Smart personal assistance and communication robot

VEENA P.N
Lecturer, Department of Electronics and Communication Engineering,
Government Polytechnic, Soraba.

LOHIT BANAKAR
Lecturer, Department of Electronics and Communication Engineering,
Government Women's Polytechnic, Shiralkoppa.

Abstract
Communication robot: It usually refers to a robot whose shape is close to that of humans. Its definition varies according to researchers, ranging from a dual-arm upper-body robot to a biped walker. In this chapter, an actuated human-size biped robot with arms and a head, designed to achieve some human capability is considered as a humanoid robot. Robotics is an emerging field of science during which robots are fabricated and programmed to try to varied tasks. In those robots, Humanoid robots are the well sophisticated robots that perform tasks almost like humans and interact with them. The critical introduces the event of Humanoid robots is to style it effectively. The project deals with designing the humanoid robot then fabricating it using rubbish parts. The planning replicates that of the citizenry. I decided to form this project because it was very challenging. A user can control the robot using an Android interface and every part of the robot is often moved independently around during a remote location. Providing motor position change during a system and automatic controlling of the info from the measuring system reduces process time and reduce the loss of labour. The software helps to develop the complex sequences in real-time on the hardware . It also generates Arduino based code for the developed sequence which may be deployed on the controller board there by making the robot autonomous. Further development within the Humanoid robot is often carried on by attaching various sensors to the Humanoid robot to extend its degree of automaticity. Further one can integrate the artificially intelligent brain so that it can make decisions on its own.

Keywords: Robot, Arduino Uno, Raspberry Pi, Bluetooth, motor, sensors.

1. Introduction

Arduino Uno board for interfacing microcontroller with Bluetooth module and Servo Motors. You need to develop the Android app Arduino Bluetooth which is works for Arduino Bluetooth. The digital and analog input/output pins equipped in this Arduino board can be interfaced to various expansion boards and other circuits. Serial communication interface is a feature in this board, including USB which will be used to load the programs from computer. Now connect the HC-05 Bluetooth module is a generally used to provide a common platform for connecting Smart Phone with Microcontroller. Communication between Smart phone and Bluetooth will be Serial. Generally the Arduino board is not capable of providing required amount of current for running the motors. So we use a device called Motor Driver which will provide sufficient current for driving the motors i.e., used to implement base of a robot. To the smart phone in which you had installed the app. You will program the microcontroller in such a way that say whenever you press forward direction

key in the Arduino Bluetooth app, the microcontroller will make your robot to walk in forward direction. Similarly we will program the microcontroller for the commands backward, left and right. Based on the direction Key you press, your microcontroller will make your robot to walk into that particular direction.
The robot is designed to move its arms and legs to simulate human movements, making it a humanoid robot. It uses Bluetooth receive commands to find its path and adjust its movements accordingly. The project involves programming the Arduino using the C++ programming language to control the robot's movements and detect Arduino receiver Bluetooth. The project also involves building the physical components of the robot, such as the frame, arms, legs, and sensors. The frame is built using lightweight materials, such as aluminum or plastic, to ensure that the robot is not too heavy to move. Overall, the humanoid robot using Arduino and Bluetooth project is a challenging and exciting project that involves both hardware and software development. It requires skills in programming, electronics, and mechanical engineering. The roots of foundation of robotics belong back in 1950s; more than six decades has passed since then, and robotic evolution has been running unparalleled. Today we can feel the presence of robots everywhere and in every field whether it is medical, military, education or governance and so on. Robotics has become a helping hand for humans, and they are making our life easier, better and faster. Robotics is a boon for human kind, because robotic machines are giving alternatives, which is providing a great support to physically impaired people. In this model, we will use an android app to pass on the voice commands to the Arduino through Bluetooth communication using Bluetooth module.
The humanoid robot project aims to amuse people by carrying out behaviors and duties that will draw viewers' attention to itself. All of these motors have been controlled with a servo controller. The Bluetooth wireless board transmits signals to the mobile device, which allows you to use an Android mobile application to see exactly what the robot can see. Within this software, there is a microphone button that you only need to press in order to command the robot.

2. Objectives

Even though there are many varieties of humanoid robots built around the globe, there is always a way through which better design and fabrication of the humanoid robots can be made possible. Thereby, there is a scope for us to increase the efficiency to approach, a little bit towards the perfect mechanical design of a humanoid robot. Moreover, designing a humanoid is the crucial step in the development of humanoid robotics. The main problem in the humanoid robots we observed is the improper mechanical design or less priority for mechanical hardware to control, led to many aspects like the instabilities, demand for rigorous dynamic calculations for control strategies development, the need for more reduction ratios, energy inefficiency, etc. Of course, this is not in the case of all the humanoid robots built so far. Considering the majority of them into account we want to rectify the basic problem in all the humanoid robots. Even though there are many varied varieties of humanoid robots built around the globe, there is always a way through which better design and fabrication of the humanoid robots can be made possible. Thereby, there is a scope for us to increase the efficiency to approach, a little bit towards the perfect mechanical design of a humanoid robot. The main problem in the humanoid robots we observed is the improper mechanical design or less priority for mechanical hardware to control, led to many aspects like the instabilities, demand for rigorous dynamic calculations for control strategies development, need of more reduction ratios, energy inefficiency, etc. Of course, this is not in the case of all the humanoid robots built so far. Considering the majority of them into account we want to rectify the basic problem in all the humanoid robots
By combining mechanical, electrical, and computer engineering, robotics has made it possible to create intelligent machines that can perform a wide range of tasks, from simple repetitive actions to complex decision-making processes. Robots are increasingly being used in industries such as automotive manufacturing, healthcare, agriculture, and logistics. They are also being used in hazardous environments

like nuclear power plants and offshore oil rigs, where they can perform tasks that are too dangerous for humans.

In addition to industrial applications, robotics is also being used for entertainment, education, and research purposes. With the development of bio-inspired robotics, robots are becoming more and more human-like in terms of appearance, behavior, and cognition. So, if you are interested in the field of robotics, there has never been a better time to get involved. With new advances happening every day, there are countless opportunities to create innovative and exciting new technologies that can change the world.

3. Methodology

Install any Bluetooth Application for Arduino. Pair HC-05 Bluetooth modules with the mobile Default password is “1234” or “0000”.Click on the “MIC” icon and speak/instruct the robot .On speaking our speech gets recognized and converted into text. That text is transferred using Bluetooth .The Bluetooth Module receives the string, decodes it and compares it with the Instructions that are described in the program and moves the robot in direction given by the user using mobile application.

Installed frameworks are intended to do some particular errand, as opposed to be a universally useful PC for numerous assignments. Some likewise have time execution imperatives that must be met, for reasons, for example, security and convenience; others may have low or no exhibition necessities, enabling the framework equipment to be improved to lessen costs. Installed frameworks are not generally independent gadgets. Many inserted frameworks comprise of little, automated parts inside a bigger gadget that fills a progressively broad need. For instance, the Gibson Robot Guitar includes an inserted framework for tuning the strings, yet the general reason for the Robot Guitar is, obviously, to play music. So also, an implanted framework in a car gives a particular capacity as a subsystem of the vehicle itself. The program guidelines composed for inserted frameworks are alluded to as firmware, and are put away in read-just memory or Flash memory chips. They keep running with constrained PC equipment assets: little memory, little or non-existent console or screen.

4. Scope

The aim is to design a prototype that establishes wireless remote control over a network of home appliances. The application is designed to run on android device providing features like, switch mode control, voice command control and a provision to view the status of the devices on the application itself. Considering its wide range of application, following are the scope of this prototype.

The system can be implemented in homes, small offices and malls as well, being in-charge of control of the electrical appliances.

For remote access of appliances in internet or intranet. The appliances in the above mentioned environment can be controlled in intra-network or can be accessed via internet.

The development of technology friendly environment. The system incorporates the use of technology and making HAS. By the use of day to day gadgets we can utilize them for a different perspective.

5. Block diagram of proposed system

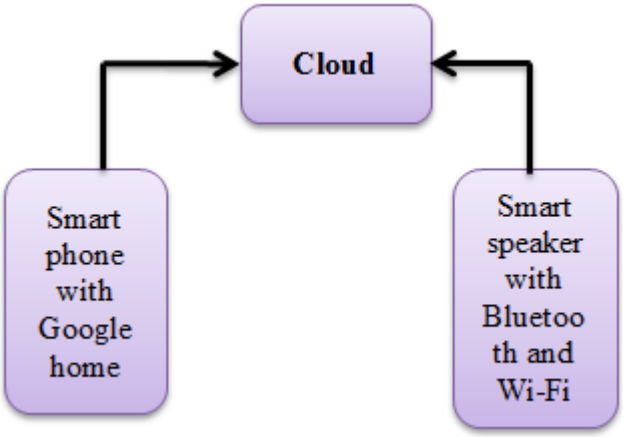
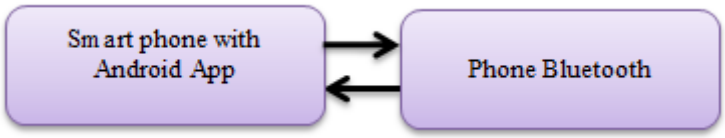
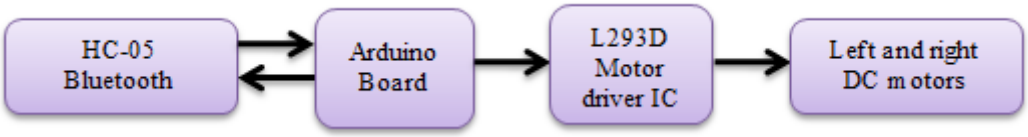


Figure 1. Block diagram of smart assistant

A. Transmitter section



A. Receiver section



ARDUINO UNO: The Arduino Uno is an open-source microcontroller board dependent on the Microchip ATmega328P microcontroller and created by Arduino.cc. It is programmable with the Arduino IDE through a kind B USB cable. It can be controlled by the USB link or by an outside 9-volt battery, however it acknowledges voltages between 7 and 20 volts. Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

Some of the key features of Arduino Uno are:

Microcontroller: The Arduino Uno is powered by the ATmega328P microcontroller, which is capable of running at speeds of up to 16 MHz.

Input/Output Pins: The board has 14 digital input/output pins, of which 6 can be used as PWM (Pulse Width Modulation) outputs, and 6 analog inputs.

USB Interface: The Uno has a USB interface that can be used to connect it to a computer, allowing for easy programming and serial communication.

Power Supply: The board can be powered by either a USB cable or an external power supply (7-20V DC).
Reset Button: The Uno has a reset button that can be used to restart the program running on the microcontroller.
LED indicators: The board has multiple LED indicators, including power, TX/RX, and pin no 13.
Compatibility: The Arduino Uno is compatible with a wide range of shields, which are add-on boards that can be connected to the board to add additional features and capabilities.
Overall, the Arduino Uno is a powerful and versatile microcontroller board that offers a wide range of features and capabilities for both beginners and experienced users.

Figure 2. Arduino Uno model

RASPBERRY PI: Raspberry Pi is a series of small, low-cost, single-board computers that were first introduced in 2012 by the Raspberry Pi Foundation. These computers are designed to be affordable and accessible, with the goal of promoting computer science education and making it easier for people to learn to code and create technology.

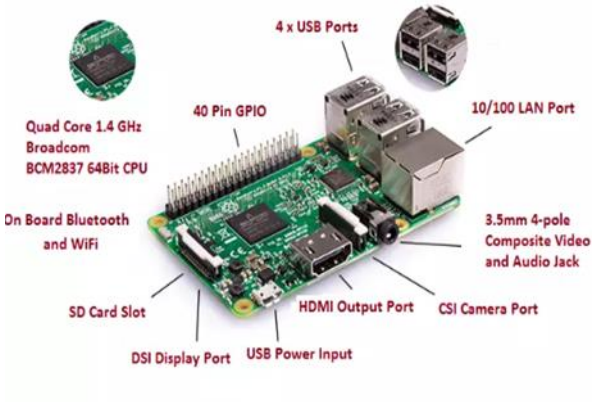


Figure 3. Raspberry pi model

The Raspberry Pi boards are about the size of a credit card, and they run on ARM-based processors. They can be used to run a variety of operating systems, including Linux, Windows 10 IoT, and various versions of the Raspberry Pi OS.
One of the key features of the Raspberry Pi is its GPIO (General Purpose Input/Output) pins, which allow users to connect the board to a variety of sensors, motors, and other devices for use in a wide range of projects. These pins can be controlled using programming languages such as Python and C++. The Raspberry Pi has been used in a variety of applications, including home automation, robotics, media centers, and even as the brains of DIY arcade machines. It has also been used in education to teach programming and computer science to students of all ages.
Overall, the Raspberry Pi is a versatile and affordable computer that has become popular among hobbyists, educators, and professionals alike. Its low cost and small size make it accessible to a wide range of users,

while its powerful capabilities allow for a variety of exciting projects and applications.

BLUETOOTH MODULE: This project work consists of two main modules: the android mobile phone and the Arduino BT board (Bluetooth module). The android mobile phone consists of several Bluetooth apps which enables the user to access the control commands for the robot. In this project we are targeting Android platform since it has huge market and open source. Android is a software stack for

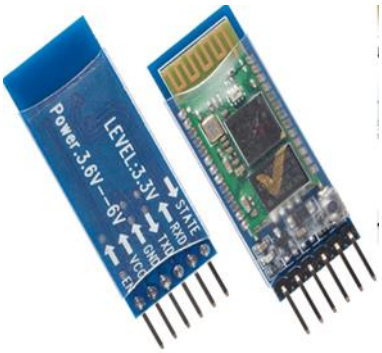


Figure 4. HC-05 model

mobile devices that includes an operating system, middleware and key applications. The Android OS is based on Linux. Android Applications are made in a Javalike language running on a virtual machine called 'Dalvik' created by Google. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Accessory mode is a feature of Android OS since version 2.3.4 Gingerbread and 3.1 Honeycomb and above. A project can also be named as smart phone Android operated robot. Here is a simple control technique for your robot/robo car using Bluetooth module and microcontroller with your android Smartphone device. The controlling devices of the whole system are a Bluetooth module, DC motors that are interfaced to the microcontroller. The data received by the Bluetooth module from android smart phone is fed as input to the controller. The controller acts accordingly on the DC motor of the robot. The robot in the project can be made to move in all the four directions using the android phone. In achieving the task the controller is loaded with program written using Embedded 'C' or assembly Language. The Bluetooth module picks up the packets sent from the cell phone. Subsequently, these packets containing the appliance status commands are pipelined through the microcontroller and the designed analogue circuitry according to the definition of each output. The DC motors are connected to the digital output ports of the controller via H - Bridge to provide sufficiently high currents and voltage compatibility. For demo purpose two DC motors are used fo the robot movement in all the directions.

In this project, we will learn how to make Voice Controlled Robot Car Using Arduino. The robotic car can be controlled wirelessly via voice commands directly from the user. The robot can move forward, backward, left, and right and can also be stopped. The Arduino voice-controlled robot car is interfaced with a Bluetooth module HC-05 or HC-06. We can give specific voice commands to the robot through an Android app installed on the phone. At the receiving side, a Bluetooth transceiver module receives the commands and forwards them to the Arduino and thus the robotic car is controlled.

DC GEAR MOTOR: In this project work two DC motors are used to operate the robot. By giving the command signals from the mobile through the bluetooth app i.e., forward, backward, right and left directions, the robot will be moved. DC motors are widely used, inexpensive, small and poweful for their size. They are most easy to control. One DC motor requires only two singals for its operation. They are non-

polarized, means you can reverse the voltage without any damage to motor. DC motors have +ve and –ve leads. Connecting them to a DC voltage source moves motor in one direction (clockwise) and by reversing the polarity, the DC motor will move in opposite direction (counter clockwise). The maximum speed of DC motor is specified in rpm (rotation per minute). It has two rpms: no load and loaded. The rpm is reduces when moving a load or decreases when load increases. Other specifications of DC motors are voltage and current ratings.

L293D MOTOR DRIVER: L293d IC is known as a motor driver. It is a low voltage operating device like other ICs. The Other ICs could have the same functions like L293d but they cannot provide the high voltage to the motor. L293d provides the continuous bidirectional Direct Current to the Motor. The Polarity of current can change at any time without affecting the whole IC or any other device in the circuit. L293d has an internal H-bridge installed for two motors. H-Bridge is an electrical circuit that enables the load in a bidirectional way. L293d bridge is controlled by external low voltage signals. It may be small in size, but its power output capacity is higher than our expectation. It could control any DC motor speed and direction with a voltage range of 4.5 – 36 Volts. Its diodes also save the controlling device and IC from back EMF. To control the max 600mA amount of current an internal "Darlington transistor sink" installed in it, which could be used to control a large amount of current by providing a small amount of current. It has also internal "pseudo-Darlington source" which amplifies the input signal to control the high voltage DC motor without any interception.

DC motor driver: We can only have full control over a DC motor if we can control its speed and spinning direction. This is possible by combining these two techniques. PWM – to control speed, H-Bridge – to control the spinning direction

- The spinning direction of a DC motor can be controlled by changing the polarity of its input voltage. A widely used technique to accomplish this is to use an H-bridge.
- An H-bridge circuit is made up of four switches arranged in a H shape, with the motor in the center.
- Closing two specific switches at the same time reverses the polarity of the voltage applied to the motor. This causes a change in the spinning direction of the motor.
- The L298N chip contains two standard H-bridges capable of driving a pair of DC motors, making it ideal for building a two-wheeled robotic platform.
- The L298N motor driver has a supply range of 5V to 35V and is capable of 2A continuous current per channel, so it works very well with most of our DC motors.

12V BATTERY: The main power source to drive the entire Vehicle including DC motors is designed to operate at 12V DC, a heavy duty rechargeable battery of 12V and 3 AH (Ampere Hour) is used as a back-up source, which drives entire. The DC motors used in this project work consumes 150 milli amps each, and other circuitry including electronic circuit & microcontroller will consume around 200 milli amps, always two motors remains in energized condition, there by total consumption of the system is 500 milliamps approximately. Since huge rating rechargeable battery is used whereas the machine consumes less power, the battery can take care of the machine for long time. The battery back-up time = battery rating / consumed energy = 3 / 0.5 = 6. Means the battery can with stand up to 6 hours (approximately) continuously. During the idle condition, the battery is charged with 0.5A current. At this rate, the battery charging time = battery rating / charging current = 3 AH / 0.5 A = 6 hours. To define how long the vehicle has to run, it is purely depends up on the capacity of the battery. The DC motors selected to drive the mechanical transmission section operates at 12V DC, hence output of the battery can be used to drive these motors directly. The control circuit designed with microcontroller required a stable supply of + 5V DC, here using a positive voltage regulator of LM7805, constant supply of +5 V is generated, though the battery voltage varies +/_ 30

%, the output of the regulator remains constant..

ULTRASONIC SENSOR: Ultrasonic Sensors also known as transceivers when they both send and receive work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material. For example foam on the surface of a fluid in a tank could distort a reading.

SPEAKER: Speakers are used to connect to a computer to generate sound, which are one of the most common output devices. Some speakers are designed to connect with any kind of sound system, while some can be hooked up only with computers. With the computer speaker, the computer's sound card creates a signal that is used to produce sound. The primary objective of speakers is to offer audio output for the listener. The electromagnetic waves are converted into sound waves through the speaker as they are transducers. The devices, like an audio receiver or computer, give audio input to speakers, which may be in the form of analog or digital. The function of the analog speaker is simply to magnify the analog electromagnetic waves into sound waves.

MIC: It captures audio by converting sound waves into an electrical signal, which may be a digital or analog signal. This process can be implemented by a computer or other digital audio devices.

6. Arduino IDE software

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and

Figure 5. Arduino IDE

communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and

exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. Installation The steps to get started with Arduino UNO are listed below: o Install the drivers of the board. As soon we connect the board to the computer, Windows from XP to 10 will automatically install the board drivers. But, if you have expanded or downloaded the zip package, follow the below steps:

1. Click on Start -> Control Panel -> System and Security.
2. Click on System -> Device Manager -> Ports (COM &LPT) -> Arduino UNO (COMxx). If the COM &LPT is absent, look Other Devices -> Unknown Device.
3. Right-click to Arduino UNO (COmxx) -> Update Driver Software -> Browse my computer for driver software.
4. Select the file "inf" to navigate else, select "ArduinoUNO.inf" Installation Finished.

7. Results

The results and discussion sections of a project involving a humanoid robot using Arduino and Raspberry Pi would aim to provide a comprehensive overview of the project's methodology, findings, and implications, and to situate the project within the broader context of robotics research. There are several existing AI voice assistant robots on the market, including Amazon's Echo devices with Alexa, Google Home devices with Google Assistant, and Apple's Home Pod with Siri. These devices are designed to respond to voice commands and perform tasks such as playing music, setting reminders, and answering questions. Additionally, there are a number of other home automation devices that integrate with these voice assistants, such as smart thermostats and smart lights. There are several limitations of voice assistant robots, such as: 1. Limited understanding: Voice assistant robots may have trouble understanding certain accents, dialects or specific language nuances, which can make them less effective for certain users. 2. Limited knowledge: Voice assistant robots may not have access to all the information that a human would, which can limit their ability to provide accurate answers to certain questions. 3. Privacy concerns: There are concerns about the security and privacy of personal data that is collected by voice assistant robots, as well as the potential for misuse of that data. 4. Limited tasks: Voice assistant robots may not be able to complete all the tasks a human can, such as cooking, cleaning, or other physical tasks. 5. Internet connectivity: Voice assistant robots require internet connectivity to function which can be a limitation if the internet connection is poor or not available. 6. Dependency: Overreliance on voice assistants may cause a decrease in the ability to remember things, the ability to focus, or the ability to perform simple tasks. 7. Cost: Some of the advanced voice assistant robots can be expensive, which may make them less accessible for some consumers.

8. Conclusion

Humanoid robots are a new and promising application area for robotics. The Intelligent humanoid robots are considered one of the core technologies. All current humanoids are capable of stable dynamic walking but few are able to walk or even run-at speeds comparable to humans. Moreover, flexible motion generation in realistic environments still remains challenging. Aiming at fast and autonomous bipedal locomotion, the development of the humanoid robots possesses several features, but their construction and control are not without challenges. There are limitations to their capabilities, including the following key features:

Bipedal Locomotion: Bipedal locomotion is a vital feature of humanoid robots. It is challenging for robots to learn how to coordinate their lower body movements, just as it is for humans. While human hands have 30 degrees of freedom, replicating this level of dexterity in robots is difficult.

Balance and Stability: Humanoid robots must be designed to maintain balance and stability while

performing tasks. This requires a combination of sensors, software, and mechanical engineering to ensure that the robot does not fall or lose its balance. Sensing and Perception: Humanoid robots must have the ability to perceive and understand their environment to perform tasks successfully. This requires the integration of various sensors, such as cameras, microphones, and tactile sensors, to allow the robot to sense its surroundings. Manipulation and Control: Humanoid robots must be capable of manipulating objects with a high degree of precision and accuracy. This requires sophisticated control algorithms and mechanical engineering that allow the robot to manipulate objects in a way that is similar to human hands. In summary, while humanoid robots possess several features, their capabilities are limited, and their construction and control require careful consideration of these features.

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