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ROBOSNAKE FOR MILITARY APPLICATION

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ABSTRACT:

With the aim of making human life and work simple robotics and automation has played a key important role. This project deals with the study of robotics. This project focuses on building a spying robot which have similar characteristics as biological snake. it has mechanical part which is constructed by using aluminum metal. for movements we use servomotors which can be rotated at a particular angle when they are programmed with PWM coding technique. the snake is attached with wireless camera which sends signals to the base station using RF transmitter and receiver. this robot also has the ability to move autonomously and it avoids obstacles as it moves. a snake is ideal for travelling through rough areas, exploration, remote sensing in hostile areas, landmine detection resulting into saving human life in war fields.

INTRODUCTION:

With the goal of developing a high-tech technology that can serve high speed technology, advanced capacity to control the robots. In todays world it is need to make improvements in technology so that high performance products and technology can be delivered to the world. We realize that our standards need some technical improvements along with few changes are made in robotics field. It is necessary to build high performance robot to create a faster, reliable, accurate and more intelligent robot which can be devised by advanced control algorithm, robot control devices and new drivers. Nowadays robots are controlled using wireless and user friendly technologies but earlier they were controlled using wired technology. This made the use of robotics field complicated and limited.

Robot is machine capable of carrying out complex series of actions automatically especially one programmable by a computer. Robots are designed to perform variety of tasks which are difficult and risks human life. Robotics combines study of several engineering branches. While designing a robot, first we have to construct it's body which can be made by wood/metal/plastic. Then a mechanical assembly action takes place to mount the wheels on the body and connecting them to the servo motors and keeping the body much similar to be like snake. To make snake move there is electronics to power them and microcontroller to control the actions of robot snake. To drive the project at last there is software to programs the motors, IR sensor module. Software understands the study of servo motors, IR sensor module and metal detector. In this project we build a robot snake which will have characteristics as same as a biological snake. This robot has the ability for exploration and avoiding obstacles. The obstacles can be avoided by using IR sensor, Supersonic sensor or Ultrasonic sensor. A robot snake is ideal for travelling through rough areas and keeping a low profile. This robot features many applications such as exploration, remote sensing in hostile areas, land mine detection, and maintenance work inside narrow passageways.

From the past few years research on snake robots has increased and several improvements were done. Lateral undulation is the fastest, flexible, efficient and most common serpentine motion pattern used by biological snakes. This motion pattern has been implemented the most of the times. Lateral undulation is widely used motion pattern. Lateral undulation forces snake to traverse through rough terrain to push against to move forward. Nowadays passive caster wheels or metals are added inside the snake robot body to recreate the method of locomotion of biological snake to the robot snake. However, speed and efficiency of robot snake depends on ground surface and only relative fast locomotion is obtained. With caster wheels used in robot snake it adds fast locomotion. Caster wheels are mostly used because it can be used for climbing operation. It's construction helps it to climb at some level. If wheels are not used in snake robots friction between the snake robot underside and the ground plays important role when it is moving by lateral undulation. This is because the friction property of the snake robot links must be such that the links slide more easily forward and backward than sideways for efficient snake robot locomotion by lateral undulation. Hence, the friction model must be accurate to recreate the snake robot motion in simulations.

1.1 ABOUT ROBOSNAKE:

Snakes are characterized by a long, slender body and they have a wide variety of species. They do not possess limbs or external ears. Snakes possess a

backbone and ribs that may number in the hundreds. The eyelids are not movable, but they are fused to form transparent spectacles.

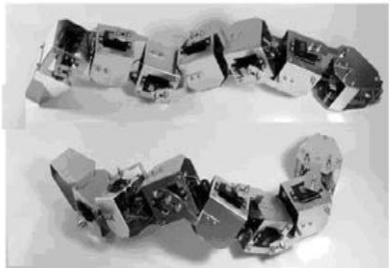


Figure 1. Actual robosnake

The robot snake that will be built and programmed is consists of some segments. It has three sections, head and tail each and six body sections where servo motors are placed. These six servo motor segments are placed alternately so that the first segment moves in a horizontal motion and the next segment moves in a vertical motion. This sequence repeats itself for all segments. The head section is built in a way that it gives the snake enough flexibility to move its body in multiple ways in order to achieve locomotion, in much the same way as a biological snake. PIC microcontroller is used to control the robot. To sequence the movement of each of the snake's body sections via servos controller plays key role. The microcontroller also monitors an infrared sensor so that the snake will avoid obstacles as it explores.

BLOCK DIAGRAM:

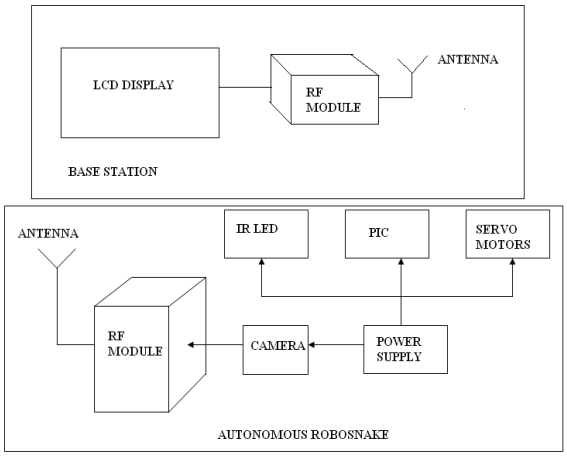


Figure 2. Basic block diagram of robosnke

2.1 PIC MICROCONTROLLER:

This section focuses on the construction of the robot's main controller circuit and the fabrication of the printed circuit board (PCB). Lists all of the parts necessary to build the controller board is given below. All of the robot's functions are controlled by a Microchip PIC 16F84 microcontroller. The microcontroller is an entire computer on a chip and makes it possible to eliminate a erwise be required. The microcontroller serves as the robot's "brain," controlling and managing all functions, sensors, and reflexes. The 16F84 microcontroller that we are using will be clocked at 4 MHz and operates on a 5-volt DC supply, produced from a 78L05 voltage regulator, with the source being a 9-volt battery.

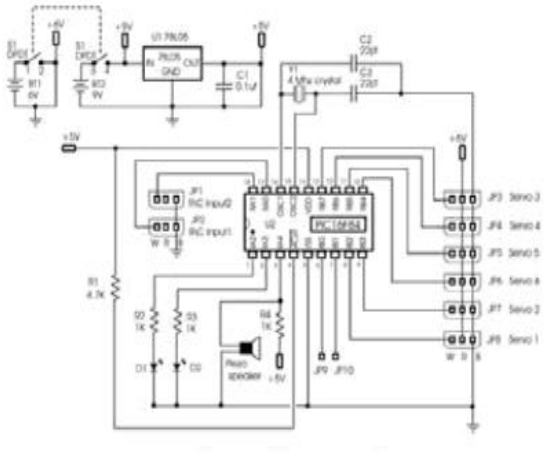


Figure 3. Serpentronic main controller board schematic

2.2 SERVOMOTOR:

Servos are DC motors with built in gearing and feedback co drivers required. Servos are extremely ntrol loop circuitry. And no motor popular with robot, RC plane, and RC boat builders.Most servo motors can rotate about 90 to 180 degrees. Some rotate through a full 360 degrees or more. However, servos are unable to continually rotate, meaning they can't be used for driving wheels (unless modified), but their precision positioning makes them ideal for robot arms and legs, rack and pinion steering, and sensor scanners to name a few. Since servos are fully self-contained, the velocity and angle control loops are very easy to implement, while prices remain very affordable.

Figure 4. Servomotor

To use a servo, simply connect the black wire to ground, the red to a 4.8-6V source, and the yellow/white wire to a signal generator (such as from your microcontroller).Vary the square wave pulse width from 1-2ms and your servo is now position/velocity controlled.

2.3 INFRARED SENSOR BOARD:

An infrared sensor board will be fabricated to give the snake obstacle avoidance capabilities. The sensor board is comprised of an infrared LED and a Panasonic PNA4602M IR sensor module. A single-channel sensor is being used because the sensor board will be mounted at the front of the robot's movable head.

The snake is able to move its head in an arc of 180 degrees, allowing it to sense objects in front, and to either side of its body as it explores the surrounding environment. The sensor board schematic is shown in figure . There is a list of all the parts needed to construct the board. The 555 timer in the circuit is used to modulate the infrared LED at a frequency determined by C1 and R3. R3 is an adjustable 10k potentiometer that will be used to find the optimum frequency during calibration. In our application, we will use a frequency between 38 and 42 kHz, so that a meaningful signal will be sent from the PNA4602 sensor module to the microprocessor.

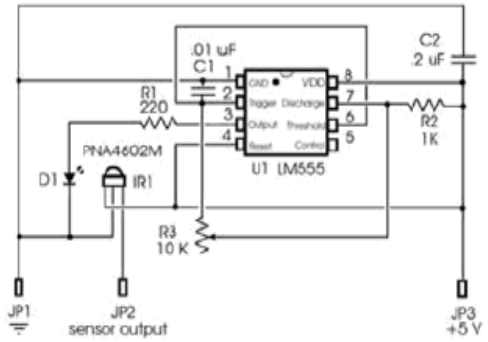


Figure 5. Infrared sensore board schematic

The PNA4602M is designed to detect only infrared radiation that is modulated at 38 kHz, and rejects all other light sources. This makes the module an ideal sensor for daylight conditions. The features include an extension distance of 8 meters or more. No external parts are required, and a resin filter makes the module unsusceptible to visible light. Below is lists the PNA4602M module's main characteristics. The output signals from the module will be processed and filtered by the microcontroller with a software routine.

2.4 POWER SUPPLY:

Power supplies are used in many industrial and aerospace applications and also in consumer products. Some of the requirements of power supplies are small size, light weight, low cost, and high power conversion efficiency. In addition to these, some power supplies require the following: electrical isolation between the source and load, low harmonic distortion for the input and output waveforms, and high power factor (PF) if the source is ac voltage. Some special power supplies require controlled direction of power flow. Basically two types of power supplies are required: dc power supplies and ac power supplies. The output of dc power supplies is regulated or controllable dc, whereas the output for ac power supplies is ac. The input to these power supplies can be ac or dc.

IC 7805(Voltage Regulator IC):

Specifications:-

- Available output DC voltage = +5V
- Line regulation = 0.03
- Load regulation = 0.5
- Vin maximum = 35V
- Ripple rejection = 66-180db

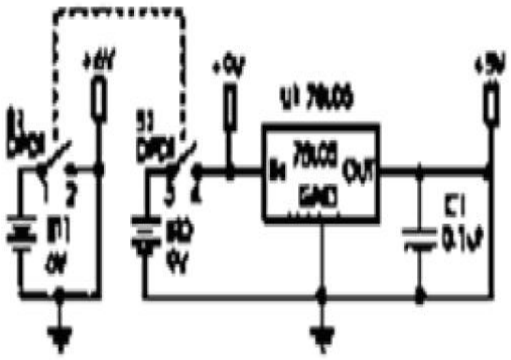


Figure 6 .power supply circuit

HARDWARE IMPLMENTAION:

3.1.HEAD SECTION :

The snake's head will house the controller board that will sequence all of the servos in each body section and will monitor the infrared sensor. The infrared sensor will also be mounted at the front of the head. Cut a piece of 1/16-inch thick aluminium to a size of 3 inches _ 6-1/4 inches. Cut, drill, and bend the piece, as shown in figure 3.3 the finished piece, labeled G, is shown in figure. 7

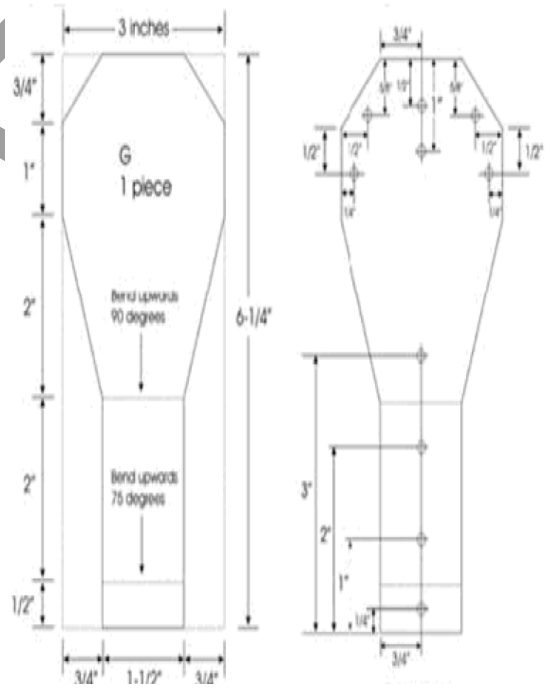


Figure 7.cutting ,drilling and bending guide for bottom head piece.

Cut a piece of 1/16-inch thick aluminum to a size of 3 inches _ 3-3/4 inches. Cut, drill,
and bend the piece, as shown in figure. 8 Cut two pieces of 1/16-inch aluminum to a Size of 1 inch _ 3-1/2 inches. Bend and drill each piece according to the dimensions shown in figure .8

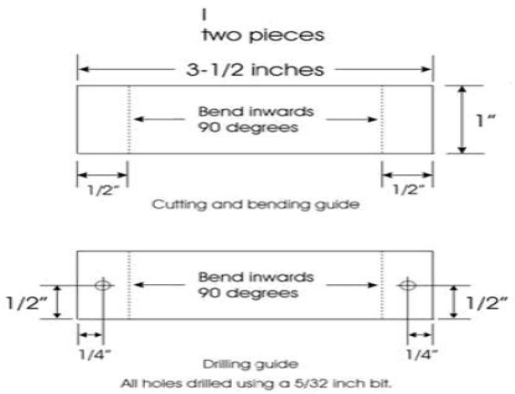


Figure 8.Cutting ,drilling and bending guide for head support piece labeled I

Each of the four head pieces will be assembled to form the robot's head. Use five 6/32 inch _ 1/2-inch machine screws and locking nuts to assemble the head. Connect the two pieces labeled I to the bottom head piece labeled G. When those are secured, attach piece H to piece G, and the two pieces labeled as I.

3.2.BODY SECTION :

Start by cutting six pieces of the 1/16-inch aluminum to a size of 7-1/2 inches _ 2- 1/2 inches. These pieces will be identified as piece A of each of the six body sections. Use figure 3.5 as a guide to cut the six pieces to the dimensions shown. When the piecesare cut, use a 5/32-inch drill bit to drill the holes, as indicated in the diagram. File any rough edges from the pieces.Bend each PiecePiece in a table vise or on the edge of a table, as indicated. The next piece that will make up each of the body sections is also cut from 1/16-inch thick aluminum. Cut six pieces to a size of 2-1/2 inches _ 5-3/4 inches each. These pieces will be identified as piece B of each of the six body sections. Cut the six pieces to the dimensions as considered. When the pieces are cut, use a 5/32-inch drill bit to drill the holes, as indicated in the diagram.File any rough edges from the pieces. Bend each piece in a table vise or on the edge of a table, as indicated. Each of the six pieces should look like same.

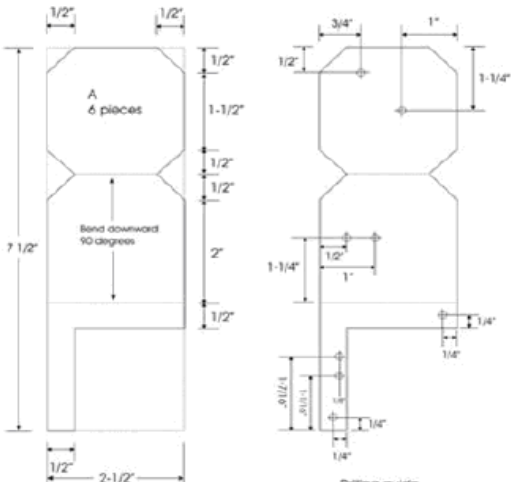


Figure 9. cutting ,drilling and bending guide for body section .

3.3.TAIL SECTION:

The snake robot will need a tail that will be used to brace the rear end of the body and provide friction when the robot is moving forward and turning, as well as for the aesthetic purpose of completing the body. The tail section is constructed using 1/16- inch thick aluminum stock. Cut a piece 2-1/2 inches _ 8-1/2 inches. File any rough edges and place the piece on a table. Photocopy the cutting and bending guide in figure.10 Use the photocopier enlargement features so that the dimensions are exactly 2-1/2 inches _ 8-1/2 inches. Cut the template out and use a glue stick to glue it onto the piece of aluminum of the same size. Use a metal cutting band saw or hacksaw to cut the piece, as shown in figure 3.6. Drill the mounting holes as indicated, using a 5/32-inch drill bit. Bend the aluminum in a vise or on the edge of a table, as shown in figure.10

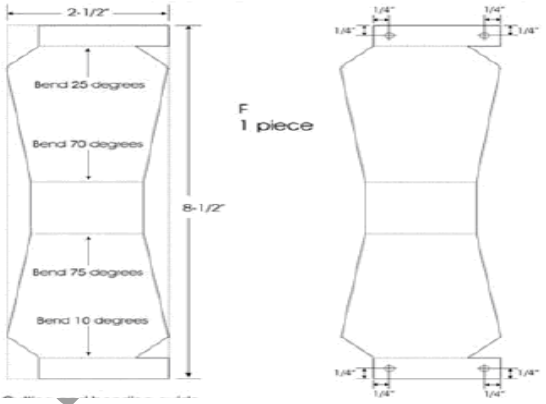


Figure .10 Cutting ,drilling and bending guide for tail section.

WIRELESS CAMERA :

We are using a wireless CCD camera, which are commonly available in the market. This camera works on 12 volts DC supply. The camera has a receiver, which is placed in the remote station. Its output are in the form of audio and video signals. These signals are directly sent to a television or a computer through a tuner card. This CCD camera is placed on the robot. The camera captures the audio and video signals and sends those signals to the remote station and with the help of the camera receiver which is connected to the television or a computer through we will be able to see the captured signals. This is a mini wireless monitoring video camera and wireless receiver set for home and small business surveillance, security and is used by us for demonstration purpose. Robot vision systems are getting better at detecting humans in a "scene,"tracking moving objects, making out saturated colors, and roughly understandin g three-dimensional objects. They still struggle with telling men from women,interpreting objects if the camera is in motion, determining what materials objects are made of, and determining "gaze direction" (where the person is looking). Honda has made some advances with the latter problem. The current version of its Asimo humanoid can tell where a person is looking if the person both looks at and points to the target object. Encoders— Optical or magnetic sensors that "read" the rotation of a robot's wheels to measure distance traveled.

SOFTWARE IMPLIMENTION:

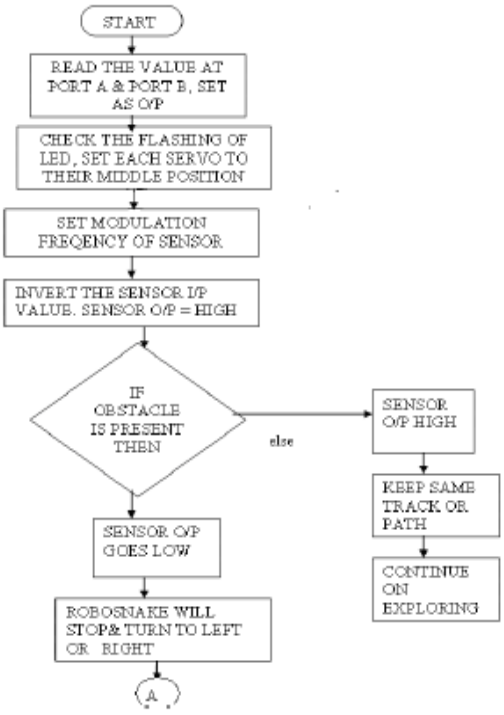
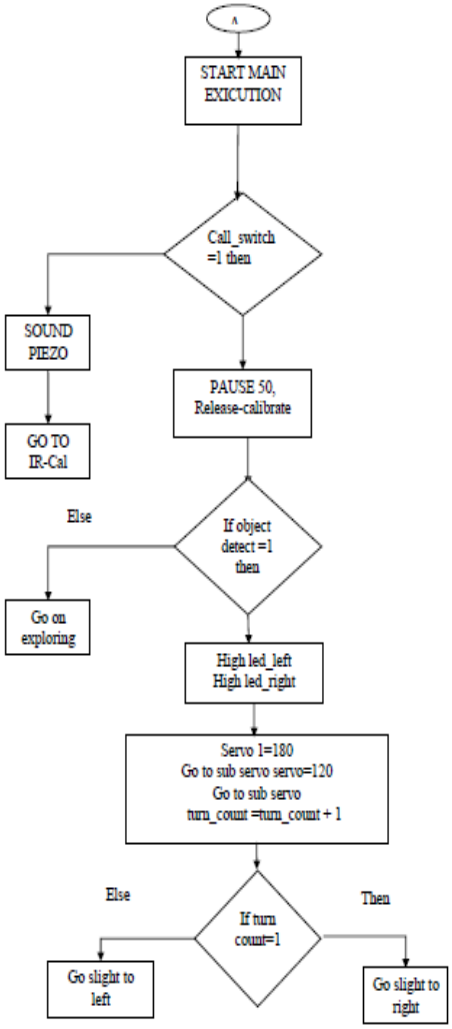


Figure 7. flow chart



CONCLUSION:

The primary need for our paper would be accuracy. We have been able to view the things accurately that are currently happening in the surrounding area. Our design has not caused any sort of disturbances. The robot will move depending on the motor direction based upon the input we give through command by remote section unit. It display the current operation is going on as example left robot, near to object, clear up. Also due to use of camera we get the remote area information at base station on LCD without going there. At the war field, by using this snake we scan the area. It will reduce the risk to life involved in the process. Ease of obtaining information and greater reliability. Storage of information and data. We also hope to improve the scope of this project in the future so as to make it applicable in the actual field. An infrared sensor board will be fabricated to give the snake obstacle avoidance capabilities. Wireless camera will give better visual feedback. Using RF communication we can see the area in front of robosnake.VB based software gives us more user friendly interface. While including few .dll files in Windows XP we can communicate with PC parallel Port and we can control and monitoring the robots movements.

FUTURE ENHANCEMENT:

We can connect this system directly to internet by using zig-bee with Wi-Fi. By using internet we can control the system via remote location. In the future we can use GPS for accurate positioning of the robot on uneven surfaces as well as increasing the range of scanning. Use of multiple sensors such as Ground Penetrating Radar (GPR) for accurate detection of all kinds of landmines.

REFERENCES:

i. "Karl Williams", *"AMPHIBIONICS: Build Your Own Biologically* Inspired Robot", By "McGraw Hill" 1st edition
ii. "*Codrin Pacsa" "History Of Robotics*" By "University of Ottawa"
iii. "Manfred Huber" , *"Robotics For Intelligent Environment"*
iv. "Dr.Ahmet Ozkurt*"," Introduction to Robotics*"
v. "Karl Williams, Insectronics—*Build Your Own Walking Robot",* McGraw-Hill, New York, 2003
vi. "Gareth Branwyn", "*Absolute Beginner's*
vii. *The 8051 microcontroller and embedded system using assembly and C, 2nd edition* (ISBN: 9780131194021) by Mazidi Muhammad Ali (2008).
viii. Dhiraj Singh Patel "*Mobile Operated Spy Robot"* International journal of emerging technology and advanced engineering (IJETAE), 2013.