Arduino Based Snake Robot

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Abstract: Snake robot may be the most important aspect for the present/future timeline, being help for the society in rescue means. Considering the harms of being falling into any drainage pipe or being trapped in such pipe, the snake robot can come handy in such safety rescue missions.

The snake robot can become the part of military, fire brigade or can play the important part in medical section as well.

Snake robotics has always been a subject of constant fascination and experimentation for researchers. Research in the field of snake robots began as early as 1972 with Shigeo Hirose introducing the world's first snake robot – 'ACM' (Active cord mechanism).

Keywords: Arduino NANO, DC Motor, Bluetooth Module(HC-05), ESP32-CAM.

INTRODUCTION

Robotic Snake mechanisms are designed to move like biological snakes. The main advantage of such mechanisms is their long and exile body, which enables them to move and operate in challenging environments where human presence is unwanted or impossible.

Snake robot suit a wide range of applications. The snake robot could crawl through destroyed buildings looking for people. It could also carry small amounts of food or water to people. Snake robots represent a fascinating and innovative approach to robotics, drawing inspiration from the serpentine motion of snakes to navigate and traverse various environments. These robots are designed to mimic the slithering movements of snakes, enabling them to navigate through confined spaces, rough terrains, and complex environments with remarkable agility and flexibility. The unique locomotion mechanism of snake robots allows them to overcome challenges that conventional wheeled or legged robots may encounter.

Snake robots employ a serpenoid locomotion mechanism, which involves a series of undulating motions along the body of the robot. This allows them to move smoothly through tight spaces and navigate complex terrains with relative ease.

Many snake robots are designed with modular segments, allowing for flexibility and adaptability. The modularity enables the robot to adjust its shape and size according to the specific requirements of the task or environment. Snake robots are often equipped with a variety of sensors, including cameras, infrared sensors, and other environmental sensors. These sensors provide valuable data to the robot, enhancing its perception and decision-making capabilities.

COMPONENTS USED
ARDUINO NANO:

The arduino nano it is an open source microcontroller-based electronics device with total number of 16 digital pins that can be used for various purposes. The ardiuno nano uses a variant of the C++ programming language.

The Arduino Nano is the microcontroller is designed to operate on a voltage of 7 to 12Volts.

It has on board voltage regulator that allows it to powered by a 9V or 12V power source, Such as a battery or a wall adapter. There are 16 sensor inputs to the one Nano input used in the Arduino Nano.

You can power the Arduino Nano with the $3 \times AA$ alkaline cells which is connected to 5V pin. The 4.5V can also be suitable for the powering a servo motor and AA cell will last longer then the 9V PP3 style battery.

The Arduino nano can be used from minor to massive industrial-scale projects and can be also used for prototyping and developing new applications. The Arduino Uno is programmed using the Arduino Software (IDE), our Integrated Development Environment common to all our boards and running both online and offline.

Fig1: Arduino NANO

DC MOTOR:

A DC motor in a snake robot is typically used to actuate the joints or segments of the robot's body. These motors provide precise control over the movement of each segment, allowing the snake robot to navigate through various terrains and perform tasks such as inspection, search and rescue, or environmental monitoring. DC motors are chosen for their compact size, efficiency, and ability to provide the required torque for locomotion.

Using a DC motor in a snake robot offers precise control and efficient movement. They can be coupled with encoders for feedback control, enhancing the robot's accuracy and stability during operation.

Fig2: DC Motor

Bluetooth module (HC-05):
Type: Bluetooth to UART Transceiver Module
Range: Up to 10 m in open space
Data Rate: Adjustable, up to 115.2 kbps
Usage: Suitable for projects requiring longer-range communication. It operates in the 433 MHz frequency band.

In this project, we will learn about HC-05 Bluetooth Module, how to interface this Bluetooth Module with Arduino and how the HC-05 Bluetooth Module can be used for controlling the Arduino Board over Wireless Communication (Bluetooth). Bluetooth Communication is a 2.4GHz frequency based RF Communication with a range of approximately 10 meters

Fig3: Bluetooth Module (HC-05)

MOTOR DRIVER IC L293D:
The L293D is a popular 16-pin Motor Driver IC. As the name suggests it is mainly used to drive motors. A single L293D IC is capable of running two DC motors at the same time; also, the direction of these two motors can be controlled independently. So if you have motors which has an operating voltage of less than 36V and operating current of less than 600mA, which are to be controlled by digital circuits like Op-Amp, 555 timers, digital gates, or even Micron rollers like Arduino, PIC, ARM, etc.
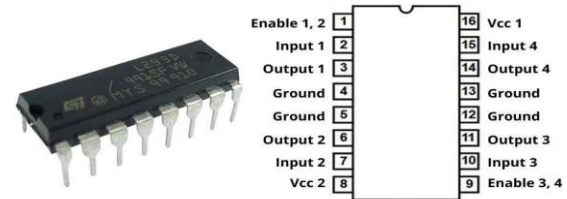

Fig4: Motor Driver IC L293D

REGULATOR IC 7805.
Voltage regulators are very common in electronic circuits. They provide a constant output voltage for a varied input voltage. In our case the 7805 IC is an iconic regulator IC that finds its application in most of the projects. The name 7805 signifies two meaning, "78" means that it is a positive voltage regulator and "05" means that it provides 5V as output. So our 7805 will provide a +5V output voltage.
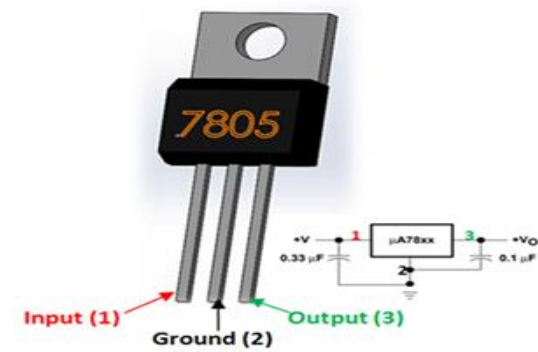

Fig5: Regulator IC 7805

The regulator IC 7805 consist of following 3 pins are:
Input: - Input voltage of (7V to 35V).
Ground: - Ground voltage of(0V).
Output:-Regulated output voltage of 5V (4.8V to 5.2V).

Wi-Fi camera:
Selecting a Wi-Fi camera for a snake robot involves considering factors such as size, weight, power consumption, resolution, and compatibility with your robot's control system. Here are a few Wi-Fi cameras commonly used in robotics, including snake robot.

ESP32-CAM:

Type: Wi-Fi Camera Module

Features: Integrated ESP32 microcontroller and OV26-40 camera sensor.

Compact size.

GPIO pins for external connections.

Supports microSD card for local storage.

Usage: Suitable for small robotic applications due to its compact size and integrated Wi-Fi capability.
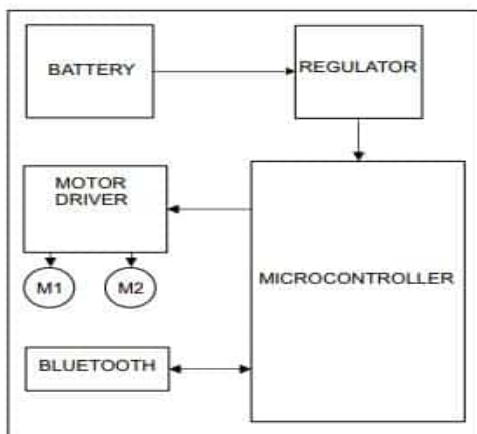

Fig6: ESP32-CAM
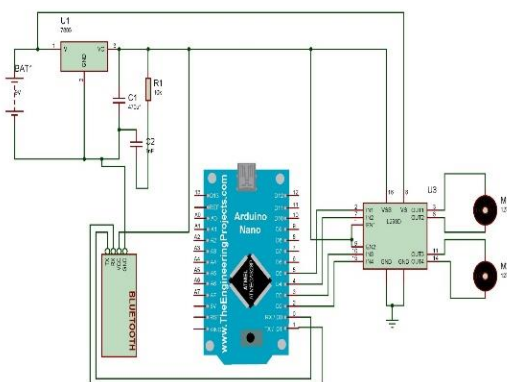
BLOCK DIAGRAM:

Fig7: Block Diagram

CIRCUIT DIAGRAM:

Fig8: Circuit Diagram

TESTING:

The thorough study of the model is going on, the prototype is under construction. Once the prototype is ready the testing of the prototype will be the next step, the working prototype will be sent to the place like deep pipe and on the ground surface to test the visual condition of the snake, the surveillance application will be tested thoroughly during the testing phase. The prototype is looking fine, once the complete assembly is completed the robot snake will be ready for full fledge testing.

Fig9: Final View Of Snake Robot

CONCLUSION

The snake robot is going the great and the most important factor in the areas of military, medical and other fields like fire fighting area. The snake robot is also doing great job in surveillance. The further development in the range and the structural adaptivity will definitely boost this project, also it can be used in the space programs for the research purpose after the development in the future.

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