Humanoid Robot With Surveillance And Virtual Voice Assistance

Neethu K N[1], Jaisankar B[2], Dayanand P[3], Hari Prashanth P[4]

[1]Electronics and Communication Engineering, REVA University, (India)
[2]Electronics and Communication Engineering, REVA University, (India)
[3]Electronics and Communication Engineering, REVA University, (India)
[4]Electronics and Communication Engineering, REVA University, (India)

Abstract: Humanoid robots are those resemblance of their motion and functioning similar to human beings, having capabilities of doing day to day activities similar to man and replace him in every possible way. These activities vary from daily activities such as walking, standing, to staircase climbing, running, and kneeling. The main purpose of this project is to build a personal assistance which resembles a human but, with voice and surveillance. The problem in this is to Sync the 17 degree of freedom (DOF) motors to perform human action's using voice commands. The humanoid robot is voice controlled with artificial intelligent (Virtual voice assistance AI technology). At first the parts need to be designed as per the human form by fixing each of the joint's with DOF motors which is in-turn connected to the 18-channel steering servo drive control panel. And we need to program it to perform actions such as walking, waving hand etc. With these feature's we intend to implement a virtual voice assistance (AI database) to the computer processor as well as surveillance camera to it. The expected result is that, the humanoid robot should perform the action as per the given command, to answer the questions we ask and can surveillance the area around it.

Keywords : humanoid robot, virtual voice assistance & surveillance.

1. Introduction

Nowadays robots have become very powerful elements in industry because of its capability to perform many different tasks and operations with artificial intelligence and virtual voice recognition technology. Moreover, it does not need the common safety due to it doesn't feel anything like human being. Besides these industrial robots, there are significant advancement have been made in the development of biologically inspired robots or social robots. Bipedal robot especially, Humanoid is from the functional mobility of the human body. However, the complex nature of the human system cannot be reproduced in this. A bipedal robot therefore has some degrees of freedom (DOF) than a human body's in their joints. It is very important to choose the number of DOF for each expression of the biped robot. The system understands the vocal voice and converts it to binary, not its meaning given from the speech. The purpose of our research is to provide simpler robot's hardware architecture but with computational platforms, so the designer can focus on their research and tests instead of other connection infrastructure. manufacturing, packing, design, construction, and use of machines to perform tasks done traditionally by human beings. Robots are broadly used in such industries such as automobile manufacture to perform simple repetitive tasks and in industries where work must be performed in environments hazardous to humans and personalized robots with voice assistance are also made now-a-days like Sophia, KHR-1 etc. the main problem faced is to control 17 DOF motor according to the instruction or the command given and in a synchronized way and to stabilize the robot to stand without falling while all the DOF motors work.

Then to implement a virtual voice artificial intelligent with some internet database and where it would be capable for answering the questions asked by the user. Along with it we can accessing the surveillance camera through internet protocols and IP address.

In the project we are working on, the design of robotics part as per human form and attach those parts to the servo motors and program it to perform some action along with virtual voice artificial intelligent assistance and surveillance. We are expecting our robot to perform the actions as described in the command or instruction and to answer the question's based on internet database collection along with the surveillance.

2. Headings

This paper contains a total of 7 Sections through which the proposed system has been explained in detail. The sections are as follows:

1. Introduction
2. Headings
3. Literature Survey
4. Hardware and Software used
5. Construction and Proposed methodology
6. Results
7. Conclusion
8. Acknowledgements

3. Literature survey

For our first paper we referred to a Voice controlled robot using android application. The authors are - Preeti Muluk, Rupali Mohite, Aishwarya Lanke, the authors worked on Controlling a robot using mobile through WIFI communication and some components of the mobile and robot. The robot is controlled by a mobile phone by moving the robot upward, backward, left and right side using the android application such as Arduino, Wi-Fi and Bluetooth. It tells us how to interact with the robot-controlled car using Wi-Fi module through android application on an android mobile phone. Even in the absence of an android phone we can control the robot by sending a normal SMS.[1]

For our next paper we referred a Robot Controlled Car Using Wi-Fi Module. The authors are - Vipul Mehta, Javed Khan, Reshma Kalane. They designed to control a robotic vehicle by voice commands and manual control for remote operation. An ATMEGA32 microcontroller is used together with a Bluetooth device interfaced to the control unit for sensing the signals transmitted by any Android application. The data sent from the Android application to the Bluetooth receiver is interfaced to the microcontroller and processed. It sends a control command through the Bluetooth which can control the speed of the motor, to sense and share the information with phone about the direction and the distance of the robot from the nearest obstacle. The purpose of this paper is to provide powerful computational android platforms with simpler robot's hardware architecture.[2]

The next paper is regarding the Walking Patterns for a Biped Robot. The authors are Takanishi et al, Dasgupta et al, Rostami et al. Their main motive was to develop a smooth uniform walking characteristic to replicate the human way of walking. They presented the research on Biped motion in which three axis moment was compensated in IEEE in Japan. A biped robot tends to slip over easily, so, it is necessary to take stability into account when determining the walking pattern. The authors have proposed a method of gait synthesis for static stability. Methods of gait generation by minimizing the cost function of energy consumption were proposed. This paper also describes a proposed method for planning the walking patterns, which includes the ground conditions, dynamic stability constraint, and relationship between walking patterns and actuator specifications.[3]

This paper was proposed for a Voice Controlled Robotic System using Arduino Microcontroller. The authors are Mr. Vedant Chikhale, Mr. Raviraj Gharat, Ms. Shamika Gogate, Mr. Roshan Amireddy. The robot is controlled by voice commands received through an android device. The robotic vehicle consists of an arm which operates as per the given command, for this function they have used Arduino in the system. The robot is controlled with a android application. The wireless camera is connected with Arduino to record movement through a server. A robotic arm is mounted at the front of the vehicle and a lcd screen to view the received commands. An obstacle detector is added to protect the robot from obstacles on its way by using an ultrasonic sensor.[4].

4. Hardware and software used

We have used the below hardware and software components during our development, designing and testing phases.

Hardware requirements:
- DOF humanoid robot clamps
- Arduino Servo motor controller
- Raspberry pi 3 b+
- Camera
- TowerPro MG995
- lithium battery

Software requirements:
- Arduino IDE 1.8.13
- Raspberry pi OS

5. Construction and proposed methodology

A.   CONSTRUCTION

☐   **Power supply: -** We have used LiPo battery (Lithium Polymer) of 7.4V 2200mAh and 60C rating (means 2200*60/1000=132amps) Max Burst Discharge of 60Ci s 132.0A. we are using this classified battery to power up 17 servo motors where all will draw amp of 0.5amps-0.9amps according to the load at idle and at any working of motor it will draw amps from 1.5amps – 8.9amps. and we need to power the CPU which will draw 1amps – 2amps according to load and of 5v.due to this we have selected this battery.

☐   **Arduino uno r3 based Bluetooth USB 18 servo controller: -** We have chosen this board because it has 18 pins which are recommended for the servo and along with it is provided with feature of UART and Bluetooth where these works on a baud rate of 115200 so the signals are transferred and received fast. This helps in developing the motions for the robots.

☐   **Raspberry pi 3 b+: -** We have used this board to implement voice assistance so, this board have a Quad Core 1.2GHz and Broadcom BCM2837 with 64bit CPU. it is also provided with 1GB RAM which is sufficient and Bluetooth Low Energy (BLE) which is used for portable audio in the process. It also has a camera port in it. This helps in deploying the voice assistance.

☐   **Camera: -** we use this in our raspberry pi which helps in object detection which we have trained for few objects.

☐   **TowerPro MG995: -** we are using this servo motors because of its low cost and which provides 8.5 kgf.cm (4.8 V), 10 kgf.cm (6 V) .so this helps in moving.

B.   PROPROSED MERHODOLOGY

This project consists of 17 DOF (degree of freedom) motors and a computer processor in it. To control all the DOF motors we are using a Servo Motor Controller Board to control all the motions and parts of the humanoid robot. Now we install a camera to the processor and program it for surveillance through the internet. For the virtual voice assistant AI, we install a computer processor with an operating system in it and updating the firmware. By taking the internet database and programing it to a virtual voice assistance AI. Now by connecting it with each other combining it with the module's and placing it with the humanoid robot. Now we expect to have the humanoid robot to perform the action as per the given command, to interact with the questions we ask and can surveillance the area around it. This robot is designed to be a personal assistance for a person.
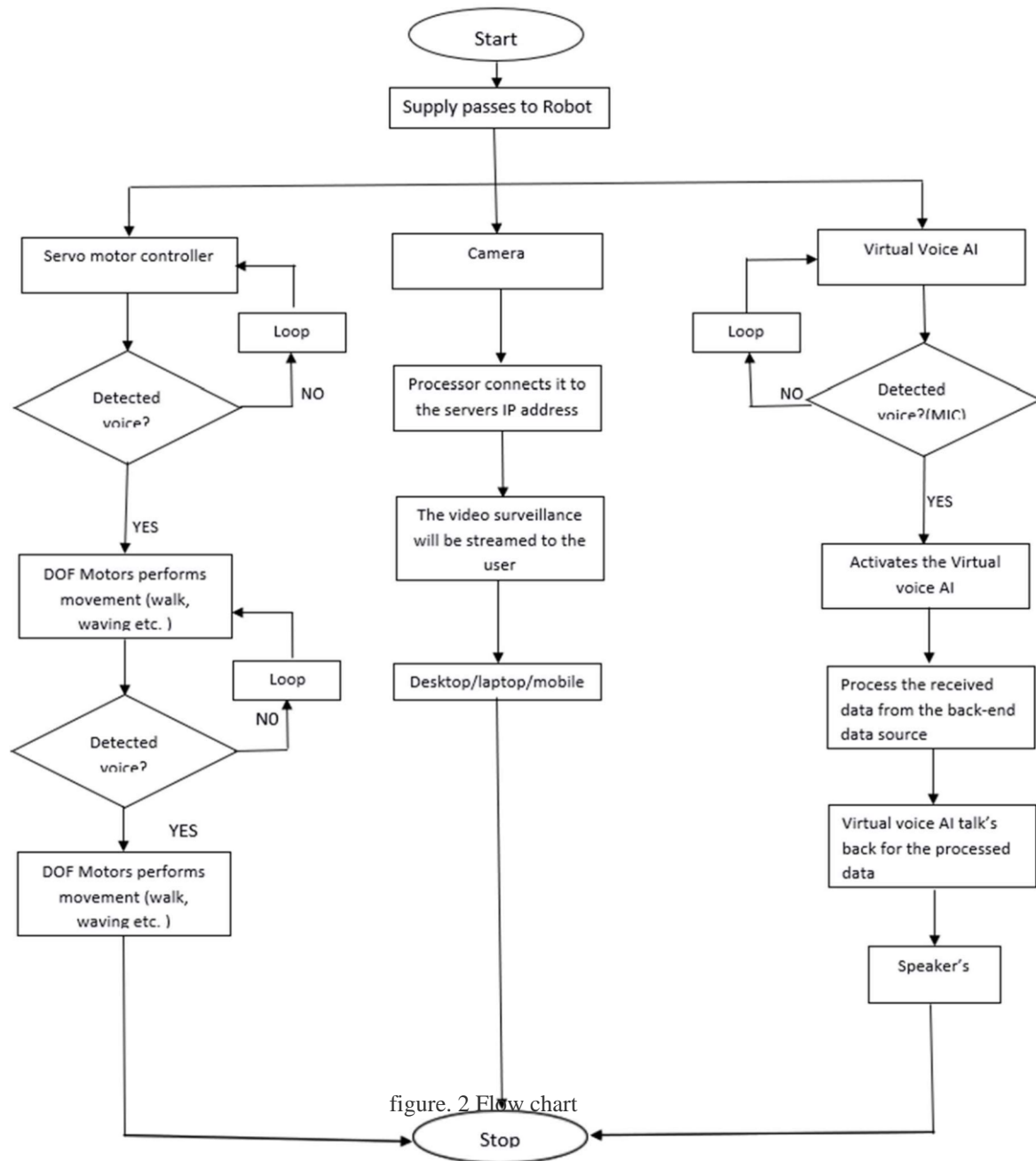
C.   Block Diagram

The diagram explains about the modules used, inputs and output source.

figure. 1 Proposed Block Diagram
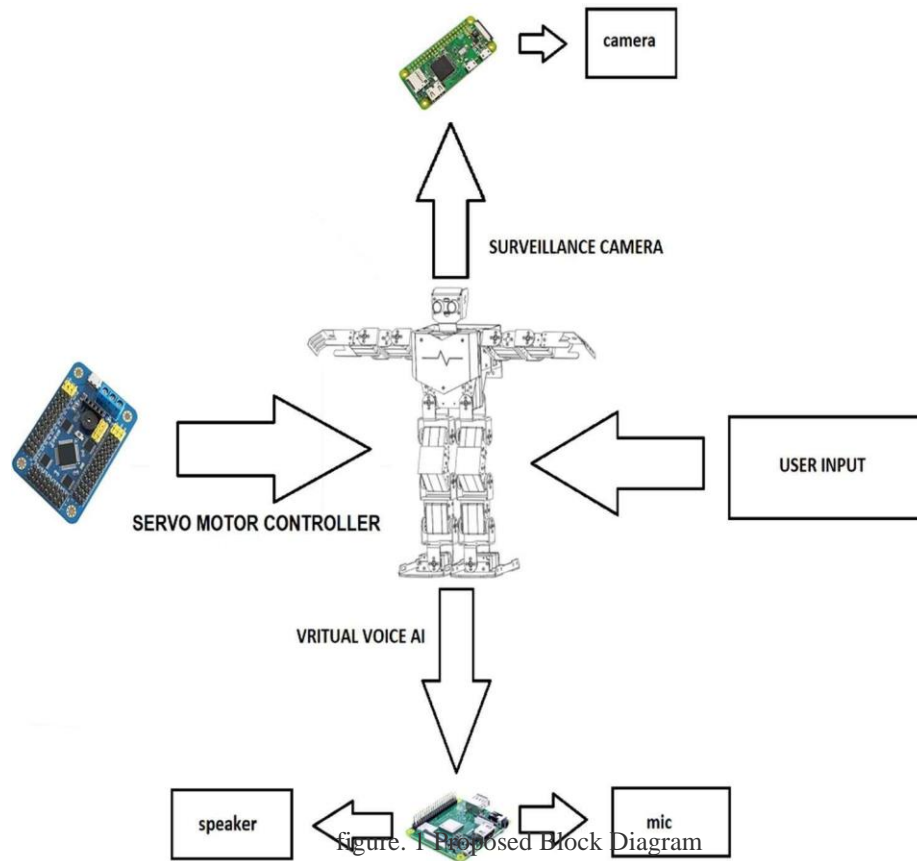
A.   Flow Chart

In detail flow of the complete project implementation is given in the below figure 2.

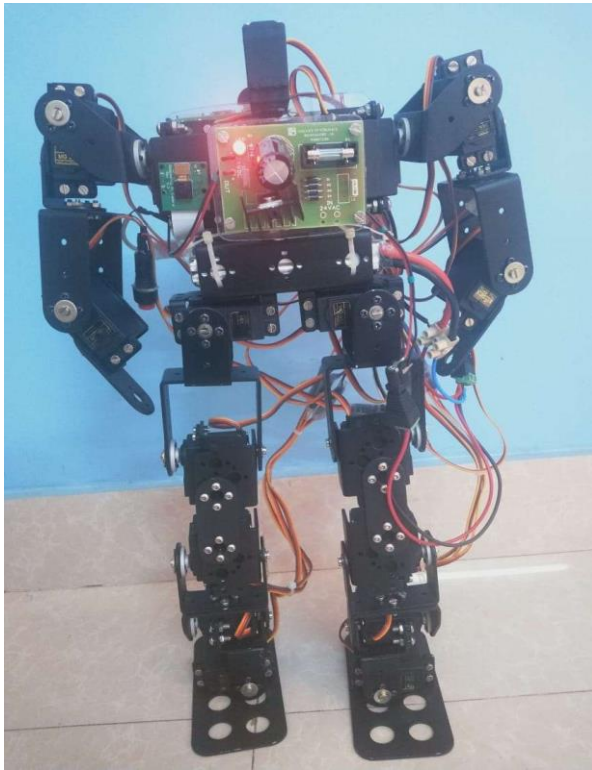figure. 2 Flow chart

6. Result

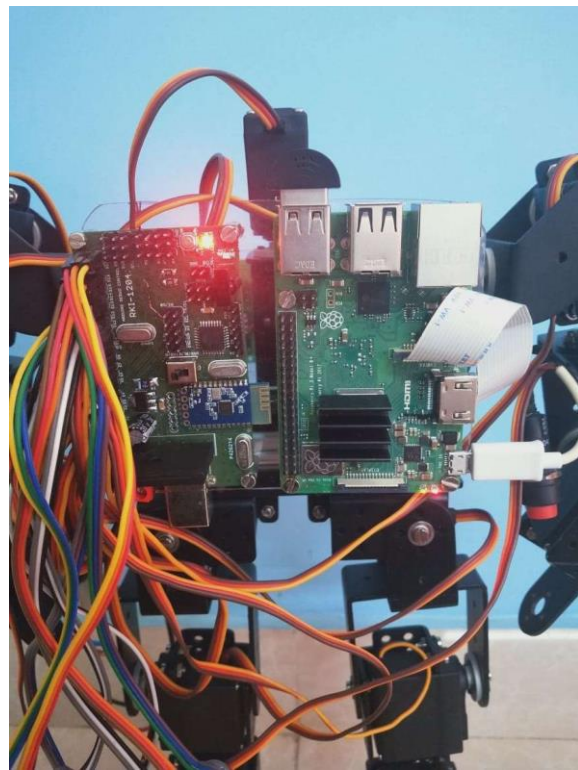figure. Prototype front   figure. 4 Prototype back

The figure 3 shows us the result of the robot doing some actions with the help of microcontroller board in figure 4 and the virtual voice assistance is uploaded in the CPU which results in user calling a wake word to ask the question and its answered according to the program.
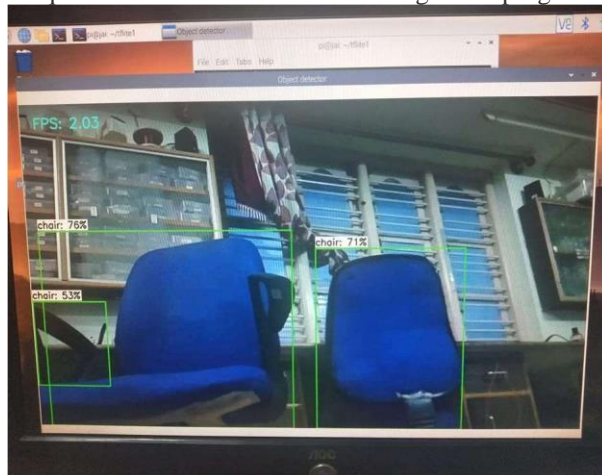

figure. 5a Object detection   figure. 5b Object detection

The figure 5 and figure 6 shows the object detection through camera which is connected to the CPU where both object detection and voice assistance works parallelly. Camera identifies only the trained objects other objects which aren't trained code wouldn't identifythem.

7. Conclusion

• The expected result is that, the humanoid robot should perform the action as per the given command, to answer the questions we ask and can surveillance the area around it and the expected personalized humanoid robot is made. Humanoid robots can perform similar as human does, so long as they have the proper software, although they look realistic, they have no cognition or physical autonomy, they can be used for future dangerous & distant space exploration missions, they can serve as the companions & assistants for the humans in day-to-day life.

• The growth of Humanoid robots and AI has been exponential in the last decade. The advancements in this field have made our lives easier. This system is just a minor addition to this vast field of automation. The system is still in its in early stages. With proper improvements this system will be boon to millions.

8. Acknowledgements

• Figure 3 is the full product model.
• This model is working perfectly fine and available for personalized commercial use.
• As described above this project can be modified according to the user's requirement since all the software are open source so any user can modify it.

A.   future scope

<u>Limitation</u>

After multiple trials and analysis, we observed these limitations:
☐   The robot tip to fall front or back due to the motors weight and other clamps weight.
☐   This entire system is heavy and open source.

B.   future works

many different Companies like Softbank Robotics have created human-looking robots which is used for medical assistants and teaching aids. At present, humanoid robots are becoming experts in the medical industry, especially as companion robots. nevertheless, large industry companies are currently using humanoid robots to fill all engineering tasks.

References

1. Vipul Mehta, Javed Khan, Reshma Kalane "Robot Controlled Car Using Wi-Fi Module", Vol-3, Issue- 2, 2017
2. Atul Shrivastav, Nidhi Rathod, Tanvi Patil, Prof. M. R. Gorbal "Voice Controlled Surveillance Car" , volume: 07 Issue: 05 | May 2020
3. Qiang Huang, Member, IEEE, Kazuhito Yokoi, Member, IEEE, Shuuji Kajita, Member, IEEE, Kenji Kaneko, Hirohiko Arai, Member, IEEE, Noriho Koyachi, Member, IEEE, and Kazuo Tanie, Member, IEEE " Planning Walking Patterns for a Biped Robot" , IEEE TRANSACTIONS ON ROBOTICS AND AUTOMATION, VOL. 17, NO. 3, JUNE 2001
4. Mr. Vedant Chikhale, Mr. Raviraj Gharat, Ms. Shamika Gogate, Mr. Roshan Amireddy "Voice Controlled Robotic System using Arduino Microcontroller" , ISSN: 2454-4116, Volume-3, Issue-4, April 2017 Pages 92-94

5. J. Yamaguchi, A. Takanishi, I. Kato "Development of a biped walking robot compensating for threeaxis moment by trunk motion" Paper presented at the IEEE/RSJ international conference on intelligent robots and systems, Yokohama, Japan, 26-30 July 1993

6. K. Nagasaka, H. Inoue, M. Inaba "Dynamic walking pattern generation for a humanoid robot based on optimal gradient method" Paper presented at the IEEE international conference on systems, man, and cybernetics, 12-15 Oct. 1999

7. Sung-Won Jung , Ki-Won Sung , Moon-Youl Park , Eon-Uck Kang ,Won-Jun Hwang , Jong-Dae Won, Woo-Song Lee , Sung-Hyun Han Robotics "A study on stable walking control of biped robot on uneven terrain" IEEE ISR 2013.

8. Thomas R. Kurfess, "Robotics and Automation Handbook", 2004, Taylor & Francis Group, CRC Press, UK.

9. AN EXPERIMENTAL STUDY ON SELF HAELING CONCRETE AND EFFECT OF DIFFERENT BACTERIA ON THE STRENGTH, C S Manohar, J Vijay Chandra, International Journal Of Advance Research In Science And Engineering http://www.ijarse.com IJARSE, Volume No. 10, Issue No. 02, February 2021 ISSN-2319-8354(E).

10. Jha A, Singh A, Turna R, Chauhan S. "War Field Spying Robot with Night Vision Camera " Journal of Network Communication and Emerging Technology. 2015 May.

11. Naik YM, Deshpande CM, Shah RR, Kulkarni "RR.ANDROID CONTROLLED SPY-ROBOT" International Journal of Software and Web Sciences.

12. Yeole AR, Bramhankar SM, Wani MD, Mahajan MP "Smart phone controlled robot using ATMEGA328 microcontroller" Int. J. Innovative Res. Comput. Commun.Eng. 2015 Jan.

13. Lim H, Kaneshima Y, Takanishi "Online Walking Pattern Generation for Biped Humanoid with Trunk" In: Proc. IEEE Int. Conference on Robotics and Automation, Washington, DC., USA, May 2002.