A Survey Paper on 6-Legged Crawling Robot for Virtual Telepresence

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In recent times, humans desire to replicate the animal movements to achieve efficient results. With this idea, it enables humans to realize that we can use robots for certain tasks instead of risking human lives. Hence, there is a need for such robots which can move in areas with different landscape conditions where wheeled vehicles cannot reach remote locations. The spiders, in comparison with the majority of others animals, it has the ability to access to that kind of environment where others animals or even the humans can't. This animal structured robot can play a significant role in telepresence.

Tele-presence refers to a set of technologies which allows a person to feel as if they were present there to give the effect or appearance of being present, via tele-robotics, at a place other than their true location. Tele-presence requires that the users' senses be provided with such stimuli as to give the feeling of being in that other location.

The attributes of the spiders are taken into this project in order to design and develop a six-legged spider robot in conditions to move in all kind of directions and perform such movement like ascend or descend for virtual telepresence so that participants can view remote locations and feel as if they were there.

IndexTerms **– Telepresence Robot, Robot, VR headset, Video Streaming, Animal movement, Gait Patterns.**

I. INTRODUCTION

With great development in Science and Technology, the concepts and applications of robots are widely used in all areas of research. The robot is an electromechanical system which can carry out complex series of action automatically. By copying the physical structure of legged animals, the performance of the mobile robot increases. This legged structure of the robot can be used to access remote and dangerous places that cannot be accessed by humans.

Six-Legged movement is the most effective walking pattern out of all the living beings. They have very complex locomotion pattern which is hard to understand and it provides the means of moving on surface where wheeled robots will fail. This Six-Legged movement is achieved in 2 ways.

i) We use Artificial Intelligence and Machine Learning algorithms like Genetic Algorithm to train the robot with the locomotion patterns of the Six-Legged animals. If the training is good with a high accuracy rate, we achieve a greater performance in terms of mobility and power consumption.

ii) We using walking patterns called Gait Patterns which gives a view of the walking movement.

Further advantages of the robot could be weight and the size of the robot.

This proposed model provides a real-time experience to view the surrounding environment. It solves the lack of cost-efficient telepresence robotic platform for complete and immersive remote operation, with stereoscopic machine vision and ready to deploy in indoor environments such as hospitals, museums. This gives the user a real-time experience as if he/she were present where the robot is located.

A telepresence robot is a remote-controlled, Six-Legged robot with a display to enable video streaming which enable the participants to view remote locations, as if they were there. The project consists of a VR headset, with a smartphone in dual screen to experience virtual reality. The movement of the robot is controlled by using a remote controller. Video streamed is received by the smartphone using the IP address specified by the Raspberry Pi. Ultrasonic sensors is used to detect obstacles which helps the robot from collision.

The camera for the video streaming is synced with the robot's movement which enables us to embed the camera into the robot. The Gyroscopic data is received from the smartphone which is in the VR headset, is used to sync the user's head movement with the robot.

The objective of this project is to develop a reliable platform that enables the implementation of six-legged robot which is stable, fast and has dynamic movement on any terrain for virtual telepresence.

II. LITERATURE SURVEY

- The paper [1] describes the design of the six-legged robot which can have various complex locomotive patterns. The structure provides stability in walking and movement. This paper provides the walking gait for the robot which is a tripod gait or alternating triangular gait. In this gait, the front and rear legs on the side of the body and the middle leg on the other side move more or less together, and alternate in their movements with the triangle of the remaining legs. Ultrasonic sensor used in the paper helps to detect obstacles while the moving. The model calculates the distance value depending on the acoustic wave motion.

- The paper [2] provides a legged platform for the movement of the robot. In addition, the paper explains the classification of the walking robot. The classification could be based on the body shape, number of legs, number of degrees of freedom and locomotion techniques. Additional walking gaits like creep gait, trot gait are proposed in the paper. The leg's lift angle is explained using inverse kinematics.

- The paper [3] explains the video streaming for virtual telepresence. Raspberry Pi acts as the brain of the system. It receives input from the smartphone via Wi-Fi and sends the controlling pulse to move the robot. The Raspberry Pi board is connected to Wi-Fi and an IP address is programmed. The captured video by the Raspberry Pi camera is sent over the Wi-Fi modem. This video can be viewed in the smartphone by connecting to the same Wi-Fi connection and IP address of the Raspberry Pi.

- The paper [4] explains the working of the virtual telepresence using a robot. In addition, the paper includes a detailed description the hardware and software requirements necessary for the project. Aurdino Mega acts as the directional processor, Servo Motors allows precise control of the angular or linear position, velocity and acceleration , Raspberry Pi acts as the brain of the robot. Bluetooth and Wi-Fi modules for the video streaming and transmission on directional commands.

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