

PLC Based Farm Automation

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ABSTRACT

We have developed a field model to demonstrate our applications. PLC is used for batch process control.[1] This paper describes an automation model developed for irrigation and fertilization using Programmable Logic Controller (PLC). The brain of the system is PLC which is used as controller. To control the performance of these machines, a large amount of information has to be captured by soil moisture sensors and water level sensor and transmitted to PLC and stored in data logging systems for further processing. To determine the crops water demand is essential to estimate the soil moisture. Under irrigation or over-irrigation system leads to excessive or less water supply which may cause worse result i.e. yield reduction. The project is based on irrigation and fertilization in an accurate manner by checking the moisture content in soil by the arduino soil moisture sensor and fertilizer's mixing by stirrer motor. When the machines and processor are in operation, the state of surrounding systems, as well as interactions between the agricultural production process and its environment, must be considered. Mass and energy flows should be therefore be accompanied by information flows. The facts require the introduction of an information-based agriculture, the so-called "precision agriculture".

Keywords: PLC, Solenoid valves, pump, level switch, relay, stirrer motor, etc.

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I. INTRODUCTION

Agriculture is the backbone of Indian Economy.[2] Sustainable agriculture aims at the production of high-quality food and raw material in sufficient quantity for a wide range of consumers. But today's situation the availability of the labour of caring out agriculture activities is rare. For this reason, modern field machinery and equipment should be able to cope with complex agriculture process and to execute difficult operations at high efficiencies and without any environmental pollution. For controlling performance of the machines, a large information has to be sensed by sensors and transmitted to data logging systems for further processing. Moreover, agricultural production takes place in an open system that has different relations to its surroundings.

This paper is divided in to sections II, which explains existing systems for automation in agriculture. Section III defines problem statement. Section IV gives idea about role of PLC in project execution. Section V explains details of proposed systems. Section VI explains system analysis.

Section VII is the result. And section VIII gives conclusion of the project work.

II. EXISTING SYSTEM

In Today's world, automation in agriculture field is taking to the next level of automation. Currently, everything is done manually in so many rural areas. Existing system of agricultural process is 80% manually and 20% automation. For example, let us take small example of farming a plant. One has to manually check the Soil moisture in the existing soil. If the sand is not having enough moisture in it then one has to provide sufficient water to the sand. So to pump water from the canal or from the well manually using pulleys. One has to check the water level in well and to drip that water. To check Fertilizer, farmers now a days are checking manually and there is no accuracy maintained during the fertilization. Everything is done almost manually from top to bottom. Our system is the best solution on existing system.

III. PROBLEM STATEMENT

The major problems faced by the Indian agriculture are those of depleted soils, lack of modern technology, population pressure, and poor facilities for storage. To obtain great result in agriculture we should use technology here also. It will not only reduce the human efforts but also increase the production. It will consume less time and it will be inexpensive.

Agriculture is carried out in the world to satisfy our basic need of food, and for this water is key input for plant growth and is instrumental in the upkeep of the environment. Although water is a renewable source, it is quite dynamic and scarce. So irrigation remains the most dominant component in the overall investment in agriculture. Without proper use of water, it is difficult to get good outcomes on better high yielding seeds and higher doses of fertilizers. But all these type of things are done manually. So, this kind of work is very time consuming, more need of man power, and money too whereas outcome is less.

Therefore we made the project PLC based farm automation showing few examples how it can be developed and achieved more production with better irrigation system.

IV. PLC

Before the advent of solid state logic circuits, logical control system were designed and built exclusively around electromechanical relays.

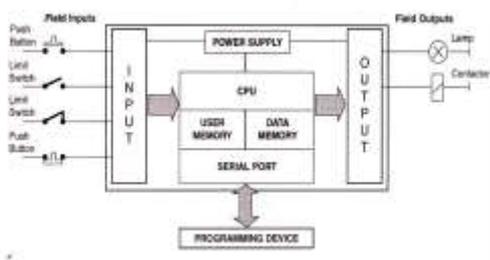


Fig.1: Block Diagram of Basic PLC

Relays are far from discarded ones in modern design but have been replaced in many of their former rolls as logic levels control devices, relegated most often to those applications demanding high current /high voltage switching. System and processes requiring “on/off” control industry, but such control systems are rarely built from either electro mechanical relays or discrete logic gates. The engineering firms developed in nonproprietary terms as Programmable Logic Controller. A PLC has many “input” terminals through which it interprets “high” and “low” logical states from the sensors and the switches it also has many output terminals, through which it gives outputs as “high” and “low” signals to various devices lending themselves to on/off control.

V. PPROPOSED SYSTEM

In the proposed system, we have given five models for advance precision agriculture systems:

- Soil moisture sensing system.
- Water level system.
- Water dripping system.
- Fertilizer mixing system.
- Fertilizer dripping system.

a) Soil moisture sensing system is used to check the moisture of the soil for every crop. Different water content is required, it also depends on the soil types whether it is sandy, clay, loam, sandy loam and also on ingredients present in the soil.[3]

b) Water level system is used to check the water level of the water tank to avoid from the short-circuit of the motor. And also it gives the advantage to save excess water wastage.

c) Water dripping system is used to irrigate the land this will provide efficient uses of water are sources over conventional flooding methods.[4]

d) Fertilizer mixing system is used here to mix the chemicals and make fertilizers out of it. It will be useful because the manual mixing of fertilizer may be harmful.

e) Fertilizer dripping system is used to provide the mixed fertilizers to the crops roots through the dripping system.[5]

The most highlighting virtues about automation are improved uses of resources and quality of product, enhanced efficiency as well as optimization of man power. So farming today, along with modernized methods and integrated with automation can remarkably become fruitful. To grab this advantage of both automation model which is based on PLC. A programmable logic controller a specialized digital controller that can control machines and processes, and controls output in order to automate machines and processes. As the need for increased productivity reliability and efficiency grows, the agriculture sector searches more ways to use sophisticated control techniques. PLC can be a sophisticated controller module for controlling the various operations of process.[6]

VI. ANALYSIS

- Improved field management.
- Yield increases, which would reduce energy consumption per unit product.
- Reduced direct contact with hazardous chemicals and fertilizers.
- Reduce run off water and nutrients.
- More timely work which is very inclined.
- More accurate cut off.
- Assist in management of higher flow rates
- Gives indication of 0% to 100% of water content in any type of soil.
- Proper water level system leads to avoidance of short circuits.[7]

V. RESULT

The result of PLC based farm automation is that it is providing a proper irrigation and fertilization to the farm. PLC the heart of the system is providing interlock facility to the system. Dehydration to the crops is avoided. Arduino soil moisture sensor provides accurate humidity of soil and it converts it into voltage as it is a smart sensor. Stirrer motor is mixing fertilizers with delay of 10 seconds. Solenoid valves provides flow of water and fertilizer. The system provide timely work.

VI. CONCLUSION

The work implementation of PLC based farm automation is completed with implementing the five systems. The system is checking the moisture content of the soil and as per the content it is supplying water to the field by water dripping system. This water dripping system is having level in the tank by the water levelling system. The Fertilizer mixing system is also proposed in this model to avoid harmful chemicals direct contact with farmers and also to reduce the cost of the systems the drip lines are also used to inject the fertilizers to the roots of crops & get a good yield. PLC gives interlock and provides safety to the whole system.

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