



Automated Drip Irrigation System based on Embedded System and GSM Network

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ABSTRACT: Agriculture is the largest livelihood provider in India. It also contributes a significant figure to the Gross Domestic Product (GDP). Irrigation plays an important role in agriculture. World's water resources are vanishing, use of proper method for irrigation is important and it is well known that irrigation by drip is very economical and efficient. In this paper the design and implementation with a prototype of Automated Drip Irrigation System that provides the exact field condition and used to control the wastage of water in the field, atomizing the agricultural environment by using the components and building the necessary hardware in mentioned. This system use GSM which helps in periodically learning the field status from the sensor deployed in field spaces, the irrigation service is influenced by the change of field status. The farmers are allowed to access this said drip irrigation system with their personal communication devices. The system monitors the field conditions and guides the farmer to the deal with irrigation scheduling. Proposed System has overcome limitations of previous systems like distance problem, range problem. The system focuses to automate the irrigation system, so that the drip devices can be controlled automatically from anywhere and anytime. This approach is very beneficial and efficient for water conservation. This system's automation-based irrigation policy has the potential to smoothen the operations of irrigation systems, as well as mitigate labour related work on field.

KEYWORDS: Drip Irrigation; Hardware Control; GSM; Android Application

I. INTRODUCTION

Today continuous increasing demand of the food has lead to rapid improvement in food production technology.

In India, Agriculture is the largest livelihood provider as the economy is mainly based on it and the climatic conditions are isotropic, still we are not able to make full use available of agricultural resources. The main reason is the lack of rains and water supply shortage of land reservoir water to agriculture fields. The continuous extraction of water from earth is reducing the groundwater level due to which lot of land is coming slowly in the zones of un-irrigated land. Another very important reason of this is due to unplanned use of water due to which a significant amount of water goes waste.

At the present era, the Agriculture sector heavily relies on human interaction with the physical space and entity. The farmers in India have been irrigating the land at the regular intervals manually. This process sometimes consumes more water or sometimes the water supply is delayed due to which the crops get dried. This problem can be perfectly rectified if we use automatic microcontroller based drip irrigation system in which the irrigation will take place only when there will be intense requirement of water.

Drip irrigation, also known as trickle irrigation or micro irrigation or localized irrigation, is an irrigation method allows water to drip slowly to the roots of plants, through a network of valves, pipes or emitter. Drip Irrigation prevents soil erosion, saves water and fertilizer can also supplied by it. Using this technique in modern irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants drip by drip due to which a large quantity of water is conserved. This sector consumes approximately 70 percent of the world water resources for irrigating farmlands and is liable to fulfill about 40 percent of the world's food requirement. The efficiency of an irrigation management system is highly dependent on irrigation methods and schedules utilized such as surface irrigation or drip

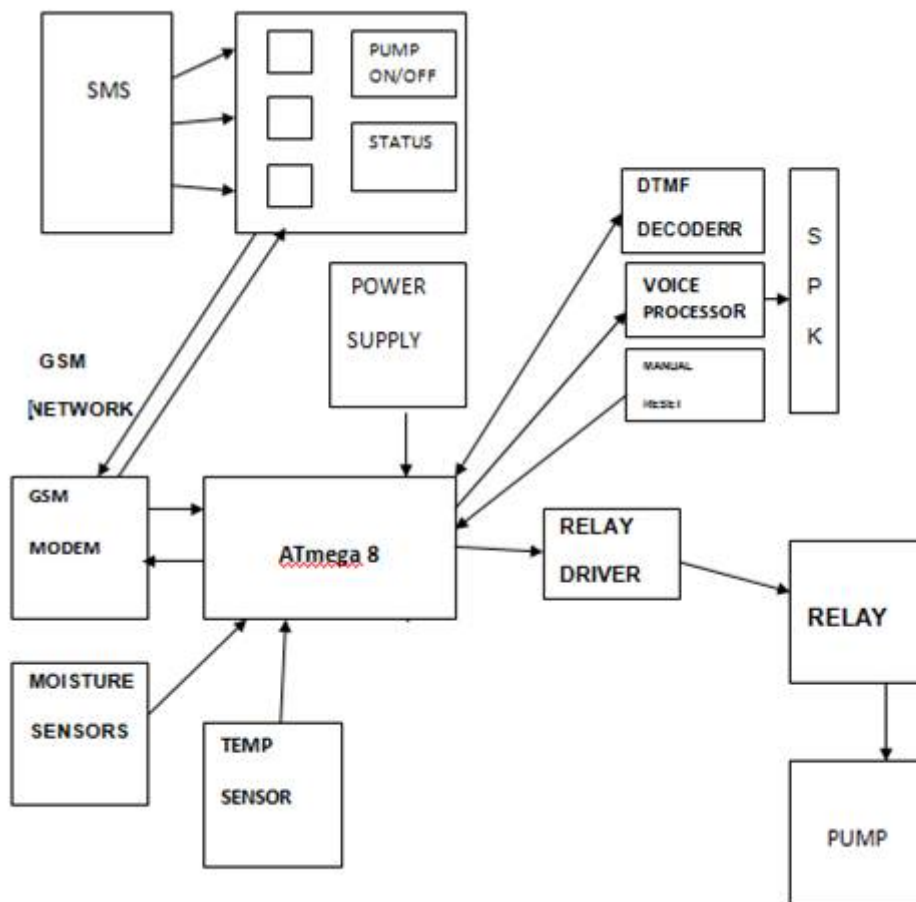
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irrigation. The system can be used by multiple tools such as Android application, Interactive Voice response by calling. Thus allowing user to have a hassle free user experience.

II. SYSTEM BLOCK DIAGRAM



ATmega 8

The system uses ATmega 8 Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It acts as a mini computer. A serial I/O module to allow data to flow between the controller and other devices to perform tasks for certain time periods. An ADC to allow the microcontroller to accept analogue input data for processing.

GSM Modem- SIM 900 -TTL UART

It is used for communication with mobile devices and provide hardware control for distance range. The Android users have access to hardware via GSM Modem.

DTMF Decoder

DTMF(Dual tone Multifrequency) signalling was originally designed for telephony signalling over voice quality telephone lines. This signalling technique has been applied to a multitude of control and data communications systems. This is used in interactive voice response system in drip irrigation system for other users(Non android phones)



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Relay

It is electrically operated switch. It is used to control circuit or pump by low power signal.

Moisture and Temperature Sensor

The sensors are deployed to provide information about environmental conditions on agricultural field.

SMS-Short Message Service

It is the Text Messaging service component of mobile communication systems. The Android application uses SMS in background to communicate with the drip devices.

II. RELATED WORK

In existing system farmer has to work physically to control the drip irrigation system. Traditional instrumentation based on discrete and wired solutions, presents many difficulties on measuring and control systems especially over the large geographical areas. Every time excess of water is given to the fields if conventional irrigation system is used.

Limitations of existing system:

- a. Physical work of farmer to control drip irrigation
- b. Wastage of water
- c. Wastage of time

But now there is development in the field of use of automated irrigation system. Various systems are being developed and to understand the different technologies and monitoring schemes properly, the systems studied can be broadly showing the classification of the existing systems based on different criteria:

- A. Technology Used
- B. Processors Embedded
- C. Sensors Incorporated

The prime objectives of new generation agriculture system are :

1. Remote monitoring
2. Remote control
3. Information transfer
4. Communication

There are various irrigation systems available based on above specified classification and to meet the required objectives, there is continuous scope of development to provide more efficient drip irrigation systems.

III. PROPOSED WORKING METHODOLOGY

A. Description

The Automated Drip Irrigation System works on real time field information based on which it plans and schedules water resource allocation for field by farmers. Several technologies are used to monitor real time field status like Android application, Interactive Voice Response.

1. Android Application

We have designed a Android application module for android phone user that will communicate with a microcontroller using GSM Modem. Only Authenticated users can login into android application with allocated username and password. After login android application provides three buttons on ,off and status . The on/off

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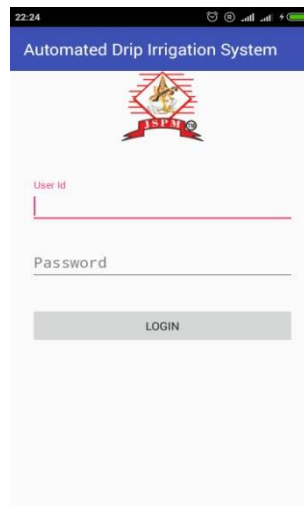
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button will turn on and turn off the motor. Status button is used to get the real time data of agricultural field with parameters like motor on/off, temperature and moisture status respectively.

At backend application will send an SMS to authenticated sim number in GSM modem to perform following functions. Microcontroller decodes input received via modem and performs specific task based on user input

A.1 Application prototype



2. Interactive Voice Response

This module can be used by both android phone users and others(non android phone users).

If the farmer wants to switch on the motor he just needs to call to the particular mobile number which is placed near the motor and connected to DTMF Decoder. The called mobile checks whether the call is coming from authenticated user, if it matches it will auto answer to the call. If the farmer wants to switch on the motor he just needs to dial 1 after call is setup. Similarly to switch off motor press 2 and press 3 for status etc. We implemented calling feature here as it is easy to use and also the farmers don't have sufficient knowledge for sending SMS.

B. Algorithm

The formula below can be used to calculate agriculture water requirement manually based on parameters like

$$E_{T_o} K_c = E_T \text{ crop}$$

$E_T \text{ crop}$ = crop evapotranspiration or crop water need(mm/day), K_c = crop factor

E_{T_o} = reference evapotranspiration (mm/day)

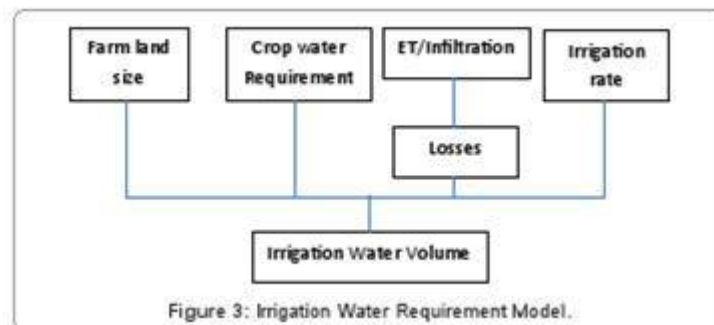


Figure 3: Irrigation Water Requirement Model.

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IV. MATHEMATICAL MODEL AND SIMULATION RESULTS

System $S = \{S_1, E, X, Y, F, DM, ND, M\}$

Where, S_1 = Smart Irrigation System

X = Set Of Inputs = $\{X_1, X_2, X_3\}$

Where,

X_1 = Water pump on/off

X_2 = Value of Temperature Sensor

X_3 = Value of Moisture Sensor

Y = Output

$Y = \{y_1, y_2\}$,

Where

y_1 = Turn on/off drip devices, y_2 = Failure

F = Failure cases

Where, $F = \{f_1, f_2, f_3\}$

f_1 = Failure in sensors, f_2 = Network Connectivity, f_3 = System Failure

DM = Deterministic Data = Sensor values

ND = Non Deterministic Data = Water Availability, Weather Conditions

E = End State

V. PERFORMANCE EVALUATION

A. Application prototype

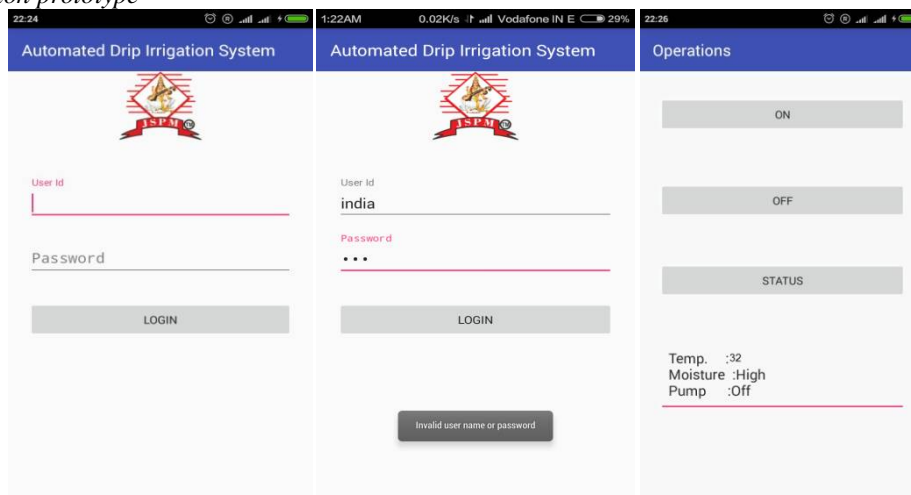


Fig1: login

fig2: Unauthorised login

fig3: Status

The security feature is provided by application by access to authorized user through provided username and login. The android application also shows the status information as displayed

B. Comparison

The figure below indicates a significant impact of micro-irrigation technology on a range of production and income indicators for farmers across four states included in the India Micro-Irrigation Program. So we can see automated drip system are useful and there is scope for its use. The proposed system will be provide user friendly experience.

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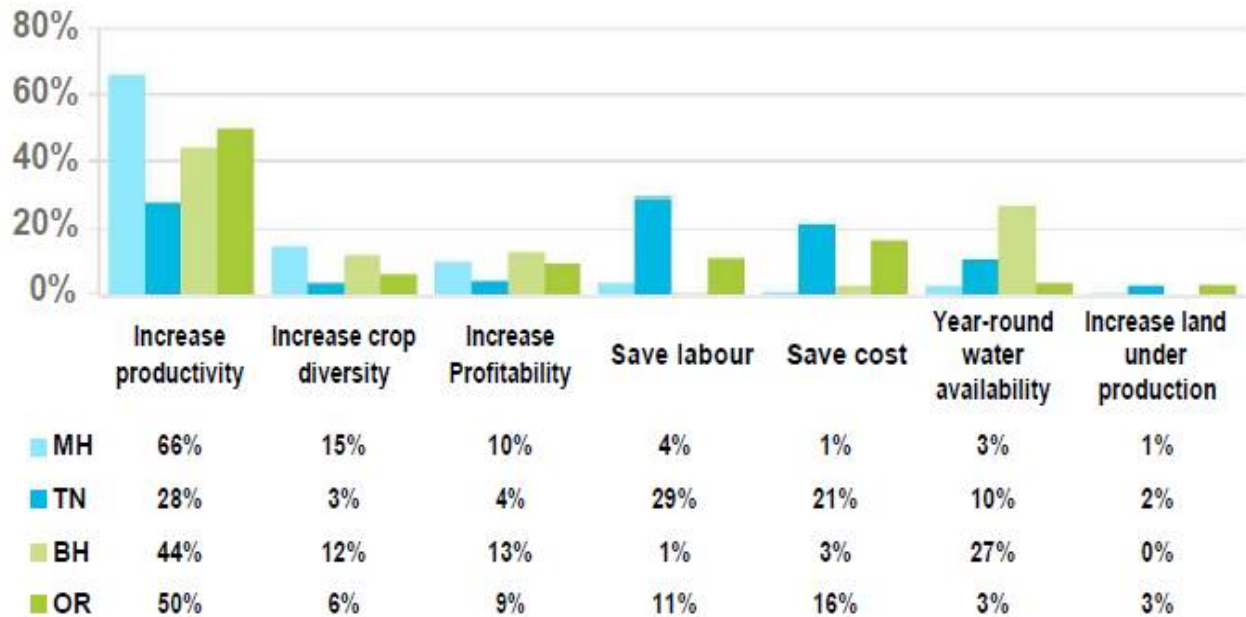


Figure represents main reason for providing the micro-irrigation technology by 4 states, Maharashtra, Tamil Nadu, Bihar and Orissa

VI. CONCLUSION AND FUTURE WORK

The main advantage of this system is the farmer can remotely control drip irrigation devices by using his mobile phone can be anywhere in the world. An automated system can save you literally thousands of gallons of water a year simply by drip wise water supply. . Using these system productivity increases and water consumption reduces. The main focus on system architecture of propose system that can be use for implementation of agricultural projects. The proposed system is beneficial for farmers and avoids the wastage of water as well as no manpower is required and system is relatively quick. This system protects your financial investment and just requires minimum maintenance for efficient operation.

As competition for water resources and the need for water conservation increases, applications of drip irrigation will also increase. So we need to use need to use water resources carefully to avoid drought like conditions in future .This system offers the ability to very precisely place water, nutrients, and other chemicals in the plant root zone at the timing and frequency needed..In these system use of precised devices can provide the more efficient way to control the drip irrigation system. With proper design, installation, and management, drip irrigation systems can provide good and reliable performance in future.

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