Fabrication of Kinematic Robot Used In Agri Field for Seed Sowing and Water Spraying

K.Sathish Kumar[1], R.Gnana Sekar[2], D.Dhanus Kumar[3], P.Dhinesh Kumar[4], N.Arjunraj[5], V.Gogulkannan [6]
[1, 2] Assistant Professors, [3,4,5,6] U.G Scholars,
[1,2,3,4,5,6]Department of Mechanical Engineering,
[1,2,3,4,5,6]Sree Sakthi Engineering College, Coimbatore, India.

Abstract:In this our research we have selected a six legged robot which is biologically inspired by insects. We are focusing mainly on locomotion on uneven terrain using opposite gait of locomotion. The stabilization of legs are inspired by biomimetic stepping leg transferences with an active balance control so as to reduce the propagation of instability while performing rapid stepping actions for a fast walking gait. This paper describes the proposed design and construction for the six legged normally called as hexapod robot to navigate on the uneven terrain. This robot is mainly used in agricultural purposes which can seed and spray the water automatically. The hexapod is an insect inspired robot which has six legs that enables to move flexibly on various terrains. The main advantage of this type of robot is its stability. The nature inspired the researchers and new innovative ideas come in mind but sometimes they are simple and effective, sometimes cumbersome and critical. This walking machine had four legs arranged into pairs. Legged machine have been used for at least a hundred years and are superior to wheels in some aspects: Legged locomotion should be mechanically superior to wheel or to tracked locomotion over a variety of soil conditions and certainly superior for crossing obstacles.

Index Terms **– Kinematic Robot, Seed Sowing, Water Spraying, Motor Operated.**

I. INTRODUCTION

US army investigation reports that about half the earth surface is inaccessible to wheeled tracked vehicles, whereas this terrain is mostly exploited by legged animals. Wheeled robots are the simplest and cheapest also tracked robots are very good for moving, but not over almost all kinds of terrain. There are different types of legged walking robots. They are roughly divided into groups according to the number of legs they possess. Bipeds have two legs, quadrupeds four, hexapods six and octopods have eight legs. Bipeds' robots are dynamically stable, but statically unstable, such robots are harder to balance, and dynamic balance can only be achieved during walking. Hexapods are six legged robots, on the other hand, have advantages of being statically stable. During walking they can move three legs at a time, thus leaving three other legs always on the ground forming a triangle. Previous work proved the feasibility of fabricating a crawling insect scale robot capable of forward locomotion on flat ground, and the results motivated multiple improvements in design . The hexapod provides additional degrees of freedom for the robot's censors and on board equipment. Some general purpose robots were tested for this application at the first but now day's specific prototypes developing special features are being built and tested. The Titan VIII walking robot, a four legged robot developed as a general purpose walking robot at the Tokiyo Institute of Technology, Japan. For some time now, researchers have been aware of the reservoir of insight available from a well guided stud of existing biological systems. The objective of this research is to develop an efficient terrain negotiations and locomotion for hexapod.

II. LITERATURE REVIEW

A new technology emerges faster by adapting a new idea to develop a new design, prototype and new system control. One of the technologies that has high pace advancement such as the technology of six legged robot which has increased from a simple function, size and weight to a various functions, bigger size and weight. LAURON is the example, a six-legged robot which has been developed at the ForschungszentrumInformatik Karlsruhe (FZI) in Germany. The first LAURON project was started in early 90s and continuously improved until the latest project called as LAURON IV.The six legged robots have various types and functions. Some of them are quite simple in the design and controller, while some of them possess a complex design and controller. For instance, in the tele-operation system, the robot is capable to perform various tasks using a remote control at hazardous and narrow area which is cannot be covered by human beings. The operations are search and rescue, monitoring radiation hazard and planetary exploration. However, the most important factor to accomplish the task in a shortest time is the speed of the robot. The movement of robot by the wheels is faster than movement of the robot by legs. Thus, one method to increase the speed of six legged robot is by equipped it with maneuverable wheels.

The system designs of six legged robots from each journal have their own differences. RHexdeveloped by is a different robot compared to other six legged robot because it is actuated by brushed DC motor. The motors that are used at this robot are Maxon type motor with a 33:1 planetary gearhead powered by a 24V NiMH battery. The design of the leg is one degree of freedom and half-circle. According to the author, the method is easy to build and maintain the robot and no sliding friction during spring displacement. This design is most suitable for stair climbing. Another six legged robot, Bill-Ant-P robot done by is made of 6061 aluminum and carbon fiber sheets. It uses MPI MX-450HP hobby motors for its reliability, high torque, and affordability movement. The motor have 8.37kg-cm of torque, can rotate about a 60 degree in 0.18sec, and has a small internal dc motor consumes 1125mW of power at stall torque.In the journal done by, a robot called as Gregor has been developed. The Gregor robot development model has Autodesk Inverter 9.0 to define properties of parts such as mass. Rhinocerus 2.0 software is used to

coordinate of the constraints and model the robot that can be easily exported into the dynamic simulation environment which is also used the same software.

MSR-H01 six legged developed by Micromagic System is built from 26 precision laser-cut 5053 aluminum body and leg components. It is controlled by using a p.Brain-HexEngine and used eighteen servomotors from three different types of servomotors. The link for the robot is Bluetooth with quality 99.2% from 17215 packets sent, 17083 packets are acknowledged. Six legged robot developed by used Devantech SD-21 board to control 18 servos by interfaced with the preferred microcontroller, which is ArduinoDecimilla board. The software that is used to control the servo controller is Matlab. In other to control the robot leg, Jacobian inverse matrix method is used to define the angles and leg position.Thesix legged robot's journal done by states that the six legged used smart actuator module Dynamixel RX-28 by ROBOTIS as joint actuators. The control board based on the16-bit AVR ATmega128 and able communicates with external computers by RS232. The main controller communicated with the robot by sending and receiving data packets to the motors and sensors. The walking robot Ragno developed by is 33 cm long and 30 cm wide and 2.15 kg weights. It has four layers control architecture where the first is at off-board to compute the appropriate control signal for all leg's joint and send control commands to robots. The second layer is on-board control layer that interprets commands from first layer and sends to leg controllers. There are six leg controllers that work simultaneously and control the inputs send to them. The robot has a double axis accelerometer and a gyroscope to measure the trunk orientation in a 3D space. The on-board and off-board parts of the control system communicate by means of a Bluetooth connection.

III. COMPONENTS/MATERAILS REQUIRED

3.1. FRAME

This is made of mild steel material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

3.2. DC MOTOR

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

3.3. ELECTROMAGNETS AND MOTORS

To understand how an electric motor works, the key is to understand how the electromagnet works. An electromagnet is the basis of an electric motor. You can understand how things work in the motor by imagining the following scenario. Say that you created a simple electromagnet by wrapping 100 loops of wire around a nail and connecting it to a battery. The nail would become a magnet and have a North and South pole while the battery is connected.

Now say that you take your nail electromagnet, run an axle through the middle of it, and you suspended it in the middle of a horseshoe magnet as shown in the figure below. If you were to attach a battery to the electromagnet so that the North end of the nail appeared as shown, the basic law of magnetism tells you what would happen: The North end of the electromagnet would be repelled from the north end of the horseshoe magnet and attracted to the south end of the horseshoe magnet.

3.4. BATTERY

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern.

3.5. CURRENT RATINGS

Lead-acid batteries are generally rated in terms of how much discharge currents they can supply for a specified period of time; the output voltage must be maintained above a minimum level, which is 1.5 to 1.8V per cell. A common rating is ampere-hours (A.h.) based on a specific discharge time, which is often 8h. Typical values for automobile batteries are 100 to 300 A.h. As an example, a 200 A.h battery can supply a load current of 200/8 or 25A, used on 8h discharge. The battery can supply less current for a longer time or more current for a shorter time. Automobile batteries may be rated for "cold cranking power", which is related to the job of starting the engine. A typical rating is 450A for 30s at a temperature of 0 degree F.

3.6. SPROCKET AND CHAIN DRIVE

A chain is a reliable machine component, which transmits power by means of tensile forces, and is used primarily for power transmission and conveyance systems. The function and uses of chain are similar to a belt. There are many kinds of chain. It is convenient to sort types of chain by either material of composition or method of construction. This is a cycle chain sprocket. The chain sprocket is coupled with another generator shaft. The chain converts rotational power to pulling power, or pulling power to rotational power, by engaging with the sprocket.

3.7. HINGE

A hinge is a mechanical bearing that connects two solid objects, typically allowing only a limited angle of rotation between them. Two objects connected by an ideal hinge rotate relative to each other about a fixed axis of rotation. Hinges may be made of flexible material or of moving components. In biology, many joints function as hinges like the elbow joint.

IV. WORKING PRINCIPLE

The basic working principle of the six leg kinematic walking with seed and fertilizer sprayer is that the rotational motion of the motor is converted into the (legged) walking motion of the robot. There is a motor connected by the chain drive to the spur gear arrangement of the machine. The spur gear shaft is attached to the legs of the walking robot, so that the robot can convert the rotational motion into the linear motion of the legs. The legs are interconnected with each other so that there exists the linear motion of the legs and the legged action. The DC motor can run through the battery power supply. One more DC motor is used to spray the seed by using impeller mechanism. Seed is filled to the hopper arrangement which is made up of mild steel mechanism.

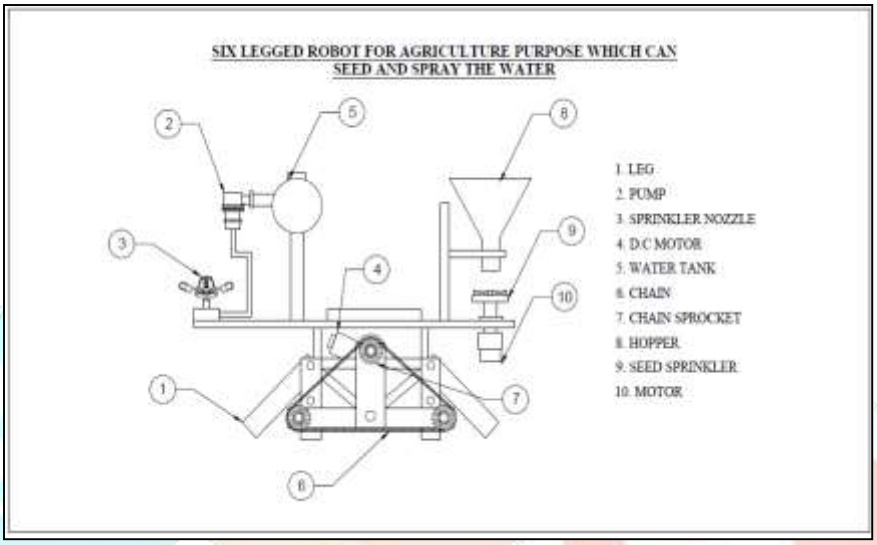

Fig.1. 2D Drawing of kinematic Robot

V. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between the institution and the industries. The Six Legged Robot for Agricultural Purpose Which Can Seed and Spray the Water is working with satisfactory conditions. We can able to understand the difficulties in maintaining the tolerances and also the quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed a Six Legged Robot for Agricultural Purpose Which Can Seed and Spray the Water which helps to moving and the respective operation using the developed kinematic machine. By using more techniques, they can be modified and developed according to the applications.

Fig.2.Fabricated Model of Kinematic Robot

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