

Eco-friendly Irrigation Alert System (e-IAS)

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In traditional rice cultivation, farmers generally keep the field continuously flooded from transplanting to physiological maturity of rice crop. However, it is well established that continuous flooding is not necessary for rice to achieve high yields. After seedling establishment phase, even in the absence of standing water in field, rice plant can extract soil water from the below surface soil around root zone. Over the past few decades, water scarcity has emerged as one of the biggest challenges for sustaining rice production. Development of novel irrigation scheduling technologies is an important step to help rice farmer cope with water scarcity.

One of the important decisions in irrigation scheduling is to decide the right time of irrigation. One of the methods is the use of perforated pipe in rice fields for deciding the right time of re-irrigation. In this practice a perforated pipe (40cm length and 15cm diameter) with drilled holes (2 cm apart) is sunk into the rice field until 20 cm protrudes above soil level. The perforations permit the water to enter inside the tube from the soil, where a scale is used to measure water depth below the soil surface. The water level in the pipe is monitored regularly and the field is irrigated as soon as the water level reaches a

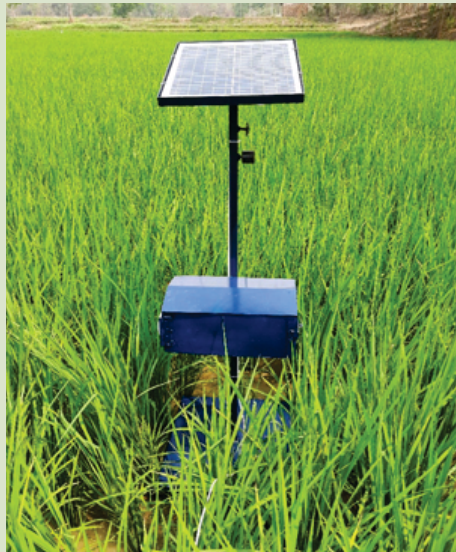


Fig 1. Eco-friendly Irrigation Alert System (e-IAS) installed in the field

threshold level (15 cm). Monitoring the water level in the pipe on regular basis in the distant fields is a difficult task for the farmers, very often, the monitoring is not done properly, which results in late irrigation, and ultimately the adverse effect is reflected in the crop performance. For

overcoming the manual monitoring, ICAR – NRRI has developed Eco-friendly Irrigation Alert System (e-IAS). In this system, a sensor is attached with the perforated pipe installed in the rice field at desired depth. The sensor is connected to a microcontroller and relay module. The whole system is powered by a 12V battery and the battery is charged by a solar panel installed at the top of the structure. As soon as the water level in the rice field goes down below the desired level, the sensor communicates the signal to the microcontroller, which switches on the red bulb and alarm. The glow of red bulb and alarm sound aware the farmer for the irrigation event. Moreover, on reaching the threshold level, the microcontroller and GSM modem also sends an alert message to the farmers' mobile number registered with the system.

Methodology

This is a fully automated system controlled by microcontroller (ATmega 328) and powered by photovoltaic system consisting of solar panel and battery as energy storage.

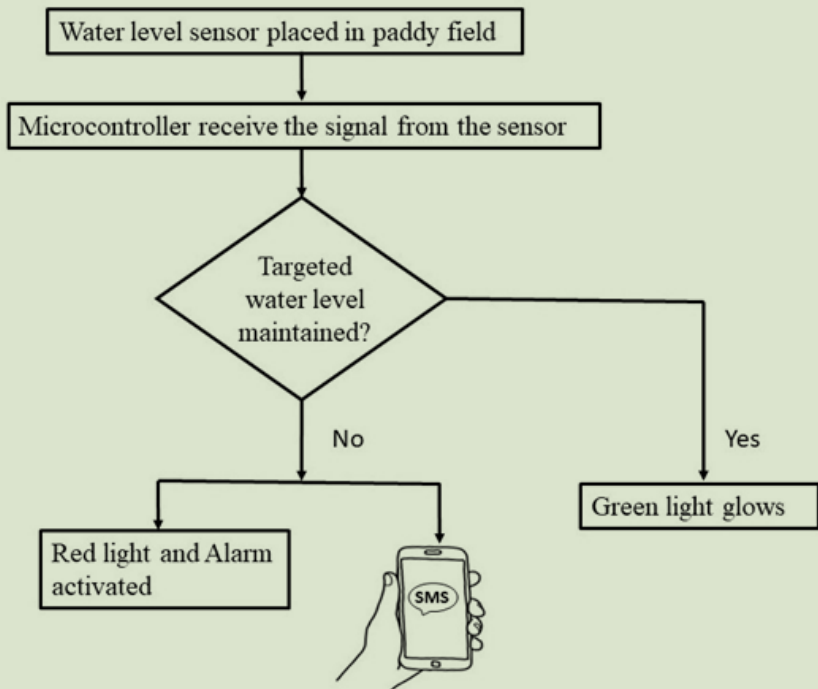


Fig 2. Flowchart of operational procedure of Eco-friendly Irrigation Alert System

The system consists of:

1. **The Sensing Module**
2. **The Control Module**
3. **The Communication Module**

1. The Sensing Module

This unit is responsible for real time sensing the water level in the field. The system consists of a perforated pipe and a water level sensor. The sensor is placed inside the perforated tube (40 cm length and 15 cm diameter) with drilled holes (2 cm apart). The perforated tube is sunk in the field and the perforations present in the pipe allows the soil water to enter the pipe. The sensor is placed at a depth of 15 cm in the perforated tube. Once the water level in the tube falls below 15 cm, the sensor sends signal to the microcontroller.

2. The Control Module

The control module generates a control action based on the water level. It consists mainly of an Arduino AT mega 328 microcontroller (Master Arduino), and a relay block module for receiving instructions from the Arduino AT mega 328 microcontroller (master controller). The master Arduino via the water level sensor receives the real time water level data and with the help of relay block it controls the light and sound alert system.

Range A – The microcontroller sends a signal to enable the green light, until the water level in the field is upto desired level.

Range B – The microcontroller sends a signal to enable the red light and sound alert system as soon as the water level in the field falls below the desired level.

Range C – The microcontroller sends a signal to enable the GSM modem to send an SMS to registered mobile number of the end user as soon as the water level in the field falls below the desired level.

3. The Communication Module

The GSM communication system is connected to the microcontroller directly and text messages (SMS) are sent to the registered mobile number of the end user.

Power Requirements

The system is powered via a combination of a solar panel and a 12V battery system. The solar panel charges the battery and powers the system during the day and the battery pack supplies the required power at night and getsrecharged the following day in sunlight via the solar panel and solar charge controller.

Advantages

This system provides real time monitoring and is automatically controlled. This system avoids over irrigation or/and under irrigation and thus reduces the wastage of irrigation water. This system runs on clean energy (solar power), hence, it eliminates the necessity of electricity. This system alerts the end user through SMS, light and sound alarm and thus it facilitates effective monitoring of real time water level in the field. It has the potential to save around 30% of irrigation water without having any negative impact on grain yield. Thus, it increases the water productivity by 40%. It also increases net return for farmers by reducing pumping costs and fuel consumption. It also curtails the methane emission from rice field by around 37%.

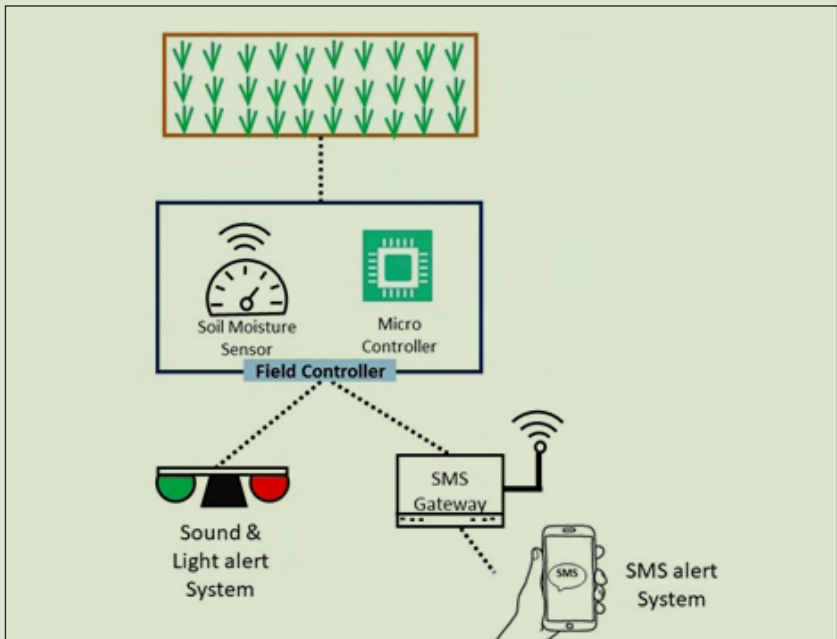


Fig 3. Operational procedure of Eco-friendly Irrigation alert system

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