

## **Farm Monitoring Mobile Robot Speed Controlled of DC Motor Driver System Using PID Controller.**

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**Abstract:** The ARM Based controller for DC motor Drive system for mobile robot which are used for The farm environment and plant condition such as temperature, humidity soil moisture content etc. are continuously monitored through suitable data acquisition system incorporated in the robotic system. A DC motor based robotic arm is designed for collecting soil sample and test various soil parameters. A closed loop feedback algorithm based on Digital PID controller has been developed for precise position and speed control of mobile robot. A mobile Robotic system for monitoring these parameters using wireless network has been developed based on ARM platform. Robotic platform consists of ARM7 based LPC 2148 processor, Motor driver, robot mechanical assembly .The multi-sensor measurement over a wireless connectivity for various distances. From an application point of view, a mobile robotic platform is developed to test the multi-sensor embedded system for Agro- Industrial Applications. The indoor and outdoor range for wireless transmission has been presented. It is observed that for better transmission of signals via wireless communication, the low frequency along with low baud rate and line of sight range is required to minimize the signal loss.

**Keywords-** Embedded System; Sensors and Actuators; Wireless Mobile Robots; Wireless Connectivity

### **I. INTRODUCTION**

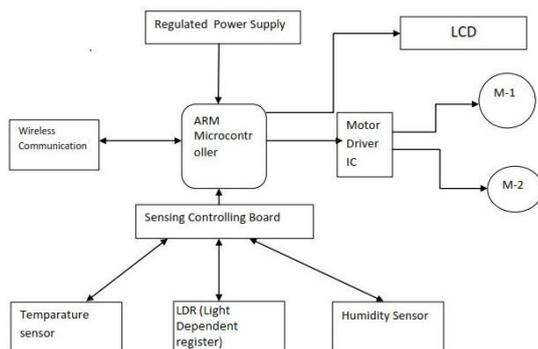
A "smart sensor" is a transducer (or actuator) that provides functions beyond what is necessary to generate a correct representation of a sensed or controlled quantity. The "smart sensor" functionality will typically simplify the integration of the transducer into applications in a networked environment. Embedded with a microcontroller unit, a smart sensor has much more built in intelligence over a traditional sensor. So, it can perform more powerful functions such as self-identification, self-calibration, converting the raw sensor signal into a digital form. Multi-sensor systems are now used in many application areas,

including environment and habitat monitoring, healthcare, home automation, and traffic control especially in agro and food applications like Reverse Osmosis (RO) plant automation, fish pond management systems, environmental monitoring, precision agriculture, machine and process control, building and facility automation. Wireless based Smart sensor module has drawn attention of the industry on account of low cost, low power consumption, flexibility, and use in remote areas. Precision farming is the conjunction of a new management perspective with the new and emerging

Agriculture is one of the most ancient activities of man in which innovation and technology are usually accepted with difficulty, unless real and immediate solutions are found for specific problems or for improving production and quality. Nevertheless, a new approach, of gathering information from the environment, could represent an important step towards high quality and eco sustainable agriculture. Nowadays, irrigation, fertilization and pesticides management are often left to the farmer and agronomist's discretion: common criteria used to guarantee safe culture and plant growth is often giving a greater amount of chemicals and water than necessary. There is no direct feedback between the decision of treating or irrigating plants and the real effects in the field. Plant conditions are usually committed to sporadic and faraway weather stations which can provide accurate and local measurements of the fundamental parameters in each zone of the field. Also, agronomic models, based on monitored data, cannot provide reliable information. On the contrary, agriculture needs detailed monitoring in order to obtain real time feedback between plants, local climate conditions and man's decisions.

## II SYSTEM DEVELOPMENT

The most suitable technology to fit an invasive method of monitoring the environment is a Wireless sensor Network (WSN) system.



SYSTEM BLOCK DIAGRAM

In this System block diagram it show that.

### A. ARM Based Controller Unit:

ARM7 based Philips (LPC2148) microcontroller is used to control the various task. This provides a small size microcontroller solution to the handheld device and ordinary application of low price, low power consumption and high performance. This 32 bit microcontroller

has ARM7T processor core integrated inside A with maximum master frequency of 400 MHz. This high end processor is used to accomplish the task in this robot.

### B. Power Module and Battery

7 Ah lead acid battery from nex robotics is used to supply the power to all module of the system. Power supply module is designed for power requirement of 12V, 5V 3.3V and 1.8 V.

### C. Driver Module

For controlling the motor speed and direction a interface circuit with L293D is used .Speed is controlled using PWM signal generated by mini2440 .Driver module comprises 2 DC motor for various task of robot.

### D. Sensor Module

Sensor module included temperature sensor, humidity sensor, LDR(Light dependent resister) sensor.

### E. Communication Module

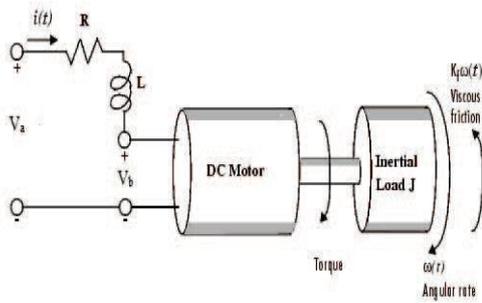
Communicating wirelessly between host and target Through wireless module from Mobile hand set is used. This is used to send commands to mobile robot and to receive data from mobile robot.

## III. DC MOTOR MODEL

Direct-current (dc) motors are one of the most widely used prime movers in the industry today. Advanced manufacturing techniques have also produced dc motors with ironless rotors that have very low inertia, thus achieving a very high torque-to-inertia ratio. Low-time-constant properties have opened new applications for dc motors in computer peripheral equipment such as tape drives, printers, disk drives, and word processors, as well as in the automation and machine-tool industries. The dc motor is basically a torque transducer that converts electric energy into mechanical energy. The motor torque  $T$  is related to the armature current,  $i$  by a torque constant  $K$ ;

$$T = Ki$$

The generated voltage,  $V_a$ , is relative to angular velocity

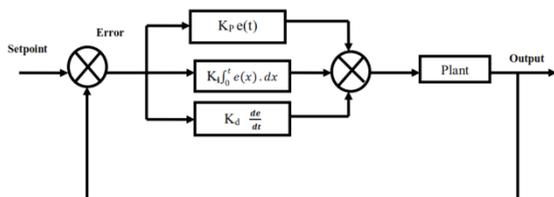


#### IV. Digital PID Controller:

Proportional-Integral-Derivative (PID) control is still widely used in industries because of its simplicity. No need for a plant model. No design to be performed. The user just installs a controller and adjusts 3 gains to get the best achievable performance. Most PID controllers nowadays are digital. In this document we discuss digital PID implementation on an embedded system.

##### Different forms of PID

A standard “textbook” equation of PID controller



The time domain relation for Continuous –time controller is

#### III. Fundamentals of PID controller

PID controllers are the most widely-used type of controller for industrial applications. They are structurally simple and exhibit robust performance over a wide range of operating conditions. In the absence of the complete knowledge of the process these types of controllers are the most efficient of choices. The three main parameters involved are Proportional (P), Integral (I) and Derivative (D). The proportional part is responsible for following the desired set-point, while the integral and derivative part account for the accumulation of past errors and the rate of change of error in the process respectively.

$$u(t) = K_p e(t) + K_i \int_0^t e dt + K_d \frac{de}{dt}$$

Where,

Error,  $e(t)$  =Set point- Plant output

$K$ =proportional gain

$K_i$ =integral gain

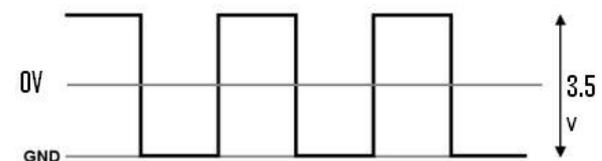
$K_d$  = derivative gain

#### V. SOFTWARE DEVELOPMENT AND IMPLEMENTATION

Actual Implementation of PID controller was done using ARM based microcontroller LPC2148 through an interfacing circuit. For software part two software routine are running in every 1/10th of a second, one is for calculating speed and second one for generating control efforts.

**Device-driver for timer:-** PWM duty cycle is controlled by a device driver program this device driver program is customized as described below. Flow chart.

$$\text{Speed} = \text{Time of counting} * \text{Number of Count} / N$$



PWM Duty Cycle Is Controlled By A Device Driver waveform.

#### VI. RESULTS AND CONCLUSION

A real time Digital PID controller has been developed and closed loop approach is adapted to control the speed of the DC motor using embedded system. Character device driver program is developed for DC motor control strategy. This design is implemented on ARM7 based LPC 2148 microcontroller. Proportional, integral and derivative parameters are obtained for various load conditions to set the speed. Speed control with precision and high speed of operation is important in robotic application. High precision control implementation requirements have been met on ARM board because it is 32-bit microcontroller; additionally it has all necessary facility for concurrent programming and real-time control for fast handling of events in Robotic applications.

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