International Journal on Applications in Mechanical and Production Engineering
Volume 1: Issue 8: August 2015, pp 3-6. www.aetsjournal.com ISSN (online): 2395-3500

Design And Development Of Snake Like Robot Based On Environmental Condition Using Arduino

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Abstract— Development of robotic vehicles becomes an important tool to explore the human's life. Here a remotely operated robotic snake is taken into consideration over Autonomous vehicle to overcome the unavoidable loss and it is highly maneuverable. This remote vehicle adopts the environmental approach in the design aspects. The appealing nature of biomimetic approach is helpful for the robotic model. The possible design shape is analyzed and embedded with electronic subsystem like sensors: ultrasonic sensors, the actuation is provided by the dc motor. The kinematics and controllability of the snake robot is compared with the biological snake and the escape responses is given to the robotic snake to avoid the obstacle. The brain of this snake robot is an Arduino Uno microcontroller in addition to that wireless camera is interfaced with the board, placed in the area of front head portion of the snake and the whole body is made up of aluminum which is suitable and reliable for the fabrication purpose. As the wireless camera is placed in front really useful for the surveillance and monitoring purpose. The oscillating body of the snake is imitate the anatomical form of snake.

Keywords: snake robot, environment, ultrasonic sensors, remotely operating robot

I. INTRODUCTION

In the advancing field of robotic is mainly focuses on the communication sector and the automation industry little has been done in the area of disasters to search and rescue operations, also in exploration of cluttered areas and industrial surveillance purpose.Some of new construction of snake robot have ropes around body it helps to shake and move the body [1]. The (2D) snake robot have the essential control principles of planar perspective [2].From the time of development of robotic snake mechanisms, the locomotion and obstacle avoidance have many limitations. The models of planar snake robot locomotion [3].which has less accuracy, but more suitable for model-based control design. Themovements of snake have dynamic characteristics that make it capable of crawling in different types of terrains. To design a snake robot which acts as a real Biological snake is very complex with some issues. We adopt the wheels as a physical parameters [4].This helps to constraint forces on passive wheels [4].To provide an essential issues of snake locomotion to the snake robot they are constructed by joining series of modules with perpendicular twist angle between adjacent modules[5,6]. Here the robotic snake should satisfy prototypical advantages that include good stability and effectiveness. This paper provides complete design of snake like robot based on the environmental condition. Basically the idea of this paper is to explain a method of using the modern technical advancement in emergency where Humans cannot work and the time frame to complete the job in small time period. The snake robot is made of a prototype which is made up of many modules connected one after the other and is

Capable of taking shapes in more than one plane. Description of on-line method and calculation are done [6].also the magnitude and direction of the snake robot velocity are proposed [6].

This paper tells thestability of biological snake locomotion inspiresto meet the ever demanding need of robotic snake mobility on irregular and challenging environments. The application of the snake robot based on the design, it may include several fields such as:

1) In search and rescue operations, where the snake robot can help humans in finding blockages and detecting live humans under debris as in case of earthquakes.

2) In thesurvey [5] we found out that the snake robot issuitable to explore unknown environment; this ispossible due to thesupport achieved from thedistribution of mass of the snake robot over a wide area.

II. SYSTEM ARCHITECTURE

The complete system architecture was designed as each module have the wheel. Front head portion of the module contain the local power control, meaning an on-off switch. Furthermore, it is desirable battery and controller at the following module.Finally, there should be one master control that starts the entire sequence. Sothat each of the modules actuation sequence is synchronized.

III. METHODOLOGY

A. Body Shape

The shape of the biological snake somewhat cylindrical and it degree of freedom is 360deg.Here the robotic snake body shape is same include with some wheels. By this shape of the body is highly addition points for its locomotion. Snake locomotion is achieved through this shape of the body

B. Block Diagram

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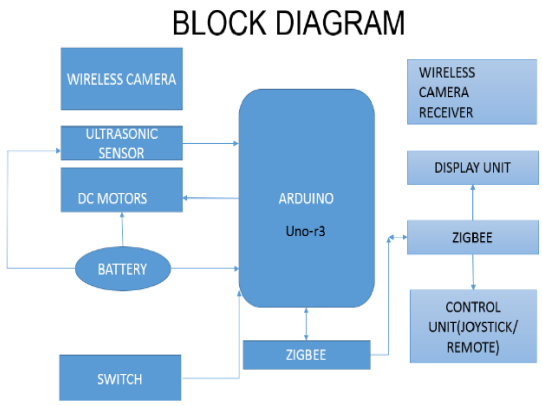

Fig 1 Block Diagram For Robotic Snake Control

As the block diagram shown in fig 1 gives that the arduino controller controls the entire system as the program coded. This type of snake robot requires the real time response and thus the zigbee module is used to send real time data from the sensors to the users.at the user end computer is used for the monitoring purpose. Theuser can control the snake using joystick on viewing from the computer. The controller here used is arduino Unoboard. Power supply are given through the battery connected to the snake robot. The controller have sensors and detect the human and also environment.

C. Kinematics And Design Model

The snake robot utilizes a advantages to have a kinematics and dynamics model.it has multi linked snake robot that's helps the robot to move in such a fasion.to compute the torque and entire motion relevant to the snake design[5].in order to design robotic snake they optimized certain performance characteristics.

IV. MECHANICAL OVERVIEW

The development of snake like robot is currently expensive to produce. As we require manual assembly of many small parts because of the many section and joints.it is important for search and rescue application, we would place the robot in location where it likely that destroyed. We have used an alloy of aluminum and steel called GI and is chosen because it was dumped by a local workshop house as their waste materials which helped in reducing waste and also helped us reduce the net cost[5].the snake robot here it consists of 6 modules and a head. The head module move side winding and horizontal motion. Each links have point joint and the snake robot design is shown in below in the construction area.

V. SNAKE HEAD AND BODY

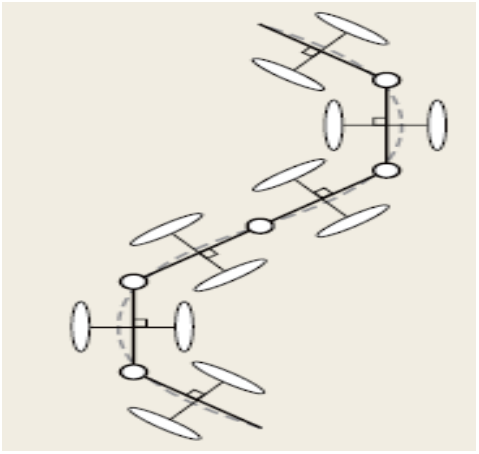

Fig 2 Robot Snake Design With Wheels

The snake robot design is shown in the figure 2. Here it is clearly can get the idea that each link carries the pair of wheels and the joints are point joints [7].the locomotion of the front wheels is connected with dc motor and by the motion the other wheels are works accordingly. We can connect the no of links as we needed. By the alternating signal to the motors we can attain the motion of snake to the snake like robot.

A. Constructing The Body Sections And The Head

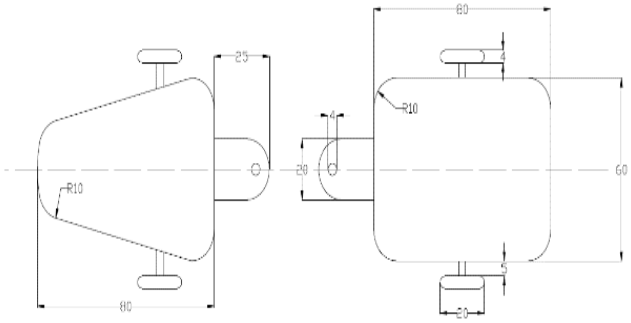

Fig 3.1 2d Model Of Snake With Dimensions

The dimensions of the snake and its body is shown in figure 3.1. The dimensions are based on the controller dimensions and all other electronics components. Thedimensions of the controller board is shown below fig.so all electronics components are fixed inside the snake and that helps the snake robot to look like the snake. With the help of the snake robot we can achieve the application to rescue and search purpose. Also used for monitoring purposes.

B. Design Of Snake Robot

The design of the robotic snake is done with pro-E software shown in the figure 3.2. It is the 3D model of the snake robot as we discussed in this paper. Here it shown the roughly calibrated snake robot. It needs to add some more links to get the same locomotion as biological snake.

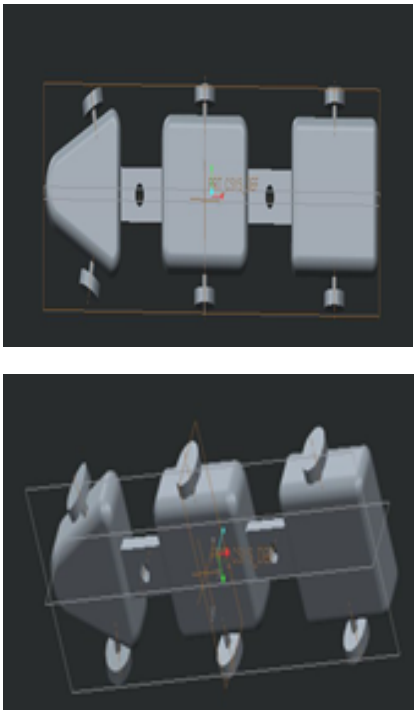

Fig 3.2 3d Model Of The Robotic Snake

VI. ELECTRONICS OVERVIEW

The snake robot are satisfy by using the capable controller. Use of arduino controller the feature provides the snake with all required action are available. Various processor are manufacturing by the electronics companies. At-mega is the controller manufacturing company providing the arduino Uno controller.it has the flash memory of 32kb its operating voltage of 5v.it input voltage various (7-12) v and output voltages various (6-20)v. Its static memory of 2kb and eeprom memory of 1kb.pulse width modulation digital I/O pins 6.analog input pins 6.clock speed 16 MHz .Its converts the pulse width signal to the control to move the snake robot. The generation of PWM

Signals using motor driver which helps the dc motor to rotate at required torque.

A. Controller

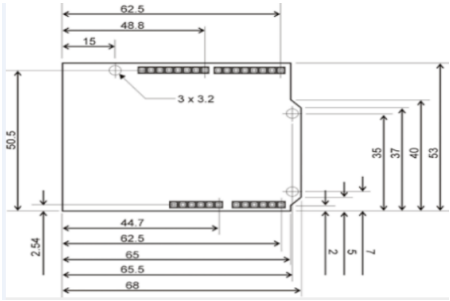

Fig 4.1 Dimensions For Arduino Uno Board

Arduino controller is used to control the entire snake motion. Its dimensions is shown in figure 4.1.

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again[8]. Arduino uno board is shown in figure 4.2.

Fig 4.2 Arduino Uno Board

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases [8]. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

B. Driving Circuit And Sensors

The snake robot locomotion is mainly depends on the motor movement and it helps to control with the help of motor drivingL293d ICin which simultaneous running of two motors is possible.to make the robotic snake work in desired way and make if function various sensors are used to attach in the robot body[5].The snake robot is equipped with ultrasonic sensors. Ultrasonic sensors are also used for transceivers as they both send and receive, and referred as transducers. ThePrinciple of ultrasonic sensor depends similar to SONAR or RADAR, byevaluating attributes of a distant object.

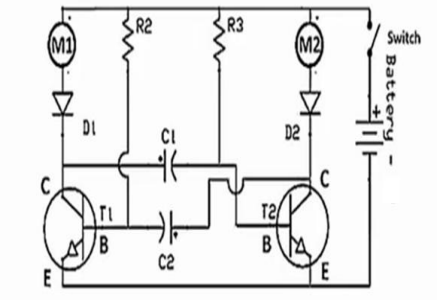

Fig 5. Circuit Diagram For Locomotion

Here the circuit shown is multi-vibrational circuit were the power supply is alternatively supply to both the motors. By this the locomotion of the snake robot can be achieved.in the circuit we have to attach the ultrasonic sensors and camera for monitoring purpose.by this we can achieve the snake like robot locomotion with very cost.

VII. MONITORING SECTION

Monitoring is very important and responsible for controlling the robot by monitoring and it is done with the help of PC at the user side. It uses the zigbee technology for sending and receiving the controlling signals. The arduino microcontroller receives the information for the sensors as it is processing head. When an action needs the controlling is done by the user at the controlling devices.

VIII. SIMULATION AND INTERFACE

The simulation of motors for the snake locomotion is done through Proteus 8 professional software and the coding is done in Arduino software. The interfacing details is as follows the three dc motors are connected to the output pin (9, 10) of micro controller board. The ultrasonic sensor is used to avoid the obstacles since it can sense the environment.so it is most suitable for this application. This sensor is connected to the pin (7). The camera transmitting side to pin (2) while receiver side to (3). For simulation, Arduino Uno library have to import first into the display and then sensors & motor have to be imported. As pin configuration is stated above the connections are made in the software. Later the program is loaded into the microcontroller for the simulation.

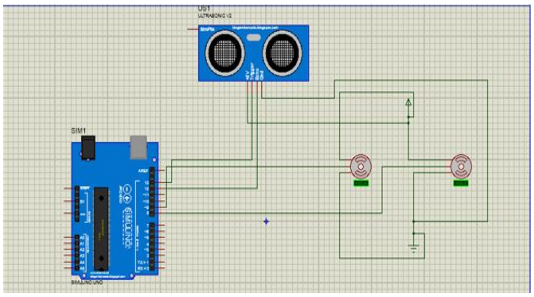

Fig 6. Simulation Output For The Dc Motor

IX. CONCLUSION AND FUTURE WORK

This paper has described overall design for biological snake inspired robotic implementation. This robotic snake is less expensive, robust and it is a helpful tool for the clustered areas. The department for scientific survey and surveillance purpose. The ongoing and future work is concentrated on the improvement of body design by implementing the multi-link body joints to attain the enhanced snake body sign motion and to some extent of military purpose it can locate the mines with help of advanced Sonar. the ability to traverse complex and difficult terrains like gaps, small holes, and pipes. Using zigbee wireless technology the snake robot mechanism is controlled. The snake robot is design and developed such as weight, reliability, size and several metric design for performance. The main objective of our work is to provide a powerful embedded real time system for search and rescue operations, surveillance, exploration of planet and several. Other applications where it is difficult for humans andConventional machinery to approach. The model that here is designed and Conforms that locomotion of a real biological snake by Understanding specific class of gaits. Finally, a full robotic snake can design and implement using an innovative manufacturing process aimed at reducing costs.

ACKNOWLEDGEMENT

The author is highly indebted to his mentor, Assistant Prof. M.Vignesh Kumar (Dept. of Mechanical Engineering, Jeppiaar Engineering College, Chennai) for his guidance and constant supervision as well as for providing necessary information regarding the project. Also thankful to Dr.V.Natarajan (HOD, Dept. of Mechanical Engineering, Jeppiaar Engineering College, Chennai) for his valuable guidance during course of the project. And we this achievement to my beloved family without whose support and sacrifices our life would have lost all meaning.

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