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PHOTO VOLTAIC PANEL BASED E-AGRICULTURAL ROBOT

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Abstract:

The objective of our project is to design an agricultural robot which performs ploughing and seeding operation and takes supply from PV panel. A sensor guidance method is presented to guide a robot platform which is designed independently to drive through the crops in a field according to the design. It is mainly comprised of the rear and front cabins, the driving devices with wheels and the frame.

The power supply, motor controllers, and other controlled components are placed in the front cabin and IR sensor is fixed in front of it for finding edge location of both sides. The rear cabin can be used for storage boxes to store some materials such as pesticides, insecticides, and fertilizers. The driving devices include DC motors, gear mechanism with sprocket and wheels.

To design a robot which is autonomous and self-sufficient requires enough energy to operate. But they have to be made parallel to optimize the robot energetically. In particular, a power supply solution that utilizes solar cells and a microcontroller has been chosen to power and control the robot.

Keywords **— PV panel, crops, gear mechanism, microcontroller**

I. INTRODUCTION

Agricultural vehicle guidance for row crops is a skill and labour intensive task for manuvering equipment without overrunning crops. The adoption of new agricultural technologies, such as precision agriculture, makes the maneuvering even more difficult. The shortage and aging work force in agriculture results, in decrease in the skilled machine operators. Therefore, the development of automated or autonomous agricultural equipment is considered to be of commercial significance and societal importance.

Agricultural robot is the autonomous agricultural equipment performing various agricultural operations. Automated navigation aims to guide the robot to follow a desired path automatically. It requires a guidance system be able to detect robot posture, create proper steering signal, and steer the robot according to the signal. The posture is the position and orientation of the robot

So far batteries and/or capacitors are used as power sources. The battery supplies only a DC voltage used for the control board of a robot; the capacitor supplies AC voltage for the control of the mobility of a robot by electrical servomotors. The battery uses more time than the capacitors to charge and to discharge energy. There are two strategies for recharging batteries and capacitors: solar panels on the robot and power stations

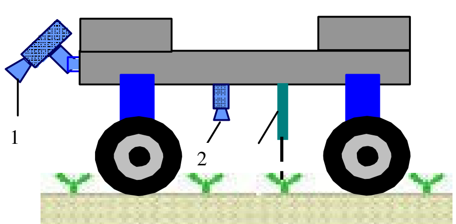
The DC battery system, is the main power source for the robot. Normally this system consists of a combination of switched mode DC power converters. Experimental results show the converter efficiency and voltage ripple at rated load. A discussion of lessons learned provide insight into the need for proper component selection and placement, printed circuit board fabrication, and ensuring a proper ground plane for successful implementation of a switched mode DC power converter.

This paper presents solution of the challenging problems to on a developing agricultural robot and to maximize the energy output using PV panel. In addition, some field tests were carried out for investigating a performance of the developed robot.

II. AUTONOMOUS AGRICULTURAL ROBOT

The design concept of open architecture was applied to the agricultural robot described in this work, which includes open design on structure system and control system. As for openness of structure system, it reflects open design on hardware, which means that it should be taken into account by replacing the different actuators to adapt to different tasks during the design and the number of sensors can be appropriately increased or reduced. Meanwhile, the control system should retain sufficient interfaces to control the actuator and receives sensors signals.

The production tasks can be transformed in the same body by replacing the relative hardware and actuators. The operations of vegetables spraying (pesticides or seed)and ploughing control are represented in figure in). Likewise, it reflects open design on software, which means that it is easy for second development and intelligent expansion. It helps in the control of actuators



a)

1 – sensor

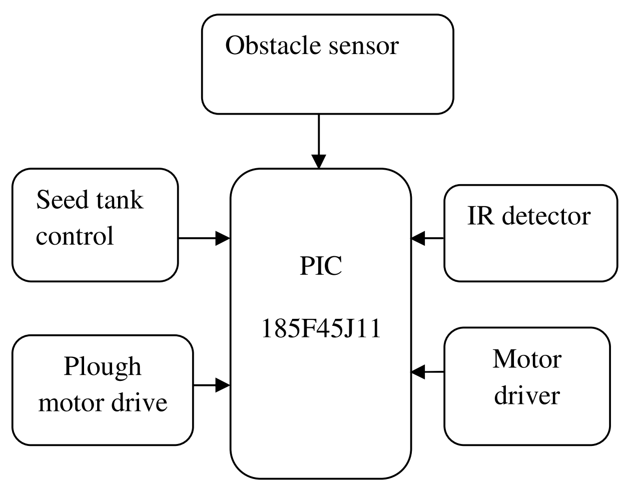
2 – Ploughing mechanism

The organization level is the decision-making system of the robot with highest level of intelligence to accomplish task planning according to operation tasks. It can construct model of the environment in the light of environmental information, maps knowledge and planning knowledge and make a global path planning with other information such as position and orientation of the robot.

The coordination level is the interface between the organization level and the implementation level to receive planning information and provide the best control program on action commands of the decision-making system through the coordination mechanisms and information fusion algorithm.

The implementation level, the bottom of the hierarchical control with high precision and low intelligence, will produce the control output to complete the corresponding action according to the expected value output from the coordination level. It also can sense and measure the environmental information, body status and information of position and orientation information and handle emergency of the system.

2.1 GENERAL METHODOLOGY



2.2 PERFORMANCE OF PHOTO VOLTAIC PANEL

There is a large variety of autonomous robots: these can be classified according to their structure, dimensions, manoeuvrability, main tasks, and so on.

In any case, every robot requires a power source to make all its functions, like mobility, control, measures, to mane just the most important. So we have seen that in most cases, robots have a storage system that self-recharges during the mission or at the beginning of the mission, by power stations.

This solution increases the robot weight and consumptions, then we are here exploring about the added value, in terms of increased autonomy, of an autonomous power source installed on the robot.

In particular, we concentrated our attention on the photocell technology (increase of efficiencies) that cheap (decrease of cost for Wp), as well as on the possibility to use cells on the flexible support, increasing the adaptability degree at any surface of every form.

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Multilink robot contains rotatable transformers placed in their joints, thus avoiding the use of movable cables. A miniature opto-electric transformer, consisting of a p-n junction photocell and a multilayer spiral coil transformer monolithically fabricated on a silicon substrate. It converts the optic energy, acquired from a photocell, into voltage.

A system for resupplying power to self-contained mobile equipment, including a fixed station having a external power source and consisting of a high-frequency generator and an induction coil as well as, on or in the equipment, a pick-up coil, a current filtering and rectifying device, a rechargeable battery pack and a microcomputer-controlled tracking system is also previously studied.

Also mobile robots for the localization by means of a transmitter-receiver system positioned on the robot and on a fixed point in the environment.

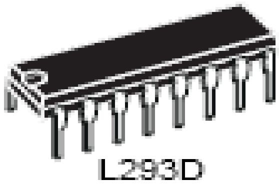
III. Autonomous Scenarios

a. Motor Driver:

The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. The input is high then the associated drivers are enabled and their outputs are active and are in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors. To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic package which has 4 centre pins connected together and used for heat sinking

The L293DD is assembled in a 20 lead surface mount which has 8 center pins connected together and used for heat sinking.



L293D
Powerdip (12+2+2)

b. MATLAB IDE

i. It is a integrated development environment for the development of embedded applications on PIC and dsPIC microcontrollers
ii. It supports project management, editing, debugging and programming of Microchip 8-bit, 16-bit and 32-bit PIC microcontrollers.

c. PROTEUS ISIS

It is a compilation of program design and simulation electronics, developed by Lab centre Electronics consisting of two main programs:

i. Ares and ISIS
ii. VSM and Electra modules

Intelligent **S**chematic **I**nput **S**ystem allows designing the wiring diagram of the circuit to be performed with components varied from simple resistors, even occasional microprocessor or microcontroller, including sources Power generators signals and many other components with different performance. Isis the designs can be simulated in real time, using the VSM module directly associated with ISIS.

IV. CONCLUSION

A preliminary analysis of the feasibility of a photovoltaic system with batteries to supply a mobile robot has been presented. By analyzing both the power drawn by the robot during the movement at various speed rates and efficiency of the most used PV cell technologies it is clear that the PV system can supply only the control, sensing and wireless transmission systems. However some qualitative evaluations on the possibility of using less power consuming motion system and at the same time the presence on the market of very efficient PV cells (i.e. triple junction) forecast the feasibility to extend the photovoltaic power to supply to whole robot. Further investigation is therefore needed in this direction.

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