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Original Contribution

DESIGNED BY SERVO MOTORS WITH MULTI-PURPOSE FOURLEGGED ROBOT SPIDER DESIGN

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ABSTRACT

It should be understood that the robot is not a simple automatic machine and has certain intelligence. Several intelligent robots which have been developed in the author's laboratory, designed for past 15 years. These robots perform many kinds of play like cup and ball game, top-spinning, stilts, etc. When a human plays these games, one needs some special intelligence or skill [1]. In this paper we tell a robot development design. We try to have walked it with four legs. So it hasn't got wheels and it can move on every land. Lots of robotic system was designed as a multi-wheeled. Therefore, with each round in terms of land can not act. And we used servo motors to control the legs of spider. We call this design as "spiderbot".

Key Words: *Radio frequency identification, VeriChip*

INTRODUCTION

Since the year 2000, major manufacturers including Honda, Toyota, and Sony have exhibited humanoid robots that look like diminutive suited astronauts[1].

Though they can climb stairs, dance, and run communicate with their operators, and even play musical instruments. they are not nearly as sophisticated as the fictional androids depicted in movies like AI Artificial Intelligence (2001), or I Robot (2004). Nevertheless, these entertainment robots have come a long way from the first industrial robotic arms that were integrated into production lines to spray paint and spot weld in the decades after World War II.

During the last 30 years. Robotics has expanded beyond manufacturing and entertainment to the medical, military, exploration, and service industries. Walking and flying insect-bots wheeled and track-propelled mobile robots, precision arm and hand robots are only some of the configurations incorporated into such fields as space and underwater exploration, environmental cleanup, mining and excavating, construction and manufacturing, surgical, search and rescue, and combat operations.

The robots making headlines today are the result of four decades of improvements in robot kinematics, perception, and artificial intelligence [2].

HISTORY

The word *robot* was introduced to the public by Czech writer Karel Čapek in his play *R.U.R. (Rossum's Universal Robots)*, which premiered in 1921 [3]. The play begins in a factory that makes artificial people called *robots*, but they are closer to the modern ideas of androids and clones, creatures who can be mistaken for humans.

The word robotics, used to describe this field of study, was coined (albeit accidentally) by the science fiction writer Isaac Asimov. Many ancient mythologies include artificial people, such as the mechanical servants built

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by the Greek god Hephaestus[18] (Vulcan to the Romans), the clay golems of Jewish legend and clay giants of Norse legend, and Galatea, the mythical statue of Pygmalion that came to life.

In the 4th century BC, the Greek mathematician Archytas of Tarentum postulated a mechanical steam-operated bird he called "The Pigeon. Al-Jazari (1136–1206), a Muslim inventor during the Artuqid dynasty, designed and constructed a number of automated machines, including kitchen appliances, musical automata powered by water, and the first programmable humanoid robots in 1206.

TYPES OF ROBOTS

Robot can also be classified by their specificity of purpose. A robot might be designed to perform one particular task extremely well or a range of tasks less well. Of course, all robots by their nature can be re-programmed to behave differently, but some are limited by their physical form. For example, a factory robot arm can perform jobs such as cutting, welding, gluing, or acting as a fairground ride, while a pick-and-place robot can only populate printed circuit boards.

General-purpose autonomous robots are robots that typically mimic human behavior and are often build to be physically similar to humans as well. This type of robot is therefore also often called a humanoid robot. General-purpose autonomous robots are not as flexible as people, but they often can navigate independently in known spaces. Like computers, general-purpose robots can link with software and accessories that increase their usefulness. They may recognize people or objects, talk, provide companionship, monitor environmental quality, pick up supplies and perform other useful tasks. General-purpose robots may perform a variety of tasks simultaneously or they may take on different roles at different times of day.

PURPOSE-BUILD ROBOTS

Industrial and service robots can be placed into roughly two classifications based on the type of job they do. The first category includes tasks which a robot can do with greater productivity, accuracy, or endurance than humans; the second category consists of dirty, dangerous or dull jobs which humans find undesirable.

Several types of robots exist:

- **Soft Robots:** Robots with silicone bodies and flexible actuators (air muscles, electroactive polymers, and ferrofluids), controlled using fuzzy logic and neural networks, look and feel different from robots with rigid skeletons, and are capable of different behaviors .A swarm of robots from the Open-source Micro-robotic Project
- **Swarm robots:** Inspired by colonies of insects such as ants and bees, researchers are modeling the behavior of swarms of thousands of tiny robots which together perform a useful task, such as finding something hidden, cleaning, or spying. Each robot is quite simple, but the emergent behavior of the swarm is more complex. The whole set of robots can be considered as one single distributed system, in the same way an ant colony can be considered a superorganism, exhibiting swarm intelligence. Swarms are also more resistant to failure. Whereas one large robot may fail and ruin a mission, a swarm can continue even if several robots fail. This could make them attractive for space exploration missions, where failure can be extremely costly [5].
- **Haptic interface robots:** Robotics also has application in the design of virtual reality interfaces. Specialized robots are in widespread use in the haptic research community. These robots, called "haptic interfaces" allow touchenabled user interaction with real and virtual environments.

STRUCTURE OF A SPIDER LEG

Structure of a spider leg is shown figure 1. *The Arachnids*: Arachnids are a class of joint legged invertebrate animals in the subphylum Chelicerata. All arachnids have eight legs, although in some species the front pair may convert to a sensory function. The term arachnid is from the Greek word ἀράχνη or *arachne*, meaning spider, [7] and also referring to the mythological figure Arachne. The chief *external feature* of the Arachnida is the division of the body into two parts, properly called the *prosoma* and the *opisthosoma* [6].

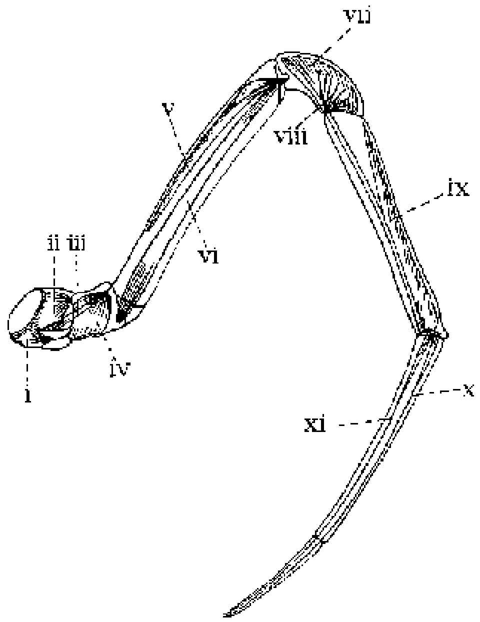

Figure 1. *The Muscles of a Spider's Leg. After F. D. Wood. [Species Theridion tepidariorum-prosurface of left leg.] i. Extensor trochanteris, ii. Flexor trochanteris; iii. Flexor longus femoris; iv. Flexor bilobatus femoris; v. Flexor bilo- batus patellae ; vi. Flexor patellae ; vii. Protractor tibiae ; viii. Flexor tibiae : ix. Flexor metatarsi ; x. Extensor tarsi ; xi. Flexor tarsi [6].*

STRUCTURE OF SPIDERBOT SYSTEM

The behavior principles of spiderbot are given figure 2. According to information from environmental sensors and task planning decision is made. In the meantime, re-evaluation with feedback sensors status shall be regulated by controlling the process again.

Environment sensors help to build a map of the workcell and generate the necessary data for the task planner.

Task planner identifies a hierarchy of *jobs* for the arm to undertake in order to accomplish the task.

Intelligence aids the task planner in dealing with the sensory information.

Control action produce the torque/force values necessary to realize the desired motion.

On-board sensors are feedback the actual variables to the controller to compensate for any tracking errors.

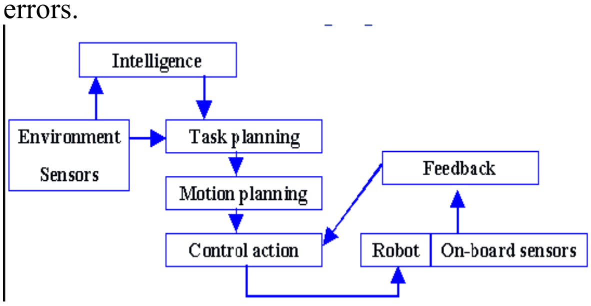

Figure 2. *Structure of spiderbot system*

MECHANICAL STRUCTURE OF SPIDERBOT

The appearance of all the mechanical structure of spiderbot is given in Figure 3. It has got four legs. The first two feet in front of, behind two ones are the rear right and left foot. Every leg has got three servo motors.

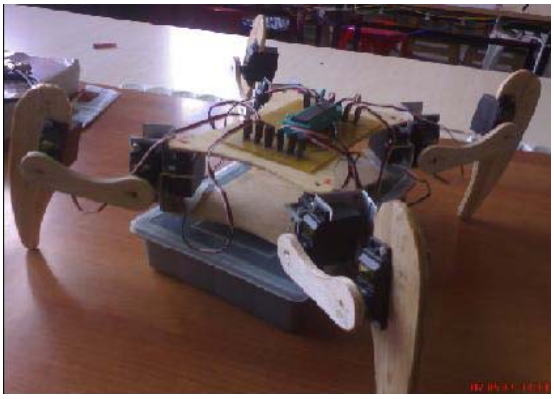

Figure 3: *The appearance of all the mechanical structure of spiderbot.*

The movement direction of the servo motors is given figure 4. Servo 1 moves the foot of the leg. Servo 2 carries the leg and servo 1 up and down. Servo 3 moves the whole leg forward and backward.

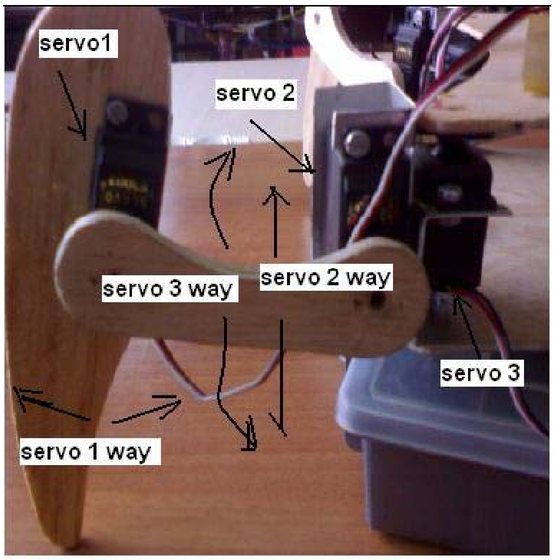

Figure 4: *The movement direction of the servo motors*

For one step algorithm is given below:

- servo 2 pulls up the foot,
- servo 1 pushes the foot forward,
- servo 3 moves the whole leg forward
- servo 2 pulls down the foot,
- servo 1 pushes the foot backward,
- servo 3 moves the whole leg backward,

The step order is
1. front right leg
2. back right leg
3. front left leg
4. back left leg

ELECTRONIC CONTROL UNIT

Electronic design block diagram of the spiderbot is given figure 5. PIC 16F877 is used as programmable controller. And JAL microcontrollerprogram is preferred as compiler. All servos connected one port of controller. So twelve ports are separated for movement control. The sensors can be added as desired. Like distance sensor, temperature sensor, light sensor.. etc.

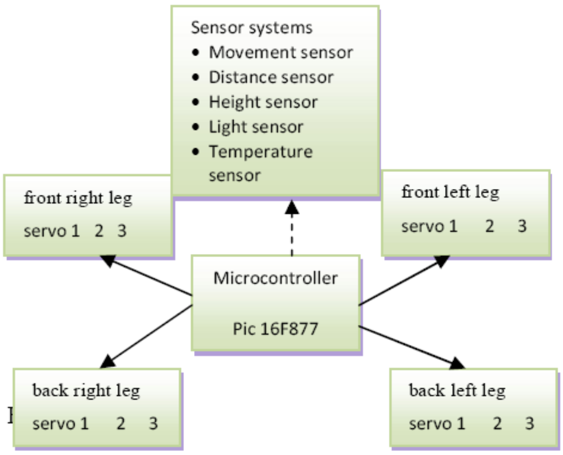

Figure 5: *electronic design block diagram of the spiderbot.*

The appearance of the spiderbot electronic control system is shown in figure 6. All motor control and sensors connect on this circuit.

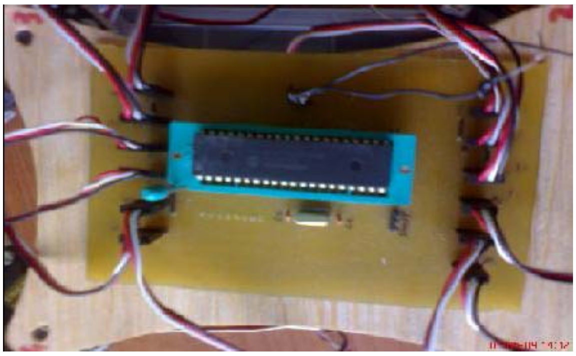

Figure 6: *Appearance of the spiderbot electronic control system*

CONCLUSIONS

We try to imitate a spider walks this project. And firstly we research how a spider steps. And we try to simulate this walking. After this project we plan that to add some different specialties. Some of these specialties are to recognize barriers, and it can be walk around the barriers. And the second goal is to recognize barriers height. And if the barrier is just the height, spiderbot can through over the barrier. And the other goal is to provide the energy from sun by solar batteries.

REFERENCES

1. Miura, H., *"Emerging Technologies and Factory Automation"*, 1994, ETFA apos;94., IEEE Symposium on Volume , Issue , 6-10 Nov 1994 Page(s):2 – 9 Digital Object Identifier.
2. Lisa Nocks, *"The robot: the life story of a technology"*, Edition: illustrated, Greenwood Publishing Group, 2007, ISBN 0313331685, 9780313331688
3. Zunt, Dominik. *"Who did actually invent the word "robot" and what does it mean?", http://capek.misto.cz/english/robot.html. Retrieved on 2007-09-11.*
4. John Schwartz, "In the Lab: Robots That Slink and Squirm" http://www.nytimes.com/2007/03/27/science/27robo.html, Retrieved on 2008-09-22.
5. Knapp, Louise (2000-12-21). "Look, Up in the Sky: Robofly". Wired Magazine. http://www.wired.com/science/discoveries/news, Retrieved on 2008-09-25.
6. **The Arachnids - Systematics** http://members.tripod.com/Spinnenman/ArachnEigensch.htm
7. "arachnid". *Oxford English Dictionary* (2nd edition ed.). 1989.