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FABRICATION OF CROCODILE ROBOT

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***Abstract*— A crocodile is an inspiration to this paper which can serve both surveillance and monitoring purpose in wildlife. The robot is designed with respect to the shape of the crocodile's body. It is to be controlled by a microcontroller and the leg motion mechanism is driven by DC geared motors. The robotic counterpart is to be fabricated out of Aluminum metal and sheet metal for body covers. The robot will be able to move in forward direction only. Movement mechanism is provided by the modified crank lever mechanism. Each leg is free to move around and is not dependent on the other legs. The motion will be similar to that of the reptile species and mammal species in which alternate legs will act in response to the other set of legs in a looped fashion. Power supply will be provided by AC supply which is to be stepped down through standard transformers. Microcontroller is employed to direct the motors to function as directed to create locomotion. Temporary joints were made to hold the components and to join them (screws, nuts and spacers). The body is fabricated into two parts so as to avoid hassle while in movement. At the end of the making, the robot was successfully tested and the locomotion came out as expected propelling the robot forward.**

***Index Terms* — Surveillance, Microcontroller, DC geared motor**

INTRODUCTION

The robot is mammal like a machine is developed to execute a specific function. In modern they are variety of robot is designed, developed and fabricated to carry out predefined action. Such as seabed walking robot, crablike robot, and subsea robot legged walking robot (mono legged, two legged, three legged, four legged, six legged and multi legged robot). The crocodile robot one of special robot. It has four legs indented to provide loco motion in one direction for the surveillance and monitoring purpose in wildlife. The detailed literature under legged robot was mentioned.

The four legged autonomous mobile robot was build with bounding locomotion in small size, the simulation was performed it provides the very good locomotion velocity and spped among other type of locomotion[1].An amphibious inspection robot system (AIRS) was developed with four legged and several cameras for inspection of underwater structures in nuclear power plants. The robot movement is controlled with inverse kinematic algorithm [2].The multi functional (like insect, mammalian, reptile, or human) four legged robot was developed with high walking speed compare to the classic design [3].

The quadruped walking machine was designed and implemented with continuous and discontinuous gaits. The discontinuous gaits have notable advantages over the continuous gaits in terms of energy and adaptability. The results conclude that the quadruped walking machine with discontinuous gaits is suitable for rough terrain and it consumes less energy [4].The four legged (Flimar) robot was designed and developed for walking and turning without skidding as well as tracking. The Flimar has AI control with sensors for different environment [5].The new flourish in robotics is begin to flower in the mid of 1980's by different source. The robots were made by Artificial Intelligent, Genetic Algorithm, neural network and adaptive algorithm [6].The rule based reasoning in force distribution approach is used to control the four legged robot KHEOPS [7].The four legged (mother robot) robot was developed to walking on ground and crushing underwater with satisified motion performance. It plays a prominent role in underwater monitoring and recovery purpose when compare other bio-inspired micro robots [8].

MECHANICAL STRUCTURE OF THE CROCODILE ROBOT

The fabrication of the crocodile is done by aluminum metal of thickness 2 mm. All the four parts namely head, body, trunk and tail are fabricated using the aluminum metal. Tools such as metal cutter, hacksaw blade, drilling machine were used for fabricating the parts. Files were used to get good surface finish and to blur the sharp edges.

The fabrication was aimed at to make the robot look like a crocodile; hence it was fabricated keeping in mind the appearances of the crocodile. The mechanical structure of the robot is shown in Fig.1and Fig.2. The clamps are fitted and bolted all the leg parts are fitted to the cranks, and supporting clamps. Head and tail are also bolted to the front part and end part respectively. The motors are connected to the onboard power supply and all the necessary arrangements are made.

The Leg parts as in Fig.3 actuate the motion mechanism. Rotating link is fixed to the crank of the motor

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and the reciprocating member is fixed to the supporting clamp. The cross member is attached at the one end to the horizontal link and the other end is attached to the vertical rotating member. All the joints are jointed with the help of spacers, screws and nuts.

Fig.1. Top View of the Crocodile Robot

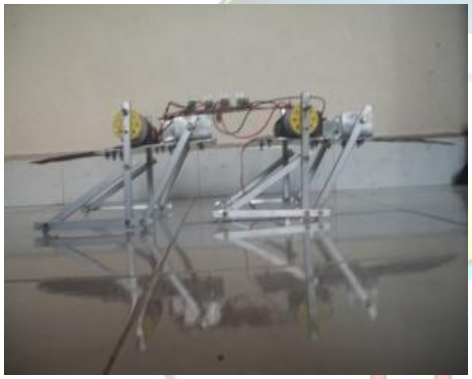

Fig.2. Front View of the Crocodile Robot

Fig.3. Assembled Leg Parts Crocodile Robot

CONTROL OF THE CROCODILE ROBOT

PIC16F877A Microcontroller

The PIC16F877A CMOS FLASH-based 8-bit microcontroller is used to control the crocodile robot. The PIC controlled system often resides machines that are expected to run continuously for many years without any error and in some cases recover by themselves if an error occurs. Performance Many of the PIC based embedded system use a simple pipelined RISC processor for computation Power consumption A PIC controlled system operates with minimal power consumption without sacrificing performance. Memory Most of the PIC based systems are memory expandable and will help of this we can easily adding more and more memory according to the usage and type of application.

DC Geared Motors

30RPM Centre Shaft Economy Series DC Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside. Although motor gives 30 RPM at 12V but motor runs smoothly from 4V to 12V and gives wide range of RPM, and torque.

Calculating the Robot Speed

The robot speed can be measured by using the equation 1 given below. By knowing the angular speed of motor in RPM and diameter of the crank, the robotic speed can be approximated.

$$V = \omega \times D / 19.1 \quad (1)$$

V = robot speed in inches/sec

ω = motor speed in revolutions/minute (RPM)

D = wheel diameter in inches

19.1 is a conversion factor to make the units consistent

ω = 30 RPM,

D = 1.377 inches, substituting the values in the above equation we get,

$$V = 30^* (1.377/ 19.1)$$

$$V = 2.16 \text{ inches/sec}$$

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CALCULATING THE TORQUE OF THE MOTOR

Torque of the motor can be found using the equations 2 and 3:

$$F = 1.33 \times W \times a / g \quad (2)$$

Where

F is the force in ounces needed to accelerate the robot

W is the robot weight in pounds

a is the acceleration in inches/sec-sec

g is the acceleration of gravity = 32.2 feet/sec-sec

W = 4.29 pound

a = 2.16 inches/ sec-sec substituting these values in the above equation,

F = 1.33* 4.29* (2.16/32.2)

F = 0.38 ounces

For torque,

$$T = F \times R = F \times D / 2 \quad (3)$$

T = 0.38 * (1.377/2)

T = 0.261oz-in

CONCLUSIONS

This model promises to produce a robust mechanism for the crocodile locomotion successfully. The dynamics of the robot is electrically controlled using microcontroller. The PIC16F877A was embedded with DC geared motor for complete control of the entire robot. The crocodile robot is designed in a way that the parts cannot disintegrate at any motions. The complete structure of the robot was developed and fabricated to ensure smooth mobility with a speed of 2.16 inches/sec.

FUTURE WORK

Aluminum links to be replaced by rigid metal so that it can give more responsive mechanism. The GPS, voice recorder and video camera to be fitted to serve the basic need of surveillance. Animal tagging, injections to be accommodated with robot to serve as a tool in wildlife management. Robot to be made water-proof and swimming mechanisms to be included, so that it can track even through water.

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