Intelligent Agent System for Humanoid Interaction through Artificial Emotion

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The purpose of our work is to realize an agent for intelligent interaction between humans and robots, embedding a computational model of artificial emotions with learning and self-adaptation features. The gesture of a human can cause the robot to change its “emotional state”, which is exhibited by means of integrated visual media, environmental lights, music, and changes in robot’s style of movement and behavior. We adopted our emotional agent architecture for developing the agent. The system is a sort of "Emotional Activator", which plays the role of stimulating the human creativity. In our environment, humans do not need to wear any special on-body sensor.

Humanoid robotics is an application area of robotics in which robot is designed in human form and can perform human-like behaviours. Although humanoid robotics is a new field of robotics it is growing rapidly worldwide.

Humanoid offers a unique research tool in several scientific areas. Besides they can facilitate our everyday lives as being personal assistants. The humanoid has to understand human’s high-level task requirements by using its low-level sensory modules such as eyes, ears and tactile sensors. Presence of certain features, the dimension of the head and the total number of facial features heavily influence the perception of humanness in humanoid head.

In general humanoid robots 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'

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:

- Self-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)

- 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, generally humanoid robots are more complex than other kinds of robots.
- Avoiding harmful situations to people, property, and itself
- Safe interacting with human beings and the environment
- There are currently two ways to model a humanoid robot. The first one models the robot like a set of rigid links, which are connected with joints. This kind of structure is similar to the one that can be found in industrial robots. Although this approach is used for most of the humanoid robots, a new one is emerging in some research works that use the knowledge acquired on biomechanics. In this one, the humanoid robot's bottom line is a resemblance of the human skeleton.

Emotions are not only a basic part of rational processes, but a necessary and the most efficient way to establish a good communication and work atmosphere between humans and machines. Our attitudes towards machines are similar to those related to human beings, but we need the machine’s feedback. Therefore, first attempts to embed emotions into machines were focused on to creating machines which could simulate showing human emotional states.

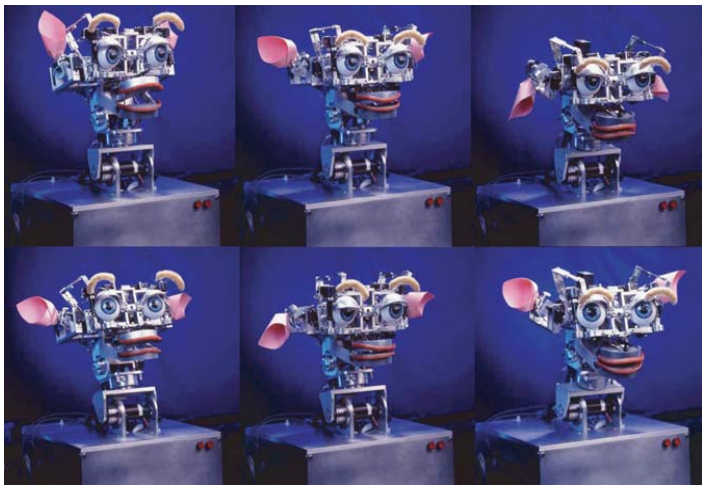
A second way of research is trying to create true synthetic emotions: that is, artificial systems with emotional regulatory systems. There are several ways to integrate emotions into artificial environments (computers and robotics), which we will cover in this project.

To develop a humanoid head with emotions, expressing anger, fear, sadness, happiness, excitement and disgustness, each component operates under influences from the other modules. As a whole, they work to map the input parameters of the external world to the output.

First of all the outside view of the robot will resemble human face to a certain degree. Next it will accommodate the features such as eyes, eyelids, nose, ears, chin, mouth etc as much as possible. The degree of freedom of the robotic head should define by the motions performed by the head would be determine by considering the mechanical constraints on the design.

For this structural components, their materials, electronic equipment and actuators would be selected in order to satisfy the dynamic behaviour of a human head. In order to do this, the motion types, ranges and velocities of a human head should be closely examined focusing on the dimensions, weight and movements.

Following is the picture showing the emotions of robot



1)Surprise 2)Normal 3)Sad 4)Angry 5)Disgust 6)Happy

Objectives:

- To develop an intelligent agent for interaction between humans and robots embedding artificial emotions.
- To realize a multimodal interaction between human and robotic agents through artificial emotion
- To develop a camera-based sensor system to increase its input capabilities.
- Outputs would produce through three components:
    - i) Rational
    - ii) Emotional
    - iii) Reactive.
- Each component operates under influences from the other modules.
- As a whole, they work to map the input parameters of the external world to the output ones.
- The system works as "Emotion Activator" stimulating the human creativity.
- This means that it is not only to behave like a human based on the emotional understanding from human movement, but also to "activate" human by integrated outputs.
- To Develop of humanoid robot at an entry level stage using simple mechanisms with capabilities like-
- Steady walk
- Speed modulation
- Face recognition
- Voice Output
- Status Display
- Hand Shake
- Mobile/Remote Control

Total Estimate for Project:

Sr. No.	Name of Component	Brand	Quantity Reqd	Cost per unit	Total Cost	Use
1.	Servo Motors	Futaba/Hi-Tec	18	1000	18,000/-	To create various axis of movements in various joints.
2.	AVR (ATMega128 Development Board)	Custom Designed	1	4000	4,000/-	For the main control unit.
3.	Speech Recognition Module	Sunrom	1	5,500	5,500/-	For speech recognition
4.	Image processing Module	Sunrom / Custom designed	1	4,000	4,000/-	For facial recognition purposes
5.	Voice generating/ decoder Module	Sunrom / Custom	1	4,000	4,000/-	To generate voice responses
6.	Medium Resolution Webcam, with USART	S.M. Electronics	1	4,000	4,000/-	
7.	Aluminium & Acrylic Chassis	Custom Designed	1	4,000	4,000/-	
8.	Gear Boxes and Mechanics	Custom Designed	Various	7,000	7,000/-	
9.	40 Ah 12 v Battery	Exide	1	3,500	3,500/-	
10.	Optical IR sensors	Custom Designed	6	200	1,200/-	
11.	Ultrasonic transducers	Sunrom	3 Pairs	600	1,800/-	
12.	CCD camera		04	1000	4,000/-	Image Recognition
13	CPU 64bit Risc Processor		01	50,000	20,000/-	
14	Software	µKeil	01	15,000/-	15,000/-	
15	Sensors		40	100	4,000/-	
16	Books		4	10,000/-	10,000/-	For information
17	Misc Components	N.A	N.A	N.A	5,000/-	
Total Budget					**1,15,000/-**	