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STAIRCASE CLIMBING ROBOT

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ABSTRACT

Staircase climbing robot are important for conducting scientific analysis of objectives. Current mobility designs are complex, using many wheels or legs. An eight wheeled rover capable of traversing rough terrain using an efficient high degree of mobility suspension system. The primary mechanical feature of the stair case climbing mechanism design is its simplicity. Which is accomplish by using only two motors for mobility. Both motors are located inside the body where thermal variations and disturbance is kept to minimum, increasing the reliability and efficiency. Eight wheels' stair case climbing design robot is used because stability purpose.

Keywords— Stair case climbing robot, suspension system, mobility, climbing.

I. INTRODUCTION

Robotics is the area of automation which integrates the technology in various field like mechanism, sensors and electronics control system, artificial intelligence and embedded system. The synthesis of mechanism is the very first step in any robot design depending upon its application. According to a locomotive mechanism to achieve the desired mobility, mobile robots may be split into following categories: leg-type, track-type and wheel type mobile robot consumption is also the important matter of developing. Stair climbing robot is one of the attractive performance of robot in legged and wheeled. Developments have been made in various kind of stair climbers, considering how to make it climbing ability higher and its mechanical complexity reasonable and practical. We introduce some solutions to realize stair climbing machines that we developed. Each of them has good performance as in a category of their kind, e.g. various numbers of wheeled shapes. Then, we discuss a development of adjustable high grip mover, which we think one of the best solutions as the stair climber.

2. LITERATURE REVIEW

This paper studies Omni-directional walking of a hexapod robot with a locked joint failure by proposing crab gaits and turning gaits. Due to the reduced workspace of a failed leg, fault-tolerant gaits have limitations in their mobility. As for crab gaits, an accessible range of the crab angle is derived for a given configuration of the failed.

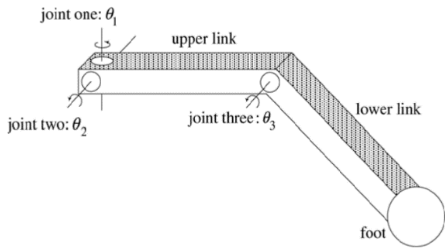

Fig 1 Three-joint leg model.

As for turning gaits, the conditions on turning trajectories guaranteeing fault tolerance are derived for spinning gaits and circling gaits. Based on the principles of fault tolerant gait planning, periodic crab gaits and turning gaits are proposed in which a hexapod robot realizes tripod walking after a locked joint failure, having a reasonable stride length and stability margin. The proposed fault-tolerant gaits are then applied to an obstacle avoidance problem of a hexapod robot with a locked joint failure. The kinematic constraints of fault-tolerant gaits should be considered in planning the robot trajectory.

A design of a six-legged walking robot with supervisory control is presented. A hierarchical control system of the robot incorporates a hybrid computer. In recent years the problem of developing a robot, moving on legs in a rough terrain,has been extensively investigated [1-10]. The legged, off-road vehicles exhibit mobilityadvantages and provide more comfortable movement than that of tracked or wheeledvehicles. Now, some scientific as well as technical problems requiring the applicationof such vehicles may be mentioned. However, the advantages of a walking robot over other types of moving vehicles result from its greater complexity. A large number of controllable degrees of freedomrequires highly efficient drives properly arranged, special design of feet to dissipate theenergy of the strike, etc. It is a rather difficult task to design a control system for alegged vehicle having all of its advantages. The control system has to process theinformation about the terrain, to decide on the type of the motion and to execute it.Thus the problem of the control seems to be the main problem of the walking robot. Itshould be mentioned, that the experience in designing most complex systems of theautomatic control cannot be directly applied to the problem of a walking robot control.

As a matter of fact, the problem of spatial movement control in such a complicated formis being solved for a first time.The results of numerous biomechanical studies may be helpful in solving the arisingproblems. The principles of motor control in animals and man have been studied byseveral authors.The control system of the described robot is based on the idea of the synergy of theregular gait, which constitutes the main pattern of the motion. When necessary, thatmotion is modified to adapt the gait to an uneven surface or to perform different man oeuvres to avoid or to overcome obstacles. It is called a quasi-regular gait.

Now as many as 90 million anti-personnel mines are left buried and continue to kill orinjure many people all over the world. The Cold War has already ended. However, regionalwars and conflicts continue to break out one after another and new mines are being buried. Asa collaboration of the world's top-level nations in robotics, the leading countries shouldpromote surveys and research to detect and dispose of these anti-personnel mines for theultimate good of the environment by using its advanced robotics technologies. Our project hasdeveloped and studied high instrumentation technologies for mine detection, then mine detectionstrategies using measuring equipment mounted on walking robots based on six-leggedtele operated high technology.

Axis-legged hydnl Ulic walking machine, called MECANT I, is introduced. It has been developed for research purposes in outdoor environment. The paper descnbes the motion planning method used. It is based on a "top down" approach where the vehicle body velocity control is executed by !he body path planning which in turn is divided into two parts called profile tracking and terrain adaptation.[2]

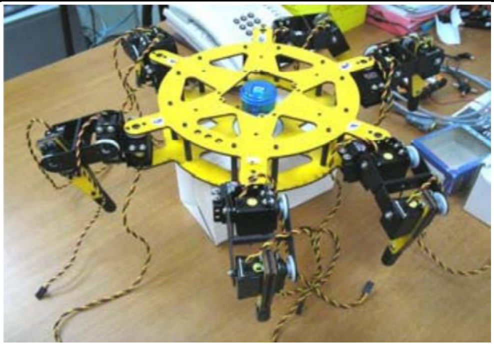

Fig. 2 Body of Hexapod agent

The estimated support plane is used as a model of the localterrain. The kinematic constraints are included into the body path planning by applying a "plan-and-check" approach .The free gait planner based on a "state machine" approach is introduced. The gait planner uses a role based methodwhen determining the time instant for support pattern change and the new supporting leg configuration.[3]

This paper reports the design methodology and control strategy in the development of a novel hexapod robot HITCR-II thatis suitable for walking on unstructured terrain. First, the entire sensor system is designed to equip the robot with the perceptionof external environment and its internal states. The structure parameters are optimized for improving the dexterity of the robot.Second, a foot-force distribution model and a compensation model are built to achieve posture control. The two models arecapable of effectively improving the stability of hexapod walking on unstructured terrain. Finally, the Posture Control strategybased on Force Distribution and Compensation (PCFDC) is applied to the HITCR-II hexapod robot. The experimental resultsshow that the robot can effectively restrain the vibration of trunk and keep stable while walking and crossing over the unstructuredterrains[4]

The authors propose a new control approach to solve the problem of motion control of six legged walking robot. Obtained control law does not require knowledge of inertia matrix of therobot. A proof of the asymptotic stability of the robot motion has been provided. To illustrate the effectiveness of the controller a numerical example is shown. PREUMONTREUMONT[5]

In this work Markus eachdescribed a proprioceptive control approach for our hybrid legged-wheel robot ASGUARD. The robot is controlled by four individual pattern generators for each of the four actuated leg wheels. We presented our layered architecture which is using a closed loop feedback between the individually generated motion patterns and the internal position controller. In contrast to existing hybrid legged wheeled robots, we did not use a fixed or predefined motion pattern for stairs or even terrain. The patterns are generated

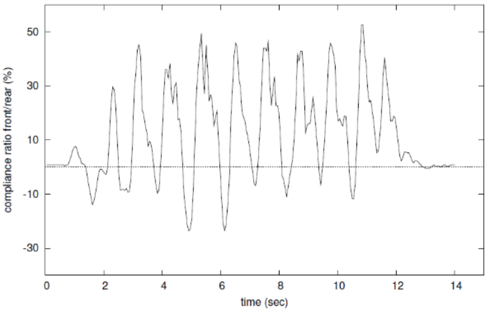

Fig. 3. The average rear leg compliance in respect to the front legs during the stair run.

And modified by the direct force feedback applied to each leg. This was achieved by a direct coupling between the applied torques and the stiffness of the position controller. We showed that by only using a proprioceptive torque feedback the robot is able to climb stairs. We found out that a strict controller performs better on flat and even ground. On the other hand, the same strict proportional controller led to several back flips on stairs. We therefore added another proprioceptive tilt feedback in order to perform a weighted merge of the two controllers (maximum stiffness versus maximum adaptation). We showed that this versatile control approach for hybrid legged-wheeled systems was able to perform best possible on a flight of stairs and produced good results on flat ground.[6]

In the paper, Ming-Shyan Wang developed a stair-climbing robot and completed experiments of moving up/down stairs and object tracking, capturing, and loading. In fact, the stair-climbing robot can provide service for the elders by capturing the specific object at one floor and then climbing up or down to another floor. [1]

Fig 4. The stair climbing robot

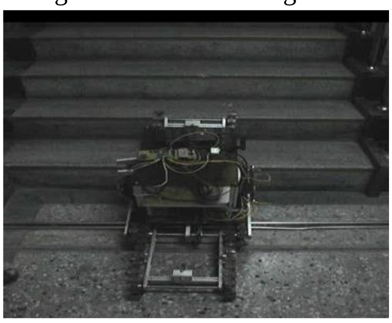

Fig 5. Realized motion of climbing up by FLC

In addition, the robot will patrol for security by the CCD camera around the house while more image processing functions are provided.

III. CONCLUSION

Based on results it is concluded that wireless staircase climbing robot is designed & implemented successfully. The performance of system is meeting satisfactory results. This system acquires input signal at the user from joystick and these signals can be analyzed by robot. The robot is mainly motivated by the improvement of mechanical ability of tracked urban vehicle to climb the stairs. It can develop an adjustable staircase climbing robot to replace the human effort to carry out difficult task in places like office, hospitals, industrials and military automation, security systems and hazardous environment.

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