IMPLEMENTATION OF HUMANOID ROBOT WITH USING THE CONCEPT OF SYNTHETIC BRAIN

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Abstract

This paper is elaborate the model of humanoid robot interacts with human being and perform various operation as per the command given by the human being. A humanoid robot having Synthetic brain can able to do Interaction, communication, Object detection, information acquisition about any object, response to voice command, chatting logically with human beings. Object detection will be done by this robot for that purpose there is use image processing concept (HAAR Technique), And to make the system intelligent that is whenever system interact, communicate, chat with human it gives proper response, question / answers there is integrates artificial intelligence and DFA / NFA automata and Prolog language concept for answering logically over the complex and relevant strings or data.

Keywords —*Humanoid Robotics, Artificial Intelligence, Image Processing, Audio Filtering.*

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1. INTRODUCTION

Synthetic Brain in robotics is an emerging technology. Synthetic Brain is nothing but the artificial brain and its working mechanism is just like as human brain. That is this technology has large scope in engineering science. It may use to develop the artificial brain of the robot and auto-respond software is as well.

Synthetic Brain means it is a respond engine respond to various events occurs in real-time. Like as conversation with people, performing the multiple-task critical one also, maintaining large dynamic database for acquisition of information about any object like fruits, books, etc. Synthetic Brain in robot is made robot able to discuss with people as per their mood and topics. I.e. by reading variations of voice frequencies. Whenever any object will given to identify to robot, robot eyes means camera's of robot gets the picture in frame format analyze it and gives brief information about the object, like if robot scanning the book as an object, if an information of that book is already available in the database then it shows else it acquire data from internet and shows brief information on any display device i.e. screen or project the data if projector will interfaced like as Author, type of book, subject, contains, index, references, etc. Robot will also able to perform some task like finding the forgotten things like keys,

There will vast scope to Synthetic Brain to make automated machines, which are able to take decision on any real-time event occurred e.g. whenever the robot have conversation with the human, there is multiple way to respond for that purpose robot uses DFA/NFA combinations of alphabets to responds. For designing and implementation of humanoid robot with synthetic brain four basic technologies are integrated Robotics, Image Processing, Artificial Intelligence, and Audio Filtering.

Robotics is used for the modeling purpose of the robots in which it includes the motion technique. And all the hardware of the robot with respect to the technology used in robot. Image Processing is the technique of performing the various operations on the images for sake of acquiring knowledge and object detection purpose. Image processing also an effective technique to respond various Artificial Intelligence technique in real-time. Artificial Intelligence is nothing but the technique of creating and implementing various intelligent responses. Artificial Intelligence is the important objective of project model which gives ability to robots i.e. acquires knowledge from the environment. Audio filtering is the technique use for processing on the voice commands.

2. PROBLEM DEFINITION

A. Robot was working on the static Knowledge concept therefore it not able to update its knowledge explicitly. Previously models uses microcontrollers and embedded 'c' language for programming and feed the knowledge the robot which had various limitations to develop the concept of Artificial Intelligence and training purposes.

B. The previously developed humanoid robots survive in real-time environment are able to do the task which textually feed. Basically robot will work only one or hardly two technologies in combination. If it is able to do conversation with human then only finite answers and response was given, it is also not able to acquire knowledge from real-time environment.

C. Robot was not navigational mode i.e. not able to navigate freely in environment. There will absence of image processing that's why was not able to process on images. Due to absence of Image Processing there is lack of techniques to develop or feeding the knowledge in the robots.

D. If image processing is present, it is work on very limited frame segments of image at a particular time slot

Due to absence of audio filtering technique i.e. by FIR filter whenever robot survive in real-time environment, it can't be able to detect right audio command.

3. OBJECTIVES

This paper proposed to develop a humanoid robot which makes combination of Technologies, which will enhance robot capabilities in real World by providing synthetic brain. Technologies involving Humanoid Robotics, Artificial Intelligence, Image Processing and Audio Filtering. To develop Humanoid Robot that provides you to intelligent task performance and interaction with human being using voice commands as well as text command also. Developing such Robot in a real-time environment and user can able to give command to do various complex work like object detection, searching data on encyclopaedia, pick-up the object which guided by user and user also can able to chat with Robot.
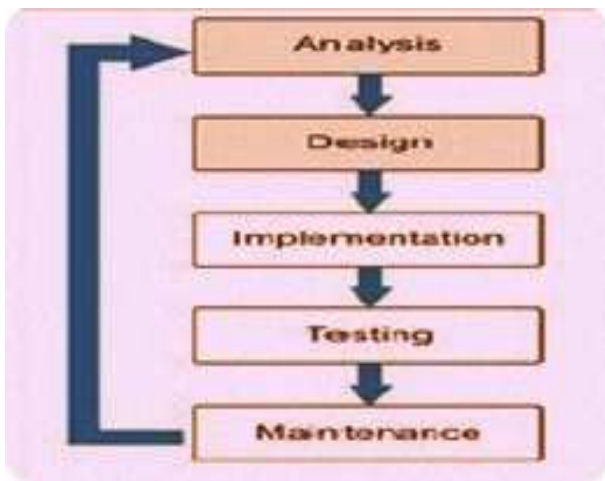
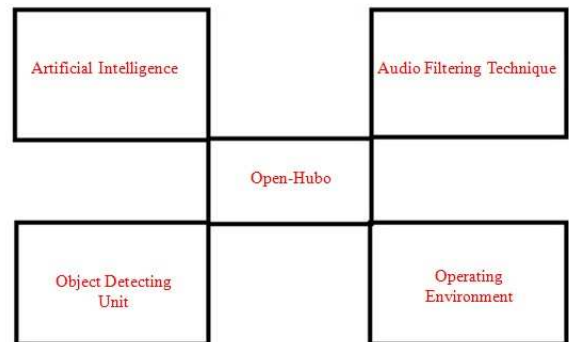## 4. METHODOLOGY

Fig 1: Study & Process Flow

Fig 2: Block Diagram

4.1. Synthetic Brain Concept

Synthetic Brain is nothing but the ability of the robot to give the proper response to user commands in real-time environment. For that purpose various techniques are integrated to give proper responses like detecting the object it includes the image processing technology(HAAR Technique), to make robot workable and mobile various motors of different strength are used, for listening the commands properly Audio filtering concept is used, For making the chatting unit in the robot VERBOT technique is used.

4.2. Image Detection Method

Image Processing is used in the project for object detection purpose by which developer is able to train the robot for multiple objects.

HAAR Classifier Technique: HAAR classifier is the open source technique for the Image processing
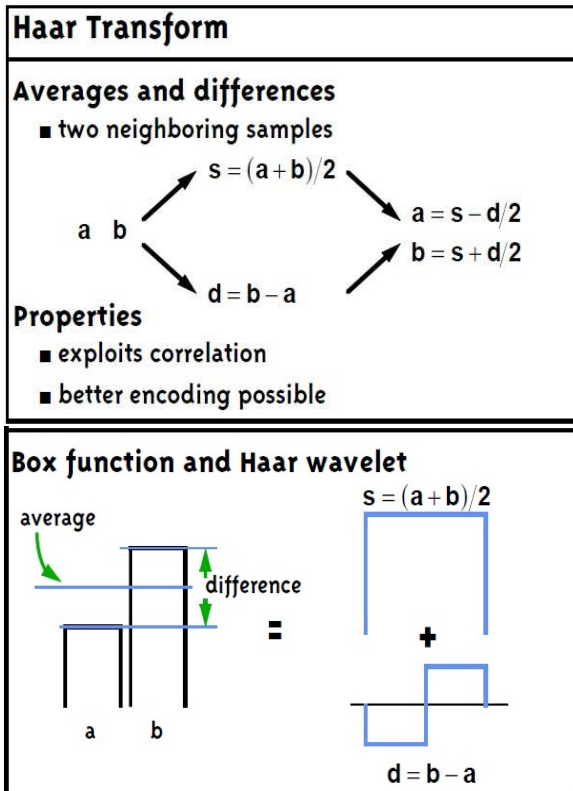
Fig 3: Image Detection Block Diagram

a) Creating the description file of positive samples
b) Creating the description file of negative samples
c) Packing the positive samples into a vec file
d) Training the classifier
e) Converting the trained cascade into a xml file
f) Using the xml file to detect the object

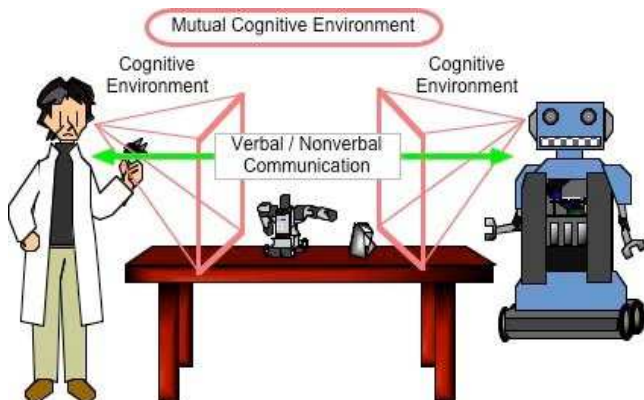## 4.3. Communication with Robot:

Fig 4: Communication with robot

In the Communication with robot, challenging task is to provide the voice command. This operation is quite difficult but due to use of a windows operating system and .net environment in our robot we can able to take the help of SAPI 5.4. It is a Speech Recognition Application Program Interface helps us to convert voice command in to text and vice versa.
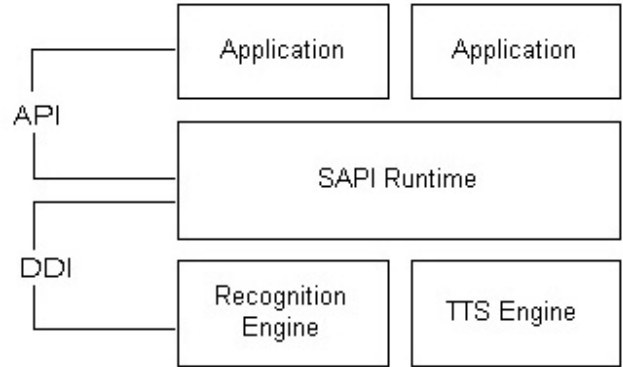

Fig 5: Mechanism to process on voice command

The SAPI API provides a high-level interface between an application and speech engines. SAPI implements all the low-level details needed to control and manage the real-time operations of various speech engines.

The two basic types of SAPI engines are text-to-speech (TTS) systems and speech recognizers. TTS systems synthesize text strings and files into spoken audio using synthetic voices. Speech recognizers convert human spoken audio into readable text strings and files.
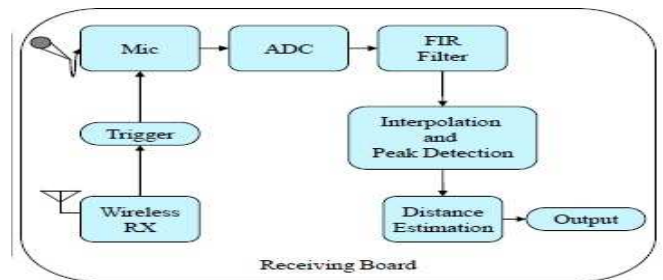

Fig 6: Block Diagram of Audio filtration

4.4. NFA/DFA Automata:

This algorithm is used for the giving proper dynamic response to the conversation of the human. That is whenever human interacts with robot there is multiple combinations of sentences, words, alphabets are possible. That's why to give proper response to human as per his/her mood (detecting by frequency of voice signal) this automata pattern is used. It is not only give proper response but also able to adopt new techniques.

4.5. Particle Swarm Optimization (PSO):

Particle swarm optimization (PSO) is used for give the knowledge to the robot regarding with the object and environmental conditions. And it is very helpful to design the humanoid model where multiple people are interacts with the machine.

4.6. RGB, HSI Optimization:

This model uses the not only RGB(Red, Green, Blue) image attributes but also used HSI model, in which H said hue (hue), S said saturation (saturation), I indicated that the density (intensity), corresponding to gray-scale imaging and image brightness. This is very important technique for detection of errorless, noiseless and clear image for processing. In the multitier image attribute system the attributes of image given to the processing is able to work on the user defined or customize mode, in which user can customize the attributes of the image like RGBHSI (Red, Green, Blue, hue, saturation, intensity),etc. Where as per the user requirement and clarity requirement the attributes will be manage by user or programmer.

4.7. Attention Control Phases:

In order to control the human's attention, we hypothesize
Those robots should perform three consecutive tasks:
(i) Attracting attention (AA)
(ii) Making eye contact (MEC)
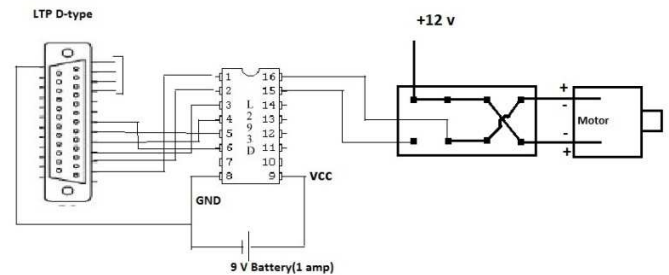(iii) Shifting attention (SA)
Fig. 1 illustrates the conceptual process of attention control (AC) in terms of sub tasks. To perform a successful AC process, both robot (R) and human (H) need to show some explicit behaviors and to respond appropriately to them by communicative behaviors in each phase. That means, R and H perform a set of behaviors, $R = \{\varphi, \psi, \omega\}$ and $H = \{\lambda, \delta, \mu\}$. We show that signals for AA, MEC and SA of the robot are able to control the human attention from one direction to that indicated by the robot through experiments. In this work, we apply a set of behaviors of robot such as $\varphi = \{$head turn, head shaking, reference terms$\}$ in the attracting attention phase, $\psi = \{$frontal face detection$\}$ in the making eye contact phase, and $\omega = \{$head turn$\}$ in the shifting attention phase respectively. We expect that humans also

Perform some responsive behaviors, such as $\lambda = \{$head/gaze turn toward the robot, body turn toward the robot$\}$ in AA phase, $\delta = \{$keep looking toward the robot while blinking$\}$ in MEC, and $\mu = \{$turning head/gaze toward the robot intended object$\}$ in SA phase respectively.

4.8. Motor Driver Circuit & Hubo-Structure:

1. LPT is a port is used for drawn output towards the L293D Amplification IC.

2. L293D IC is used for the purpose of amplification to run the relay circuit.
3. There is used Dual relay circuit for operating the motor in both directions i.e. clockwise and anticlockwise.
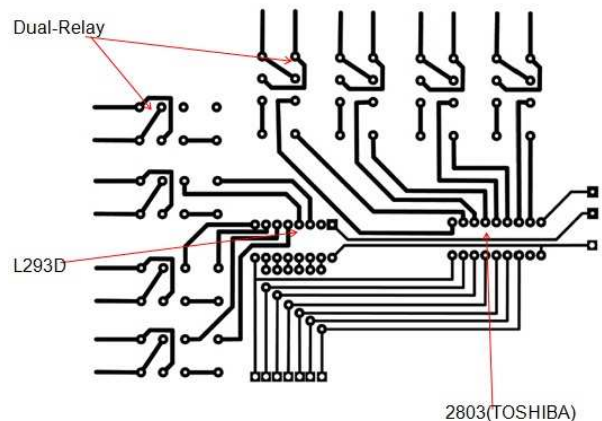

Fig 7: Motor Driver Circuit Diagram and PCB Design

4.9. Use of an Operating System:

The most important feature of our robot is, it carries the operating system. That's why we are able to do complex program and uses various open source techniques and API's with respect to our task requirement like as for the purpose of getting and parsing the voice commands we uses the SAPI 5.4 API of Microsoft corporation, we uses the Open source Verbot avatars to give proper responses and sensible chatting with human being in real-time environment, Uses HAAR technique to image processing.

Operating system not only provides the operating environment to user but also makes the programmer able to use and integrate multiple technologies within same robot and co-ordinately use it as per the task requirement.
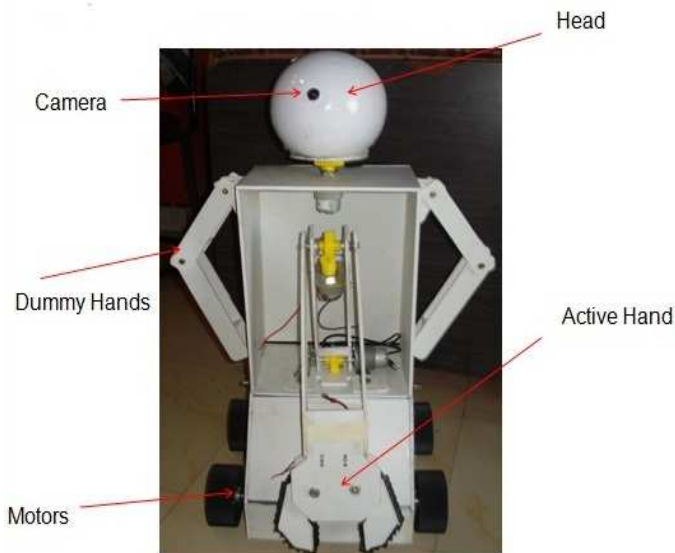
5. HUMANOID ROBOT STRUCTURE AND SOFTWARE MODULE

Fig 8: Humanoid Robot Structure

Fig 9: Software Modules in Robot

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