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Artificial Intelligence Humanoid Robot VISION for Children

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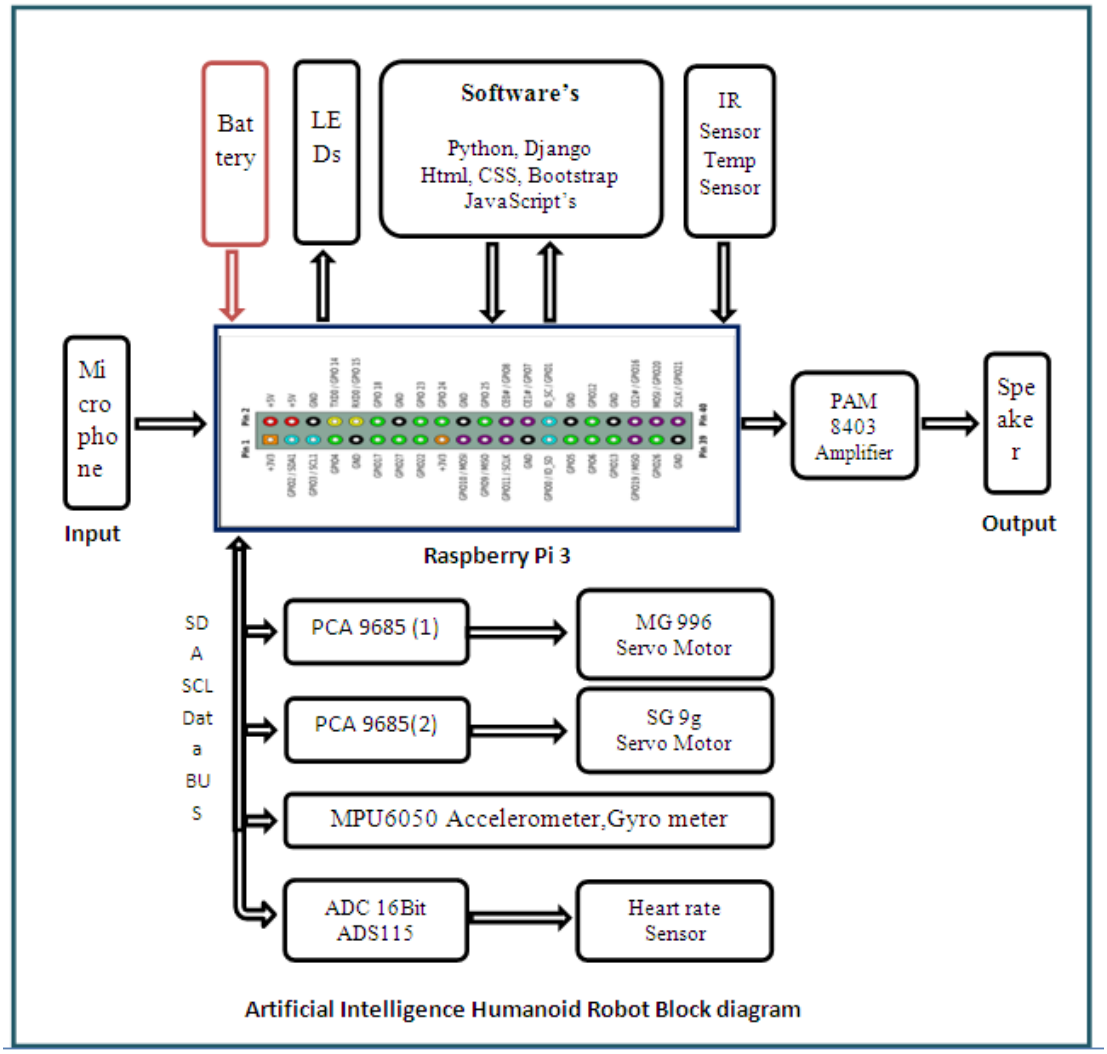
ABSTRACT:
In today's era of Artificial Intelligence and robotics, it isimperious to have a friendly system to communicate with robots so they can play a vital role in day to day human life. Human Robot Interaction is the primary system in robotics,in today's era the verbal link with a robot isanin expected way. The major struggle of the interactive system, not only lies in how to teach robots to speak but also in helping to make them understand the meaning of the real-world around us.The concept of AI robotic toy(VISION) isfor children, to provide an efficient solution for working parents. Now a day's most of the families are nuclear and both the parent are working. So parent's main concern is about how their kids can be engaged so that they can play and learnsomething good and effective at the same time.
The aim objective of this technology is to solve the problem of working parent living in metropolitan cities so that they may ensure with the efficient upbringing of their children and keep an eye watch at their learning at home.
Keywords: AI Robot, Raspberry Pi 3**,** Sensors, Embedded system, Python, AI Liberies, Website

I. INTRODUCTION

Artificial Intelligence is the study of human intelligence and actions simulated artificially, such that the consequentialallows to its design a reasonable level of rationality [1]. When people ruminateof the technology AI, the image that comes in their mind is of a robot skating around and giving motorized replies. There are so many forms of AI but humanoid robots are one of the most popular forms. This AI Robotic toy is developed for child so that they can play as well as teach them. This will also help the child to stay away from phones. This robot works with the Wi-Fi(or internet) as well as offline. In offline mode it use self-storage database.

Robot can be customized with the school syllabus of child so that they may learn. This AI robot is meant for accompanying children of up to 10 years of age. It also helps in calling the parents, sending e-mails and provide the growth graph of child to their parents as well as teachers. Robot can initiate talk with the child and distract him/ her from playing mobile games, watching TV and spending time on digital gadgets. Robot [2] comprises with the state of art microprocessor and hardware as well as software frameworks and its hardware have low costs.The hardware parts are: controller, microphone, speaker, servo-motor, servo-controller, camera, temp-sensor, infrared-sensor, different colours of led.

II. BLOCK DIAGRAM



Artificial Intelligence Humanoid Robot Block diagram

III. HARDWARECOMPONENTS

A. Raspberry Pi : -The Raspberry Pi 3 Model B+ is a credit card-sized computer. It has a 1.4 GHz quad-core ARMv8 64bit processor and a powerful Video Core IV GPU,onboard 802.11n Wi-Fi, Bluetooth and USB boot capabilities, one video and audio output, one HDMI output.

The Raspberry Pi can run a full range of ARM GNU/Linux distributions, including Snappy Ubuntu Core, Raspbian, Fedora, and Arch Linux, as well as Microsoft Windows 10 IoTCore. It also supports Power over Ethernet with a Power and dual-band Wi-Fi [3].

Fig (1) - Raspberry Pi 3

It has 40 pins including one SPI bus, one I2C bus, one UART bus ,28 GPIO Input/output pin, and3.3V, GND and 5V.The Raspberry needs an external SD card to store.

B. Camera: -The camera is an optical instrument for capturing and recording of the images[6].The camera is a remote sensing device as it senses subjects without any contact.It is help to recognize the object,face, blinking eyes. The images may be individual still photographs or sequences of images constituting videos or movies.

C. SD Card: -The SD card is installed with the image O.S and is also used as an internal storage for the RPi[4]. In this research, Scandisk Class 10 32GB SD card is used.

D. Power Supply: -Pi B requires voltage of 5V and 700mA [4]. We made lithium (3.7v) batteries of 5V 2A with voltage booster and BMC controller Power bank is used to make it portable.

E. Servo motor: -A servo motor is a rotary actuator or motor that permits for a specific control in terms of angular position, acceleration and velocity, skills that a regular motor does not have. It makes usage of a regular motor and pairs it with a sensor for position feedback. The controller is the most refined part of the servo motor, as it is precisely designed for the purpose [6].

Fig (2) - Servo motor MG996 & SG9g

We use 22 servo motors in which 10 servos have the brand name of MG996 and other 12 servo brand name have SG9g. the MG996 servo takes 7.2v and SG9g servo have the capability of 5v.

F. PCA9685:-PCA9685 has 16-channel I2C-bus controller. Each pin output has individual 12-bit resolution (4096 steps) PWM controller with a fixed frequency. It operates at a programmable frequency of typical 24 Hz to 1526 Hz with a duty cycle that is modifiable from 0% to 100% so the LED can be set to output a precise brightness. All outputs are set to same PWM frequency. It can be connected to a 62 driver boards at the most in a cascade way, which means it will be able to control 992 servos in total [7]. In this two controllers are used to drive both types of servo motors.

Fig (3)-PCA9685

G. PAM8403:-The PAM8403 is a 3W, class-D audio amplifier. It offers low THD+N, allowing it to achieve high-quality sound reproduction. The new filterless architecture allows the device to drive the speaker directly, requiring no low-pass output filters, thus saving system cost and PCB area[8].

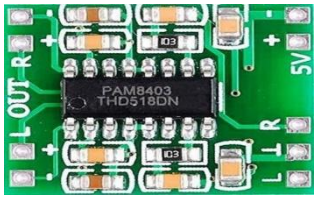


Fig (4)-PAM8403 Amplifire

H. ADC:-The ADS1115[9] are 2mm × 1,5mm × 0,4mm precision analog-to-digital converters (ADCs) with 16 .Range 2.0V to 5.5V bits of resolution offered in an ultra-small, leadless QFN-10 package or an MSOP-10 package. The powers consume only 150µA ease of implementation in mind. Data transferred via an I2C-compatible serial interface.

I. Heart rate sensor: - Heart rate is very vibrant health parameter that is directly connected to the sound of the human cardiovascular system. It can be measured either by the ECG waveform or by detecting the pulse - the pulsing expansion and contraction of an artery as blood is forced through it by the regular narrowing of the heart[10].

J. MPU6050:-The MPU6050 is a Micro Electro-Mechanical Systems (MEMS) which consists of a 3-axis accelerometer and 3-axis gyroscope inside it. It helps us to measure acceleration, velocity, orientation, displacement and many other motion related parameter of a system or object.[3]

IR Sensor: - To identify any obstacle in front of robot.
Temp Sensor: - Sense room temp, CPU temp, Weather temp
Microphone: - It is used for input voice in the robot toy.
Speaker: - It is used for output voice in the robot toy.

IV. SOFTWARE COMPONENTS

A. Python:-Python[15] is aefficient programming language.It is widely used in robotics, machine learning's etc. It is an elegant syntax and dynamic typing alltogether with its construednature; make it an ideal language for scripting and rapid application development in many areas on most of the platform. It is also suitable as an extension language for customizable applications.

B. Django:-Django is a light weight framework. It works with python interpreter. In this project we develop a website with help of

Djangotocontrol and auto-update our AI robot. This website has provided a link for updating its software and download the numbers of required features, games, etc. We use the Django for developing the website which have the ability to integrate much information and the auto updating software.

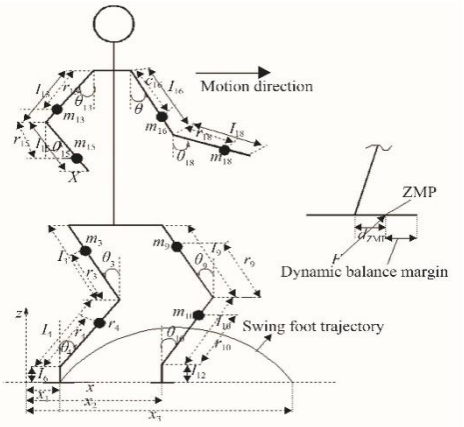
C. **AIML:** -AIML(Artificial intelligence mark-up language) was developed by Richard Wallace in 1995. AIML formed the basis for what was initially a highly extended Eliza called "A.L.I.C.E.." ("ArtificialLinguistic Internet Computer Entity")[11].We used for conversation.

D. **Open-CV2:-**Open-CV2[5] is a library of programming functions mainly aimed at real-time computer vision. It has a package includes several shared or static libraries. Our project includes libraries such as Viola-Jones or Haar classifier, LBPH (Lower Binary Pattern histogram) face recognizer, Histogram of oriented gradients (HOG).This robot detect face, eye blinking, hand gesture.

E. Tenser flow: - Tenser flow is a powerful library which is widely used in robotics, AI, machine learning.
Our project gives efficient answer with the help of neural network.

V. PID ROBOTIC TOY CONTROL

The active control of a robot consists in finding the correct generalized forces that have to be applied to the joints in order to generate the desired trajectory for an operational point.



Fig(5)-Stick body[12]

Traditional methods for robotic schemers include two main types of controller: (i) Joint Space Control, which is based on the joint space formulation and includes methods such as PD and PID ,inverse dynamics control (in this context usually called computed torque), robust control in presence of parameter uncertainty , adaptive control , adaptive compensation of gravity amongst others; and (ii) Operational Space Control, based on the operational space creation with methods such as inverse dynamics control or PD control, amongst others. Based on the resolved motion rate control in kinematics, the resolved acceleration control, which relates the task acceleration to the joint acceleration, was proposed for the fixed upper body of a humanoid robot but with the restriction that only kinematic constraints like collision avoidance and joint limits can be used in the framework [2].

The robot will get stable when its centre of mass of the whole system or body is managed as well as weight or size of object.

Inverse kinematics

The biped robot motion is considered in both the sagittal as well as frontal planes of the biped robot. The biped robot orientation of each joint has been calculated by using the concept of inverse kinematics. The mathematical expressions used to determine the joint angles of the swing leg (i.e., θ_3 and θ_4) and stand leg (i.e., θ_9 and θ_{10}) in sagittal plane, and the joint angles of swing leg (i.e., θ_2 and θ_5) and stand leg (i.e., θ_8 and θ_{11}) in frontal plane are summarized below.[12]

$$\theta 4 = \sin^{-1}\left(\frac{h1l3\sin\varphi + \cos\varphi(l4 + l3\cos\varphi)}{(l4 + l3cos\varphi) + (l3sin\varphi)^2}\right)$$

The stair case

The gait generation method for the biped robot while ascending the stair case is similar to the descending case except for a small difference in determining the position of Zero Moment Point. While descending the stair case, the acceleration due to gravity (g) is acting in the direction opposite to that of the movement of robot[12].

X-**direction**

$$ZMP(x) = \frac{\sum_{i=1}^{n}(I1w1 - m1x1z1 - m1x1(g + z1))}{\sum_{i=1}^{n}(m1(z1 + g))}$$

Y-**direction**

$$ZMP(y) = \frac{\sum_{j=1}^{n}(I1w1 - m1x1z1 - m1x1(g + z1))}{\sum_{j=1}^{n}(m1(z1 + g))}$$

Torque based PID controller

For designing a torque based PID controller initially, the dynamics of the biped robot is to be derived.The torque based PID controllers are

designed for each joint of the biped robot while moving on different terrain conditions. [12]

$$Ti, the = \sum_{j=1}^{n} Mij(q)qj + \sum_{j=1}^{n}\sum_{k=1}^{n} CijkQk + Ci$$

$$i, j, k = 1,2,3 \ldots \ldots n$$

VI. WORKING

This system takes voice as input which is converted into text form and then robot works on this text. The Humanoid works in both mode that is online and offline mode.

VII. Future Scope

This AI Robot can be made to teach advanced skills by use of neural networks and can be used as security of home as well.

VIII. CONCLUSION

The Robot is named as Vision. It has ability to teach the child while playing.It ensures the security of child and itcan also be connected with home appliances for automations.

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