c-Link Systems, Inc.
212 Eddie Kahkonen Road
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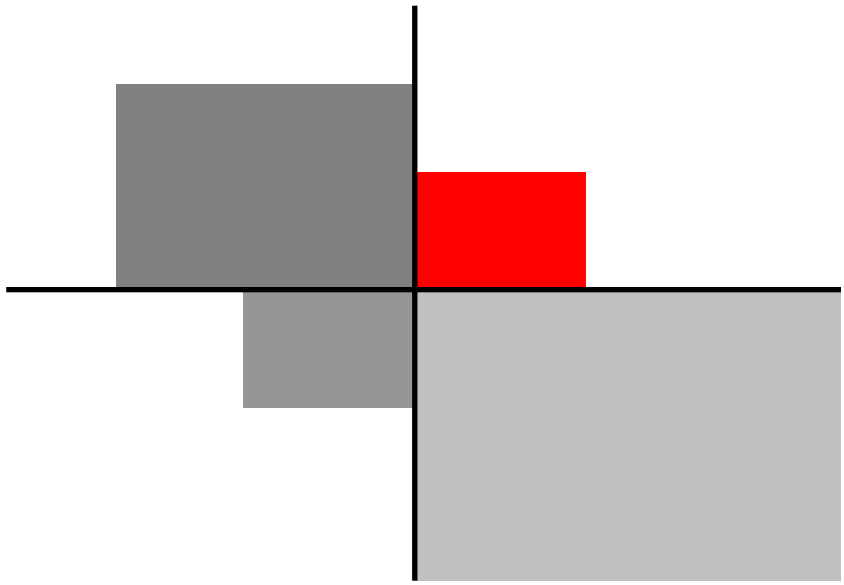
Technical Brief TB-1401

Omni-chassis styled

Autonomous Robotic Vehicle (ARV)



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Omni-chassis styled Autonomous Robotic Vehicle (ARV)

By William Lovell

Introduction

Owning an ARV Omni-chassis is analogous to having the frame for Swiss Army® knife and the ability to add the option of your choice.

Note: This brief is by no means intended to direct disparaging thoughts or comments against any other style or type of ARV chassis or construction equipment.

How is the Omni-chassis defined?

Omni: as a combining form or prefix in English, expresses the idea of "allness". One can generally paraphrase its meaning with circumlocutions. (As found in Wikipedia)

Chassis: the mechanical base on which the vehicle is built. (The written definitions are numerous so a generic one was agreed upon.)

Omni-chassis: the mechanical base to which modules may be added creating a diverse higher functionality. (Base definition)

c-Link Systems (cLS) expands the definition to encompass the whole vehicle.

Omni-chassis: a vehicle base that includes both the mechanics and the electronic intelligence as necessary for the unit to operate as an ARV.

Primary Systems

1. Core Processing
    a. Multiple FPGA used as distributive processing.
        i. Board level
            1. Single master function per board (field repair)
        ii. Silicon level
            1. FPGA can contain multiple processors

2. Drive System – wheel
    a. Hydraulic
        i. Low RPM high torque
        ii. 12VDC System
        iii. Brushless DC—Explosion proofing
3. Intra-communications (buses include protocol)
    a. Custom
        i. Fiber Optic communications
        ii. 100Mbit transfer rate
        iii. Tailored protocol
4. Sensor Suite
    a. Ultra-sonic ranging & IR close quarters ranging
        i. Forward
        ii. Sides
        iii. Rearward
        iv. Forward up (head clearance)
        v. Forward/Rearward down (holes, road edges)
    b. Other options
        i. Laser ranging
        ii. Vision for pattern recognition
5. Guidance
    a. IMU (Inertial Measurement Unit)
        i. 3-axis accelerometers
        ii. Minimum Yaw (Z-axis) Gyro
    b. GPS - Dual
    c. Compass
6. Power
    a. Battery
    b. Diesel (Optional on larger Omni-chassis)
        i. Converted to run "Green" uses spent vegetable oil – in this case the spent hydraulic fluid
        ii. Attached to a generator to charge batteries or hydraulic pump direct drive
7. Communications
    a. Zig-Bee
    b. Wireless USB

Communications and Control for disaster searching

8. Payload (most important)
    a. Interlock block stacker for landscape/retaining walls
    b. Tree planter for reforestation
    c. Debris removal after a disaster
    d. Sand bag filler and placer
    e. Communications and Control for disaster searching
        i. Contains multiple robots for searching
    f. Materials hauler

Concept Description

The basic premise is similar to buying a lawn tractor. You have the basic platform to which attachments are added. Example: if snow needs to be cleared a blade or blower is added to the front, gardening would be a roto-tiller or harrow added to the rear. The cLS Omni-chassis' are manufactured for non-military utilization with payload units for wall building, hauling or disaster search & rescue. The chassis is a complete self-contained robotic solution. The system is constructed to carry the payload (job function) supplying it with electrical power, hydraulics (if required), computational power and locomotion. The payload supplies information to the chassis as to its function and requirements. The chassis also requires information from a human interface that defines the job to be accomplished with the particular payload. The information is dependant on the final job; i.e. a retaining wall, the start point (either by GPS coordinates or a marker in the ground), length or end point, height of wall, and any curves that maybe present including different heights, see Figure 1.

In the example of the wall builder the position of the end-effecter is continually checked against the input parameters with adjustments being made. These adjustments are to physical position wither it is via the drive system or in this case the building arm.

The control system is a distributive processing system, meaning there is basically a processor for every major process or subsystem. Further information on the integration portion can be found in Application Note AN-140̸2.

Our drive systems are hydraulic allowing for large load capacity, independent wheel power and the ability to supply fluid power to the payload without adding pumps and heavy power cables to most payloads. The drive system also contains a proprietary intelligent valve to control each drive motor. In the unfortunate event of the loss of a wheel drive the motor can be put into a free wheeling condition allowing for the continued motion of the chassis.

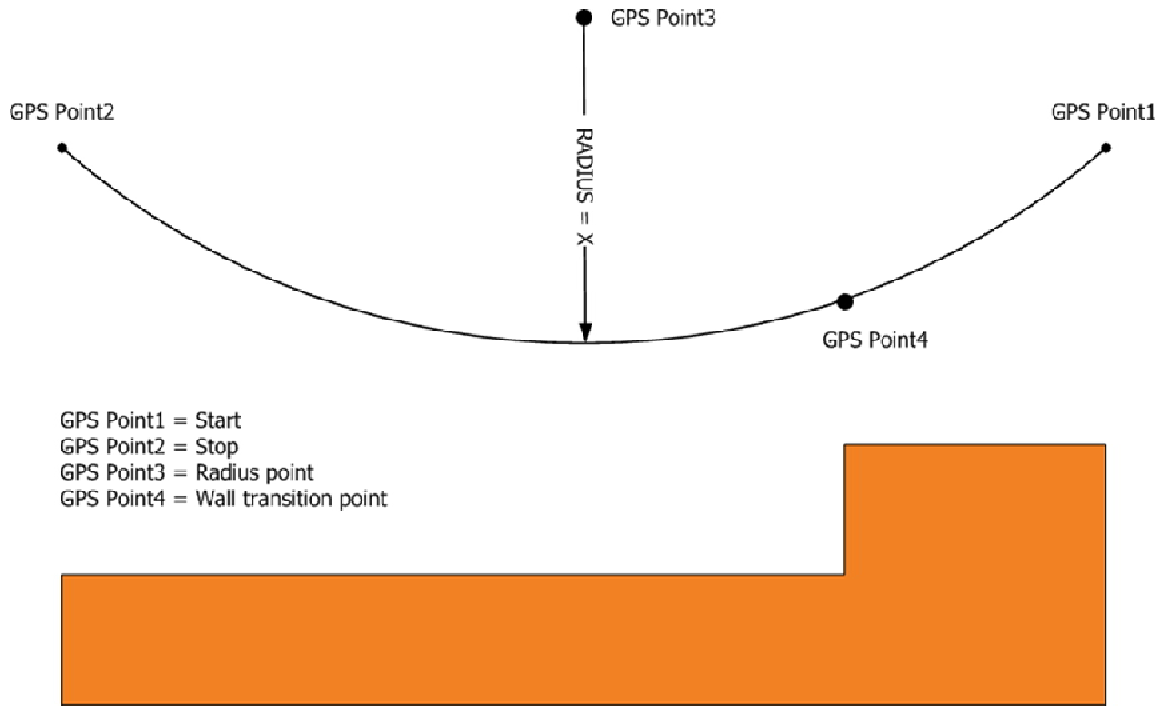

Figure 1

Conclusion

The c-Link Systems Omni-chassis is a fully integrated physical body that leaves the functionality to the immeasurable imagination of the customer. This system also allows for its job function to be rapidly changed predicated on the requirements at hand.

About the Author

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