

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2015

Online control of Agricultural Robot using LabVIEW

Shwetal Ramesh Gund, Prof. V. P. Bhope

Dept. of Electronics & Telecommunication, GHRCOEM, Chas, Ahmednagar, Maharashtra, India

ABSTRACT: This paper presents the agricultural robot based on micro-controller based fuzzy controller which can be used for various agricultural operations. Manpower can be reduce by using the agricultural robots in field. Robot is operated using remote controls from a distant place. Paper suggests an agricultural robot which is designed with an internet based remote control by using LAB VIEW. The robot is control by using ATmega32 microcontroller. The Robot control is implemented from a remote place using internet and web publishing tool in LabVIEW. Complex and expensive equipment can be replaced by easy and less expensive hardware by using LabVIEW software. The agricultural Robot can be controlled from any distant computer having LabVEIW software. Thus this agricultural Robot control reduces the manpower and becomes valuable and cost-effective.. By using the GSM/GPRS transmission of data is very rapid, long distance communication, gathers and transmits information correctly.

KEY WORDS: LABVIEW, GSM Modem, soil moisture sensor, Atmega 32 Microcontroller.

I. INTRODUCTION

In earlier days farmers used cattle to plough the field and after that tractor are used for ploughing application. For Seeding more man power is required and also it is a slow process. Also, it is depended on the person doing the task of seeding, what should be the amount of distance between the seeds . Recently we are using unique instruments for these applications. For irrigation process, farmer provide water to the crop, the humidity content of soil may diverge depending on the season. It will affect the crop and it results to decrease in overall quality of output crop.

To prevail over all these problems by using the Agriculture robot, this robot contains a seed box and soil moisture sensor. The robot is monitored through LabVIEW software. Different technologies are developed to execute the inaccessible real-time control using Internet-based technology. LabVIEW is one of the user friendly software packages used in process control applications. LabVIEW uses various protocols such as UDP/IP, Data Socket, etc. that allow remote control using Internet LabVIEW

II. RELATED WORKS

1.Masoud Nagedolfeizi, Sanjeev Arora and Singli Garcia, Survey of LabVIEW Technologies for Building Web/Internet-Enabled Experimental Setups", Proceedings of American Society.

This paper presents a study of Web/Internet-enabled technologies to create tentative setups that can fully be controlled, monitored and operated distantly. This paper discusses the major methods of interfacing LabVIEW application with the Internet/WWW that could be working for remote operation o experimental setups.

Disadvantages:

Virtual Instrument is not interacted with the user.

If a bulky number of users co-currently use the application then a reasonably notable slowdown in the implementation of application may occur.

2. Autonomous Agricultural Robot and Its Row Guidance

XUE Jinlin1, XU Liming2

A vision-based row guidance method is obtainable to guide a robot platform which is designed independently to drive through the row crops in a field according to the design concept of open architecture. Then, the offset and heading

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2015

angle of the robot platform are detected in real time to guide the platform on the basis of recognition of a crop row using machine the accuracy of row guidance is up to $\pm 35\text{mm}$, which means that the robot can move with a sufficiently high accuracy.

Disadvantages:

Complex design.

3. Verification of a Weeding Robot “AIGAMOROBOT” for Paddy Fields Teruaki Mitsui, Takahiro Kobayashi, Toshiki Kagiya, Akio Inaba, and Shinya Ooba.

The “AIGAMO-ROBOT” is a weeding robot. In this paper, it is suggested weeds are decrease in paddy fields without resorting to herbicides.

Disadvantages:

It is expensive.

4. Design and simulation of fuzzy controller for closed loop control of chopper fed embedded dc drives N.S. Kumar, V. Sadasivam, K. Prema Dept. of EEE, Mepco Schlenk Eng. Coll., India

An INTEL 8051 microcontroller based fuzzy controller for closed loop control of dc drive fed by dc/dc converter. The controller build has two loops. First loop is an inner current controller and second loop is an outer fuzzy speed controller. Computer simulations estimate the designed fuzzy controller. The controller is used to modify the duty cycle of the converter. Then the voltage is fed to the armature of the separately excited motor to control the speed. The simulated results are compared with experimental results by using a buck converter with the fuzzy controller implemented in 8051-based embedded system.

Disadvantages

Performance is not better

1. Proposed System

Figure 1 shows an agricultural robot as a server system. Robot is connected with internet connection and is assigned static IP address. The client system can be any personal computer or laptop with internet connection.

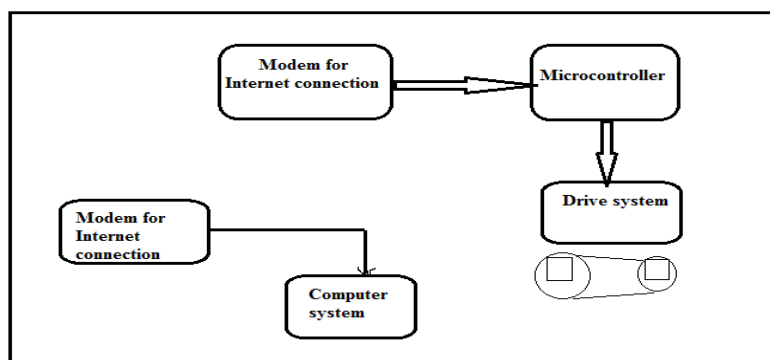


Fig: 1 Internet based controlled loop.

Figure 2 shows the block diagram of the control system for motors. The system consists of H-bridge converter for driving the separately excited DC Motor in both forward and reverse direction.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2015

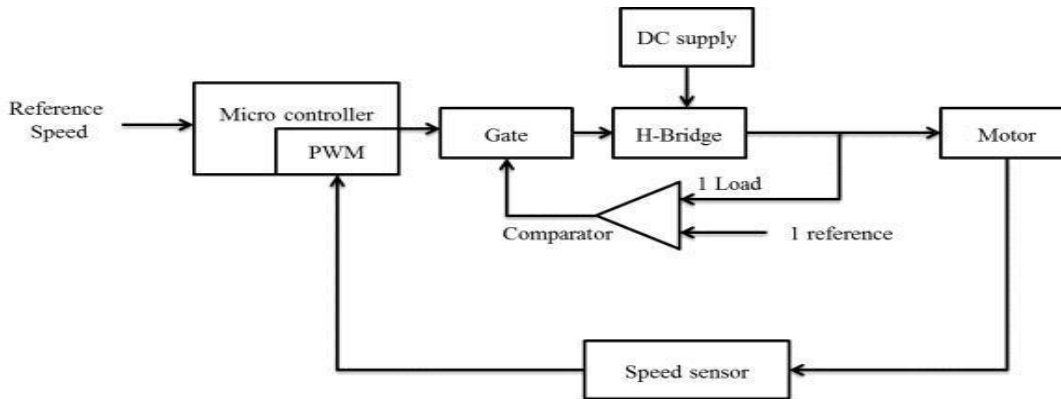


Fig: 2 Block diagram of the proposed motor control system

The performance of DC drive will be based on the choice of controllers. The closed loop control has two loops. One is outer speed control loop and another one is inner current control. In outer speed control loop, the speed is fed back and is compared with set speed.

The designed FLC was then implemented microcontroller. By using the programmed microcontroller the agriculture robot's speed and steering angle is controlled.

A program was developed for the movement of ploughing tool using a DC motor and for controlling the seed flow from the seed box. This program is also implemented in the same microcontroller.

Mathematical model of DC motor:

In any electric motor operation is based on simple electromagnetism. A current carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force comparative to the current in the conductor, and to the potency of external magnetic field. DC motor has axle, rotor, stator, commutator, Field magnet(s), and brushes. The stator is stationary part of the motor, this includes the motor casing and two or more permanent magnet pole pieces. The rotor consists of windings which is electrically connected to the commutator.

The simulation and design of the controller was done using equation models of the motor and H-bridge converter. The DC motor has been modeled with the following equations.

By Krichoffs law

$$I_a R_a + L_a \frac{di_a}{dt} + e_b = V_a \text{-----(1)}$$

$$T = K_t I_a \text{-----(2)}$$

$$J \frac{d^2\theta}{dt^2} + B \frac{d\theta}{dt} = T \text{-----(3)}$$

$$e_b = K_b \frac{d\theta}{dt}$$

where

I_a - Armature current

V_a - Armature voltage applied

R_a - Armature resistance

L_a - Armature inductance

e_b -Back Emf

J - Moment of Inertia of the motor

B - Friction coefficient of the motor

K_t - Torque constant of the motor

K_b - Motor back emf constant

T - Torque developed by motor

e - Angular displacement of shaft

W - Angular velocity of the shaft

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2015

2. Fuzzy System

Fuzzy Logic (FL) is a multi valued logic that allows intermediate values to be defined between conventional evaluations like true/false, yes/no, high/low, etc. Notions like rather tall or very fast can be stated mathematically and processed by computers, so that a more human-like way of thinking can be applied in the programming of computers.

DC Motors simulation module is used to control the steering angle and the driving speed of Robot. The speeds of these motors are transformed according to the reference values when the Robot reaches the end points. Control logic is build to decide the track of Robot movement based on the initial position and current position values of the Robot.

The real speed is fed back and is compared with the reference speed. After comparison, the error and the change in error are estimated and are given as input to fuzzy controller. The error is normalized to per unit value with respect to the reference speed. This helps in using the fuzzy controller for any reference speed. The fuzzy controller will attempt to reduce the error to zero by varying duty cycle of switching signal.

The control algorithm of a process that is based on fuzzy is defined as fuzzy control. The controller which uses control which is based on fuzzy is called as fuzzy controller. Fuzzy, unlike Boolean or crisp deals with elusiveness, uncertainty, qualitiveness.

It tends to mimic human being thinking which is fuzzy in character. In conventional set theory, based on Boolean a particular object or a variable is a member of a given set then its membership value is 1, or if it is not a member of a given set then its membership value is 0. But in fuzzy set theory based on fuzzy, a particular object has a degree of membership in a given set that may be anywhere in the range of 0 to 1.

3. LABVIEW

LabVIEW is a program development atmosphere, similar to modern BASIC or C development atmospheres, and National Instruments Lab Windows/CVI. However, LabVIEW is different from those applications in one important aspect. Other programming systems use *word-based or text-based* languages to generate lines of code, whereas LabVIEW make use of a pictorial or *graphical* programming language, *G*, to create or generate programs in block diagram appearance.

LabVIEW, similar to C or BASIC, is a general-purpose programming system with widespread libraries of functions for several programming job. LabVIEW consists of libraries for data acquisition, serial instrument and GPIB control, data presentation, data analysis, and data storage, etc. LabVIEW also includes conservative program development tools, so you can place breakpoints, animate the execution process to see how data transfers or travels through the program code, and single-step during the program to formulate debugging and program development uncomplicated.

LabVIEW is a general-purpose programming system, but it also consists of libraries of functions and development tools designed particularly for data acquisition and instrument control.

LabVIEW programs are called *virtual instruments (VIs)* because their operation and appearance can mimic real instruments. However, VIs are analogous to the functions of conventional language programs.

A VI includes an interactive user interface, a dataflow diagram that provides as the source code, and icon connections that permit the VI to be called from higher level VI. More particularly, VIs are structured as follows:

- **FRONT PANEL:** The interactive user interface of a VI is called the *front panel*, because it is the panel of a physical instrument. The front panel can include push buttons, knobs, graphs, and other indicators and controls. Data is entered using a keyboard and mouse, and then analyze the results on the computer screen.
- **BLOCK DIAGRAM:** The VI obtains orders from a *block diagram*, which you create in *G*. The block diagram is a graphic solution to a programming problem. In other words, *block diagram* is source code of VI.
- VIs are modular and hierarchical. We can utilize them as high-level programs, or as subprograms inside other programs. A VI within an additional VI is called a *subVI*. The *icon and connector* of a VI is like a graphical parameter file so that other VIs can pass data to a subVI.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2015

With these structures, LabVIEW encourages and adheres to the idea of *modular programming*. You partition an application into a sequence of tasks, which you can divide again until a complex application becomes a sequence of simple subtasks. You construct a VI to achieve each subtask and then merge those VIs on another block diagram to accomplish the bigger task. Finally, your top-level VI includes a collection of subVIs that symbolize application functions.

Because you can execute each subVI by itself, debugging is much easier. Also, many low-level subVIs often perform tasks familiar to several applications, so that you can develop an expert set of subVIs compatible to applications you are likely to construct.

III. SYSTEM IMPLEMENTATION

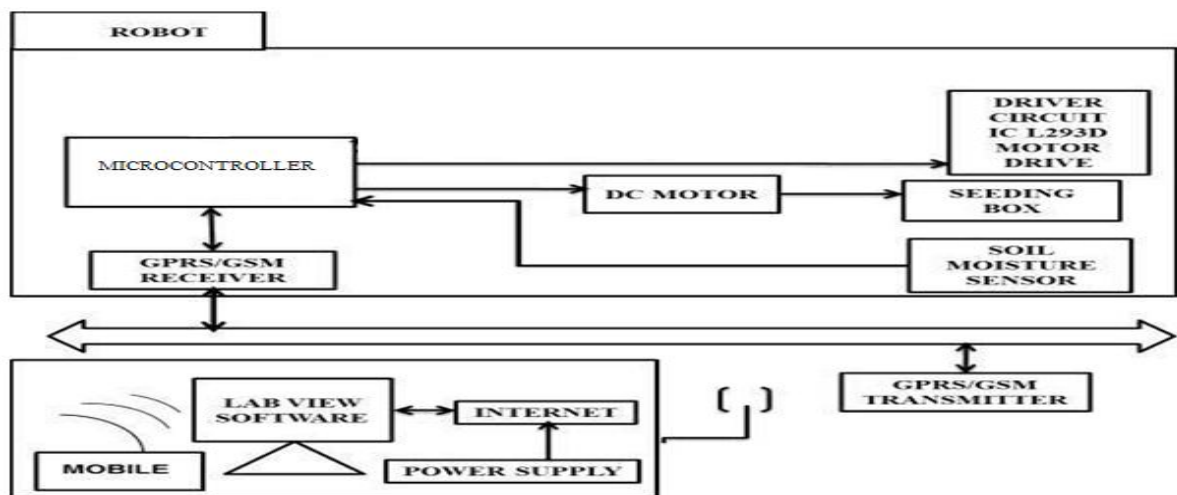


Fig: 3Block diagram of Agricultural Robot using LabVIEW.

Figure 3 shows the block diagram of the agricultural robot. It consists of the following system.

- 1] Robot system
- 2] Data transmission system
- 3] Client system

Robot system:

An agricultural robot is treated as a server system, internet connection and assigned static IP address. Agricultural robot is treated as a monitoring center which is assigned with a fixed IP address.

The client system can be any PC with internet connection. The system is composed of monitoring terminal, data transmission networks and monitoring center. Monitoring center server is provided with a fixed IP address.

Data transmission system:

The system of data transmission network is formed by GSM network and the Internet, which is the data transmission channel between the monitoring terminal and monitoring center. Monitoring terminal on which integrates GSM communication module collects the operating data of Agricultural Robot through the transmitter of field meter. The GSM communication module controlled by microcontroller sends the data to monitoring center via GPRS wireless network.

Client system:

Any personal computer having internet connection is treated as client system.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2015

IV. RESULTS AND CONCLUSION

Using LabVIEW, the designed fuzzy controller was tested. The simulation results were compared and established by Real time performance. The speed reregulation was verified using fuzzy controller.

The LabVIEW Embedded toolkit has the advantage of increased performance, reduced cost and reduced time to implement the design. The conventional control needs design objectives such as steady state and transient characteristics of the closed loop system to be specified. But fuzzy control overcomes the problems with uncertainties in the plant parameters and structures encountered in the classical model based design.

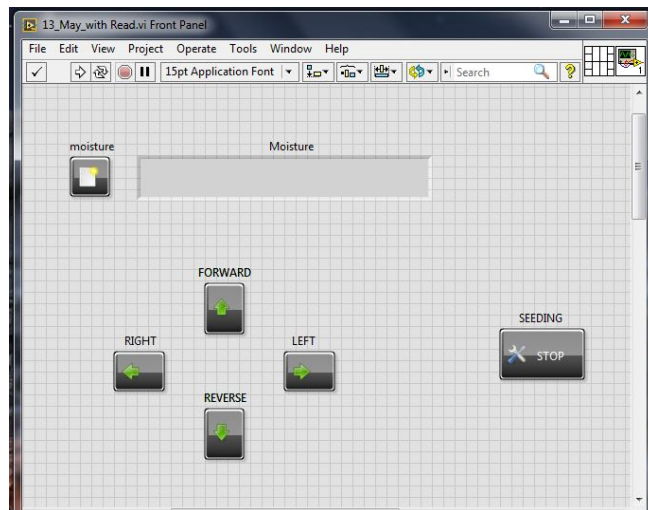


Fig 4: Front panel of agricultural robot

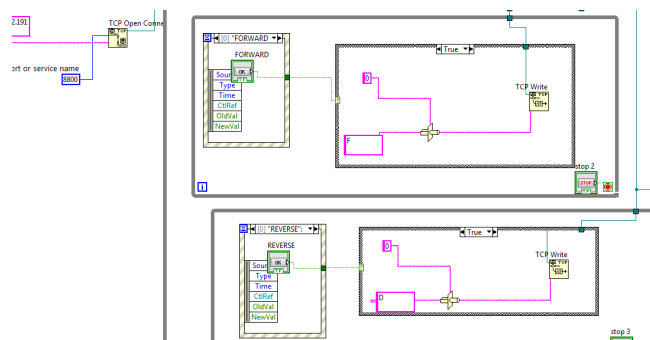


Fig 5: Block diagram of forward and reverse operation of agricultural robot.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 7, July 2015

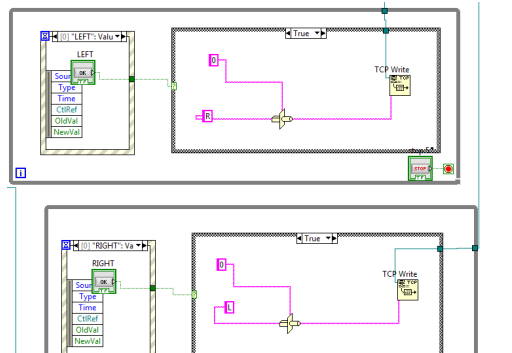


Fig 6: Block diagram of right and left operation of agricultural robot.

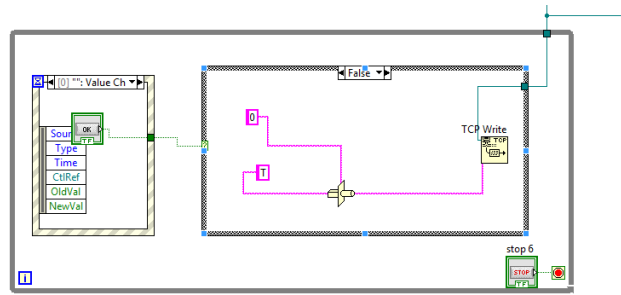


Fig 7: Seeding Operation

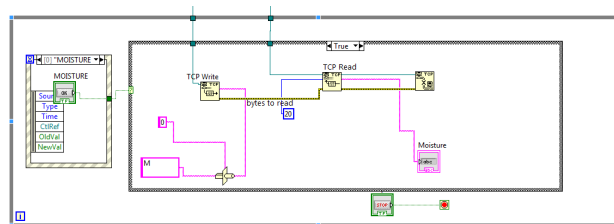


Fig 8: soil moisture sensing operation

REFERENCES

- [1] Masoud Naghedolfeizi, Sanjeev Arora and Singli Garcia, "Survey of LabVIEW Technologies for Building Web/Internet-Enabled Experimental Setups", Proceedings of American Society.
- [2] "Autonomous Agricultural Robot and Its Row Guidance" XU Liming², XUE Jinlin¹
- [3] "Verification of a Weeding Robot "AIGAMOROBOT" for Paddy Fields" Teruaki Mitsui, Takahiro Kobayashi, Toshiki Kagiya, Akio Inaba, and Shinya Ooba.
- [4] "Design and simulation of fuzzy controller for closed loop control of chopper fed embedded dc drives", V. Sadasivam, N.S. Kumar K. Prema Dept. of EEE, Mepco Schlenk Eng. Coll., India.
- [5] "Virtual Instrumentation Based Process of Agriculture by Automation" K.P. Thooyamani, 1 2V. Khanaa and 3R. Udayakumar Middle-East Journal of Scientific Research 20 (12): 2604-2612, 2014 ISSN 1990-9233 © IDOSI Publications, 2014 DOI: 10.5829/idosi.mejsr.2014.20.12.647
- [6] "An Intelligent Remote Control System With Robots For Agriculture Process By Using Fuzzy Controller And Virtual Instrumentation" Sindhu.M, Ramya.U Embedded System, Anna University.