Smart System in Irrigation Field

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ABSTRACT
With the water requirements in irrigation being large, there is a need for a smart system that can save the water and increase the productive of crop. This paper aims at saving time and avoiding problems like constant vigilance in irrigation field, it also focus on water conservation by automatically providing water to the field depending on their water requirement at different stages of crop growth. Hardware model has been developed to check the water level in the field and underground sump, with the help of water level sensors, based on that pumping motor will automatically pumps the water into the field. In this system, the main controlling device is microcontroller. Water level sensor will give the status of the water level to the microcontroller, based on that microcontroller will display the status of the water pump on the LCD and switch ON or OFF the pumping motor through relay.

In irrigation process, monitoring of water level in the field is of important factor, which increase productivity of crops, so monitor the water level condition are been carried out by magnetic floating sensors, which senses whether the water level is of desired level or not and it is continuously monitored by the microcontroller. In the present work Keil µvision4 and isis7 professional software are used for programming.

Keywords
Microcontroller, Magnetic Floating Sensor

1. INTRODUCTION
To make better use of our limited freshwater resources, farmer need to have not only an efficient method of delivering the water to the plants, but also an efficient watering schedule, so that the plants are getting watered with the right amount at the right time[1].

Smart irrigation system consists of a series of sensors that measure field's water level. The data gathered from these sensors is sent across a low cost, low power consumption microcontroller network [2] [3]. These sensors are effectively distributed over the cultivated area, given that different areas of the field (or fields) have different water requirements. The sensors monitor these parameters and send readings to a microcontroller. Microcontroller uses an intelligent software application to automatically analyze the data and act upon it by selectively activating irrigation nodes only in the areas required.

2. PROBLEM IDENTIFIED DURING SURVEY
Problem 1: Today most of the farmers have replaced conventional pumps with electrical pumps. But they find it very inconvenient for the condition of water pump because there is no effective water level indication system in the field. As a result, there is a plenty of water wastage and wastage of power consumed by the motor pump.

Problem 2: It is observe that most of time during summer and draught season water is not available in the sump. If the centrifugal pump is still in operation then, definitely pump will be heated up, which leads to failure of winding, wear and tear losses. The water also acts as a coolant to cool down various components of pump. If pump is running dry then due to heat factor, parts can be damaged and this will cease the pump.

2.1 Problem solution
Solution 1: Magnetic floating sensors are used in the cultivating field which sense the water levels in the cultivating field and operate the motor pump automatically.

The motor is turned ON if the water level in the cultivating field falls below the desired level and the motor pump is turned OFF if the water level in the cultivating field reaches the desired level.

Solution 2: Magnetic floating sensors are used to detect the water level from the pump suction port tank or sump. If this sensor does not sense water, then the water pump is not allowed to run, protecting it from burning out.

3. OBJECTIVE
The main objective of the paper is to monitor the water level in cultivating field. Based on required water level in the field and underground sump, pumping motor will be automatically switch ON or OFF through relay using microcontroller. This saves the water at the same time and on the other hand the plant can get optimum level of water, so increasing productivity of crop. It also protects the water pump from burning out. Figure 1 shows the block diagram used in the present work.

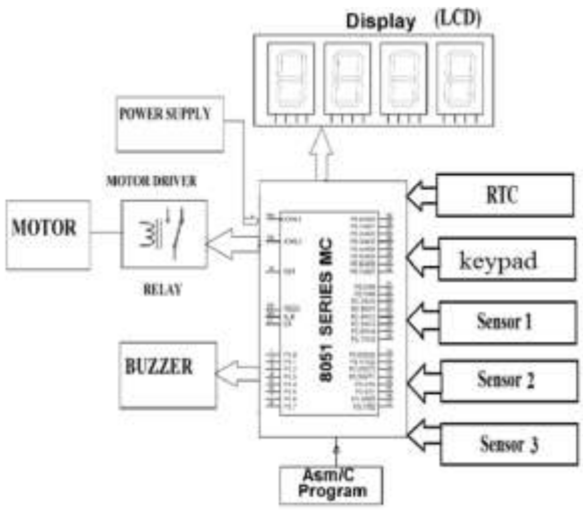

Fig.1: Block Diagram

4. CASE STUDY

Survey has been carried out to study the water requirement in paddy field at different stage of its growth and ensure safety of submersible pumps from burning of coil due to dryness of water main during summer and draught seasons. The water requirement for rice crop is comparatively higher than other crop of the similar duration. Assured and timely supply of water has a considerable influence on the productive of the crop. During the crop growth period, the requirement of water is generally high at the initial seedling establishment stage. After the transplanting, water should be allowed to stand in the field at a depth of two inches till the seedlings are well established. Secondly the most important critical stage is tillering to flowering and in this period the crop should not be subjected to soil moisture stress. The water supply should be ensured in required amount during panicle initiation to flowering stage. About four inches depth of water for first two months then about six inches of water for next one month should be maintained in the field. Before harvesting, water should be drained out from the field to allow quick and uniform maturity of grain [4].

4.1 Step by step paddy growing process

Step 1:

- Purchase rice seeds from any farmer's supply store.
- Choose your planting location.
- Gather at least 28.5g To 56.5g of rice seeds to sow.

Step 2:

Plant the rice seeds throughout the soil, during the spring season.

Step 3:

- Thin or space out, the rice seeds to prevent crowding, and wait for rice grains to mature.
- Maintain 4 inches of water level for 2 months till plant grow from 7 inches to 12 inches.
- Maintain 6 inches of water level for 1months till plant grow from 12 inches to 17 inches.

Step 4: Harvesting

- Let the water dry out or drain any excess water before removing the rice for harvesting. Over the course of the next two weeks, they'll turn green to gold. It is the sign that, it is ready for cutting.

Table.1 shows complete process involved in paddy growth

Step No	Length of the plant	Water requirement	Duration	Loop used
Step 1	-	-	-	-
Step 2	Seeds	Two inches of water above the soil level	8 days	Open
Step 3	7 to 12 Inches	Four inches of water above the soil level	60 days	Close
	12 to 17 Inches	Six inches of water above the soil level	30 days	Close
Step 4	17 inches	-	-	-

5. HARDWARE DEVELOPMENT

Table.2 List of components used

Sl. No	Components	Purpose
1	Transformer (12-0-12)V	Step down 230 VAC to 12 VAC
2	Rectifying circuit- full wave bridge rectifier	Converting AC to DC
3	Diodes IN 4007	Unidirectional current flow and current switching
4	Voltage Regulator LM7805	To obtain fixed output voltage
5	Capacitors	Stores charges and removes harmonics
6	Resistors	Biasing purpose regulate the current flow
7	Relay	On/OFF Control of motor
8	Microcontroller (AT89S52/AT89C51)	To interface components and to run the program
9	LCD (44780)	To display status of motor and water level in underground sump
10	Buzzer	To indicate OFF condition of motor
11	Magnetic float Sensors	Detects water level in cultivating field and underground sump
12	RTC	Operate motor for a particular time slot
13	Keypad	To set ON and OFF time of motor
14	Switches	To shift from open loop to close loop
15	LED	Lighting purpose

Table.2 gives the details of components used in the present work.

6. CIRCUIT DIAGRAM OPERATION

The circuit diagram mainly comprises of Microcontroller, Power supply block, Relay, RTC, keypad, LCD, Three magnetic float sensors, Buzzer and Motor.

The work is divided into two parts they are,

1. Open loop operation
2. Close loop operation

6.1 Open loop operation

The open loop has an RTC interfaced to microcontroller. The input voltage 230V AC is stepped down to 5V DC using a Bridge Rectifier which acts as a source voltage to microcontroller, The ON/OFF control of motor is done by microcontroller through relay or optocoupler. An LCD and a buzzer is also interfaced with the microcontroller to know the status of the motor.The farmer has an option of entering the ON time and OFF time of the motor, once the entered ON time matches with the RTC time then the motor is turned ON and the motor is turned OFF if the entered OFF time matches with the RTC time. But before motor is turned OFF or turned ON, the condition is whether there is water availability in the underground sump is checked using a magnetic float sensor near the suction port of the pump which is interfaced with the microcontroller. If and only if there is water in the underground sump the motor is turned ON if not the motor remains in the OFF condition.

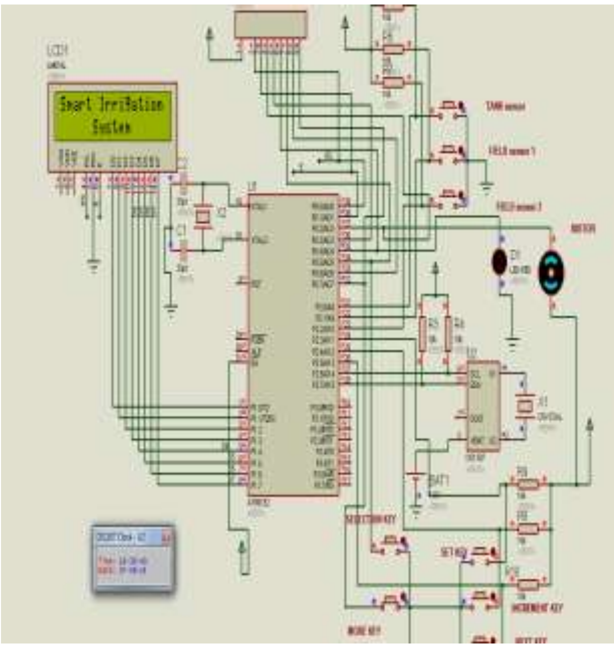

Fig.2: circuit diagram

Once the motor is turned OFF when water is not available in the underground sump the buzzer generates the sound signal and LCD displays that the motor is in OFF condition.

6.2 Close loop operation

The close loop has two magnetic float sensors placed in the cultivating field. To activate either of two sensors the switch is provided, these two sensors output is given to the microcontroller and depending on the output of these sensors the microcontroller controls the ON/OFF state of the motor.The first sensor is placed 4 inches above the soil level and is activated for 2 months, and the second sensor is placed 6 inches above the soil level and is activated for 1 month, to select which sensor has to be in active, switch is provided.If the water is below the desired level the motor is turned ON and if the water level reaches the desired level the motor is turned OFF. The switch is provided to shift from the open loop to the close loop.

7. CONCLUSION

The smart system for irrigation field has been successfully designed and developed. The sump pump is turned ON and OFF according to the water levels in cultivating field as well as in underground sump. Compare to other conventional methods, the smart system shows excellent performance with its reliable digital technology and it is cheaper and durable. The smart system is a promising system in terms of system response in water level control. Installing Smart system saves time and ensures optimum usage of water. Moreover this system uses microcontroller which promises an increase in system life and reducing power consumption.

8. REFERENCES

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