and sensory-motor co-ordination in robotic grasping has been proposed at the ARTS LAB, based on the integration of visual and tactile perception, processed through anthropomorphic schemes for control, behavioral planning and learning. The problem of grasping has been sub-divided into four key problems, for which specific solutions have been implemented and validated through experimental trials, relying on anthropomorphic sensors and actuators, such as an integrated fingertip (including a tactile, a thermal and a dynamic sensor), a retina-like visual sensor, and the anthropomorphic Dexter arm and Marcus hand. (See Figure 1)





Figure 1: The Marcus Hand with the integrated fingertip And the Dexter Arm In particular,

1. Planning of the pre-grasping hand shaping,

2. Learning of motor co-ordination strategies.

3. Tactile-motor co-ordination in graspind and

4. Object classification based on the visuo-tactile information are described and reported in the following paragraphs.

**1.3.2 A NEURO-FUZZY APPROACH TO GRASP PLANNING:**

The first module has the aim of providing the capability of planning the proper hand, in the case of a multi-fingered hand, based on geometrical features of the object to be grasped. A neuro-fuzzy approach is adopted for trying to replicate human capability of processing qualitative data and of learning.

The base of knowledge on which the fuzzy system can process inputs and determine outputs is built by a neural network (NN). The trained system has been validated on a test set of 200 rules, of which the 92.15% was correctly identified.

**1.3.3 INTEGRATION OF VISION AND TOUCH IN EDGE TRACKING:**

In order to validate the anthropomorphic model of sensory-motor co-ordination in grasping, a module was implemented to perform visual and tactile edge tracking, considered as the first step of sensory-motor co-ordination in grasping actions. The proposed methodology includes the application of the reinforcement-learning paradigm to back propagation NNs, in order to replicate the human capability of creating associations between sensory data and motor schemes, based on the results of attempts to perform movements. The resulting robot behavior consists in coordinating the movement of the fingertip along an object edge, by integrating visual information on the edge, proprioceptive information on the arm configuration, and tactile information on the contact, and by processing this information in a neural framework based on the reinforcement-learning paradigm. The aimed goal of edge tracking is pursued by a strategy starting from a totally random policy and evolving via rewards and punishments

CHAPTER 2. REAL-TIME FACIAL GESTURE RECOGNITION SYSTEM

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2.3.2 ROBOT TEACHERS IN CLASS BYITSELF

2.3.3 ROBOTS AS SECURITY GUARDS

**CHAPTER 2. REAL-TIME FACIAL GESTURE RECOGNITION SYSTEM**

Gestures are an important form of communication between people. We regard expressions of the face as one of the most natural forms of human expression and communication. People who are elderly, disabled or just inexperienced users of computer technology a gesture interface would open the door to many applications ranging from the control of machines to “helping hands”. The crucial aspect of a gesture interface is not only real-time performance, but also the ability to operate robustly in difficult real world environments.

To understand human gestures based on head movement a system must be capable of tracking facial features in real-time. We consider real time to be NTSC video frame rate (30Hz). If facial tracking is done at lower rates then it is very difficult to understand gestures.

The real-time facial gesture recognition system consists of two modules running in parallel; a Face Tracker and a Gesture Recognizer. The face-tracking module fuses information from the vision system with information derived from a two-dimensional model of the face using multiple Kalman filters.

We use dedicated hardware, which tracks features in real-time using template matching. Relying solely on such dedicated hardware it is not possible to reliably and robustly track a human face since under normal lighting conditions the shape and shading of facial features will change markedly when the head moves. This results in a failure by the vision hardware to correctly match the changing templates. Kalman filters are used to solve this problem that uses data from the tracking system with a geometrical model of the face. A face tracker is built that operates under natural lighting without artificial artifacts. The system is robust and runs at video frame rate. Reliable and rapid tracking of the face gives rise to ability to recognize gestures of the head. A gesture consists of a chain of atomic actions, where each atomic action represents a basic head motion. e.g.: upwards or to the right etc. The “yes” gesture is represented the atomic action chain of “move up”,”stop”,”move down”, etc. if an observer reaches the end of a chain of atomic actions then a gesture is deemed to have been recognized. We use a probabilistic approach to decide if an atomic action has been triggered. This is necessary since it is rare for identical actions to be exactly the same e.g.: nobody nods in the same way every time.

* 1. **THE VISION SYSTEM:**

The use of MEP tracking system is made to implement the facial gesture interface. This vision system is manufactured by Fujitsu and is designed to track in real time multiple templates in frames of a NTSC video stream. It consists of two VME-bus cards, a video module and tracking module, which can track up to 100 templates simultaneously at video frame rate (30Hz for NTSC). The tracking of objects is based on template (8x8 or 16x16 pixels) comparison in a specified search area. The video module digitizes the video input stream and stores the digital images into dedicated video RAM. The tracking module also accesses this RAM. The tracking module compares the digitized frame with the tracking templates within the bounds of the search windows. This comparison is done by using a cross correlation which sums the absolute difference between corresponding pixels of the template and the frame. The result of this calculation is called the distortion and measures the similarity of the two comparison images. Low distortions indicate a good match while high distortions result when the two images are quite different.

To track a template of an object it is necessary to calculate the distortion not only at one point in the image but at a number of points within the search window. To track the movement of an object the tracking module finds the position in the image frame where the template matches with the lowest distortion. A vector to the origin of the lowest distortion represents the motion. By moving the search window along the axis of the motion vector objects can be easily tracked. The tracking module performs up to 256 cross correlations per template within a search window.

The MEP tracking vision system works perfectly for objects that do not change their appearance, shade and are never occluded by other objects.

When the vision system is used to track a face in a head and shoulder image of a person then problems arise because the head occupies most of the image, one template of the entire face exceeds the maximum template size allowable in the vision system. Therefore, it is only possible to track individual features of the face such as the eyes or mouth. The facial features with high contrast are good candidates as tracking templates. For e.g.: an eyebrow which appears to be a dark stripe on a light background (light skin) and the iris of the eye which appears as dark spot surrounded by the white of the eye are well suited for tracking.

These problems are further complicated by the fact that well suited tracking features can change their appearance dramatically when a person moves their head. The shading of the features can change due to uneven illumination and the features appear to deform when the head is turned, moved up, down or tilted to the side. All these changes increase the distortion even if a template is matching precisely at the correct position. It also results in low distortions at the wrong coordinates, which then cause the search window to be incorrectly moved away from the feature. This problem arises when a head is turned sufficiently far enough for one half of the face with all its associated features to completely disappear. Once the tracking feature has left the search window the movement vectors calculated by the vision system are unpredictable. There is a method developed to allow a search window to correctly find its lost feature thus yielding a reliable face tracker.

**Sensors**

A sensor is a device that measures some attribute of the world. Being one of the three primitives of robotics (besides planning and control), sensing plays an important role in robotic paradigms. Sensors can be classified according to the physical process with which they work or according to the type of measurement information that they give as output. In this case, the second approach was used.

**Proprioceptive sensors**

Proprioceptive sensors sense the position, the orientation and the speed of the humanoid's body and joints.In human beings the otoliths and semi-circular canals (in the inner ear) are used to maintain balance and orientation. In addition humans use their own proprioceptive sensors (e.g. touch, muscle extension, limb position) to help with their orientation.\_ Humanoid robots use accelerometers to measure the acceleration, from which velocity can be calculated by integration; tilt sensors to measure inclination; force sensors placed in robot's hands and feet to measure contact force with environment; position sensors, that indicate the actual position of the robot (from which the velocity can be calculated by derivation) or even speed sensors.

**Exteroceptive sensors**

An artificial hand holding a lightbulb. Arrays of tactels can be used to provide data on what has been touched. The Shadow Hand uses an array of 34 tactels arranged beneath its polyurethane skin on each fingertip.[3] Tactile sensors also provide information about forces and torques transferred between the robot and other objects.

[](https://en.wikipedia.org/wiki/File:Shadow_Hand_Bulb_large_Alpha.png)

An artificial hand holding a lightbulb

Vision refers to processing data from any modality which uses the electromagnetic spectrum to produce an image. In humanoid robots it is used to recognize objects and determine their properties. Vision sensors work most similarly to the eyes of human beings. Most humanoid robots use CCD cameras as vision sensors. Sound sensors allow humanoid robots to hear speech and environmental sounds, and perform as the ears of the human being. Microphones are usually used for this task.

**Actuators**

Actuators are the motors responsible for motion in the robot. Humanoid robots are constructed in such a way that they mimic the human body, so they use actuators that perform like muscles and joints, though with a different structure. To achieve the same effect as human motion, humanoid robots use mainly rotary actuators. They can be either electric, pneumatic, hydraulic, piezoelectric or ultrasonic.

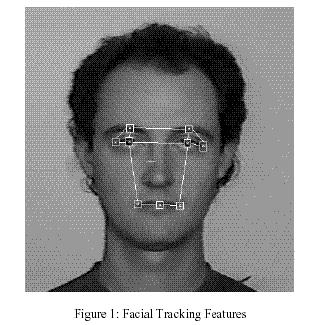
Hydraulic and electric actuators have a very rigid behavior and can only be made to act in a compliant manner through the use of relatively complex feedback control strategies. While electric coreless motor actuators are better suited for high speed and low load applications, hydraulic ones operate well at low speed and high load applications.

Piezoelectric actuators generate a small movement with a high force capability when voltage is applied. They can be used for ultra-precise positioning and for generating and handling high forces or pressures in static or dynamic situations.

Ultrasonic actuators are designed to produce movements in a micrometer order at ultrasonic frequencies (over 20 kHz). They are useful for controlling vibration, positioning applications and quick switching. Pneumatic actuators operate on the basis of gas compressibility. As they are inflated, they expand along the axis, and as they deflate, they contract. If one end is fixed, the other will move in a linear trajectory. These actuators are intended for low speed and low/medium load applications. Between pneumatic actuators there are: cylinders, bellows, pneumatic engines, pneumatic stepper motors and pneumatic artificial muscles.

* 1. **TRACKING THE FACE:**

Our basic idea is that individual search windows help each other to track their features. From the known geometric relationship between the features in a face, a lost search window can be repositioned with help from features that are still tracking. We use a two-dimensional model of the face in which features for tracking are joined to form a small network. The reference vectors connecting the features are derived from a single image automatically by the system or by a human operator. Figure 1 shows a face with boxes marking the nine (9) tracking features. We use the iris, the corners of the eyes, the eyebrows and the middle and corners of the mouth. The sizes of the boxes shown are the actual template sizes (16x16 pixels). The line connections shown in the figure indicate which features assist the other features for readjusting the search windows. We also use several templates to track features that can change their appearance. For example the eyes can be open or closed. In such cases we use three (3) templates for the different states (opened, closed and half-open-closed) of the eyes simultaneously. This makes it possible to determine the state of the tracking features e.g. an eye is open or the mouth is closed.



As discussed earlier if a person turns their head the distortions of all the templates increases greatly. In this situation some features may disappear and others may change their shade and appearance. It is difficult to determine whether search windows are tracking correctly or incorrectly. Lost search windows influence the tracking position of the other search windows. A situation can easily arise in which the system will lose the entire face. Simple thresholding of the distortion is insufficient to distinguish the lost windows from the tracking ones. An approach that can cope with noisy data is needed. Kalman filters were used solve this problem.

The Kalman filter is a recursive linear estimator, which merges the measurement of sensors observing the environment with a prediction that is derived from a system model. The Kalman filter is used in many applications such as navigation of planes, missiles and mobile robots where uncertain measurements from sensors that observe landmarks are used to localize a vehicle. By merging sensor information, the Kalman filter guarantees an optimal estimate of the sensor data in terms of a minimum mean-square error if an appropriate system model is used. All sensor data has co variances associated with it, which indicate the reliability of the data. The output of the filter also has a covariance, so the control system does not only obtain an estimate, but it also knows the reliability of the estimate.

Using Kalman filtering yields a system, which copes with head rotations of about 30 degrees during facing tracking? Further robustness was added to the face tracking by implementing dynamic search regions, which look for a feature inside a specific area of the image. The size of the search region is dependent on the variance of the features (determined from the Kalman filter). We also extended our 2D model of the face to allow for tilting. This extra technique allow the head to be rotated up to 60 degrees, tilted acutely from side to side, and enables quick recovery even when all the tracking features have been lost.



Figure 2: Tracking the face

Figure 2 shows four (4) images taken from a tracking sequence. The predicted estimates of the tracking features are marked with small white crosses.

Another improvement considered is to grab templates of the features dynamically while the system is tracking the face. This would not only improve the tracking, but the system would also cope with much greater ranges of changing illumination. It is planned to create a dynamic face model that adapts to the gathered data. Such a dynamic system would learn how to track the face of an unknown person. The system would be initially provided with several generic faces including startup templates and face geometries. It selects the most similar model for the unknown person and then learns the exact templates and geometry.

The figure 3 represents some of the recognizable facial gestures that are commonly used in our daily day-to-day life

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Figure 3: Recognizable Gestures

## A gesture recognition module is implemented which runs in parallel with the face-tracking module at video frame rate (30Hz). This approach adopted produces reliable results and is robust to noise. The system accurately discriminates between 13 different gestures. Even though some gestures are quite similar to each other.

**2.3 APPLICATIONS OF HUMANOIDROBOTS**

**2.3.1 HUMANOID ROBOTS ASSOLDIERS**

•Humanoids can be a prospect us soldiers as they have no feelings, follow all the orders without questioning and don’t get tired by looking for prospectus danger in any side continuously for days or months, whereas the humans get tired and thus their efficiency decreases.

•Pentagon hires British scientist to help build robot soldiers that 'won't commit war crimes'

•The US Army and Navy have both hired experts in the ethics of building machines to prevent the creation of an a moral Terminator-style killing Machine that murders indiscriminately.

•Last month the US Army took delivery of a new robot built by an American subsidiary of the British defense company QinetiQ, which can fire everything from bean bags and pepper spray to high-explosive grenades and a 7.62mm machine gun.

**2.3.2 ROBOT TEACHERS IN CLASS BYITSELF**

•Japan's robot teacher calls roll, smiles and scolds, drawing laughter from students with her eerily lifelike face. But the developer says it's not about tore place human instructors.

•Unlike more mechanical-looking robots such as Honda Motor Co.'s Asimo, the robot teacher, called Saya, can express six basic emotions --surprise, fear, disgust, anger, happiness, sadness -- because its rubber skin is being pulled from the back with motors and wiring around the eyes and the mouth.

**2.3.3 ROBOTS AS SECURITY GUARDS**

•Schools in Korea could soon be guarded by hi-tech robots that will patrol their grounds, according tore ports.

•Sadly for anybody hoping for a Terminator, Robocop or even a Johnny 5, OFRO has a top speed of just 5kmph, and is equipped with a camera and microphone rather than a big gun. And rather than a giant metal person, it looks more like a large wireless router stuck onto a tiny tank, with a periscope bolted onto it.

•Japanese robotics company Tmsuk has announced its latest creation, the T63 Artemis Guard Robot. Artemis will autonomously patrol a multi-story building and report back wirelessly to security HQ if it finds anything amiss. Though not yet capable of apprehending any intruders, it is armed with several non-lethal offensive weapons such as a fluorescent paintball gun and the capability to spray a cloud of mist to temporarily blind the intruder.

**Advantages**

The first main advantage is that Humanoid Robots bring to the table is hat they can do things that people can do and even things that people are unable to do.

Having these robots can make companies more efficient in their work and also spur the economy with their revenue growth.

Humanoid robots can soon be in everyday life where they can do jobs that people generally wouldn’t want to do and do them more effieciently as well. It will be useful for going far away from planets. Spying on people in ways people can't move and from views humans can't reach. Going far down into the unknown waters where humans would be crushed. Giving us information that humans can't get. Working at places 24/7 without any salary and food. Plus they don't get bored. They can perform tasks faster than humans and much more consistently and accurately.

Robots can work in factories and do the same thing over and over again and not do it any differently. They can capture moments just too fast for the human eye to get, for example the Atlas detector in the LHC project can capture ~ 600000 frames per second while we can see at about 60. Most of them are automatic so they can go around by themselves without any human interference. They can entertain us and help us in certain tasks

**Disadvantages**

1) People can lose jobs in factories

2) It needs a supply of power

3) It needs maintenance to keep it running

4) It costs money to make or buy a robot

CHAPTER 3

CONCLUSION

REFERNCES

##### CHAPTER 3 – CONCLUSION

The humanoid research is an approach to understand and realize flexible complex interactions between robots, environment and humans.

A humanoid robot is an ideal tool for the robotics research; First of all it introduces complex interactions due to its complex structure. It can be involved in various physical dynamics by just changing its posture without need for a different experimental platform. This promotes a unified approach to handling different dynamics. Since it resembles humans, we can start by applying our intuitive strategy and investigate why it works or not. Moreover, it motivates social interactions such as gestural communication or cooperative tasks in the same context as the physical dynamics. This is essential for three-term interaction, which aims at fusing physical and social interaction at fundamental levels.

Integrating human body components such as human prostheses for upper limbs, and anthropomorphic control and behavioral schemes can approach the humanoid robotics.

The Gesture Recognizer module that runs in parallel with the face-tracking module is capable of recognizing a wide variety of gestures based on head movements. Gesture recognition is robust due to the statistical approach we have adopted. In future the plan is to record and analyze the head gestures of a large sample of people. The plan is also to explore the prospect of allowing the machines to learn gestures based on observation.

The ultimate aim is to use the facial gesture recognition system in a robotic system for the disabled. The interface will allow disabled persons to feed themselves by using facial gestures to communicate with the helping robot.

**References**

[**http://studymafia.org/**](http://studymafia.org/)

[**www.google.com**](http://www.google.com)

[**www.wikipedia.org**](http://www.wikipedia.org)

[**http://www.scribd.com/doc/23885816/Humanoid-Robotics#scribd**](http://www.scribd.com/doc/23885816/Humanoid-Robotics#scribd)